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From cinema for teaching to video pedagogy

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Chapter VI
**The experimental research: the impact of regarding visuals activities
combined with chat activities on the learning outcomes
in the FaD model experimentation**

Teaching and learning with new technologies at university is the theme of this book. A few decades after the first distance learning experiences, we are witnessing the metabolization of the theoretical principles of that type of "unconventional" teaching within the degree courses in attendance. Not only. The use of digital technologies in formal learning and teaching contexts is now one of the main factors in the qualification of teaching activities.

This underlines the urgency, more strongly than ever, of overcoming the classic transmission teaching model based on the ex-cathedra lesson, prevailing in most cases. The speed of change in work, social, technological and cultural processes that are distinguishing our society requires educational models that are more functional to the growth and training (continuos) of individuals: collaborative and experiential learning, on the one hand, the need to transform the teaching paradigm, based on verbal and written language, in a learning paradigm, based on multimedia languages, network logics, multiple contributions and shared responsibilities, on the other hand, seem to be the mainstay on which to support the new teaching. This in line with the potential offered by 2.0 pedagogy environments that are catalyzing the attention, as well as of political decision-makers, also of educators, trainers, pedagogists: participatory culture and the birth of social knowledge, the forms of collaborative construction of knowledge, the new social and didactic paradigms in the direction of collective and connective intelligence, the spread of open educational resources and the approximation of the formal and non-formal dimensions, the habits and media consumption of the new generations, as well as the new learning styles.

These needs should make a contribution to overcoming, this is the hope, the resistance to the use of technologies highlighted a few years ago by Laurillard (2008, p. 1): "education is on the point of being transformed by technologies for learning; but education it has remained on that same point for a few decades now".

To this we must be added considerations with respect to the historical period we are experiencing, I refer to the health emergency about Covid-19 and the commensurate measures to contain the infection. Measures that have seen the mandatory use of telematic teaching in schools and universities, causing an epochal change. For years there has been discussion, as has been done by Giovanni Ganino in this text, on whether or not to introduce digital cognitive technologies and artifacts in schools and universities. Today, suddenly, school and university, considered as physical environments, have been replaced, due to the social distance imposed by law, by digital connections. The future that seemed far away is already here.

The health emergency has changed our habits, our lifestyles, the way we work, our social relationships. Everything has moved into digital platforms, speeding up a process of digitization of human action that began a few decades ago, which has become unexpectedly all-embracing today. We have practically coercively started to practice social distancing, forced into an isolation that will

leave an important mark at the end of the emergency measures. The world to come, after the defeat of Covid-19, will be very different from the previous one, in particular with respect to co-working and e-learning. Environments, those of work and higher education, within which the positive influence of digitization, artificial intelligence and advanced multimedia processes can no longer be treated with sufficiency.

The life of "inmates at home" certainly will make us rediscover and appreciate human relationships, the beauty of a gaze not mediated by the screens, the value of a handshake. At the same time, we will have discovered the value of digital in making relationships more human, in enabling remote and sustainable working activities, in enhancing digital environments in teaching and learning processes.

The concept of community can only emerge strengthened. The hope is therefore that the world to come will no longer put the analogue to the digital in contrast, humanism to the technology. The adversity that is affecting the whole world in its dramatic evidence can be transformed into an opportunity in the educational technology sector. Provided that the concept of "learning environment" remains central, within which to reconstruct those central educational and teaching dynamics in conventional teaching.

This premise situates the present work within a problematic framework, far from a technocentric vision, but at the same time close to those theories that consider technological cognitive artifacts, used wisely from a pedagogical point of view, useful for university teaching. The history of teaching, and today more than ever, is deeply linked to the invention and use of technologies, but only their correct use can allow significant learning understood as "a change in human disposition or ability that persists beyond a period of time and is not simply attributable to the growth process" (Gagné, 1985).

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INTRODUCTION

This research project comes from the need - and from the attempt - to reflect, in a global sense, on formative practices and their prototypes, lastly focusing on the consequences, not always unequivocal, that one and the other have towards behaviours and learning. The specific aim of this research is to analyse the main epistemological paradigms that guide university professors in the use of cognitive artifacts, paying particular attention to audiovisual and multimedia resources (going from a multimedia presentation to a web conference). These resources are by now increasingly fully or partially used in substitution or/and as integration of lectures and teachings.

The field of reference is the one of media teaching and the essential idea is that, if used according to the right methodologies, technology can contribute to the process of teaching and learning in schooling activities, being either physically present or distant.

The field of investigation finds itself in the theoretical debate concerning the teaching/learning approach with technology and on the wake of the already started research, from the late Nineties, in the *Centre of Communication Technologies*, *Innovation and Distant Learning*, of the University of Ferrara.

To rightly investigate this phenomenon, it is vital to outline the state of the art of some themes that can help us visualize better the problem through a work of recognition of its main scientific literature.

Referential frame: relationship between technology and teaching

The spread of the informational technologies and communication (ICT) in the last decades in industrialized countries and the affirmation of the informational paradigm (Castells, 2000; 2002) has been such to determinate the birth of expressions such as "knowledge society", "information society", "web society". These expressions are a clear sign of the closest correlation, on different levels, between digital technology and all the processes that dictate human conduct: working, training, social, communicative and economic procedures.

In parallel, the ICTs have determined epistemological and methodical challenges not only in the social and economic studies but in the humanistic and pedagogical areas as well.
 Beginning from the late Seventies, didactic technologies have had a relevant role in the teaching system, even without ever finding a concrete application in relation to clear methodical and didactical principles.

Nowadays, in Italy, educational technology policies are listed within the *National Digital School Plan* (PNSD, 2015), stipulated by the *Italian Digital Agenda* of the Ministry of Education, born with the aim to "rectify the learning environments to the changes of the knowledge society with the needs and rhythms of the contemporary world." The National Digital School Plan's slogan, "the

workshop in class and not the class in the workshop: one strategy, many actions", underlines the need for a shift from ordinary teaching to a collaborative learning experience.

The Ministry of Education policies' aim is to convert the educating paradigm, founded on the verbal and written technique, in a learning model based on new multimedia scripts, web logistics, multiple contributions and shared responsibilities, in line with the educational and didactical potential offered by online 2.0 environments that are catalysing attention, as well as political decision makers, educators and pedagogues. Engaging culture, the birth of social knowledge (Jenkins, 2006; Jenkins *et al*., 2010), and the forms of collaborative construction of knowledge, along the definition of new theoretical paradigms such as the ones of collective (Lévy, 1994; 1999) and connective intelligence (Siemens, 2005; 2006), the spread of open educative resources and the approach of the formal dimension to the informal (Bonaiuti, 2006; 2010; Ferri, 2008; 2011), and the media uses and costumes of the new generation (Rivoltella, 2006; Ferri, 2011) are at the base of many teaching initiatives, generically termed *2.0*. More specifically, we talk of *pedagogy 2.0* (McLoughlin & Lee, 2011) or *school 2.0* (Ferri, 2013), about those teaching scenarios able to use technology according to socio-constructive theoretical principles that generate method learning dynamics (Galliani, 2011). Naturally, there is no scientific evidence on the effective impact of technology, especially when talking about "open" environment technology effectiveness in regards to the self-building knowledge of students (Calvani, 2007; Calvani & Ranieri, 2011).

The National Digital School Plans' intentions, at least in theory, are in line with the scenario just described, but we'd like to report what has been stressed by Antonio Calvani, just a few years ago, in correlation to the effectiveness of technology school policies: "the element that most characterizes the history of ICT in school is the continuous repetition of the same illusions, similar stereotypes, which result in similar failures: starting again from scratch, or with a new generation of teachers who ignore what happened before them" (2007, p.19).

Certain of a change of course, guided by methodological awareness, it seems important to listen to Luciano Galliani (2011, p. 9) who points out how there is still no scientific evidence on the effectiveness of the use of technology in teaching/learning processes, and how the course to follow should be directed towards the creation of a processional dynamic of learning through "a complex relationship between formal, institutional and organizational education contexts, aimed at the teaching of disciplinary knowledge, application skills and cross-curricular skills, the non-formal learning contexts of work organizations, where skills and competence are acquired through professional practices and their continuous updating, and the informal context of family and social life in which attitudes and interests are cultivated (music, amusement, sports, tourism, mass media and new media, etc.) and where one learns through experiences and relationships with others" (Galliani, 2011, p. 9). It is clear then how any approach to the relationship between technology and teaching should be based on reflections that are meditated on didactic, methodological and normative aspects. As Maria Ranieri stresses (2011, p. 59), some cautious realism has to be maintained: in front of the "magnificent and progressive ways" praised by some authors, the history of technology in education is much more controversial. Even though over the last twenty years technology facilities of schools and universities have increased dramatically, much of the promises of transforming processes and educational practices have not materialized and the potential for learning technology seems to have been realized only occasionally". Says Laurillard (2008, p. 1): "Education is about to be transformed by technology to learn, but it has remained stuck on that point for a few decades now."

This premise puts said work in a problematic light, far from a techno-centric view (Gramigna, 2012), but at the same time close to the theories that consider cognitive artifacts, from a pedagogical point of view, useful for teaching. Two parts are involved, one more theoretical (*Theoretical Foundations*), and the other experimental (*Experimental part.*
Multimedia teaching situations: case study at University of Ferrara).

Theoretical Foundations (Part I)

The first part seeks to retrace the relationship between cinematographic and television artifacts and the learning teaching processes in critical terms. From the 1960's onwards, research in between the fields of communication and education has dealt with the relationship between didactics and image according to the dual declination of "to the media" and "with the media" education, referring, in the first case, to the semiological paradigm based on the centrality of languages and meanings (media as an object of analysis and study: education in cinema, television and image), in the second, to a technological paradigm, functional to the use of audiovisual codes as representation of didactic content, supporting and enriching (with scientific film, with audiovisual, with didactic television) the teaching/learning processes[1]. The pedagogical-didactic roots of scientific research in those years, linked to the distinction between education "to the" and "with" media, recalls Luciano Galliani (2002), refer to scholars of various fields such as G. Flores d'Arcais, L. Volpicelli , R. Laporta, G. Mialaret, H. Dieuzeide, M. Tardy, R. Lefranc. In the next decade the debate is fuelled, on the one hand, by mass media sociology studies (Rivoltella, 2002) and psychology of perceptual-cognitive-emotional processes (Messina, 2002) particularly in the audiovisual media, on the other, by the appearance of the first computer and computer tools that will lead to a breakthrough in the telecommunications sector and all the work, social and economic activities. In the same years, recalls Galliani (2002), the scientific debate is accompanied in Italy by concrete activities in support of the school and the university: the Ministry of Education creates the *National Centre for Audiovisual Aid* with the task of coordinating the provincial centres scattered around all over the national territory; RAI increases its offer of school broadcasts, from the experiences of *Telescuola* to the creation in the late nineties of *Rai Educational*; in some universities there are audio visual centers and laboratories linked to the educational technology sector that carry on research pathways and educational relapse[2].

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[1] In regards to media education, theoretical orientations have developed, along with didactic practices related to disciplines such as Image Education, Media Education or Visual Literacy.

[2] Institute *A. Gemelli for the experimental study of the social problems of visual information* whose research activity, linked to the international magazine IKON, was directed towards the psycho pedagogical field and mass media communication (with a sociological, semiotic, philosophical point of view); the *Laboratory of Didactic Technologies* of CNR based in Genoa, whose technological and engineering work has investigated throughout the 80s and 90s the use of audio visual and computer techniques in teaching processes, as is apparent from the many application research reported in the *Teaching Technologies* magazine; the ECED (European Centre for Education), then the NICET (National Italian Centre of Educational Technologies) where one of the first experiences of *Multimedia Laboratory* is being carried out; the *Audiovisual Laboratory* of the Institute of Pedagogy of the University of Padua, equipped since 1968 with a closed circuit television system and a Film and television studios magazine, born on the model of the *Laboratoire de Pedagogie Audiovisuelle* which in France, led to didactic research and school interventions (Galliani, 2002).

The first chapter, *The role of visuals in the construction of the knowledge: a historical path between cinema and television*, specifically investigates the use of audiovisual mass media in educational processes (from school cinema to integrative television), trying to identify the actual results in light of initial expectations. We will analyse the linguistic features of functional cinemas in the teaching process, the various theoretical positions, in favour or otherwise, in the scientific and sectorial journals, institutions created in the field of the correlation between cinema and education, technological and logistic aspects. The same will be done for television, with a greater focus in this case on the use of television as a substitute for the school system. Experience with a number of obvious limits is found in the scientific debate, but it is important to better understand the current relationship between audiovisual and didactic technologies.

The second chapter, *Video pedagogy and visuals cognitive artifacts: for multimedia design in education*, leads the cognitive audiovisual artifacts to the latest educational resources whose characteristics (simplicity of use, cost-effectiveness, personal and interactive fruition) seem more suitable for use in teaching processes. Already between the 60s and 80s, the debate about the use of video as a learning resource in Italy demonstrates the interest of the scientific community towards this technology (Bettetini, 1979; 1984; Laeng, 1980; Pizziola, 1981; Galliani, 1979 a, b; Galliani & Luchi, 1983; Maida, 1983). Today, however, in the absence of clear scientific evidence from a number of studies, it can be seen how video resources can provide valuable support to didactic processes if their use is adequately prepared during the design of the formative intervention. Without entering into the complex and ultimately unsolvable issue, as recalled by Antonio Calvani, (2011a, p. 21) concerning the typological classifications of the forms of visual communication, which many authors have subjected to different kinds of criteria and classifications (Braden, 1996; Clark & Lyons, 2010; Paoletti, 2011) it is evident how classical educational channels have been going alongside the digital media, through which young people learn a tremendous amount of information. In current educational practices, the use of video artifacts is increasingly important: much knowledge is acquired through multimedia applications, digital content offered in the form of tutorials (video courses on any field of human sciences, made by teachers, professionals, enthusiasts), disseminating MOOC (*Massive Online Open Courses*) platforms, which are essentially composed of video lessons, the use of YouTube (the *Edu channel* has more than 10 million subscribers), hundreds of video portals focused on editorial lines, and a huge online database of educational videos. The course includes the definition of video technology to differentiate it from cinema and television, its historical evolution in the direction of web and hypertext applications, its communicative and fruition characteristics in relation to possible didactic applications (didactic video, video lecture, web conference lesson), a set of methodological indications, technological and logistic aspects, and criticality.

The third chapter, *Multimedia learning and cognitive processes: for design in education,* after analysing the concept of cognitive artifact and its role in learning[3] (Norman, 2000; 2015; Bruner, 1992; Vygotskij, 1930; 1931; 1934; Cole, 2004), examines the theoretical models of the principles of visual and multimedia communication, whose use is crucial if critical and reflexive learning processes are to be promoted. The most interesting studies are those related to cognitive psychology and the

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[3] To better analyze and understand the phenomenon of teaching technology it becomes important to analyze the functionality of cognitive artifacts, devices that act in various ways on information, to preserve it, transmit it, or modify it, thus expanding human cognitive skills. The use of cognitive artifacts finds its most obvious application in the field of teaching, especially in e-learning.

principles of the Instructional Design: Clark and Lyons (2010) have identified a series of guidelines based on the communicative and psychological features of the different types of images, Mayer (2003; 2009) investigated the principles of multimedia learning (generative theory of multimedia learning), and Sweller (1988; 2010) the mechanisms of cognitive loading (cognitive load theory).

 Knowledge of this disciplinary field is essential both for designing and making educational artifacts consciously (from a multimedia power point presentation to more complex products) and to use and possibly appropriately modify open video resources.

In the same direction goes the fourth chapter *Educational paradigms, cognitive artifacts and multimedia design:*

1. the rationalist-informational paradigm based on the process of transferring information from teacher to student (Watson, 1930; Bruner, 1998; Norman, 2000; 2015);
2. the systemic-internationalist paradigm that underlines the importance of cognitive factors in favouring the achievement of educational goals (Piaget, 1967; Ausubel, 1968; Novak, 1990; 1998; 2002; Bruner, 1998);
3. finally, the constructivist-social paradigm that emphasizes how the meaning is the result of a relational process between the mind of the individual and the environment (Merrill, 1991; Bruner, 1992; Varisco 1998; 2002). It is no coincidence this is the reference between paradigm of didactics and network technologies, based more and more on activities such as cooperation, sharing of knowledge and interaction (collective and communicative intelligence).
4. a peculiar aspect of connectivism is the centrality of the network, the nodes and connections are used as a metaphor to explain how learning takes place. In this metaphor, a node is anything ranging from: information, data, images, feelings. Learning is a process that creates connections and develops a network (Siemens, 2005; 2006). "In the indications of researchers in the connectivist area, the ability to connect to information sources and networks of people through digital technologies is more important than the knowledge actually possessed: learning means ultimately remaining connected" (Ranieri, 2011, pp. 129-130).

Theoretical models are investigated to better understand the constructivist-social paradigm on which the didactics are based on the effective use of information and communication technologies (ITC) and its principles such as interaction, cooperation, participation and sharing dynamics.

Experimental activity (Part II)

As mentioned at the beginning of the introduction, this research project born from the need to reflect on the training practices and their models. The intent is to verify through scientific evidence the teaching attitude of the professors of the University of Ferrara towards multimedia learning: the analyzed teaching experience is called *FaD To attend at distance*, not to be confused with the acronym *FaD Distance learning*.

 At the Humanistic Department of the University of Ferrara, a part of the lessons, starting from the academic year 2013-14, was structured according to a new didactic model: this model is based on the integration of the classroom lesson with the distance learning methodologies (web conference, forum, chat, collaborative online activities, self-assessment test etc.).

The declared objective of the University of Ferrara at the beginning of the experimentation was to apply the FaD model to all the University courses over time, in order to:

1. enrich traditional teaching methods using technologies and related paradigms;
2. build more flexible university courses to allow a personalization of the educational path, especially for workers or off-site students;
3. erase the concept of non-attending students;
4. reduce the number of students enrolled for supplementary years;
5. foster the management of inter-university courses;
6. improve student's performances;
7. make the educational offer of the University of Ferrara more interesting and closer to the new learning "styles" of the young generations.

The objective of this experimental research is to control with rigorous procedures the effects of the teaching innovation described.

Our starting point was the result of the observational study, a mapping carried out in the second semester of the 2016/17 academic year (February 2017-May 2017) on the FaD model: this mapping that involved hundreds of lessons highlighted a situation problematic. This problematic situation led us to define the university teacher as a "teacher 1.0" and, at the same time, convinced us of the need to identify a teaching method based on scientific evidence to improve the model.

In a mediatised 2.0 teaching situation, the classic transmission-style teaching models have been moved; the true potential of the technologies in the direction of the most participatory, collaborative and relational paradigms has not been used. Among all the tools that the Fad model has made available to teachers the only one used was the web conference and even this without take advantage of its teaching and communication potential. On this tool, the web conference, focused our attention.

In terms of learning, the effects of a lesson built using multimedia tools (as it's the case with the web conference) are different depending on the way the teaching communication is structured to support the verbal comment of the teacher. The our hypothesis is therefore the following: *the valorization of the didactic content presented by the professor of higher education using web conference in according with multimedia learning principles regarding visuals activities combined with chat activities increase the learning outcomes in the FaD model experimentation.*

We subsequently identified the variables of the model, a control group and two experimental groups, a methodology was developed and the related tools to be used. A course on which to start experimentation was then identified to the Department of Humanistic Studies (Course of *Literature for Children*). Finally, an operational plan was elaborated including times and places, of the sample concerned, of the method of analysis.

The final aim is naturally to make a contribution to the improvement of learning processes in Media teaching situations: go beyond the limits of the laboratory to offer operative indications to university teachers but also to Instructional designers in order to make more effective, in terms of significant learning (Ausubel, 1968), mediated teaching communication.

Part I

THEORETICAL FOUNDATIONS

Chapter I

THE ROLE OF VISUALS IN THE CONSTRUCTION OF THE KNOWLEDGE: A HISTORICAL PATH BETWEEN CINEMA AND TELEVISION[4]

The theme of using dynamic images as resources for didactic activities, despite being faced by several studies (Galliani, 1979 a, b; 1986; 2002; Farnè, 2002; 2003; 2006; Malavasi, 2007; Calvani, 2011 b) remains actual in light of the new opportunities offered by the advent of the digital technologies. Of course cinema and television, the first media that allowed the broad of knowledge dissemination, have played an important role in this path, but today many people are wondering what the pervasive presence of digital audiovisual communication can entail. It will be interesting to observe and investigate the role of the educational video, incorporating within this methodology, all forms of current moving images, from television to multimedia presentations, used in formal educational environments (attendance, distance, blended courses).

As Bonaiuti says "teaching and learning through pictures and videos is a new and at the same time ancient way (2010)". By expanding the speech to static images, in the history of humanity the man, to integrate the verbal communication, has employed signs or visual objects with the aim to reduce the ambiguity of the word by linking it to concrete contexts: from prehistoric huntings to medieval iconography, from rock paintings to stained glass in Gothic cathedrals, from paintings to sculptures. In the indications of Roberto Farnè (2002, p. 16): "From Galileo onwards, modern science finds in the instruments and techniques of vision and representation – that marks the end of the Renaissance and the transition from the Mannerism to the Baroque - a fundamental support".

So, the iconology played a role in the history of education (Farnè, 2002), but cinema and television, as mentioned, were the first media to allow on large-scale the diffusion of knowledge; thanks to their communicative characteristics that make the languages accessible to anyone, and to their technological characteristics that allow the retention of informations produced and their mass diffusion.

This chapter investigates the use of mass media, cinema and television in educational processes, tending to identify the actual results in the light of initial expectations. Going through the main stages of this path, to find limits and difficulties encountered in the past, can help to better understand the phenomenon and propose didactically effective solutions (Cassidy, 1998, Selwyn, 2011). Despite the fact that this statement, as remarks by Maria Ranieri (2011) are obvious, scholars, policy makers and educators have not paid much attention to the relationship between education and technology with a historical cut. A retrospective look can bring benefits by envisioning ways to deal with the problems that are most likely to arise in the present (Cassidy, 1998).

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[4] The content of this chapter has been published in Italian: Ganino (2018).

I.1. CINEMA FOR TEACHING: EXPERIENCES, INTERNATIONAL DEBATE, CRITICALITY

Despite the lack of clear evidence, moving image has played an important role in the teaching practice since its birth, just think at the role that the scientific cinema has played *to see better* as a support to research, supplanting the defect of our senses in the process of analysis/verification of those invisible information to our eyes without technological aids, or, "the inadequacy of traditional, verbal and written language" during the transmission of acquired data (Tosi, 1984). It is enough to remember, for example, the work of the astronomer Pierre Jules-César Janssen who in 1874 used the technique of interval photography, similar to the one known today as a *step-one approach*, to record the steps of the Venus passage in front of the Sun with the *photographic revolver* (prototype of the camera). Thanks to the use of cinematographic technology it was possible to record a rare and precious event, that in this way allowed it's analysis and study by astronomers. Consider that since the birth of the telescope until today the phenomenon occurred seven times (every 122 years in pairs of events interrupted by each other for eight years), Janssen could only attend it again in 1882, because the next event would have been visible 122 years later, in 2004 (Merzagora, 2006).

The cinematography technologies to be able to see better extend the ability of the human eye to see far, to observe microscopic dimensions, to intervene on time (increase or decrease of duration, acceleration or slowdown of a phenomena, etc.), but also allow the sharing of same observations with other scientists. These features, on one hand, extend the capabilities of our senses and allow us to overcome the subjectivity of the observation without recording tools, on the other, attribute to the cinema precise didactic and scientific functions. In Italy within the positivist paradigm the pedagogue Roberto Ardigò (1893) praises the didactic potential of cinematographic technologies that can represent "the movement" and enlarge "what is small".

Likewise, the sequential projection of a series of still images the *filmstrip*, which was used in the mid-1800s in various schools in the United States and Europe, was greeted at the time as "an extraordinary opportunity for students and teachers to have a direct glimpse of the world, this fueled the enthusiasm for visual-based education" (Ranieri, 2011, p. 31).

With the spread of cinema, starting in the early twentieth century, and with the emergence of the first specialized journals, starts the debate on the use of the film in educational processes: this is related to *school cinema*, *educational cinema*, *teaching film* and *cinedidactic*. Film as an educational tool or as a teaching material to be used in teaching and learning situations? And in the latter case, are there disciplines that more than others are supposed to be supported by cinematographic subsidies? Can the cinema be used to replace the books or the teacher? On these issues it's extremly intresting Lux's initiative, "Monthly magazine of cinematography, photography, phonography and similar", published an article in 1908, where emphasizes the necessity to start questioning on methodological aspects related to media pedagogy: "Do you believe that Cinematographer isuseful as a means of teaching in schools, and would you support the necessity for it when needed?" (in Marangi, 2004, p. 9).

A Symptom of the popularity growth of visual education is the first catalogue of educational films, published in 1910, *Catalog of Educational Motion Picture*s, where thousands of titles on different disciplines were present (Hackbarth, 1996). Both in a scientific and didactic field, the cinematographic image seems to make the teaching process more effective: "the scientific cinematography and the production of so-called *teaching films* were born around 1910, which, in the

context of a positivistic pedagogue, attenting to valorising any applied technology to teaching, were presented as the most effective and innovative support to develop schooling" (Farné, 2002, p. 293).

In favor of the use of demonstrative and representative images of life in support of the teacher's word, Alfonso Napolitano (in Marangi, 2004, p. 8) pronounced in 1910 in favor of a school opening to concrete reality. For these realistic features he advances the idea of the cinematographic use in all school buildings: "the Image is the most direct and straightforward way between the outside world and perception, and has on the spoken word and on the written word the advantage of showing how things really are and not because of conventional sounds and signs. The Cinematography is the subsidiary medium that best represents life with great facts and moving scenes, and it is necessary to bring it from adult society to adolescent society to give, through an easy and attractive way, spontaneous cognitions around the World, Man and Society".

The debate also comes out from the educational environment determining approximate positions (often coming from inventors of cinematographic technology) but which nevertheless testify to the centrality of visual communication over the course of the century. Thomas Alva Edison, inventor and entrepreneur of the United States, prefigures in 1913 a scenario in which the cinematographic image can be used as a substitute for the book by virtue of its attractive potential: "When we have the cinema in school, the boy will have a lot of fun and he will sit at his place before the bell rings, because the eye is the natural vehicle of knowledge" (in Marangi, 2004, p. 9). Edison's position is even more confident than the revolution of the educational system through cinema, to say that the moving image "in a few years will largely replace, if not entirely, the use of books. (...) Future education will be based on the use of the moving image and visual education, where it will be possible to get 100% of the efficiency" (Edison 1922, in Cuban, 1986, p. 9).

A more conscious attitude focused on the integration of new languages can be seen in France, in the 1920s, in the words of Minister of Education, André Honorat, who introduces the concept of cinema as a "help in all teaching orders from elementary to superiors, from all subjects, from scientific disciplines to literary and philological disciplines. The future of teaching with cinema is extraordinary, it is a new era that opens for the education of younger generations" (Marangi, 2004, p. 11).

The first country in which the cinematography becomes a concrete part of the teaching offer are the USA, where the classes are equipped with screens and projectors and disciplinary of audiovisual content is produced and are organized teachers' training activities to learn how to use the new tecnologies. All this in function, as Cuban says (1986), of the area of optimism that was inspired since the 1920s on the educational power of the cinema, considered a powerful tool of "modernity didactic" in the service of a "progressive" teaching, able according to Tiagert (US Commissioner for Education) to create "the most powerful weapon that has ever existed in the world to fight ignorance" (cit. in Selwyn, 2011). Specifically, they showed the didactic potential: "cinema was believed to be able to approach life-giving in an extraordinary way, enabling, on the one hand, to represent the reality of images and, on the other, to inspire life and emotion in what was previously inanimate, written and printed" (Ranieri, 2011). In practice, the realism of the image allowed the transmission of knowledge through the facts, the development of perceptual-motility skills, encouragement of motivation, attitudes and opinions (Allen, 1956). These considerations emerged in the United States around the late 1950s in a series of disciplinary teaching activities, based on the use of audiovisual support to increase teaching and learning processes. In 1956 a working group was led by two teachers from the

Massachusetts Institute of Technology, Jerrold Zacharias and Francis Friedman, to set up a *Physical Science Study Committee* (PSSC) whose goal was to identify new physics teaching strategies in the High School. "The teachers realized that the textbooks used in schools did not stimulate students' interest in matter, did not teach them to think and solve problems. The teaching material created by the working group was designed to emphasize the principles fundamentals of physics so as to *foster* understanding rather than *memorizing*, making the subject more interesting for the students. The first edition of the physics text accompanied by footage for high school appeared in 1960 and followed by many editions. The program was brought to Italy and is still published by the publishing house Zanichelli" (Goracci, 2014, p. 286).

Research activities also seemed to go in this direction, as is risulting from literature (Allen, 1956). Some experimental studies have verified how the use of the didactic film determined greater learning abilities in information and in concepts. According to other studies among teachers the belief in the possible substitution of the teacher with audiovisual support had spread, especially in cases where the informative and factual element was dominant.

In Italy the attention to the problems concerned on related between the cinematography image and educaion is evidenced by the creation of the *International Institut of Cinematography Education* (ICE), inaugurated on November 5, 1928 by Mussolini in the presence of the King of Italy Vittorio Emanuele III. The main aim of the "ICE" was to encourage the production and the subsequent international exchange of educational films to foster mutual knowledge and cooperation between States, in line with the aims of the League of Nations. Within this general objective, the Institute is commissioned, as Roberto Farnè reminds us (2002), from the Society of Nations to study all the different aspects and problems of cinematography applied to teaching and education. It is not a coincidence that the ICE cared for the publication of the International Educational Cinema Magazine (RICE), whose pages testify the researching experiences in those years about media pedagogy. The approach that is being developed is defensive and protective respect to the power that the mass media were taking. These are the years of propaganda use of the main media, the emergence of the American Studio system and the consequent problem of cultural imperialism, the years of the total power of the media that can be synthesized in sociological and psychological matrix theories, *Hypodermic needle* and *Bullet Theory*. In front of such power the school can only intervene, in a perspective that over the years will be overcome, to defend the new generations from the negative messages coming from cinema, radio and later on the television.

Alongside the theme of the cinema as an educational tool (reading activity for audiovisual messages for protection purposes) a debate is developing about the cinema as a teaching tool (images that can be used to support / integrate educational processes). It begins with thinking of how French, Swiss and English contributions make it clear that the character of the *substitute of reality*, peculiar to the recorded image, can make an important contribution to the teaching and learning processes. We briefly summarize the various positions that developed in those years, reported by Farnè (2002). Some of them are characterized by a technocentric and simplified processes of psycho-pedagogical, not supported by any scientific evidence, as in Louis Angè's 1930 intervention (in Marangi, 2004), which states that "cinema will make it easy to learn according to the principles of pedagogy rational, so it is possible to have the maximum intellectual yield with the minimum of brain fatigue". The suggestive and attractive power of the image, as well as its realistic dimension, according to Angè,

would be able to make the learning process more effective, usually complex and laborious, "from the dark wave of speech and the darkness of concepts".

The use of the Film appears more balanced and mature, reported about twenty years later, in an article by Remo Branca (1952), as an aid to lessons due to its representative features, such as the science of cinematography: "Cinema transfers physics, natural sciences, geography, and so on, on the concrete ground of experimental and practical learning of phenomena. (...) Via the geese stuffed by the natural history school museums, oiling by naphthalene! It is a world that belongs to the past and makes the students smile ,as well as being very expensive. The lessons of science, physics and geography today are a serious thing with the help of the film".

Apart from the fact that foreign authors favor the innovative imprint of cinema in the didactics, it is evident on the pages of "RICE" and "Bianco e Nero" a more critical attitude from the Italian pedagogy of neo-idealist derivation (Farnè, 2002). For example, there is a lack of learning through the reduction of the "learning work", as there can not be a link between learning and fun, as indicated by a positivist pedagogy pedagogy. From this, the criticism of using the sound and color cinema in educational processes (Calò, 1934), guilty of increasing the realistic, spectacular and emotional dimension at the expense of "didactic rigor" which requires analysis, abstraction and conceptualization. By contrast, academic of the age exalt the most regressive media whose grade of technological complexity is minimized and is easily controlled by the teacher, syllabary, printed page, and so on. This attitude of defense determined by the fear that the introduction of advanced technologies can reduce the centrality of the teacher / student relationship in teaching processes leads to the unintentional dissolution of any technological plant" (Farnè, 2002, p. 755) and will determine a school model based on the exclusive centrality of the educational act to the expense of educational techniques.

During the 1950s the pedagogical reflection moved on the pages of the *Bianco e nero* magazines of the *Experimental Center of Scientific Cinema* and *Lumen* directed by Giuseppe Flores D'Arcais. Although the debate is still anchored to a series of prejudices of essentially idealistic nature (Farnè, 2002), on one hand they start to give space to a concept of integrated didactic environment, consisting in the lesson, the book and the film, and on the other hand to consider the cinema not only as a support to the lesson but as a more comprehensive educational experience, inspired by its spectacular language and the cultural patterns behind it (Valpolicelli, 1949).

Even in the United States after the initial enthusiasm mentioned above, between the 1950s and 1960s, they start to doubt about the scientific evidence from the previous literature in favor of a more cautious attitude in view of the fact that cinematographic technology did not have a meaningful impact at school and university (Smith, 1962). Maria Ranieri (2011) citing Hornbostel (1955) and Cuban (1986), well summarizes the reasons for this failure which has led to the decline in the didactic use of cinema: the necessity for more time from teachers, greater coordination at the central level, the necessity for better technological infrastructures, the need for technical support for teachers, the high cost of films and equipment and the restricted audiovisual repertoire at a disciplinary level.

The idea that the didactic functionality of a technology depends on the way it is used (the problem is methodological) start sto make herself space. The Cinema can therefore facilitate the carrying out of certain tasks provided as long as such lightening determines the enhancement of the cognitive capacity of individuals and not their flattening (De Piano, 2016). In the classroom, for

example, pens and notebooks allowing you to take notes cause a lightening of our psycho-physical load and thus help our limited mnemonic capabilities. They do not change memory, but our task.

The use of cinema in educational processes is complicated by its "bulky" technology: to use film, documentary and single sequences in the classroom means to provide schools of projectors, movioles, and appropriate spaces, and so with geographic maps, texts, pens and illustrations on paper, you have to intervene on the didactic setting. A functional setting for the use of cinema at school should for example eliminate logistical problems (the use of the film takes place in another classroom) and those that result in a spectacular enjoyment that does not facilitate the activation of reflective and study processes (the use of the film must be cooled, for example, by using a moviola with which you can act on the time of the vision; and the fruition must not take place in a dark environment). This would allow the teacher, on one hand, not to lose the visual control of the class, on the other to identify specific didactic objectives within the sequences employed (introduce the sequence, explain what to locate within the class sequence, ask questions at the end of the vision, etc.). Moreover technology must be invisible (Weiser, 1991; Norman, 2015), to look natural and stay in the background. Students' attention must be placed on the task, not on the instrument, as is done with pen, book, and blackboard. It is obvious that the process of standardizing a technology is rather long and depends on the different grade of complexity of the functions allowed. The complexity of cinematographic technology has in the end made its structural use in the teaching field difficult, even if there are no isolated examples of its effective use.

I.2. TELEVISION AND DIDACTIC: ITALIAN EXPERIENCES, POTENTIALITY, CRITICALITY

The Television, officially born in Italy on January 3, 1954, seems to offer to the didactic of its peculiarities, certainly beyond what is allowed by the cinema. Its simplicity of use, domestic use, the interest aroused by the the treated topics, the publishing strategies and communicativeness in direction of the representation of the middle values and the norms, commonly shared by our society, that don't find resistance from the audience, so that the television became the medium of mass culture par excellence. For these characteristics, apart from the educational and didactic features of motion pictures already identified for the cinema, the television is studied by the media pedagogy disciplines as an educational tool and its possible applications in teaching and learning processes.

The use of cultural and educational intent is an integral part of the editorial line of television of many industrialized countries. In 1952, the US Federal Communications Commissions opened 242 educational television channels in the United States, and in the same years many universities have had their own channel (Morehead, 1955). In the United Kingdom, in the same years, a process, that determines on one hand an important production of educational programs and, on the other hand, the creation of technological infrastructures that allow in the 1970's to three quarters of schools to use television in the classroom, is initiated. In Italy, as in other European countries, the pedagogical vocation of television is embedded in its model of development centered on public service and state intervention that has determined that "up to a certain point, a monopoly of programming that defined the model of a real *state TV*, similar to the *state school*" (Farné, 2003, p. 19).

So the Italian television is born with an educational soul, a public service voted for the public education, which is based on the paradigm of *informing*, *educating* and *entertaining*, the same as John

Reith had identified as "mission" at the British BBC. The educational genre played an important role in the first twenty years of the Italian Television until the creation of private competition, without the pressure of the listening index, television wears the teacher's clothes and holds a lesson for TV shows. Sometimes with a purely didactic intent, linked to formal education experiences, others with an educational aim at the cultural growth of the population.

At the origins of the Television, this editorial line of pedagogical nature based on cultural aspects has been favoritised for many reasons. First of all, the necessity to create national identification paths, historical values and roots after the tragic experience of the liberation war in a country which is still divided, to a century of unity, in linguistic and cultural regionalism. There was a desire to unify and differentiate the diversity of publics for culture, language and social origin (Livolsi, 1998). As a result of this action, the new medium "produced a giant cognitive anticipation, a real cultivation of socio-cultural models. The Television, proved to be capable of building the social reality of its users, all of them fundamentally not competent compared to the medium and the communicative dynamics created by it" (Morcellini, 1995, p. 30).

Secondly, the fight against illiteracy and the rise of average schooling - only 25% of the population speak a proper Italian - necessary in view of the changes introduced by the economic miracle. Italy between the 1950s and 1960s turns from an agricultural nation to an industrialized nation and is characterized by the south-north migratory flow and the consequent process of multiculturalism. Such social and economic changes require functional competences for the new industrial society.

Let's consider how, after a century of elementary schools of the Kingdom and the Republic, dialects were the most prevalent language, throughout the peninsula and "Italian" remained a literary language: "in the undertaking where - for historical, geographical and cultural reasons - they did not succeed in printing and radio, but above all in which the school had essentially failed, television is now ventured" (Morcellini 1995, p. 13). Of course it was not only the television that taught Italian to the people but at the same time the school infrastructure was increasing considerably and the schooling requirement was also high, but for the sake of our speech, one can not but underline the educational potential inherent in the new medium, only functional to assist Italians to become familiar with the common language.

Television responds fully to the needs descrive above penetrating into the new social fabric as no other means of communication had been able to do. Movie enjoyment needed a physical shift, and the films, especially those with exclusively commercial intent, not always could fulfill the function of transmitting useful knowledge to the children of the economic miracle. And compared to the radio and the printed paper, the communicative completeness of the image accompanied by sound, which was used daily, facilitated the reading of the information. The dissemination of literary and theatrical works, scientific documentaries of biology, physics, chemistry, great characters, historical, social and environmental issues, study of the functioning of the human body, animal life, topics of national and international interest, Practical arguments to move in a rapidly changing society and disciplines known exclusively by industry specialists thanks to the cathode tube enter into the homes of everyone, intellectuals, peasants, workers, employees and teachers.

Through functional communicative gimmicks to soften the cultural pill according to the ancient Orazio's canon of *miscere utile dulci* in his early years of life, in the paleotest television and monopoly era, the television "teaches illiterates, ponders great literature with historical scripts and increases the

knowledge of the game with quiz games" (Freccero, 2013, p. 29). On Fridays, for example, was dedicated to prose, Giorgio Albertazzi read novels; Alessandro Cutolo (professor of the University of Milan) amiably conversed with the viewers in the transmission *Una risposta per voi* (An answer for you).

Assuming that pedagogy is the theoretical and practical science that has as its object of reference education in its many aspects, which carries out a critical analysis of education and which ultimately intentionally elaborates the design and educational competence (Bertolini, 1988), speaking of television from a pedagogical point of view means first of all recognizing the complexity of such articulation. The educational function is inherent in the media as it happens for all cultural communication experiences, on printed paper, radio and film. The task of pedagogical research is to find out the ways in which the educational function of television takes place.

I.2.1. THE TELEVISION BECOMES SCHOOL

Since 1958 the State pedagogy is reflected in the creation of a series of experiences, which we can define as e-learning. The Italian television, in collaboration with the Ministry of Education and on the basis of similar experiences, experimented first in 1949 in the United States and then in the following decade in France and England, is programming a complete secondary education program goodwill (*Telescuola*). It is the beginning of an experimentation of the model e-learning, which is characterized by a substitute paradigm that attempts to attribute to the television the school's characteristics.

Let's start by pointing out that the enthusiasm for the didactic potential of television was higher than that of cinema (Ranieri, 2011). Its "window on the world" features of reality, of communicative completeness, enable students toh ave real experience, authentic and superior to those allowed by cinematic technology. A second advantage is given by its diffusive ability, the television brings the programs directly to people's home, according to the paradigm of distance education.

For these characteristics, the school's relationship with television makes it possible to think, on one side, of possible applications in the field of distance education, on the other, to the improvement of teaching and learning processes: "Television can surely increase 'Effectiveness of teaching and also expanding class size" (King, 1954, in Ranieri, p. 38).

A series of empirical evidence, as shown by researches conducted in the United States in the 1950s, reported by Maria Ranieri (2011), seemed to support this thesis. These studies show that most teachers expressed positive judgment on television lessons (Allen, 1956), or how educational television has had a significant impact on the formation of teachers in the Samoan islands in the Pacific (Cuban, 1986). Certainly, this technology has had a major impact on teaching practices as it is from a series of data that in the mid-1960s four out of five students spent from one-quarter to one-third of their school-based time watching television lectures, followed by exercises and questions led by the teacher (Cuban, 1986).

The research of American derivation (in Farné, 2003) has produced in the 1950s a series of studies, in which three major communicative paradigms were identified about the uses of the television: "Televised-Education" Approach, "Broadcast-Production" Approach, "Video-instrumented Teaching" Approach". The first was based on the principles of moving the lesson on the television medium through null stepts of teaching situations. The teacher (*teacher-on-camera*)

performed in a television studio his lesson to a group of students under the "objective" eye of one or more cameras. The presence of the pupils had a dual function: to make the lesson realistic through the possibility of creating a teaching-student relationship; to encourage greater participation by the pupils in the educational process through their greater identification in the virtual didactic setting.

The second model was to overcome the shift of the lesson and a greater intervention in the adaptation process. The lecturer did the lesson to the audience directly at home, he focused his communicative ability in relation to the television medium on the didactic process. What before was the "Teacher on camera", becomes the "Teachers the Camera" (Dunham et al., 1957, in Farné 2003), and was asked to put in field very similar skills to those of a television presenter, alongside the didactic ones.

The third model attempts to distance itself from substitute television to identify a road that can lead to a possible enrichment of educational processes, on one side, through the transmission of programs capable of dissipating all the potentialities of audiovisual language, on the other, through the use of television, allowed by the videorecording technologies, of the "closed circuit", which can favor active teaching processes.

Also in Italy in the period in which the publishing logic of the television was being defined, the Rai's management thinks, on the basis of other European experiences, in particolar the French one, to devotes part of its programming to "the development of education and culture", alongside the school work (Farné, 2003, p. 24). The result of such editorial choices were the first experimentations realized in collaboration with the Ministry of Public Education, through which the television media provides the second generation Fad (distance learning) with its technological and communicative potential. On November 25, 1958, the programming of *Telescuola* (1958-1966), as previously mentioned, equivalent to a full secondary training course, aimed at those who for a number of reasons could not enroll in postgraduate elementary courses. As stated by the then Minister of public Education Aldo Moro, the purpose of the training course was to offer to the 11-14 year-old guys a formative opportunity, a vocational industrial training course, otherwise impossible in places without secondary schools. The *Telescuola* program, broadcasted twice a day in the afternoon and marked by a substitute paradigm (teledidactic overcoming the lack of school buildings), allowed us to study and reflect on the technologies and methodologies of media supported by the television.

The communicative and didactic approach chosen by the director of the program, Maria Grazia Puglisi, reflected on the Televised-Education model, the resumption in a television studio of the lesson in the classroom: "The audience to which we were addressed was made up of children and teenagers belonging to predominantly peasant environments to which the atmosphere of a secondary school class was largely unknown.The assumption was that the television representation of a classroom could be a way of making some place for families where, in any case, those TV students would have to endure the final exam" (Puglisi, 1960, p. 64).

A significant element of the television scene was the presence of pupils' with the function of immediate test on the contents of the lesson. In the television studio, some children coming from a poor social contest with mediocre intellectual characteristics, gave real-time instruction to the teacher about the possible reactions of the tele-students. This television extension of the classroom experience (double audience, one in the classroom, and the other at a distance) forced the teacher to have a double communicative register in the management of the two classes. This immediately made clear the

necessity to reflect on the skills of the "teacher-on-camera" who had to be able to "decline the didactic competence on the register of television communication" (Farné, 2003, p. 36).

The broadcasting of the program was accompanied by educational activities carried out in the presence of about 3,000 *Telescuola* listening posts (PAT), then reduced to 800 and transformed into separate sections of the secondary school. In the PATs a central role was played by an animator-teacher, whose task was to act as an intermediary between the television teacher and the viewer-students, supporting them in the learning processes, until the preparation of the final exam. The didactic model included the integration of the tele-lesson with paper teaching units, the carrying out of tasks and verification tests, positive reinforcements with awards and certificates for the best students.

The experience was not positively evaluated for its characteristics of "antiscuola", the users looked at the unfolding of the lesson from the keyhole and without relational possibilities, and "antitelevisione", did not exploit the communicative potential of the medium (Tarroni, in Farné, 2003).

There were two reasons for criticizing the experience of *Telescuola*. The first relates to the inability of television to distance itself from the methodology of the move that determined "the faded and distant television copy of a school already largely incapable of communicating with the students" (Farné, 2003, p. 38). The second, within the Italian school, related to the great backwardness in terms of educational communication and impervious to the innovative currents of European and American pedagogy: "the didactically backward model of scholastic TV corresponded to the backward model of teaching that was practiced in the Italian school, which was not able to suggest to television any innovative proposal, scientifically matured within it" (Farné, 2003, p. 38).

Perhaps the most negative fact is that the experience has not given rise to pedagogical research activities, as has happened in other countries, whose possible results could have brought benefits on didactic innovation.

These reflections have appeared useful for the preparation of subsequent experiences of teledidattica always in agreement between the Ministry of Education and Rai. In 1960, exactly on 15 November, a program for illiterate adults began to be broadcasted, *Non è mai troppo tardi* (It is never too late), structured in two parts, each corresponding to a training course: the first part (Type A: illiterate), lasting of six months, entrusted to Alberto Manzi, equivalent to the first cycle of elementary; the second part (Type B: semi-illiterate), for who left the following year and was led by maestro Carlo Piantoni, was aimed at those who had passed the first. The course that allowed its members to obtain the elementary license had as a priority objective to make a contribution to the fight against illiteracy, a phenomenon widespread in particular in Southern Italy. This time, however, with Maria Grazia Puglisi's indications, through different communicative paradigms, able to support the teacher's work with techniques of television staging: "while always keeping the master as protagonist, the television should have drawn all its weapons, that is all its most suggestive spectacular possibilities, scenes, actors, animations, drawings, all a kaleidoscope of various kinds would have to creep almost unconsciously into their minds so as to entertain teaching and leaving the illusion that more than going to school it was like they went to enjoy a television show" (Puglisi, 1965, p. 66).

In practice we realize how television can not overlap the school by becoming its substitute impoverished by the lack of the relational part, but it can transmit educational contents in a different

way, according to its own peculiarities. If it is true that every educational experience (and therefore also that of the scholastic type) is based on a relational structure made of interpersonal communication and cultural transmission (Bertolini, 1988), the problem was to redefine these two assumptions, starting from the specificity of the television, rather than moving them to the TV in their typically scholastic structure. This introduces a still current and unresolved theme, "the creation of a new language", functional to a teaching communication mediated by the screen. An important contribution in this sense is given by Alberto Manzi, the proponent of a paradigm shift (Farnè, 2003, pp. 42-43): "Manzi was convinced that there were two essential aspects to start from: the first was born from the observation that TV is not a school, but it can become a school on condition not to deny, but to enhance its specificity, the fact of being based on an audiovisual language that seeks to attract the attention of the general public through pleasurable forms of entertainment. The second aspect took into account the audience to whom the program was addressed. *Non è mai troppo tardi* was an instruction course for illiterate adults; it was therefore a matter of elaborating a communicative style that did not give the impression of treating those adults as children who start going to school".

The theme of the episode was introduced by a question that the teacher asked the children, from 7 to 10, arranged in a semicircle. The attention and curiosity were then continually kept steady by the centrality of the design, carefully designed according to precise didactic logics, and functional to the "visualization of the mental process that leads to reading and writing" (Tarroni & Meliciani, 1975, p. 18). Both the graphic elements proposed and the way they took life on the blackboard were the result of a careful preparation process, as well as the relationship between the image and the verbal comment: "Manzi drew a sketch more than a complete figure, which on one side lent itself good to an immediate reading, the other contained an implicit teaching message, as an invitation to trace with his own hands signs on sheets of paper (...), without the fear of making mistakes (...). keeping the public's attention alive, Manzi used the expedient to start drawing from those traits that did not make it immediately understandable, a clever and pleasant visual game made of signs that gradually took shape and aroused curiosity in the audience. (...) the television image was so animated by an internal dynamism that, while capturing the visual attention of the audience on the formation of the drawn figure, involved listening to it through the words on which Manzi accompanied that graphic action" (Farné, 2003, pp. 42-43).

Among the innovative elements of *Non è mai troppo tardi* there was the insertion of information modules related to the topic of teaching. For example, from a written and read word, thematic insights were opened on related topics to the word. This facilitated the storage of contents, allowed the linking of the training activity to more general experiences and the widening of the target audience: the structured transmission according to more popular methods could be followed by the viewer interested in his own cultural growth. Another stratagem was to invite "in the classroom" famous people whose surnames began with the letters of the lesson, with the aim of creating other television moments. More generally, Alberto Manzi proves that he knows the rules of television writing: "he intended to favor in the public an affective and meaningful relationship with a program that, although aimed at education, was to please his audience as they like a television program. We must not forget that those illiterate adults were not obliged to learn to read and write, but simply invited (encouraged) to do so, through the TV. The opportunity to see in that educational broadcast a popular TV personality, usually present in other entertainment programs, was used to accredit *Non è mai troppo tardi* to the public as a television broadcast tout-court, rather than as a school television "(Farnè, 2003,

p. 45). It is not a coincidence that the success and educational effectiveness of the program are both competing with the staging techniques used and the communicative skills of the teacher-presenter. Manzi is an anchorman ante litteram, the first true character of the Italian cultural and educational television, able to keep the viewer hooked to the television thanks to his communication skills, his clear and not authoritarian style. Teacher Manzi thus became a well-known face of the television even in the most remote Italian villages, assuring great popularity in the television series: his merit of having achieved more than a million illiterates the elementary license (Monteleone, 1999, p. 183). The road that has *Non è mai troppo tardi* been able to follow. Reminds today as an example of a new kind of globalistic and multimedia education (integration of television with textbooks, correction sheets, linguistic laboratories, overhead projector).

In the testimony of Alberto Manzi (1992, p. 88) these were the numbers: "half a million people who attended the courses outside the organized listening groups, one million people who gave the exams to obtain a title of minimal study and, above all, some millions of people, among the elderly and children who did not take exams because they were not interested in. But they had learned to read and write". Alongside this, should be considered the role of the program in the transmission of knowledge to a disadvantaged public due to physical conditions and therefore unable to attend school and more generally for contributing to the spread of conviction, in large sections of the population, of the centrality in our country of school and culture of knowledge. The success in educational terms of *Non è mai troppo tardi* is evidenced by international recognition (in 1965 UNESCO considered it one of the most successful programs in the fight against illiteracy) and by having inspired television educational models in about 70 countries.

I.2.2. THE OVERCOMING OF THE DIDACTIC TELEVISION AND THE INTEGRATIVE PHASE

The widespread dissemination of schools throughout the country in the late 60s no longer justifies the presence of *substitute school* television and favors the development of a new paradigm with *integrative characteristics*: disciplinary and interdisciplinary broadcasts that can be used as teaching materials to support/integrate the lessons. The didactic objective was to exploit the potential for involving the television language and at the same time its function as a substitute for the experience to bring the student closer to concrete cases. The basic pedagogical idea was that the description in film of facts and experiences, of episodes of history and past, of technical and scientific phenomena in the various disciplinary fields, as regards external stimuli for imagination and creative thought, for encourage reflection and conceptualization, to increase the degree of involvement and participation. To promote these objectives, two strategies were followed: the accompaniment of integrative school transmissions (TIS) with specific indications on how to effectively use a lesson; the second one is functional to the organization of teaching (duration of about 25 minutes, afternoon airing and replies the following morning, communication of the programming and the didactic cards well in advance).

However, these good intentions did not serve to overcome the same technical, didactic and organizational problems that had emerged clearly in the experiences related to the use of film technologies in schools. Problems that have determined an "intrusive" nature of the integrative television: lack of hardware, movement of classes in equipped laboratories, difficulty in matching

live programming (the practice of videorecording was not yet widespread) with didactic programming, have not favored the normalization of the use of technology and audiovisual educational content. Lastly, there were criticisms of the educational quality of the programs, marked by the lack of "pedagogical intentionality" (Bechelloni, 1973), and the technological skills of the teachers.

At the transition from complex film technology to television and video, simpler in terms of technical difficulties, did not correspond to an increase in teaching effectiveness in terms of significant learning. The analysis of this path has highlighted a problem that we still find today, even with differences depending on the contexts (school, university, professional training), on the need to accompany the use of technologies with the development of functional teaching paradigms at the new setting: "the greatest difficulty lies in the inability to see in teaching a living terrain of cultural elaboration, epistemologically complex, in which the relationship between teaching and learning proves to be dynamic and problematic and where the communication technologies bring, with their own specificities, a factor of change and added value" (Farné, 2003, p. 56).

With the reform law of the Rai of April 14, 1975 (law No. 103, *New rules on radio and television broadcasting*) the *School Education Department* (DSE) was born: "In order to enhance the educational activities of the radio and television media, also in the framework of a link with teaching experiences at a local and regional level, realized within the sphere of the legal competences, the radio and television department of educational and adult programs is established, the director of which is responsible to the general manager" (Article 13). The DSE was organized into ideational-productive and planning nucleuses that responded to the direction and had competence on all the school and adult education programs: the transmissions were conceived with a service value to school education, guidance, training continuous and professional updating. The evolution of technologies on the one hand (in particular the use of videorecording) the didactic limits of previous experiences and on the other, have encouraged a more aware attitude that led to a series of changes, the most important of which concerned the use of educational strategies in the direction of the first forms of multimedia education. The transmissions were complemented by paper educational units, video and audio cassettes that allowed personalized use and the possibility of further study. A new model of multimedia educational communication that attempts to exploit the languages of each medium and especially their interaction, in the enhancement of that connective tissue made up of the relationships between the different modes of expression. Moreover, the Video Home System (VHS) technology allowed a segmented, repeated, slowed down, stopped, as well as experiences of closed circuit television and the creation of media libraries in which to store programs recorded by television or self-produced.

These potentials couldn't attribute to the DSE a strategic role in the relationship between television and school, its programs basically served to legitimize the RAI public service function. The reason is twofold, to the traditional inability of the school world to use educational technologies effectively and structurally, plus the changed scenario of television. At the end of the '70s, paleotelevision strategically based on an educational logic had to begin to confront a new way of doing television: "Once upon a time, paleotelevision, made in Rome or Milan, for all the spectators, spoke of inaugurations of the ministers and checked that the public only learned innocent things, even lying. Now, with the multiplication of the channels, with the privatization, with the advent of new electronic devices, we live in the age of neotelevision" (Eco, 1983, p. 163). The acceptation of

Umberto Eco of neotelevision is mainly based on two aspects: competition and technological innovation, a broader definition of neotelevision, including the birth of new genres and new languages, is the one proposed by Francesco Casetti (1988). In practice, from a type of consumption subordinated to an organic structure of the palimpsest according to a highly pedagogical project and to that of the individual programs destined to be consumed passively and in their textual integrity, we have moved on to the possibility of choosing between different proposals, even joining them in a swirling dance of images. The terms of the game change: if the pedagogical television gave to the public, paraphrasing Reith, *what he needed and not what he wanted*, the TV with the remote control must provide answers to the judgments of the public, now, begin to express themselves not only in practice daily but also through the listening indexes" (Sorice, 2002, pp. 117-118). In order to win their own channels, programmers applied, above all at the beginning of neotelevision, some rules already tried and tested in the USA: playing on the safe side, making a show, reflecting the society's average values, recognizability, playing on the mistakes of others, protecting prime time (Menduni, 2002). These strategies were also typical of public broadcasters. Many of their leaders feared that if listening fell below a guard level, people would wonder why they had to pay a subscription fee, or a fee, to take advantage of a service that others carried out for free.

Also for these reasons the presence of the School Education Department in the schedules of the generalist networks has been progressively reduced, ending with occupying the most marginal time slots, early morning and night. The basic problem, common to all the other European public television stations, has been identified in the irreconcilability between the pedagogical demands of educational programs and the spectacular ones of television hunting for viewers: "(...) DSE's programs had to reconcile learning with entertainment, a difficult task and exposed to various dangers: the trivialization of content, pedantry and, more often, boredom. The failure of educational television was general " (Parascandolo, 2000, p. 134).

The Italian educational and teaching television, despite international recognition, has not had a significant impact, scientifically verifiable, either on the school or on the university. Moreover, even in the most technologically advanced countries, such as the United States, the same problem was found. In the indications of a series of authors (Cuban, 1986; Moss et al., 1991), the scientific evidence refers to teachers that are not interested in the use of audiovisual media due to the costs of equipment, the need for professional updating activities, incompatibility between the contents of the television programs and the school curricula.

I.3. MEDIA AND TEACHING COMMUNICATION

The experiences of teledidattica to which we have referred make it clear how the need of mediated didactic is not television as a means of spectacular communication, rather texts of an audiovisual nature functional to educational communication and to the processes of knowledge construction. Audiovisual texts constructed in such a way as to obtain learning results in the recipient. This awareness can only derive from choices resulting from research activities linked to principles of mediated didactic, for example in the relationship between the visual register and the sound, in the indications of Flores D'Arcais (1986), "despite the widespread conviction of supremacy, in terms of persuasive capacity, of the image on the word, we must ask ourselves whether the order or invitation or advice to accomplish something will be better guaranteed by verbal or iconic language: which of

the two, that is more suitable to highlight the conative function? The recipient - the pupil, the educating - is more influenced by the word or image?" (p. 8).

The research relating to the use of audiovisuals in education is naturally linked at this stage, both to studies on mass media, in particular cinema and television, and to the psychological theories of learning processes (Galliani, 1986). The first attempt to introduce a real methodical approach to the study of the film dates back to 1964, the foundation date of the semiotics of cinema that corresponds with the publication of the article by Christian Metz, *Le cinéma: langue ou langage?* Semiotics in its complex and protean theoretical and procedural carats has granted the audiovisual text and its linguistic, symbolic and pragmatic interaction with the spectator an accurate and articulated interest. The mechanisms of functioning of the nature of the audiovisual language identified in the syncretism of the materials that compose it and the heterogeneity of the codes that govern its significant manifestation have been investigated (Bettetini, 1996). His double statement was studied: visual (images and graphics) and sound (ambient noises, effects, speech, music). Through these studies, they have obtained valuable indications on the mechanisms of signification and on the role within these mechanisms of the communicative elements that come into play. Luigi Chiarini in the *Art and Technique of the film* questions the difference between word and image, is like saying the difference between the abstraction of the concept and the concreteness of the reproduced image. The word has a synthetic capacity superior to the image because it directly expresses the concept, but if it wants to give reality a more analytical as possible and objective representation, it will never be able to compete with the image, neither for completeness nor for synthetic force. On the other hand, the image can not directly express an object because everyone can figure it in a different way. Again, the image does not always offer completeness or analytical representations of the object; the word, in the same way, is not always linked to an unchangeable meaning. In practice, the contribution of semiotic research, in the indications of Galliani (1979 a), was fundamental not only in giving cultural dignity to audiovisual communication, but in dealing with non-verbal sign systems with scientific instruments, even if for many questionable ones, providing the users for educational purposes of this new modality of expression the elements to deal with the problem of didactic communication in the school in a less spontaneous or idealistic way.

Within this context, in Italy, the research of pedagogical area on the relationship between audiovisual and didactics, after being conditioned by the behaviorist theories, and even referring to studies of semiotic and psychological derivation, has developed since the second half of the '70s a theoretical disciplinary framework on the originality of educational communication. In the presentation of his text *Il processo è il messaggio* Luciano Galliani (1979 a) writes: "The media and messages of audiovisual communication have so far been analyzed with the eye of sociology, semiotics and ideology. The book attempts to construct parameters of study according to the eye of pedagogy". Work already begun in the previous decade by the research group on Educational Communication Technologies of the Department of Educational Sciences of the University of Padua, which has conducted numerous studies and research on the methodologies and teaching of audiovisuals, investigating the different ways of representing the knowledge of both technological devices. We are referring to these studies to summarize the theoretical framework of reference in those years, but also to give useful and current information even today on the audiovisual relationship and mediatised educational processes.

In the indications of the researcher of the University of Padua, the path to be followed by pedagogical research immediately became clear. The starting point was to overshadow the instrumental use of the media (supports the transmission of information) in favor of a rationally programmed use of the overall educational communication intended as "an e-Ducare, and therefore a truly to assimilate, to refer to oneself, to give a personal form to the contents offered, and therefore to transfer the data in the act, the passivity in an activity (Flores d'Arcais, 1960). Is is clear how the use of the media should be addressed to the learning process: "because it is not only a question of giving information but also the ability to retain them, to organize them, to form concepts, to produce principles, to solve problems, to take actions, to achieve new behaviors, all supported by motivations intrinsic and extrinsic" (Galliani, 1979).

The construction of this autonomy of the pedagogical analysis, far from technocentric and instrumental visions, took place through a harsh protest, writes Luciano Galliani (1986), both of the behaviorist theories and of the Piagetiana (Piaget's condemnation of 1969 in the comparisons of "pedagogy based on image"), but also with a critical assumption of the psycho-semiotic, socio-anthropological, physio-neurological contributions. The theoretical reference, in Luciano Galliani's indications, more functional to the pedagogical investigation appeared a line of psychological research that studied mental operations in relation to visual perception ("theory of form"), able to define the outlines of a "visual thought" confirmed, on the physio-neurological level, by the theory of the functional asymmetry of the two cerebral hemispheres. Therefore an interdisciplinary approach - of social psychology and intercultural psychology (among other things of the same Piaget school), of semiotics, of neurophysiology - has appeared central in the theoretical pedagogical reflection on the relationship between the modes of the symbolic representation of reality and the ways of learning: "the learning induced by the iconic and audiovisual messages calls into question primary mental processes and also differs on the neurodynamic plane, so it is not based on a logical scheme corresponding to the linear structure of verbal and written messages, but on a statistical scheme demanded by the simultaneous and empathetic structuring of iconic and audiovisual messages" (Galliani, 1972). In practice, it was a question of investigating the mental attitudes used in the process of acquiring knowledge, structured and transmitted through the various means of communication, so as to make a "functionalization" to make teaching processes meaningful.

In this direction it is intended a research project carried out by the group of researchers in Padua with the aim of identifying the elements that influence the mediatised learning, that is the "forms" or "presentation/representation modalities" (the style of presentation, information structuring, symbolic coding systems). It seems opportune in consideration of the type of work done in Padua on audiovisual messages aimed at teaching-learning processes - the starting hypothesis was that given an audiovisual message built for teaching the effects produced on the learning plan were different according to the ways of structuring and the articulation of the relationship between iconic signs and verbal signs - summarizing some preliminary studies. One on the word-image relationship as an educational function within an audiovisual text (Bernardinis, 1986); the other on the functions of the word and the relative modalities of the enunciation in the soundtrack of the audiovisual (Amplatz, 1986). In the first study we analyze the relationship between visual text and verbal text to evaluate the different functions that they can assume in an educational context and how these functions influence the interpretation of the message. The importance of the different role played by iconic language and verbal language is emphasized: a highly codified verbal language, evaluated and

analyzed in its most diversified aspects, in contrast to an iconic language to be defined for which it was necessary to find a grammar and a syntax. In general, we can identify three ways to relate between image and word in the audiovisual text (Jacquinot, 1978): the case in which the image occupies all the perceptual space and the verbal element is therefore a subsidiary function; the case in which the word has a driving function and the image is purely illustrative; the case in which image and word operate in simultaneity with its own functional space.

In the second, on the functions of the word, Cristina Amplatz wonders about the optimal criteria on which to base the construction of the verbal register in an audiovisual message for educational purposes. Central question if we align ourselves with the position of those scholars in favor of the centrality of the report, among all the available signs, in the messages of a didactic nature. Garroni in particular, while emphasizing the necessary functionalization of all the components potentially present in the audiovisual language, underlines how an informative-didactic message, among the conditions to be defined as such, provides that information must be transmitted at the most explicit level possible, and then through a dominant use of verbal language in its specific cognitive (or restructuring) function (Garroni, 1972, in Amplatz). Consequently, it can reasonably be assumed that especially in the context of this macrogenere of texts there is a need to pay particular attention to the construction of speech, given here the important responsibility of verbal modality in specifying the effects of audiovisual learning. Cristina Amplatz cites a series of other experiments, on the relationship synchronism/asynchronousness between image and word in relation to the effects on learning (Mialaret, 1976; Croce, 1974); on the optimal density of verbal commentary (Carpenter, in Nozet, 1955) in terms of number of words per minute of projection; on the speed of elocution (Mialaret, 1976) based on the age of the recipients of the message; on the simplification of an audiovisual text without diminishing its information (Graziani & D'Orsogna, 1976); on the decomposition of complex periods into simpler ones, according to syntactic criteria of coordination (parataxis) rather than on subordination (hypotaxis), and on the use of the active form rather than on the passive. Without neglecting the modality of the enunciation, that aspect of the text that does not concern the expressed concept, the content, the thing of saying, but the way of saying a certain content.

In conclusion, the cinema and even more the television made us to think of a society in which illiteracy would be defeated and richer from a cultural point of view. We have seen an enthusiasm for these technologies at the service of teaching similar to what we find today when we talk about the possibilities of the network and multimedia as tools to improve the teaching and learning processes. The concrete result is that over time it has been realized that the most optimistic visions have gradually lost energy. The school appears as an almost marble system in its procedural ritual, codified in its time and space, not inclined to use teaching methods other than those known.

The video for his characteristics – simplicity of use, economy, personalized use etc.- seems more appropriate for a use on educational processes.

Chapter II

VIDEO PEDAGOGY AND VISUALS COGNITIVE ARTIFACTS: FOR MULTIMEDIA DESIGN IN EDUCATION [5]

On the occasion of the international conference *Online Educa Berlin* in 2012, the inventor of the term e-learning, Jay Cross, in a session dedicated to the use of video on educational processes stated: "Video is the new language of learning" (in Goracci, 2014). In Chris Anderson's indications, one of TED talks editors, the growth of educational video on web is determining the *Crowd Accelerated Innovation*'s worldwide phenomenon, a self- perpetuating learning cycle which could become just as important as the invention of printing (2010).

But if one intends to exploit technological opportunities, school and university institutions will have to face, on one hand a radical cultural openness, on the other, they will have to develop research activities able to identify educational methods and strategies functional to the effective use of video resources.

In the previous chapter, we saw how the initial enthusiasms about the use of cinema and television on teaching processes didn't bring a systemic adoption at schools and universities. The video for his characteristics – simplicity of use, economy, personalized use etc.- seems more appropriate for a use on educational processes. Since between the Seventies and Eighties in Italy the debate related to the use of video as an educational resource testifies the interest of the scientific community toward such technology (Bettetini, 1979, 1984; Laeng, 1980; Pizziola, 1981; Galliani, 1979; Galliani e Luchi, 1983; Maida, 1983). Despite this, apart some applications in technical-scientific disciplines also "the video didn't find a structured use on educational trials because of cultural resistances and organizational and logistic matters, as well as methodological" (Bonaiuti 2010). Cross and Anderson's affirmations can reasonably make think that the situation is different, that it's the signal of a change taking place that, especially in informal educational environments, is creating interesting possibilities for the construction of contents and knowledge.

Sometimes according to principles based on saving economic aspects and poor from an educational point of view. It is the case of the use of video, under the concomitant pressure of global economic crisis and development of the ICT, as an almost miraculous newfound to guarantee a mass education with relatively contained costs (Rifkin 2015). Speaking of such use of the video online, for example in MOOC form (Massive Open Online Courses), the university of Bedford (Carmichael 2013) warns against easy enthusiasms, and reports next to the rhetorical emphasis that follows its introduction in the university instruction - characterized by concepts like openness, learning centred on the student etc. - the disappearance of the pedagogy and the transformation of learners in online contents consumers.

Other times digital videos in their versatility can carry out rich and stimulating functions under the pedagogic profile, for two reasons: a) their characteristics and communicative peculiarities involve by now the individuals, especially younger people, as consumers and producers of images;

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[5] The content of this chapter has been published in Italian (Ganino, 2018).

b) because the digital revolution of the last decades favoured pedagogic research activities in the sector of the educational technologies.

The use of the video may be able, therefore, to give a valid support to for teaching and learning processes, if prepared in the planning phase of the formative intervention. To avoid the aesthetical deception that an usual tool, but of difficult decoding, could induce in the students, above all in terms of cognitive load, it's important that the use of these resources, either built "ad hoc" or collected online, is subordinated to clear methodological principles. Today, a help in such direction, comes from the studies of multimedia learning and loading cognitive theories, dealt with in the following chapter (Sweller, 1988; 2010; Mayer, 2008; Clark & Lyons, 2010). Such studies give very precise indications of the utilization of cognitive resources used in learning processes that make use of multimedia expressive forms (images, words, sounds and their combinations) and on how they can be addressed to specific educational targets. The knowledge of multimedia learning theories and relative guidelines, from planners of teaching resources (Instructional designer), makes the connection between teaching learning processes more effective. The learning of a concept, of a certain ability, of a technical-scientific procedure, is hindered or complicated if the cognitive resources of the individuals are spent for assignments not directly linked to the primary educational objective.

II.1. THE ORIGIN OF VIDEO AND FIRST TEACHING APPS

In the previous chapter, we mentioned the researching activity of the University of Padova's group *Educational Communication Technologies* aimed at identifying a pedagogical model of educational communication directed at build audio-visual texts capable of obtaining learning outcomes in the recipients. Studies begun in the 1960s and naturally connected, at least in the first phase, to mass media: about the mechanisms of significance of audio-visual language in teaching function, about the characteristics of distributive channels. Many suggestions from the research team of Padova are still currently in use within the era of video and digital communication, and for this reason we will resume it throughout the chapter.

In order to fully understand the potential of video communication in the field of education, it seems appropriate to briefly review the story of this expressive mode from television derivation, generally defined as video and considered as: "light, personal, independent, artistic, social use of the electronic image explored and practiced outside the studios, broadcasters, apparatus, in short, the production and diffusion of commercial or state television" (Lischi, 2005, p. 12). In this definition, the experimental vocation of this technology is clear and therefore the possibility to offer support for the teaching processes:

1. the creation of closed-circuit television systems that allow a cold and reasoned use of audio-visual communication in the educational and teaching field;
2. the video becomes a commonly used audio-visual communication tool: it replaces the use of small super-8 cameras in private, amateur, family, and teaching productions;
3. the video gives rise to the process that led to the emergence of the latest digital technologies and the resulting simplification of work processes in the sector; this allowed the activation of audio-visual production activities in schools;
4. video documentation of research projects and teaching practices increase;

5. the video, despite its limited distribution capabilities, lends itself to the construction of information, training and participatory paths;
6. video in all its forms (educational video, video lesson, web conference, etc.) today is perhaps the most used cognitive artifact in mediated teaching processes, both in formal and informal environments.

Video communication is greeted as a real revolution in the media system: making television programs meant to follow highly-codified industrial and work-coding procedures (genre and format system) to ensure success in terms of number of viewers. Conversely, the video, which is not subject to market laws, has allowed greater creative autonomy: "By making a schematic, the video is on television equipment like independent cinema is in Hollywood (...). We can say that in some respects *the video is television that is not there*, the television that could have been, a television capable of fully exploring and exploiting its own language and reserving a space for art, experimentation, an innovative narratives, in search of new forms of expression, new genres, new and informative modes of action; and at the same time we can say that the video collects abnormal and un-coded forms of "cinema", from short animation to documentary, to experimental" (Lischi, 2005, pp. 26-27).

For these features, video has become central to the use of technology support research, and in many educational and teaching situations. In a school program, video recording has enabled, for example, the introduction of audio-visual message in an autonomous, decentralized and selective way and in the most appropriate place and time, in relation to the learning path that the group was pursuing (Galliani, 1979 a). They were born in the 60s and 70s with this orientation several international experiences of closed-circuit television (CCTV) aimed at *making television* in pedagogical optics. As mentioned, the Italian reference point was the group of researchers at the University of Padova who headed the *Methodology and audio-visual didactics* chair of Flores D'Arcais and afterwards of Luciano Galliani. The experience whose origins date back to the 1960s and consolidates over the next decade has an innovative value: it is the first time in Italy that within a pedagogical action the size of the critical reading of the audio-visual was accompanied by that of writing. It all turned around a closed-loop television experimental laboratory, built in 1967, whose main purpose was to articulate research in an industry that was gaining importance on the social, cultural and communicative processes of the time (Galliani, 1979). In this sense, closed-circuit television has assumed its own specific orientation, not a low-cost and decentralized filiation of the television industry, but an "integrated system of planned and oriented techniques for educational and teaching purposes" (Galliani, 1976, p. 5) capable to use all the hardware and software arsenal of the great family of audiovisuals in pedagogical optics. Primarily not for information processes typical for open circuit television (eg RAI), but for those of educational communication focusing on participation and feed-back processes. Specifically, closed-circuit television has been functionalized, according to Galliani's instructions (1976, p.6), as follows: documentation-recording-distribution technique, *team-teaching* technique, *team-learning* technique, form of expression-communication, search tool.
Several innovations have appeared in such a vision, followed and reproduced in later years by the media education disciplines (media literacy, media education, education to the image):

- the ability to record on videotape TV commercials coming from open circuit television (cultural or educational programs), and messages coming from the inside of the educational

institution (teaching materials, laboratory experiences, television productions) allowed the creation of a functional archive for an audio-visual use in a teaching key (education to media and with media);

- in the use of closed-loop television as a team-learning technique, it has been proposed, among other things, an active use of the means. Audiovisual as a means of production in the hands of students and research groups becomes a message built and used directly as a means of knowledge and cultural research internally to the learning processes (Galliani, 1976). In this perspective, it began a course that introduced in formal contexts, activities of media production and active teaching, in conjunction with already codified experiences of critical reading and analysis;
- closed-circuit television technology has been used in the training of teachers: for example, the role played by cameras in the classrooms with the aim of observing and allowing a subsequent analysis of the behaviour of the teacher and pupils in a didactic situation;
- closed-circuit television has enabled the creation of an environment where teachers, students, cultural operators, and users connected on the territory could communicate and interact. Creating in this way an adept circuit that enabled the student on one hand, to participate in knowledge-building processes in real situations and, on the other, a closer relationship between school and territory.

II.2. DIGITAL VIDEO AND TEACHING PROCESSES

In current teaching and educational practices, especially in the digital education sector, in the light of technological and cultural evolution of the last decade the use of video communication in mediated didactic teaching processes has increased a lot by quantitative point of view. Digital content for LIM (Multimedia interactive whiteboards), video lessons by which content are transferred through massive online open courses (MOOCs) and ones for distance training, tutorials that make millions of views on YouTube, broadcasting content classroom lessons based on the principles of the web conference, the new visual esperanto featuring multimedia presentations, the same students who use the video to communicate what they learned, testify to the centrality of the didactic video in the presence and distance learning processes in environments formal and non-formal.

In the light of the possibilities offered by the digital instruments in terms of very large production and publication of previously non-existent video circulation, we can'tt disagree with Filippo Bruni (2013) about possible educational implications: "if we have receive the indications coming from both evolution the use of dynamic images and the careful testing of their effectiveness, it may be significant to explore a wider variety of uses".

II.2.1 THE DIDACTIC VIDEO: DEFINITION AND CHARACTERISTICS OF THE GENRE

In the almost total absence of bibliographic material on educational video, neglected by both communication experts and scholars of educational technologies, it has become crucial to try to outline its boundaries and characteristics.

This kind of audio-visual seems to have some relationship with the dissemination television, where, according to the indications made by *Lo Zanichelli*, it's attributed to the word *divulge* the meaning of s*preading, propagating, making known a fact, an event*, but also *making it comprehensible*. The dissemination process, started with the press, finds in the television language, more immediate and engaging, a precious ally to make complex concepts understandable to a wide circle of people, according to Piero Angela's motto: "on the side of scientists for content and of the public for language".

However, in the first chapter, we also saw a great difference between television marked by a spectacular and engaging language and educational television with educational intent. Those communicative elements that work on television as catalysts of attention in a teaching video can be distracting. Excessive use of synthetic images and spectacular animations can attract the student, but without any benefit in terms of learning.

In many cases, the didactic video, where linked to specific learning objectives, unlike the disseminating video, must have, on the one hand, less engaging and more concise language, on the other hand, a thematic and one way concept structure. It means that audio-visual text, a combination of different languages through a staging process, must be able to contribute to the learning process. It is not enough, therefore, to convey information, but the result of the vision must have a significant impact on the student's ability to solve problems, create concepts, organize and feel the new information. In practice it must be able to obtain a result in terms of behavioural modification in the student.

The main goal must be to communicate concepts in a clear way and didactically effectively, to this end, if necessary, the communication strategies based on spectacularization can be sacrificed, in favour of a functional language that makes the pedagogical moment significant. Central in the educational video is the *modum*, the form, the structuring of the information, style of presentation, the expressive solutions employed must avoid the use of combinations of sounds and images that distract the viewer from the didactical information by giving priority to the medium rather than the message (Ellington, 1987).

II.2.2. POTENTIALITY OF TEACHING VIDEO

We have seen in the previous chapter the potentialities and criticalities of the use of visual, television and film resources in educational processes. The undoubted educational potentialities that can be synthesized for better seeing, in bringing school and university closer to real life, in favoring students' motivation, in providing distance learning opportunities, has not led to meaningful teaching practices. Methodological problems due to teacher training and the inadequacy of specific research activities on these issues, high technology costs and difficulty in using instrumentation hindered the use of these resources. The features of digital video and the increase of experimental activities in the field of educational technologies seem to give impulse to the didactic video, namely the use of audio-visual technologies guided by clear methodological principles.

From a technological point of view, digital video, in addition to being easily accessible, has a number of features that extend its application possibilities in terms of educational applications: possibility of using resources from numerous online databases; ease, through the use of simple messengers, to isolate short fragments that contain the relevant didactic information; digital players

installed on common computers allow teachers and students to perform slow motion, acceleration, reverse view, slow motion effect, to get more analytical and in-depth visions; easy-to-use video editing software allows you to assemble the most relevant parts of different videos in a single sequence; possibility to customize self-produced or archive video with interactive features through the use of simple online applications; possibility of self-production of audio-visual teaching resources with the use of cost-effective and cost-effective shooting and mounting technologies.

Below the summary of the didactic potential found in the literature of digital audio resources, before dwelling on the methodological aspects.

Pictures like visual prosthesis. Motion pictures, said about cinema and television, are fundamental to the vision/explanation/analysis of situations where the dynamic element is central and when the text, spoken or written, can only give an abstract idea of the phenomenon in its evolution. For example, when the image becomes a *visual prosthesis* for the peculiarities of its own language: a) recording and subsequent study of events that occur in the real world, impossible to see with the naked eye (because they are too slow, too fast because they happen in unreachable places (too far, too hot, too cold, etc.); b) really possible reconstruction of situations/events in a probable way that is not adaptable to technological support (as they have happened in the past or because they still have to happen as in the case of research prototypes).

Audiovisual time and study time. A series of peculiarities of audio-visual technologies (intermittent or time-lapse shooting, acceleration and slow motion, pause), allowing you to intervene on time management, make an important contribution to the analysis of many aspects of the reality represented. Interlaced shooting (or time lapse) allows you to record at a predetermined interval a naturally slow phenomenon (flower apertures, plant growth, a body or fruit decay, creating a painting, passing from day to night etc.) to get an accelerated view, suitable for study activities. In contrast to accelerated or high-speed shooting (made thousands or tens of thousands of frames per second), it is possible to slow down the timing of a very fast phenomenon: ballistic studies, for example, use this type of shooting to study the impact of bullets on human bones. Accelerated or slowed sequences, which are now easily available with new generation and inexpensive cameras, can be used in different areas and in functional, study, observation, research, or spectacular purposes. More generally, the personalized management of video-viewing and study time plays an important role in learning processes. Bonaiuti (2010) citing studies on cognitive load (Sweller, 1988; Clark, Nguyen & Sweller, 2006) pointing to the criticality of the educational process in the presence of different learning abilities and the relationship between student understanding skills and the sliding speed of the video (Lowe, 2004), identifies the potential of personalized vision and slowed down as a response to "a precise didactic need: fostering full understanding in each student" (p. 80). Research on cognitive load has highlighted how don't load too much the work memory of learning subjects. In the case of a video we are faced with a text full of meanings whose understanding requires different visions, each vision offers the possibility of identifying new meanings and details. Understanding visual content requires observational and inferential capabilities that depend on personal skills and therefore vary from subject to subject. In a personal use as in e-learning contexts, the learner freely manages the video's enjoyment, according to his own time and abilities, but is different the case of a vision in the classroom. In this case "the teacher has to mediate the needs of each student by adjusting the rhythms and favoring the participation of the entire class. For this reason, it may be helpful for the teacher to interrupt the vision of each segment, as well as with its own comments, even with questions to verify

understanding. The viewing of the same passage can be repeated at a later time or, depending on your specific needs, with different modes: without audio or video, with subtitles, etc., in order to encourage unusual or in-depth observations" (Bonaiuti, 2010, p. 81).

Increased vision and ubiquitous student. A series of techniques allow you to get the magnification and then the infinity small (microorganisms or microscopic structures) observation through cameras or video cameras connected to a microscope. Again, applications may be different, educational, of research able, or may be the subject of dissemination.

Thanks to the use of powerful telescopes or telephoto lenses, it is possible to record phenomena that occur at considerable distance, even astronomically. These images made by robots equipped with electronic vision and data transmissions allow you to show inaccessible places. Today, the combination of radar images and radar scans made by satellites allows you to precisely map the entire planet and remedy past cartographic errors. Observing the earth from above enables us to recognize the beauties or offenses caused by man, or to understand the economic and social evolution of a territory.

In the field of *simulation or reconstruction techniques,* in recent years giant steps have been taken, computer graphics technology is now emerging from its experimental phase and is increasingly used in the field of dissemination, teaching and demonstration. The perfection achieved by the three-dimensional reconstruction naturally requires an ethical reflection, the spectator today can no longer distinguish an image taken from a camera, and therefore existing, from realistic but totally synthetic images, invented, to the point that there is who proposes to enter the D.O.C mark on films made without the intervention of digital effects (Fornara, 2001). Evidence as a criterion of truth has lost all meaning, today for the first time the image is an autonomous, synthetic product, completely independent from the real, pure result of human creativity. This can't happen without cultural consequences, the first of which is indifference to the truth, new technologies make fake and true interchangeable, at least at a perceptive level. In practice, the inflation of an apparent truth, the result of simulation, deprives the truth of its sacred aspect (Freccero, 2010). By simulating the presence of a virtual operator anywhere and at all times, past and future, it is possible to allow students to otherwise impossible experiences:

1. bring living beings back to their realistic form (think of documentaries or films that have as protagonists dinosaurs extinct 65 million years ago);
2. show the urban context of monuments and historic buildings in different periods;
3. see the treasures of archeology that have been lost due to natural catastrophes or intentional destruction;
4. view all that happens within the human body in the most diverse situations;
5. simulate machining processes in the fields of industrial, engineering and architecture;
6. allow training and teaching activities.

The use of animations in the representation (content graphic representation) of content can help students understand the variation of states or the operation of objects over time and can offer a simplified representation of the subject treated, making it easier to recognize forms and the evidence of crucial passages (Bonaiuti, 2010, p. 61). But it should be emphasized that the search for animated graphics comparing to static one, is not encouraging in the light of the greater ease of complex

animations to violate the dictates of communicative norms related to the principles of multimedia learning (Tversky, Morrison & Bétrancourt, 2002) .

More generally, in the indications given in the literature, the functions of visual communication in the teaching processes functional to the construction of "make meaning" appear different:

- describe visually facts and experiences;
- offer schemes and symbolization to form concepts;
- guiding reflection and interpretation to form principles;
- replace mental operations;
- presenting models to enhance performance and skills;
- provide external stimuli to feed imagination and creative thinking;
- stimulate intuitions, represent different points of view and complexity of situations;
- simplifying abstract and complex concepts by displaying concrete examples, simulations, behaviour patterns;
- raise questions and encourage processes of cognitive processing;
- vary the level of formalization depending on the type of message you intend to convey;
- stimulates the perceptual and visual-spatial intelligence that all people possess in varying degrees (Gardner, 2005, in Ravazzani, Mormon & Moroni, 2015). If the word describes and favors an unequivocal understanding, the image instead is able to capture the attention and stimulate the memory regardless of its style of learning and the culture of belonging (Paivio, 1986).

II.2.3. METHODOLOGICAL INDICATIONS

The didactic potential of the images is certainly exalted through a clear methodological and design system. Basically, in training practise it is necessary to contextualize the information provided so far, in a different way depending on the various disciplines. Bell and Bull's (2010) indications suggest that teaching video is not a generic methodology, teachers have to implement precise strategies according to different disciplines: in them book they reported a series of indications result of disciplinary research activities (in social discipline, technical, artistic, humanistic).

A good methodological approach according to Bonaiuti calls in question a greater awareness of the different elements that need to come into play in educational processes: "To achieve more ambitious learning outcomes, such as the ability to evaluate, rework and apply in a competent way as acquired, it's necessary to provide students with working tools that are capable of promoting analysis and reflection. Encourage pupils to watch the video focusing of a few steps, focus on certain details, or seek answers to specific questions, make them progress in this direction" (2010, p. 87). This means that you have to design the didactic intervention through a series of activities, both before and after the use of audio-visual material, functional in logic of deepening, comparison, reflection, self evaluation. The stimuli offered by the audio-visual representation of events/situations to become knowledge acquisition must be compared with classroom (in present-day situations), or with extended groups (in situations open to network logic). Discussion, constructive comparison, verbalization, and argumentation are activities that turn the video's vision into meaningful learning (Pontecorvo, Ajello & Zuchermaglio, 2004) and explore new ways of questioning and solving problems (Brown, Collins

& Duguid, 1989). Consequently, interaction and constructive relationship have a significant didactic impact: "Comparison with peers, even emotionally and affectively, allows them to expand their knowledge and to change their own viewpoint and behaviour through negotiation" (Bonaiuti, 2010, p. 90).

The planning. Learning through video use, as seen, requires the application of careful planning ranging from choosing the video to designing activities to be taught in lesson or on the Net.

Videos must be selected at a first level for their ability to attract and intrigue, then they must also be able to stimulate and ask questions. "In some disciplines, you can use videos made up of heterogeneous pieces, "blob", to stimulate memories and to activate associative mental processes. In other areas it can be a short documentary, a movie scene, a cartoon, a music video clip: the important thing is to set up a problematic context to work on" (Bonaiuti, 2010, p. 78).

If you want to make visual stimuli compete in the construction of complex meanings, the emotional involvement of the student must be adequately accompanied by critical reflection through the teacher's intervention and a series of strategies that can help systematize the experience, from the directions to give to students *about what* and *how to look.*

Another important aspect is respecting the *time of attention*, depending on the length of projection, on the characteristics of the users, and the complexity of reading of the resource used.

All aspects that should help to achieve the learning goal: content can be useful in introducing a new topic to arouse interest in students, or, inserted during or after lesson, to deepen or reflect on the topics addressed. Using video as an introductory material enables the function to anticipate the carrying structures of the subject discussed, on which build further knowledge, function defined as *advanced organizer* by Ausubel (1968).

II.3. FROM VIDEO TO WEB: YOUTUBE EDUCATION

Scholars from many disciplines are questioning about communicative perspectives (symbolic forms, linguistic and aesthetic aspects) and on the educational, cultural, social and economic significance of online video. Also in the field of pedagogy. Digital technology adds to the potential already seen of the analogue educational video, the possibilities of distribution/circulation in the network of audio-visual documents, the reuse of huge amounts of video resources, the integration of sequential video communication with the principles of multimedia and digital media. The topic has been treated in *Televisione 2.0. Tra produzione mediale e pratiche educative* (Ganino & La Vecchia, 2013), to that text we refer in this paragraph.

The innovative charge of online video appears to be revolutionary even if compared to the changes made by television. In a definition dating back to just under 30 years ago of Stephen Heath (1990) about the methodological challenges in understanding the television medium, it was evident that television was a difficult, unstable, ubiquitous object: given the speed of its transformations (in technology, in economic models), its infinite flow, its measurable daily life. In our view, this methodological difficulty is even more evident in YouTube's analysis processes. YouTube is an even more unstable study object marked by dynamic change, multiplicity of content that can not be grouped into specific editorial categories, dual platform features, *top-down* popular culture distribution, and *bottom-up* for vernacular creativity .

Any reasoning on YouTube to understand its educational and teaching potential can only start from its numbers. It's the most visited website in the world after Google and Facebook, it has over a billion users and every day people watch hundreds of millions of hours of video and generate billions of views, half of which come from mobile devices. YouTube exists in 88 countries and is available in 76 different languages (covering 95% of the population on the Internet). Every day millions of subscriptions are made and, compared to last year, the number of daily registrations is more than quadrupled. YouTube's "Partner" Program, created in 2007, has more than one million creators from over 30 countries around the world generating profits from their videos (the number of channels that earns six-digit revenue per year on YouTube increases by 50% on an annual basis).

Certainly, its evolution took place in ways not defined by its founders: "The apparent or declared mission of YouTube has continually changed due to changes in business practices and different use from user" (Burgess & Green, 2009, p. 3). Just think of the conflict between the subtitle on the site at its birth, "The archive of your digital videos," and the subsequent exhortation to broadcast yourself, "Broadcast Yourself." The shift from a logic of archivation to the use of the platform for public self-expression is an example of the participatory dynamics of the revolution conducted by the users that is discussed so much in the era of Web 2.0. In this regard, it was debated whether the technology was making possible the growth of participatory cultures, or, if the participatory practices, already existing before the birth of Web 2.0, prepared the ground for platforms like YouTube. Among the main supporters of this second position, Henry Jenkins (2006) emphasized the centrality of the various communities of fans, brand communities and subcultures, who through this common portal, learned techniques and practices from each other. In this sense, YouTube is characterized by a form of cultural collaboration.

If we join Jenkins's thesis, it is clear that the value of YouTube is not only economic (business activity as a business enterprise) but also educational, cultural and social, and how this mix of value is determined by users through new forms of consumption, generation of content, platform enhancement, and entrepreneurial activity from the bottom (Burgess & Green, 2009). According to this perspective, the centrality of YouTube within the current educational and cultural processes is evident: "participatory culture is not a rhetorical or set up exercise, it's really its core business" (Burgess & Green, 2009, p. 5).

From an editorial point of view, YouTube lets video content of different origins, broadcasts, professional videos, and user generated content videos, with spectacular, informative, commercial, non-profit, educational functions, to interact in complex and unpredictable ways. As such, YouTube represents, on the one hand, a site of conflict and renegotiation between different forms of power (Jenkins, 2006), on the other hand, lets us observe the guidelines of the vision regime of recent years (Nencioni, 2011). The twentieth century, as mentioned, was considered a century dominated by visual culture: first cinema, then television, then played an important role in determining the collective imagination. Today, these coordinates have to deal with other types of images, those available on YouTube: "Window on the world, or better, a global-size lock hole that has incorporated into a single imaginary film and television frame, information, entertainment and private life that forces us to remodel our idea of enjoyment of moving image" (Nencioni, 2011, p. 53). For all these reasons, the relationship between YouTube and the teaching and education sector is very strong.

II.3.1. PARTICIPATORY LOGIC, DIGITAL LITERACY, EDUCATION

The social dimension in YouTube has been mentioned as central for several reasons. YouTube is the most emblematic thing expressed by the participatory web culture, the simplicity of its use has favored self-sufficient practices to any type of user, is a service that has launched video sharing activities. All features that bring it closer to social networks and attribute it social potential. The user can naturally watch videos but may also express preferences and comments through a simple like/dislike or by entering critics or appreciation, can tag content. Within the system you can express relationships through video reactions. The contacts between the authors made with the tags and the comments but also with the video-responses generally respect the thematic coherence criterion: that is, socially connected groups treat similar content (Paolillo, 2008). Other tools for building relationships between users are friending (the mutual request of being friends) a subscription to the channel that allows you to be updated on content posted by a certain user, participation to collaborative videos, or collaborative channels, shared between multiple users. The purpose of collaborative channels is to find expressive forms for a specific audience sharing the same interests or to be used as a means of communication between members.

The social relationship on YouTube is also central for the circulation of published videos, favoured by the reputation of users depending on both the quality of their videos and the number of subscribers to their channel. Being part of a network is now an important value, surely greater than a business card or business suit: once thousands of friends are accumulated, everything published becomes a very powerful marketing tool. From many parts is emphasised how on YouTube what is really important are the dynamics functional in community building.

One of the most obvious signs of participatory culture is the production and sharing of creations: the subjects involved give much weight to the importance of their contribution and feel somehow connected to each other or at least are interested in opinions that others have of their productions (Jenkins et al., 2009). Technologies 2.0 and their media practices allow not only to enjoy *mainstream* stories proposed by media, but also to "write their own story" (whether it's a post on a blog, a YouTube video, or even a sequence of message on your own Facebook's wall), then publicize it and try to make it the protagonist of media space. Young people born in the age of Web2.0 are, therefore, the first generation aware of their centrality in cultural processes that are becoming in this way less industrial and addressed to niches of consumers, representing the different instances, traditions, beliefs, ways of life. We are faced with the creation of a new symbolic space, which Castells (2009) defines as "mass self-communication", rich in heterogeneous cultural forms, personal and collective content, individual stories in tune, but also in counterpoint and "almost mediated interaction" (Thompson, 1995) with the system of recognized sources. There are some who question about the ability of user-generated and self-regulated expression to evolve in contributing to the public cultural sphere and knowledge growth (Hartley, 2008). Finally, the reflections on the concept of cultural product must be framed within that profound transformation of the centrality of communicative exchange in the *media conversational system* (Peverini, 2012).

All of this undoubtedly supports democratic processes, but it is essential for more digital literacy: the greater the number of people who can create cultural meanings within a new form of digital citizenship, the more solid this participatory democracy will be.

The phenomenon of widespread author, now is clear, must invest the educational problem. The theme of education for partecipation, already dear to John Dewey (1916) in his reflections on the

relationship between education and democracy, is becoming increasingly important (Jenkins et al., 2009; Mortari, 2004, Santerini, 2010). It is no coincidence that, in technologically advanced society, the problem of digital divide, understood until some years ago as access to computers or broadband network, today includes the idea of an obstacle to participation (Jenkins et al., 2009). The focus is therefore shifting from a technological problem to a multi-literacy issue, attentive to both reading and writing skills, in order to promote, in the instructions of Ofcom, "the ability to receive, understand, comprehend and create communications in a variety of contexts" (http://www.ofcom.org.uk/advice/media_literacy/of_med_lit/whatis/).

Certainly, production and collaboration activities meet both the student's favor and in this way they can represent their enthusiasm and interest by using expressive forms next to them as well as that of many educators in virtue of the resulting social dimension. "Doing" involves division of tasks within a collective work and orchestrated based on the achievement of precise objectives. Communication skills, time management, responsibility assumption, ability to choose and make decisions by individual members of the group are indispensable elements for a functional activity in didactic processes. From the conceptual point of view, in the past, it was a widespread opinion that productions of students, with the reproduction of genres seen on television, could generate a kind of ideological slavery through naturalization of dominant practices (Masterman, 1985). Over the last twenty years this approach has been fortunately overcome. Buckingham (2003) points out that it has been largely demonstrated by the research that the reconsideration or use of particular forms of media communication highlights a clear understanding of media language as well as a form of ironic distance that is at least potentially critical. For example, through *creative consumer* techniques (ReCut, ReMix and MashUP), the user "plays" and "manipulates" cultural products such as movies, TV shows, music videos, novels, etc., and when it gives these pre-existing materials new meanings, different from the original ones, it demonstrates analytical ability, critical and expressive, from which the most unpredictable associations of thought can arise.

We talked about the importance of YouTube in editorial society (Hartley, 2008) where consumption becomes a source of value creation when it exceeds the only reading activity in the direction of multiple activities: reading, writing, sharing, circulation. And how all of this should be reflected in educational and didactic practices. Also consider how the aesthetics and the language of the audio-visual sector, on the one hand, and YouTube, as a platform for sharing, constitute one of the privileged territories in which the actions of young creative consumers are concentrated (Peverini, 2012). Of course, the aesthetics of many videos created by users is conditioned experimentation with end in itself, focused on more technological or communicative aspects. More interesting are in quantitative terms, video blogs or vlogs, considering the amount of these videos on YouTube, but above all because of their participatory feature. Technically poor, as well as all kinds deriving from the *webcam culture,* they are interesting for their relationship with *confessional culture* (Matthews, 2007), exploded in the latest outbreak of television based on the staging of daily life and reality, as well as their conversational nature. The vlog, with its uninterrupted address to the spectator, implicitly invites the reaction and leads to criticism, debate, and discussion, often in the form of other video blogs (Burgess & Green, 2009, p. 51). This is the dialogic feature behind the profound difference of online video from television, and at the same time, according to Patricia Lange (2007, a, b), of contents created by users from broadcasting ones.

Production and participation as dominant practices on YouTube that can't be overlooked by ongoing media debate on teaching practices. It is now clear that YouTube has an important role, on the one hand, in media history and in cultural participation and knowledge building policies, on the other hand, in activities that refer to the popular culture sector. The site therefore offers new opportunities for media education research, presents epistemological and methodological challenges for social sciences as well as for humanities and pedagogical ones. Most of the studies on YouTube have dealt with the informatic architecture of the site and its cataloging systems (they have been confined to informatics and computer science) and used methodological tools such as social network analysis (Cha et al. 2007, Gill et al., 2007), which are useful for analyzing recurring models in content, popularity of a video, and so on. More interesting are, for our work, Burgess and Green (2009) research on YouTube as a mediated cultural system, and Patricia Lange's ethnographic study on communicative and social practices that develop. There are so many questions emerging in YouTube debates as a participatory culture site orientated on big political and cultural questions: who manages to express him-self, who can attract attention, what are the rewards or wages for creativity and work, and all the uncertainties around the various forms of command and authority. All the questions that have emerged frequently in the debate on the value and legitimacy of popular culture (Storey, 2003).

Lastly, one important thing to remember. According to a study made by Burgess and Green (2009), it is clear that, although the video blog is a genre related to the User Generated Contend phenomenon and fundamental to the Community sense of YouTube, there is also a professional use of this kind. According to the two authors, many vloggers interpret YouTube as an entrepreneurial activity, benefiting from the sharing scheme of advertising revenue, but with a model linked to active participation in the community of the site. Therefore, say Burgess and Green,to understand the popular YouTube culture isn't wise to make a clear distinctions between two alternative production models, professional and amateur, and between commercial and community practices. All activities provided by site operation, watching, publishing, citing, commenting, scrambling the content of traditional media, linking response videos, leave a trace and thus produce a cultural effect. It is this idea of considering partecipants anyone who carries out activities within a common space inhabited by companies, individual users, professionals, organizations, who have lived with different motivations and creative practices, but according to a coherent cultural logic that can be used in constructive way within didactic logics functional to a "procedural dynamic of learning" (Galliani 2011).

II.3.2. YOUTUBE FOR SCHOOLS AND UNIVERSITIES

The platform offers a number of sections dedicated to education - *YouTube Edu, YouTube Teachers, YouTube for Schools* - that, together with some web applications, can allow YouTube to be used in teaching, distance, in presence, blended learning processes. *YouTube Edu* with its about 800,000 videos is a valuable support to teaching, studying, spreading knowledge (https://www.youtube.com/channel/UC3yA8nDwraeOfnYfBWun83g/about).

The channel is divided into three sections specific to the different stages of life learning: primary and secondary education, university, lifelong learning. Each section is further subdivided into thematic areas. *YouTube Teachers* is a channel for teacher's training with insights on how to use

YouTube in learning teaching processes. Finally, *YouTube for Schools* is a section designed for schools. Allows the customization of videos on YouTube Edu and a secure navigation for students. More generally, YouTube can be used for free by teachers and trainers as an environment where to publish, distribute, share, create discussion on self-produced video resources (video lessons and educational videos) within their own channel, such as an archive from which take resources (full or single video sequences) and organize them as thematic collections in playlists appropriately titled (math video, computer lessons, etc.), or to incorporate into your own site, blog or educational platform. Below are the most known possibilities:

- open a channel where you can put video or self-produced video lessons to use in the classroom. Resources can be shared publicly or privately (only in class);
- use existing video resources and organize them into thematic playlists, specific to their own disciplines; playlists can also be managed collaboratively;
- use video lessons resources (YouTube video tutorials, Khan academy, TedEd, Minute Physics, Less than 3 math, Visualizing Maths, Ecdl training pills);
- customize videos for a specific use (from using subtitles to simple audio and video editing with YouTube Editor);
- make interactive videos through the use of annotations (see below).

II.3.3 HYPERTEXTUAL VIDEO AND INCREASED TEACHING

It has been seen how the use of audio-visual resources, in particular cinema and television, in the processes of knowledge transmission in educational situations involves some disadvantages due to the peculiarities of the communication of audio-visual language such as the difficulty of conceptualization and abstraction and the unidirectional nature of the message. The images alone are not enough to explain a phenomenon or concept, they are pleasantly pleasing and rewarding on the perceptive and emotional level, but must be supported by other communicative modes. According to many television studies, the increase in the amount of news produced over the last twenty years has not led to greater knowledge. The theme is discussed by Giovanni Sartori (1997) that in the passage from *homo sapiens*, a product of written culture, to *homo videns*, the result of the civilization of image, we had a cultural impoverishment and of cognitive apparatus. The problem according to Sartori depends on the astonishing incapacity, of conceptual understanding, by generations formed in the era of image communication. Next to Sartori's position there are others that emphasize the active role of the spectator in the enjoyment of television messages. Moreover, the discovery of mirror neurons by a group of Italian researchers (Rizzolati & Sinigaglia, 2006, Iacoboni, 2008) also provides neurophysiological bases capable of justifying such intuitions based on evidence of reactions (nervous and muscular) determined by television fruition.

It is not in the spirit of the chapter to address this theme, simply introduced to highlight the need to find technological tools and teaching methodologies that can encourage the process of conceptualization and verbalization after the viewing of audio-visual resources. In any case, through recent technological developments, the disadvantages and limitations reported in the previous pages may disappear or at least decrease, approaching the way in which visuals are used to alphabetical and textual one. In the directions of Roberto Maragliano (1998), the two learning schemes, one based on

abstraction and the other on the immersion, can approach through the use of digital and multimedia languages. The possibility to view audio-visual documents in an asynchronous way, to manage them with the controls present on all media players (pause, rewind, etc.), modular fruition, hyperlinks, and forms of interaction in the direction of different levels of users participation , allow to overcome many limitations of sequential learning video.

We talk about interactive communication when generating feedback between the issuer and the receiver, a bidirectional and equal communication exchange (this paragraph is taken from Ganino, 2013). The possibilities of interaction are different and depend on technological and sociological-cultural factors. Technically, an interactive system in contrast to diffusive ones (with a single channel, *downstream*) needs a double way (*down-upstream*): from the issuing station to the receivers and vice versa. Interactivity is *asymmetrical* when the flow of information prevails in the downstream direction, while is *symmetric* if the flow is equally distributed.

It is worth remembering that besides a mechanical interaction, the possibility to choose links proposed on hypertexts documents or the choice of a television program through the remote control, there is also a cultural one. Viewing a movie or television program as well as enjoying all the editorial products requires a certain level of participation, interpretation and decoding: the text modifies the user, the user edits the text. The meaning of vision depends on the interaction between the individual and the message: the viewers dive into the audio-visual stream and extract some fragments, then they correlate and re-elaborate them basing on their cultural and knowledge baggage. Lev Manovich takes up the concept of *interpellation* developed by the French philosopher Louis Althusser to point out how our hypertext paths are often built by others, we exchange the structure of other's mind for ours: "We first looked at an image and mentally followed our private associations with other pictures. Now, the interactive medium asks us to click on an image to go to another image. Before we read the phrase of a tale or the verse of a poem and we thought of other phrases, other images or memories. Today, the interactive media asks us to click on an underlined phrase to go to another phrase" (2001, p. 86).

Before seeing some functional applications for transforming sequential video into multimedia documents, it is desirable to specify the actual use of such applications. We make it by citing a research project at the University of Ferrara, where from 2001 the *Audiovisual Laboratory* has developed a didactic format called " Multimedia product with audio-visual centrality to support mediate didactic" (Ganino & Poletti, 2004; Ganino, 2007). In addition to the scientifically tested benefits of the communicative model created in terms of didactic efficacy, the production process was very complex: the model envisaged alongside the teacher/content expert and the didactic expert (Instructional design) also the intervention of a team of technologists (audio-visual communication experts and languages of programming, etc.). This has led to the creation of a complex teaching set, lived as a foreign object: in a culturally impermeable environment for the use of technologies, such as university, to overcome resistance to technological innovation (Rogers, 2003, Bauer, 1995) you have to propose solution as simple as possible, lived almost in a natural way. Studies on the diffusion of innovation, "warn us that the effectiveness and validity of a new and better way of doing things, often doesn't guarantee its direct use in everyday life, in fact, the actual diffusion of innovation, as reported by Moore and Benbasat (1996), is the result not just of the perception of its features, but rather of the perception related to its use, its associated advantage, experimentation and ease of use, compatibility with own needs and values (...)" (Picci, 2013).

The applications that have been developed in recent years to create interactive video, easy-to-use, and instant as those that allow video annotation, go in that direction. In literature there are data on the didactic effectiveness of the video annotation in the field of training, highlighted by scientific feedbacks (Miller & Carney, 2007; Rafiq et al., 2004; Tripp & Rich, 2012; Tsiatsos et al., 2010) and by the commitment of many universities in the development of technologies and instruments able to guide observation and encourage critical reflection (Rich & Hannafin, 2008). The video annotation is an online and offline technology, widely used in North America, enabling you to integrate in a simple and intuitive way the classic use of video, passive and broadcasting, with an active, participative, reflective mode, by adding hypertext features temporarily synchronized. This didactic environment allows the student to have a *desk view*: images can be explored and analyzed through different levels of involvement, both cultural and physical (to navigate, deepen, choose, intervene, build, collaborate, verify the achievement knowledge).

In conclusion has been seen in this chapter how the didactic video through the use of audio-visual resources, in various forms, is making an important contribution to the field of teaching technology. Of course, as it has been in the past for cinema and television, there is still no systemic adoption in schools and universities. But in totally or partially distance-based courses, as well as in all the teaching processes that take place via telematics, in formal and non-formal environments, audio-visual resources especially in the form of video lessons and web conferencing have become central. For this reason their use must be accompanied by the development of more research activities that can identify methodologies and didactic strategies for a pedagogically effective use.

MULTIMEDIA LEARNING AND COGNITIVE PROCESSES: FOR DESIGN IN HIGHER EDUCATION[6]

The potentialities discussed in the previous chapters on the use of images in the representation and transmission of knowledge for educational purposes must be guided by clear research activities on the principles of multimedia learning.

With the term multimedia we mean the integration, mediated by technologies, of different languages and different modalities used to present information. In the psychological field, research has identified two meanings to the concept of multimedia (Mayer, 2001, in Mammarella, Cornoldi & Pazzaglia, 2005, p. 60):

1. "multimedia as a presentation format that adopts multiple sensory channels. The interest of this perspective is directed to the multimodal perceptive aspects that must be highlighted to make the simultaneous presentation of more effective information;
2. multimedia as a dynamic cognitive process that leads to "assemble" information of different types into a functional mental representation to the learning processes".

In order to favor the learning processes through the use of multimedia it is important to know a series of principles and guidelines that are the fruit of scientific work in the field of cognitive psychology and of Instructional Design. Particular emphasis will be given in the chapter to a series of multimedia learning theories: *cognitive load theory* (Sweller, 1991; 2010), the *generative theory of multimedia learning* (2001; 2003; 2009), the work of Clark and Lyons (2010) on the *communication and psychological functions of the different types of images* for teaching, and the one of Allan Paivio (1971; 1990) on *dual-coding theory*, concerning the different coding of the information, verbal and non-verbal, from the human cognitive system. All these theories are connected to each other and all have a clear reference to the cognitive processes and the mechanism of memory functioning, to which we dedicate a paragraph.

The theoretical references resulting from the integration of these areas can provide useful information to designers of communication solutions for teaching, to instructional design, to teachers who intend to use their own audiovisual and multimedia resources; just as they can serve those researchers who in Italy are interested in deepening this line of research that, as already said, has not found the attention deserved in our country. For the latter reason, it was particularly preferred with regard to the studies of Mayer and Clark & Lyons to report in a nearly literal way the synthesis of their research activities.

In general, as underlined by Mammarella, Cornoldi and Pazzaglia (2005, p. 60), experimental research "(...) shows a better level of learning when the material is presented in more formats than when the presentation is only graphic or verbal. (...) There are, however, less optimistic and simplistic comments on the effects, sometimes negative, of multimedia". The study of the theories investigated

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[6] The content of this chapter has been published in Italian (Ganino, 2018).

in the course of the chapter makes an important contribution to both the positive and negative aspects of the use of images in learning processes.

III.1. MECHANISMS OF MEMORY FUNCTIONING

The most well-known theories dealing with the relationship between images and learning all take into consideration the work done by our memory, also because as pointed out by the American psychologist David Paul Ausubel (1968) we can speak of meaningful learning when individuals link the information received to the knowledge possessed. This link between past and present that allows the active use of the acquired information depends on the functioning mechanisms of the memory. The Memory is the ability of our cognitive system to preserve information, or that psychic or mental function aimed at assimilation, retention and recall, in the form of memory, of the information learned. The Memory therefore plays an important role in learning processes and consists of three main subsystems: sensory memory, working memory (or short-term memory) and long-term memory.

Sensory Memory. The Sensory memory (visual, auditory) captures a series of stimuli, destined to disappear if they are not fixed for the time necessary for their processing by the perceptive system. The input stimuli, the visual and auditory information, end up in two different stores of sensory memory, iconic and echoic. Both the iconic and the echoic memory are experienced when the stimuli, visual and auditory, even if they are finished, continue to persist for a few moments (Levitin, 2002). The stimuli coming from the senses are rapidly extinguished: about 0.5 sec for visual information and 3 sec for the auditory one.

The information coming from the senses is continuously updated, so if it is not identified, classified and meaningful, it is lost; the appropriately coded information can instead pass into the working memory.

The Working Memory. The Working memory in cognitive psychology studies on memory processes is a model introduced in 1974 by Alan Baddeley and Graham Hitch to describe more accurately the dynamics of short-term memory. The Working memory can be defined as a temporary system capable of maintaining information on which to operate manipulations or mental transformations for a limited period of time; this system (Baddeley, 1986) is responsible for carrying out many complex activities, such as understanding, learning and reasoning; it also allows the integration of information from both sensory systems and long-term memory systems (semantic, episodic, autobiographical memory) (Baddeley, 1986). In fact, the working memory plays a fundamental role in the complex cognition; the cognitive tasks that we do daily (eg: reading a newspaper article) usually require multiple steps with intermediate results that must be kept temporarily in mind to successfully perform the task that is being carried out (Miyake & Shah, 1999).

The working memory construct proposed by Baddeley and other authors (Baddeley, 1986; Baddeley & Hitch, 1974; Baddeley & Logie, 1999) was partly to replace the short-term memory as more emphasis was placed on the active manipulation of information, rather than passive maintenance. The working memory, in fact, while retaining the characteristics of the short-term (limited capacity and temporary maintenance of information), represented a more complex system, as it does not simply work as a temporary warehouse, but allows processing information during execution of different cognitive tasks.

Technically, the function of the working memory is to code, organize and represent information in the form of diagrams, which will be then stored in the long-term memory. These schemes can be recovered from the working memory if necessary to be used in the resolution of tasks.

The original model of Baddeley describes the working memory as constituted by three elements that show how the visual and verbal information are managed separately: two short-term warehouses (phonological and visuospatial) and a central executive system. The phonological warehouse (articulatory loop) retains the verbal and acoustic information, while the visuospatial (visuospatial notebook) manages visual and spatial information, the central executive system controls the flow of information between these warehouses and other cognitive processes.

Short-term memory warehouses retain a limited amount of information that only remains available for a few seconds before it is lost. The limit of short-term memory capacity refers to both numbers of information that can be held (span) and the time when this information remains available.

Long-term memory. Long-term memory stores information and knowledge possessed by individuals in almost unlimited warehouses. Some of the information contained in the short-term memory can pass into long-term memory that can store it for days, or all of life. Long-term memory is classically divided into the following functional subtypes:

- semantic memory: memory linked to the comprehension of language, refers to the meanings of words and concepts;
- episodic memory: memory related to events (eg, the autobiographical episodic memory is relative to the events of our life);
- procedural memory: memory related to actions and procedures to perform complex behaviors.

In an educational context it is essential to allow students to process new information in the working memory in order to favor the subsequent archiving. Only in this way the students can increase their knowledge. The use of digital technologies can facilitate this process through compliance with precise communication rules.

III.2. COGNITIVE LOAD THEORY

This theory on the limits of the human cognitive system in the relationship between contents, students, and learning contexts, concerns the load imposed on working memory by the information presented (Sweller, 1988), and focuses on the analysis of cognitive resources used during learning and how they can be directed towards specific teaching objectives (Sweller & Chandler, 1991). Cognitive load theory has references to educational and psychological literature (Beatty, 1977; Marsh, 1979) and the concept of working memory treated by psychologists Alan Baddeley and Graham Hitch since 1974. Jhon Sweller was the first who investigated the role of the working memory in reference to learning processes and teaching design methods. It is not a coincidence that the theory of cognitive load is discussed as a recent development in the field of *Instructional design*, able to improve the efficiency of learning and therefore the teaching quality of the interventions. In practice, the theory highlights how important it is to consider the limits of working memory in the design of learning environments (Sweller, 1988), therefore it has an important role also in the teaching processes based on the use of visual and multimedia information. When educational designers

develop educational resources they intentionally choose a means (medium) to present information and at the same time to precise teaching strategies. These strategies determine a variety of learning effects depending on how they are used in teaching processes (Mousavi, Basso & Sweller, 1995; Sweller & Chandler, 1991; Sweller & Cooper, 1985); at the basis of their effectiveness there may be random principles, unless one considers scientifically the cognitive architecture of the students (Clark, Nguyen & Swelller, 2006). Knowledge of how students select information, organize and memorize it makes it easier to link teaching and learning processes. The learning of a concept or a certain skill is hindered or complicated if the cognitive resources of individuals are used for tasks not directly related to the primary educational objective.

In essence, the theory of cognitive load supports: a) how the working memory is not unlimited, therefore, if students are subjected to an excessive load of incorrectly structured information, this will determine a cognitive overload; b) how the structures and patterns of knowledge possessed and stored in long-term memory determine a series of advantages because they allow automatic analysis of materials, thus freeing up cognitive resources (Sweller, in Paoletti, 2011).

According to Sweller (2005), learning takes place when students are able to construct mental patterns (not available at the beginning of the learning process) and to use them automatically. This is the assumption regarding the most important multimedia learning processes of cognitive load theory since the construction of mental schemes depends on the optimization of knowledge. It is therefore necessary to avoid that cognitive resources are used to compensate for a faulty design of teaching materials: a badly set text-images-sound ratio leads to a waste of resources that could be used in a more functional way to the educational objective.

III.2.1. TYPES OF COGNITIVE LOAD

The cognitive load can be divided into three different types that refer to the mental effort of individuals. The knowledge of these forms of mental effort by those involved in Instructional design is fundamental because it is possible to eliminate unnecessary mental effort through a suitable didactic and multimedia design. Here are the three types:

1. *Foreign (or extrinsic) cognitive load*. It is the most studied form and is due to a poor design of the way of presenting information. The presented educational material causes non-functional learning processes: *division of attention, redundancy, coherence* (it forces us to process information that is not necessary). In practice, the extraneous cognitive load is not necessary because it interferes with the tasks of learning and consumes cognitive resources.
2. *Intrinsic cognitive load*. It is determined by the natural complexity of the information to be processed, therefore it depends on the interaction between content and level of expertise of the student (knowledge possessed). Naturally, "the intrinsic load will be greater for those who do not have automated procedures to deal with the learning task, it will be less for those who can use already automated schemes and procedures" (Paoletti, 2011, p. 182).
3. *Relevant cognitive load (or germane)*. It is associated with the processes necessary for the construction and development of schemes and to make them automatic. It is therefore relevant to learning processes.

The three loads, extraneous, intrinsic and pertinent, influence each other because together they can not exceed the resources of the working memory. The purpose of learning design is to reduce the loads, extraneous and intrinsic, and increase the pertinent one in order to free resources to be used according to the learning task. "Therefore the cognitive effort required of the reader can be determined by the mistakes in the design of the material, by bad design elements caused by the fact that the designer has not taken into account the way our mind works and built the material ignoring that the reader may have difficulty in: identify in the figure the contact person described in the text and vice versa; carry out similar tasks at the same time, for example, at the same time carrying out two visual activities; ignoring irrelevant details: sounds, music, visual or verbal details not connected in a relevant way with the message or redundant in a superfluous way" (Paoletti, 2011, p. 182).

A part of the cognitive load theory studies have been directed to the didactic use of combinations of images and sounds with the aim of reducing the attention that the student devotes to aspects irrelevant to the learning process. This dispersed attention that determines the cognitive burden of a stranger is more serious in situations of inexperience of the student (in this case it is not possible to refer to schemes possessed) and the complexity of the proposed materials. The effects resulting from these studies by Chandler and Sweller (1991), some of which were also treated by Mayer (2001; 2009), gave rise to a series of principles related to the relationship between image, written text, spoken text, to be considered during the design and use of multimedia material.

III.2.2. COGNITIVE LOAD AND MULTIMEDIA PRINCIPLES

The most useful principles for the multimedia teaching communication logics treated by Sweller appear as follows: *divided attention, redundancy, modality,* and the *principle on the reverse effect of expertise*. In this section, we deal with the first two, with additions drawn from studies by other researchers, Mayer in particular.
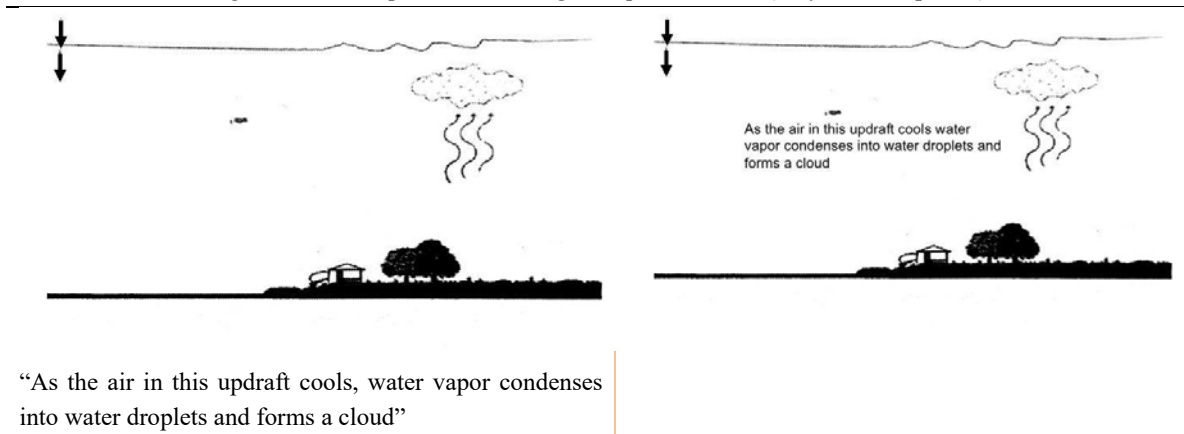
Split attention principle. This principle concerns the use of texts and images that have a relationship for the construction of a content. In this case the extraneous cognitive load increases if the sources of information that must be processed for the acquisition of knowledge are spatially separated. The increase in cognitive load is due to the effort required for cognitive processes from the division of attention to separate information sources. From this we can deduce an important principle: "*the informative text and the images must be composed according to a logic of spatial integration and not of separation*".

The principle of divided attention is the result of a series of experiments conducted (Chandler & Sweller, 1991; Mousavi, Low, & Sweller, 1995) using educational content of a scientific nature (electronic engineering, physics and biology), reported by Mammarella, Cornoldi and Pazzaglia (2005, pp. 70-72). Two groups of students were presented with information on the rain formation according to two different models: the first according to a conventional defined method, by using separate sources; the second in a visually integrated format (Figure no.1.III).

The test phase, consisting of a series of questions of re-enactment and comprehension that had to be answered in writing, took place: a) immediately; b) after one week; c) after 12 weeks. The results highlighted the *superiority of the integrated instructions* in both written and practical tests, and clearly demonstrated the long-term benefits of integrated presentation (imposes a reduced cognitive load) of multiple sources over that of separate sources. In order to understand the separate instructions the

subjects have to carry out continuous mental integrations, therefore many cognitive resources are used for tasks not directly related to the learning process; the few remaining cognitive resources do not guarantee a good level of learning.

Figure no.1.III. *Separated and integrated presentation* (Mayer, 2009, p. 140)

"As the air in this updraft cools water vapor condenses into water droplets and forms a cloud"

"As the air in this updraft cools, water vapor condenses into water droplets and forms a cloud"

Already in his early research Sweller had identified a series of problems of divided attention common to the presentation of cases of algebra or geometry: even in this case the integration of information elements facilitated learning and problem solving (Figure no.2.III). As can be seen from the right side of Figure no.2, the integration of information reduces cognitive effort because it makes it possible to immediately identify the relationship between text and image: it is not necessary to analyze the image, then read a part of the text, keep both memories in memory information, using in this process their cognitive resources in going to identify multimodal integration.

Figure no.2.III. *A separated and contiguous (integrated) placement of text*

Text Is Separate from Diagram   Text Is Integrated into Diagram
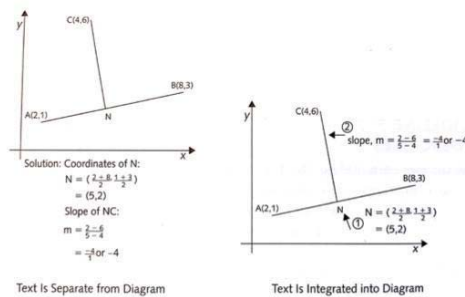
Source: Sweller, Chandler, Tierney & Cooper (1990).

The positive learning result in the case of use of integrated multimedia presentation formats was confirmed, as mentioned by Gisella Paoletti (2011), also by studies by Richard Mayer (2001) and Ginns (2006). Mayer in particular went even deeper, distinguishing between spatial contiguity and temporal contiguity (see below).

The examples show how even in the case of simple multimedia presentations, consisting of images and written texts, the way of combining and structuring information can encourage learning if consolidated communication rules are respected, can prevent it or hinder it if images are used not

significant or incorrect layout. Naturally it is well to remember how these principles, despite having been amply demonstrated, should not be considered valid under all conditions.

More generally it is possible to use formats that do not require the reader to divide the attention among the different sources of information. In the indications of Gisella Paoletti (2011, pp. 185-202) the possible solutions are: "*physical integration, to explicit text association, the choice of the sequence, the elimination of the text or the figure, the multimodality*. All these intervensions intend to reduce the request to divide attention among sources, increase the likelihood that both sources will be elaborated and integrated so as to better understand and learn multimedia material" (p. 185).

The principle of divided attention elaborated by Sweller and collaborators is important because, in addition to identifying a series of general criteria relating to the identification of the correct spatial relationship between written text and still images, it has given rise to a whole series of experiments conducted by others researchers: not only on the spatial relationship (composition inside the page or on the screen, composition on different pages or on different screens, sequential or interactive compositions), but also on the temporal level (spoken text appears simultaneously, before, or after, images or the animations to which it refers).

Principle of redundancy. This principle complements that of divided attention: the simultaneous presentation of two sources of information that have the same content (spoken text used to read a written text, written or spoken text not necessary to understand the visual part) leads to a worsening of learning (Chandler & Sweller, 1991). If the redundant information is physically integrated with the main information we must use cognitive resources to process it, then: *the integration of two redundant information produces negative effects determined by a waste of cognitive resources used unnecessarily for the purpose of the learning process.*

Mammarella, Cornoldi and Pazzaglia (2005, pp. 72-73) cite the experiment by Chandler and Sweller (1991) which shows how redundant information, presented both in a conventional format and in an integrated format, hinders learning. The material consisted of biology instructions, provided in different ways to three groups of students, on the blood flow around the heart, lungs, limbs, etc. The first group only saw the diagram of the heart without explanatory text. The second received instructions in a conventional format, that is, with the textual information at the top and the diagram of the heart at the bottom. The third group received instructions in a modified version, that is, with text and figure integration. The authors hypothesized a better performance by the first group (the one that received only the diagram), compared to the other two conditions of education: attention and mental resources could be directed entirely to the study of a single essential source of information, that is, the diagram. During the study phase, subjects were asked to read and study notes at their own place. The test phase consisted of a series of questions and problems to solve. The main findings confirmed the hypotheses, showing how the group of the diagram, although it had spent less time on the instructions, obtained a better performance than the other two groups. The experiment then shows how, by simply eliminating unnecessary sources of information, instruction time is reduced, and the learning is improved.

## III.3. COGNITIVE THEORY OF MULTIMEDIA LEARNING (BY RICHARD MAYER)

At the base of this chapter are the studies of the Californian psychologist Richard Mayer (2001; 2009) on multimedia teaching (*multimedia instruction*), a discipline aimed at the construction of mental representations based on the use of words (written or spoken text) and images (illustrations, photos, animations, movies). According to Mayer the combination of words and images (multimedia presentation) must allow the construction of mental representations to determine learning. This is possible through a clear design activity focused on the application of a series of principles or guidelines resulting from research activities.

Mayer in the preface to the second edition of his text (2009, p.x) remembers how twelve principles of instructional design, the result of experimental and research activities carried out with his colleagues at the University of California at Santa Barbara, at the base of his theory which takes the name of *Cognitive theory of multimedia learning* (Figure no.3.III).

Before summarizing the principles identified by the research group led by Mayer it is important to remember that there are three fundamental aspects underlying the cognitive theory of multimedia learning (Mayer, 2009, p. 63):

1. *Dual channels*: visual and verbal representations are processed in separate channels, in accordance with the theories of Paivio (1990) and Baddeley (1992);
2. *Limited capacity*: information processing capacity is limited, according to cognitive load research (Baddeley, 1992; Chandler & Sweller, 1991);
3. *Active processing*: the concept of active processing of incoming information is important for learning. People engage in forms of active learning by selecting relevant incoming information, organizing the selected information into consistent mental representations, and integrating mental representations with the information already possessed (Mayer, 2008; Wittrock, 1989).

Figure no.3.III. *Cognitive theory of multimedia learning* (Mayer, 2001)
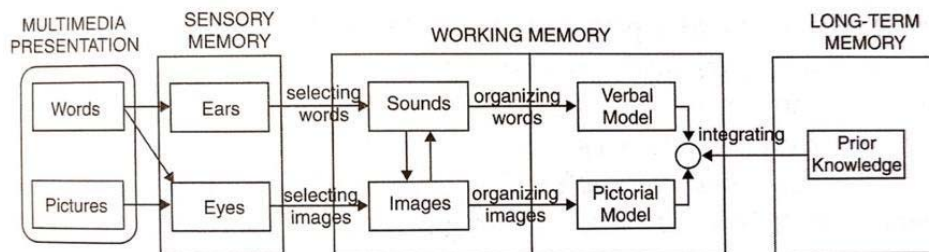
As can be seen from the model: "Text and figures come from the outside world in the form of a multimedia presentation and enter the sensory memory through the eyes and ears. The written text and figure are kept for a very short time (lower, usually, at a second) as faithful visual images in a visual sensory store, while the pronounced text is maintained as a faithful auditory image in the auditory sensory system. After this first phase, intervening phases in which the mind operates more actively. A predominant role in multimedia learning is played by the working memory system (Baddeley, 1992), responsible for the temporary maintenance and processing of information in the short term. The model involves the involvement of working memory with its phonological and visuospatial components. The phonological component will elaborate the verbal material (for

example, text) in order to select the relevant information, while the visuospatial component will be involved in the elaboration of the pictorial material (for example, illustration). The verbal and pictorial information will be subsequently organized and integrated into a single model thanks to the previous knowledge that comes from the long-term memory" (Mammarella, Cornoldi & Pazzaglia, 2005, pp. 75-76).

In Mayer's instructions multimedia learning must allow the *memory* of the information presented, and the *understanding* of what has been studied to reuse information in different situations (*transfer*): this process is favored by the ability to build an integrated model (text and illustrations).

Mayer's studies are therefore aimed at favoring the processes of knowledge construction (memory and comprehension) using a now classical series of experiments based on multimedia presentations (text only, figure only, text and figure together). To the groups involved who had to learn the same contents presented in the different modalities, the researchers submitted, after the presentation, tasks of memory or transfer. The data emerging from each experimentation activity are correlated by effect size, a value that allows for the effectiveness of teaching in terms of improvement of learning processes.

III.3.1. PRINCIPLES AND GUIDELINES

In 2001, Mayer had formulated a series of functional principles for multimedia learning: *multimedia, consistency, contiguity, signaling, modality, redundancy* and *segmentation*. In 2009, Mayer reformulated his principles on the basis of a series of experimental researches, many of which were published in a 2005 text edited by himself, *The Cambridge Handbook of Multimedia Learning*: he brings them to 12 and divides them into three areas of intervention.

1. *Principles for reducing extraneous cognitive processes* (principles of coherence, signaling, redundancy, spatial contiguity, temporal contiguity);
2. *Principles for the improvement of essential cognitive processes* (principles of segmentation, introductory education, modality);
3. *Principles for the promotion of generative processes* (principles of multimedia, personalization, voice and image).

This evolution highlights the maturity of the discipline, underlined even more by the indication of the boundary conditions of the different principles compared to the situations in which they are applied (Mayer, 2009, p. Xii), by their non-automatic and generalized use: they depend, in practice, from the relationship between the complexity of the contents, the students' skills and the learning context. The principles set out below should therefore not be considered as regulatory guidelines, but from time to time interpreted in the light of specific situations[7].

III.3.2. PRINCIPLES TO REDUCE COGNITIVE PROCESSES

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[7] For this reason the main formulation of the principle is reported in its full version.

The extraneous cognitive processes are determined by two factors: a) the presence in the multimedia lesson of extraneous materials; b) the incorrect planning of the lesson. This is what happens for example when, next to the explanation of the concept or of the process covered by the lesson, an additional information is inserted, perhaps interesting, but not directly related to the educational objective. The opening of information brackets, as well as the insertion of graphics, music or noises not directly connected to the didactic contents, capture the student's attention and distract him from the most important information. Therefore the cognitive process used for reading materials extraneous to the lesson determines a decrease in cognitive activities to be involved in essential or generative cognitive processes. The practical consequence in the evaluation activities, in the indications of Mayer (2009, p. 85), is that the student can remember part of the information related to the content, but will not be able to use it concretely in solving a problem (*transfer test*).

Coherence Principle

Students learn better if the foreign material is not relevant to the content to be learned (interesting but irrelevant words and images, interesting but irrelevant sounds and music, unnecessary words and symbols) is excluded from the multimedia presentation as it can divert attention from important information.

This was evidenced by a series of experimental investigations in which Mayer and his collaborators (2009, pp. 91-107) proposed to various groups multimedia presentations based on contents integrated with:
   a.   interesting but irrelevant words and images;
   b.   interesting but irrelevant sounds and music;
   c.   unneeded words and symbols.
Here we report the classic example used to explain the mechanism of lightning formation (Mayer, 2009): Group A: in a presentation the explanation took place with a concise animation and accompanied by a descriptive audio narration that commented on the phases of lightning formation; Group B: in another presentation the audio narration also contained some interesting phrases about lightning, sounds and accompanying music.

The comprehension test of the content showed better performances for the students of group A who had seen the concise presentation, focused in a dry way on the didactic objective, compared to group B that had benefited from the presentation "enriched" of additional information, both content (generic phrases about lightning and interesting quotes of the phenomenon), than sounds (music and noises).

To avoid incurring in such errors it would be enough to follow a widely used principle in the audiovisual communication according to which, within the process of building a message, all the visual and sound elements inserted must contribute to the construction of the sense, otherwise they appear useless and distracting. In a didactic situation this principle has an even greater weight in the interference with the tasks of learning, and therefore the seductive elements with emotional function must be excluded. In the learning processes, the cognitive interest, functional to the satisfaction deriving from the attainment of the didactic objective, must prevail over the emotional one (Kintsch,

1980). In this way it becomes easier to activate students' pre-existing knowledge and build mental patterns.

So the rule recommends building sober learning environments according to the principle that sees not only as unnecessary but even harmful the abundance of non-significant multimedia content, as evidenced by Schnotz's (1993) studies on the concept of semantic interference.

Of course, according to Mayer (2009), there are cases in which seductive details are used in multimedia presentations, chosen as the result of a series of studies linked to an involvement theory (*arousal theory*) according to which the student learns better in the face of a communicative mode that involves an emotional point of view (Weiner, 1992). In this regard*, emotional interest* is discussed (Kintsch, 1980). In Mayer's indications, this approach is based on a learning paradigm that is now outdated, that of transmission, from the teacher to the student. On the contrary: "the cognitive theory of multimedia learning is based on the view as knowledge construction - the idea that learners actively build mental representations based on what is presented and what they already know. It follows that seductive details may interfere with the process of knowledge construction (...)" (Mayer, 2009, pp. 93-95).

Signaling principle

The use of visual indicators (arrows, numbers, etc.) that highlight the proposed material improves learning.

The basic idea is that in this way the attention of the student is directed in a precise way from the alerts according to the didactic objective, reducing the extraneous cognitive load and allowing the mental connections between the different elements (Mayer, 2009).

We have seen how extraneous materials through excessive cognitive load can hinder learning processes. In many situations, according to Mayer, it is not possible to eliminate these materials from a lesson, even though many written texts often contain information that is not essential for understanding the teaching objective. So in these cases (using very long texts) we need to find a different solution from the adaptation of contents according to the principles of multimedia learning already seen. The solution is to guide students' attention to verbal content using, for example, indications to underline the instructionally important phrases, giving a title written in italics to key passages, giving voice emphasis to key words (written in bold), numbering the different steps, etc. The signals are used not to add information but to emphasize the main materials of the lesson, thus facilitating the student's mental organization.

Also according to Mayer it is also possible to use graphic indicators to direct the attention from a spatial point of view on specific elements of the image: arrows, use of different colors, flashing signals, indications, highlighting of the significant details.

Research shows that students, especially those with low skills, learn better from multimedia documents when texts are adapted with a reporting process, but Mayer's research team points out that further scientific insights are needed in this area, especially for visual signals. However, moderate use of signaling effects is recommended.
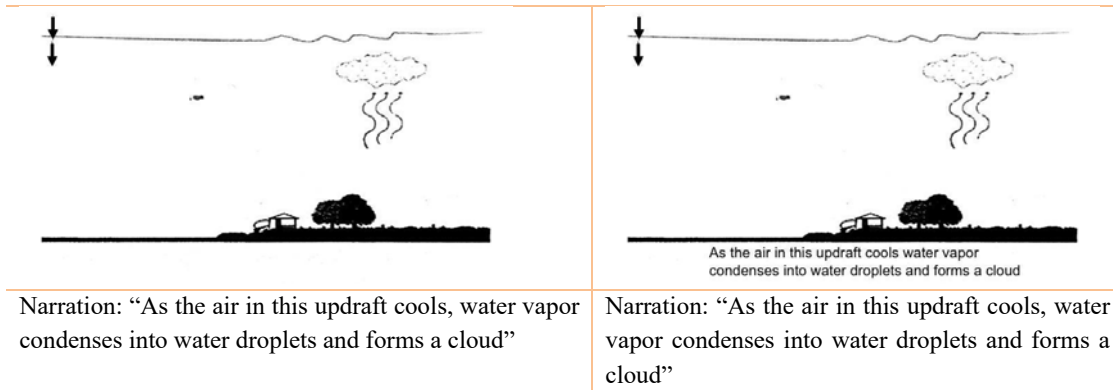
Redundancy principle

The principle of Mayer's redundancy states that people learn better if images and narratives are inserted into a multimedia presentation, rather than images, narratives and written texts.

Mayer examines the case of a student who follows a didactic content according to a double modality: narrated animation or, narrated animation with the addition of captions containing the same words of the narrated text (Mayer, 2009, p. 18).

This principle indicates how the information should be distributed on the visual and sound channels (Figure no.4.III). The redundancy between written text and narrated text would create a useless cognitive load due to the use of the same channel for the coding of two non-complementary information (Figure no.4.III). If you listen to the spoken text and at the same time you read the same written text, this leads to an increase in the cognitive burden extraneous (Kaliuga, Chandler & Sweller, 2004): reading a text activates the articulatory loop (for the sound component) and of the visuospatial notebook (for the visual part) making them come into conflict.

Figure no.4.III. *Animation with narration; and with narraion and on-screen text* (Mayer, 2009, p. 120)

Narration: "As the air in this updraft cools, water vapor condenses into water droplets and forms a cloud"	Narration: "As the air in this updraft cools, water vapor condenses into water droplets and forms a cloud"

The theoretical model behind the use of multiple information sources is based on what is called the *learning preferences hypothesis*, on the hypothesis that students learn according to individual modalities, some prefer verbal commentary, others words printed etc. (Cronbach & Snow, 1977; Jonassen & Grabowski, 1993). This model therefore provides for going in the direction of the different preferences of the students to use multiple presentation formats simultaneously so that at least one of these can be understood: "if the spoken-word path is blocked (such as for learners who are inefficient in auditory processing), verbal information can still get through via the printed-word path; and if the printed-word path is blocked (such as for learners who are poor at visual processing), verbal information can still get through via the spoken-word path" (Mayer, 2009, p. 121).

In Mayer's indications this paradigm based on a transmissive model conflicts with the cognitive theory of multimedia learning according to which student activity is based on the construction of mental schemes. As can be seen from Figure no.5.III if the words in addition to being said are also represented visually, in the form of captions, this determines a cognitive burden extraneous to the visual channel (A); contrary to what happens in the situation without redundant information (B).

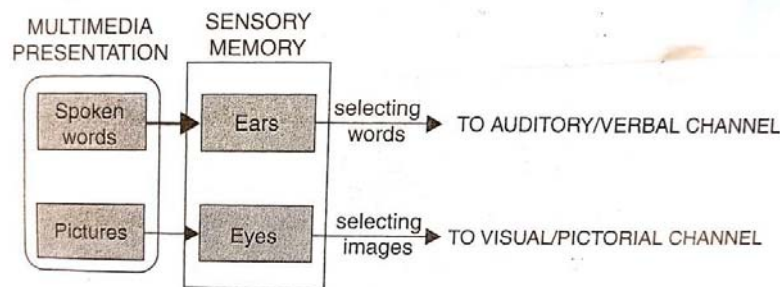*Why the cognitive theory of multimedia learning predicts that (A) animation with both narration and on-screen text is worse than (B) animation with narration only.*

A - Narrated Animation with Redundant Text Words and Pictures Both Enter the Visual Channel.
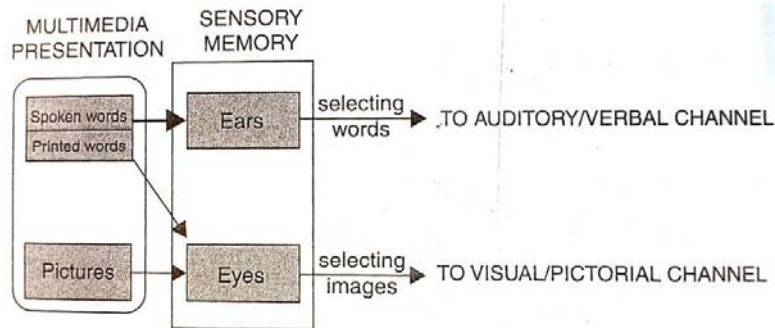
B - Narrated Animation: Only Pictures Enter the Visual Channel.

The principle of redundancy has been addressed by several authors. Some have treated it in general, for example referring to any multimedia representation in which the text was redundant with respect to the information which is given in different ways (Kaliuga, Chandler, & Sweller, 1998): the most common case is a pie chart in to which information data are evident, accompanied by a text that re-presents them. According to Chandler and Sweller (1991) when an image carries a clear meaning, that is, it explains itself, the additional text worsens learning due to an increase in cognitive load.

Mayer au contrary refers to closer situations in which the effect of redundancy refers to those situations in which learning through animations (or illustrations) and narration appears to be superior if the written text of the narration is added to the same presentation.

Finally, there are cases in which the effect of the redundancy does not create problems for the learning, for example when: the captions are reduced to a few words and placed near the image they describe; when the spoken text is presented before the printed text, rather than concurrently; when no graphic is used and the verbal segments are short (Mayer, 2009, p. 130).

Spatial contiguity principle

According to this learning principle is more effective if the corresponding words and images are presented nearby on the page or on the screen, in fact contiguous rather than distant.

Two examples are given to support this principle, which Mayer applies more easily in the following conditions (2009): when the student does not know the contents; when the diagram is not comprehensible without the use of words; when the material is complex. In the first example an animation on the formation of lightning was carried out according to a double modality: inserting the captions at the bottom of a computer screen, separated from the event described; the other with the captions inserted near the described event, in an integrated way (Figure no.1.III.). The second example refers to the same content, the formation of lightning, reported this time on a paper publication. Also in this case the two informations, captions and images, have been reported on different pages, then separately, or on the same page, according to an integrated model.

Mayer starts from the principle of the spatial limits of a computer screen or the page of a printed text. Given that in both situations space should be carefully organized to facilitate reading processes and important decisions must be taken. One of these is to identify the amount of space to devote to words and images, as well as the arrangement of the dominant words and the dominant images within these spaces. Mayer (2009) shows an example of a text on lightning training consisting of 600 words and 5 illustrations with a page layout available for two pages. Here are the different possibilities:

- place on a page the 600 words and on the other all the illustrations, according to the principle of separation;
- layout each illustration next to the paragraph of text that describes it, according to the principle of the integrated presentation;
- to guarantee a greater integration, the key words of the textual paragraph could be inserted just below the images.

Mayer always analyzes the different possibilities of the adaptation process of the same content for a multimedia presentation in an "animation" format lasting two and a half minutes: the starting point are, a reduced version of the text to which we referred (at most some hundreds of words) and about 16 visual phases of the process. The scholar recalls how the main combinatorial possibilities are two, the first linked to a communication-teaching strategy of separation, the second of integration. The goal is to understand which one is more effective in learning processes related to scientific information.

Mayer starts from a consideration referring to the transmissive paradigm of multimedia learning, according to which the double (separate) presentation of information, first the verbal one, then the visual one would favor the learning. This is because the student would follow the presentation twice and then have two possibilities to store the contents in his memory.

According to Mayer this approach is superseded by the cognitive theory of multimedia learning that learning is an active process through which the student strives to make sense of the presentation of content. And the integrated version favors in students the use of their cognitive resources for the construction of mental connections between visual and sound, the separate version instead determines processes of cognitive extraneousness. From this we can derive valuable implications for multimedia learning (Mayer, 2009, p. 149): "Our results show that meaningful learning from multimedia presentations depends not just on presenting the necessary information - both the separeted and

integrated messages presented the same material - but rather on presenting the necessary information along with guidance to the learner on how to mentally process it".

Temporal contiguity principle

Students learn better when the matching words and images are presented simultaneously rather than sequentially.

This principle has been investigated by analyzing two different ways of presenting the same content: the use by some students of a visual animation followed by a descriptive audio of the same content (asynchrony); the fruition of the visual animation and of the corresponding contemporary descriptive audio (synchrony) (Mayer, 2009, p. 153).

The asynchronous modality for the cognitive theory of multimedia learning determines cognitive overload: the student must keep the textual contents in his working memory until the animation is visualized, or vice versa, undergoing excessive extraneous cognitive load.

The most effective solution should follow the principle of temporal contiguity in the direction of a presentation in synchronous mode (simultaneous presentation). In Mayer's indications, citing a series of scientific experiments conducted by him and his colleagues in Santa Barbara, students prefer a presentation mode based on principles of synchrony between narrative aspects and animation: the simultaneous use of text and images makes the learning more effective because it facilitates the possibility of constructing mental connections between visual and verbal representations in the working memory.

The principle of temporal contiguity is apparently very similar to that of spatial contiguity; it is not by chance that the two principles were treated, as seen in the previous chapter, by Sweller and his collaborators without any distinction, within the defined principle of "divided attention". Between the two forms, spatial and temporal, we believe there are however important differences, reported by Mayer. The most evident is the degree of autonomy granted to the viewer: in the case of a presentation according to the principle of spatial contiguity, on paper or on a computer screen, the user's eye can decide on what to focus on, first on the images, then on texts, or vice versa. So the multimedia designer can not control the whole communication-teaching process. In the case of an animated presentation according to the principle of temporal contiguity, the designer can decide how to manage the presentation times and therefore also the use of different materials, first the sound, then the images, or vice versa, or sound and visual simultaneously, according to the principle of integration.

III.3.3.   PRINCIPLES   FOR   MANAGING   ESSENTIAL   COGNITIVE PROCESSES IN MULTIMEDIA LEARNING

An essential learning process is a cognitive process aimed at building a mental model of essential materials (the information necessary to achieve the educational objectives) in the working memory (Mayer, 2009, pp. 171-172). The essential cognitive process therefore represents the intrinsic cognitive load required to perform a mental task (Clark, Nguyen & Sweller, 2006).

There are cases in which, however, the essential cognitive processes required to understand the multimedia message exceed the cognitive abilities of the learner, determining cognitive overload

(Mayer, 2005): this may depend on the presence of complex material, on the students' experience, on the presentation rhythm of the lesson. The practical consequence in the evaluation activities is that the student can remember some of the information related to the content, but he will not be able to use it concretely in solving a problem (Mayer, 2009, p. 171).

To avoid this situation and favor a correct management of essential cognitive processes, the American psychologist identifies three principles to follow in the design of multimedia resources: the principle of segmentation (presenting a lesson in modulated segments rather than as a continuous unit); the principle of pre-training (giving information about the names and characteristics of the key components before the lesson); the principle of modality (present the lesson employing images and spoken rather than images and captions).

Segmenting principle

People learn best when a multimedia text is presented according to principles of modularity and segmentation with respect to a continuous structure.

Mayer cites the case of an animation narrated on the formation of lightning with a duration of 2 and a half minutes in which 16 steps are described. A multimedia version that uses the principle of segmentation should envisage the fragmentation of the sequence into 16 segments, each of them containing a short animation on a single process, usable in a personalized way through the insertion of an action button (Mayer, 2009, p. 175).

In the use of multimedia materials in case the student could not be able to understand a single passage before the next one is submitted to him, the working memory would be overloaded. The consequence of this would be a partial understanding and the impossibility of constructing the mental scheme of the functioning of the educational process. As a result in a test run the student may be able to remember some isolated fragment, thanks to his memory capacity, but the same student would surely have problems in the concrete application of the acquired skills.

To solve the problem of overloading the working memory and to favor the students' essential cognitive processes, as mentioned above, it is necessary to: a) divide the complex multimedia document into several parts, according to the modular presentation principle; b) allow the student to manage the rate of use. This is basically what happens. As indicated at the beginning of the chapter, the visual information input if captured for a few moments will be represented as images in the working memory; in the same way the sound information (speech) if maintained for a few moments will then be represented as words in the working memory. To allow the student to transform images and words into visual and verbal models, it is necessary to leave the right time for the processing of information, the same must be done to allow him to link the contents of the different modules.

Pre-training principle

The users knowledge of the names, terminology and characteristics of the key concepts of the topics addressed leads to a deeper learning.

For example, in a multimedia lesson consisting of an animation narrated on the operating mechanism of a car braking system, the application of the principle of introductory instruction would allow the student to familiarize with the names, the basic mechanisms of the object of the study and the characteristics of the key concepts (the position of the piston in the main cylinder, the brake pipes, the wheel cylinders) (Mayer, 2009, p. 189).

As a rule, the student who watches a narrated animation must pay attention to two important aspects, the general functioning of the system, and the understanding of the functioning of each single component involved in the process. The basic knowledge gained during the pretraining reduces the amount of cognitive energy to be used for the understanding of multimedia animation, thus facilitating the construction of the mental model of the presented process. The research activities of the Mayer group led to the following assumption: "Students who receive pre-training in the names and characteristics of key concepts before receiving a multimedia lesson (pre-training group) should perform better on a problem-solving transfer test than the students who receive the same information within the context of the lesson (no pre-training group). Also, this theoretical account predicts that the positive effects of pre-training should be strongest Mayer, 2009, pp. 193-194).

Modality principle

Learning is better if visual information is approached to spoken narratives rather than written texts (lettering).

To explain this principle, Mayer refers to a very precise mode of multimedia presentation, compares the learning mechanisms following the use of a video animation, accompanied by: a) an audio narration; b) or by inserting captions (written texts) (Mayer, 2009, p. 200).

The results of the research carried out show how students learn better through narrated animations rather than animations accompanied by captions, because in this way they do not cause effects of cognitive overload (*modality off-loading*). When the images and written words are presented in a way that involves the view, the visual/iconic channel can easily become overloaded, while the auditory/verbal channel remains unused. On the other hand, if the words are presented according to a mode that involves the auditory canal (spoken text), leaving the visual task to process the images, a productive synergy is achieved that increases cognitive abilities and improves learning performance.

The same effect, called *modality effect*, has been investigated by other authors (Mousavi, Low, & Sweller, 1995), but in a more generic perspective than Mayer: "the effective size of worling memory can be increased by presenting information in a mixed (auditory and visual mode) rather than a single mode" (1995, p. 321). For example, the authors cited, included within this principle, the idea that the simultaneous presentation in audio and video of an educational content is superior in terms of learning to the presentation of the same content in a sequential way, first the sound part and then the visual or vice versa. On the other hand, Mayer inserted this communicative modality distinguished by the sequential logic within the principle, treated in the previous pages, termed temporal contiguity effect. The experiments of Mayer, as mentioned, referring to the effect of the modality have instead been conducted to investigate a situation much more precise, "in which

presenting pictures and spoken text (e.g., animation and narration) is more effective than presenting pictures and printed text (e-g., animation and on-screen text)" (2009, p. 208).

At the base of this principle there are a series of theoretical principles, mentioned at the beginning of the chapter: visual and verbal representations are elaborated in separate channels (*Dual channels*), in accordance with the theories of Paivio (1991) and Baddeley (1992); the ability to process information in the two channels, both visual and audio, is limited, according to a research on cognitive loading (Baddeley, 1992; Chandler & Sweller, 1991); in order to have learning is important the concept of active processing of incoming information (active learning), through the selection of relevant information, the organization of the same in coherent mental representations, the integration of mental representations with the information already possessed (Mayer, 2008; Wittrock, 1989).

III.3.4. PRINCIPLES FOR THE PROMOTION OF GENERATIVE PROCESSES IN MULTIMEDIA LEARNING

A generative process is a cognitive process aimed at giving meaning to the information used, through the organization of information in a coherent structure and its integration with the knowledge already possessed (2009, p. 221). This means that the generative process is underused even when, despite the fact that cognitive abilities are available, these are not used due to lack of motivation. The lack of motivation, says Mayer, may depend on the way the materials are presented: a real or virtual tutor that accompanies the students in the teaching processes in an unfriendly way, materials presented in a tedious way, not very effective graphics. Generative processes can be favored through the application of 4 principles - *multimedia, personalization, voice, image* - of which the first three experimented directly by his research group.

Multimedia principle

People learn better from words and images than from just words.

This leads to opportunity to construct verbal and visual mental models and to build connections between them. In the age of digital communication it is important to accompany the use of different forms of multimedia presentations to a clear scientific reflection, we need to understand if students learn better from a lesson presented with two formats (multimedia) rather than a lesson presented with a single format (monomedial). The question to which Mayer tries to answer is the following: *Do students learn better when a lesson is presented in the form of words and images rather than only words? In short, adding images to a verbal lesson can help students learn better?*

Two different educational paradigms come into play that can help to give an answer. According to the theoretical model that refers to the cognitive theory of multimedia learning, the answer is "yes" in consideration of the fact that visual communication and verbal communication are two qualitatively different systems of representation of knowledge, one visual, the other one verbal. The joint use of the two modal systems, on the condition of a methodological correctness, exploits the characteristics of our cognitive system.

The second paradigm, linked to research on the effect of the media, is based on a transmissive mode (*information-delivery*) that involves passing information from the teacher to the student, from

the outside world to the human mind; the information subsequently stored in the long-term storage department store. According to a strict interpretation of this paradigm, "multimedia presentations are not necessary because the same information is delivered twice" (Mayer, 2009, p. 227). Indeed it would even be harmful for obvious redundancy effects. When a student receives the information in the consolidated format, namely the text, he does not need the same information in a visual format: "According to this strict interpretation of the information-delivery view, students who receive presentations in words should perform as well on transfer tests as students who receive presentations in words and pictures – as long the delivery of words is fully received by the learner" (p. 227).

In Mayer's indications, as highlighted in the previous chapters, words and images in terms of knowledge representation are qualitatively different, they can not be considered equivalent. The word has an abstract function that requires a mental effort to be interpreted, the image has a more analogical, representative and more intuitive function. Thus the two representative systems are complementary, not substitutive. In light of these considerations Mayer says: "The instructor's job is not only to present material but also to help guide the learner's cognitive processing of the presented material. In particular, learners are expected to build verbal and pictorial representations and to build connections between them. Carefully designed multimedia messages can foster these processes in learners" (2009, p. 228).

If this happens, the performance of students who take measurable multimedia lessons with tests capable of assessing comprehension are superior to those of students who follow lessons based solely on words (Mayer, 2009, p. 29).

Of course it is also important to ask itself what the role of the medium can be in multimedia learning processes. Without going into this important question, let's just mention Mayer's point of view as we have referred to his experiments in this text. In his indications, the medium is less important than the teaching technique used in the presentation of materials to help students' cognitive processes (Mayer, 2009, pp. 229-232).

Of course, the principle of multimedia is not generalizable, in the sense that, as clearly described by Mayer, it is necessary to identify the right conditions and the correct design methods to ensure that multimedia makes an important contribution to the learning processes: "The multimedia principle is somewhat vague and needs to be clarified" (2009, p. 224). The principle of multimedia should not be seen in a rigid way but considered as a starting point, a travel companion who, together with other multimedia design principles, can lead within an environment, still to be explored, in which to build the right conditions to make a significant contribution to the learning processes.

Personalization, Voice, and Image Principles

People learn better in a multimedia presentation when speaking in a colloquial and less formal way.

The group of researchers of Mayer has elaborated a series of precise indications regarding this principle: for example in an animation narrated a colloquial style can mean to say "your nose" rather than "the nose", or "your throat" rather that "the throat".

In addition to this, a preliminary research (Mayer, 2009, p. 224) would show how people learn better when the text of a digital presentation is narrated by a human rather than a synthetic voice.

Finally, people do not necessarily learn better when the image of the speaker is present in the screen (image principles).

An important concept introduced in the analysis of these principles is that of the learning as a social event. Whether you read a text, watch a narrated animation, or play a video game in which there is a tutor who provides feedback, you always activate a form of conversation between the student and the instructor. Therefore if multimedia learning is a social event then the insertion of social signals can determine from the student a greater desire to learn. In a 2004 article, Mayer, Fennel, Farmer, and Campbell claimed that to foster meaningful learning in multimedia learning environments there are two ways to follow: a) reduction of students' cognitive load; b) increase students' motivation to commit themselves to activate cognitive processes.

We have already seen what can be the teaching strategies to reduce the cognitive load. Mayer has also identified a series of principles to increase the sense of social presence, in favor of a greater student-teacher relationship.

The most investigated principle is that of personalization: a) use of the first and second person rather than the third; b) contact the students directly.

III.4. IMAGES FOR TEACHING: THE GUIDELINES (OF CLARK AND LYONS)

Graphics for Learning: Proven Guidelines for Planning, Designing, and Evaluating Visuals in Training Materials offers a valuable contribution to the answers to a series of questions on the effectiveness or otherwise of the use of visuals in teaching processes: the use of visual elements allows a deeper learning? Which visuals are more effective? How to evaluate the appropriateness of visual materials? How to design a correct use of images? How to adapt visuals to student characteristics? How to use them to increase student motivation? The text of Ruth Colvin Clark and Chopeta Lyons (2010) taken into consideration is an updated version of a 2004 work, and provides a further contribution to theories on multimedia learning. This second edition explores, with respect to the previous edition, the use of animations and videos, as well as the use of graphics in the field of mobile leraning and virtual worlds.

The principle which guides Clark and Lyons, as pointed out by Mayer (in Clark & Lyons, 2010) in the introduction to the text, is that the use of forms of communication based on words and images (*multimedia principle*), rather than just words, allows an improvement in learning processes, provided that there is appropriate graphic design.

This statement is not the result of opinions of experts or professionals of visual communication, but of scientific evidence linked to empirical research activities in the field of *graphics for learning*. For this reason, in Mayer's indications, the text of Clark and Lyons can be very useful for graphic design functional to favor learning, understanding and reasoning. Also because the principles and guidelines presented in the text as well as being based on rigorous empirical research: a) are consistent with the cognitive theories on learning processes; b) are linked to concrete educational situations; c) are accompanied by many examples. At the basis of the effectiveness of the use of visual elements in the learning processes there would be empirical-experimental tests, eye-tracking studies, and the use of *effect size* values that allow to evaluate the teaching results of each element used. In practice they reflect the current state of the art of the sector. Naturally, these principles are not universally valid,

but must be adapted to the different educational contexts and characteristics of the students: "*Graphics for Learning* helps you understand which kinds of graphics are best for helping which kinds of learners with which kinds of learning material under which kinds of learning conditions" (Mayer, 2011, in Clark & Lyons, 2010, p. 11).

Using images with learning functions means moving away from the use of decoration and seductive details to put into effect real operations of the directors, meaning with this concept the combination of multimedia codes functional to favor the achievement of the educational objective. In the indications of the two researchers the didactic value of the image depends on three elements:

1. the characteristics of the image: the superficial properties that is the external appearance, the communicative functions, the psychological functions;
2. the educational objective;
3. the pre-existing knowledge of the students.

For the purposes of our work, the characteristics of the images appear to be central.

III.4.1. SURFACE IMAGE FEATURES

The external characteristics of the images can be obtained from the technique with which they were made (animation, video, photography, drawing, etc.). The authors distinguish between different visuals: static images (illustrations, photographs, computerized synthetic images); animated images (animations, videos, virtual reality) (table no.1.III).

Table no.1.III. *Surface Features of graphics* (Clark & Lyons, 2004, p. 10)

Types	Salient Feature	Definition	Example
Static Art	Illustration	Depiction of visual elements, using various media and techniques such as pen and ink, watercolor, and computer drawing packages.	Pen and ink outline art Two-dimensional watercolor of flower parts Diagrams and charts
	Photographic	Captured image, using photographic or digital technologies.	Screen capture of a software screen Photo of person answering phones
	Modeled	Computer Generated (CG). A faithful reproduction of reality, using various media, included computer-assisted drawiong packages.	Three-dimensional representation of an office Three-dimensional representation of combustion engine
Dynamic Art	Animation	Series of images that simulate motion.	Demonstration of steps in a software procedure Process of ammunition detonation shown through line art
	Video	Series of images, captured as they occur, digitally or on film or magnetic tape, displayed serially, over time.	Capture of the hydrogen bomb test explosion at White Sands, New Mexico

	Virtual Reality	Interactive three-dimensional world that dynamically changes as the "user" moves through and views it.	Simulated walkthrough of the human heart

These elements are certainly important in terms of production models and therefore to establish costs and implementation times, but these external characteristics (the shape of the images, the media) do not determine their didactic functionality. To explain this concept Clark reports the example taken from a research by Michas and Berry (2002) which shows how it is possible to learn simple procedures (the bandage of a hand) using different visual modes, all able to represent an action that develops over time: a drawn image accompanied by captions (Figure no.6.III), an image drawn with the insertion of arrows (Figure no.7.III), a video without sound (Figure no.8.III).

In the first two examples, printed paper is used as a communication aid, and in the third a video. The results of the research have shown that the process of effective learning is not due to the media used (video or printed paper), or even to the form (design or animation), but to the communicative function: all three modalities have used a defined function transformational able to show a process that takes place in a certain time. The authors of this research report that the use of non-transformational visuals (eg drawings without movement indicators with word descriptions) has not proved to be as effective.

Figure no.6.III. *Text Communicates the Action*

Step 1: The hand is in a fist with the palm facing downward. The center of the bandage is under the wrist.

Step 2: One end of the bandage lies diagonally over the back of the hand.
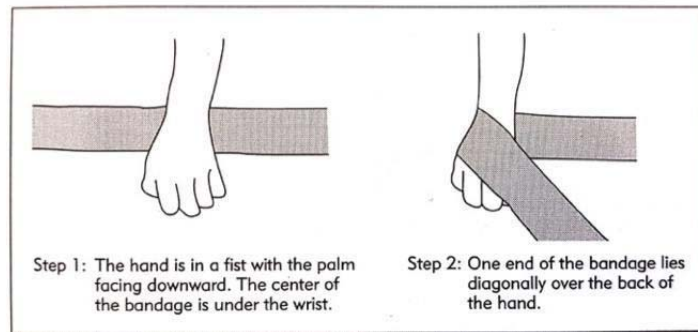
Source: Michas&Berry (2000)

Figure no.7.III. *Arrows Communicates the Action*
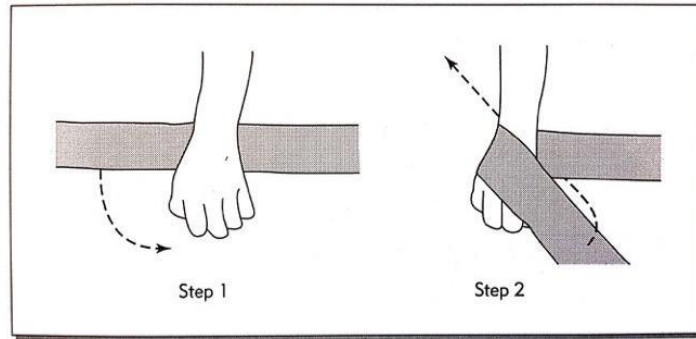
Source: Michas&Berry (2000)

Figure no.8.III. *Arrows Communicate the Action - Video*

Source: Michas&Berry (2000)

A well made video or a complex animation may not be more effective than a simple (in terms of difficulty in production) photography or an elementary design. The teaching effectiveness depends on other factors, identified by Clark and Lyons in th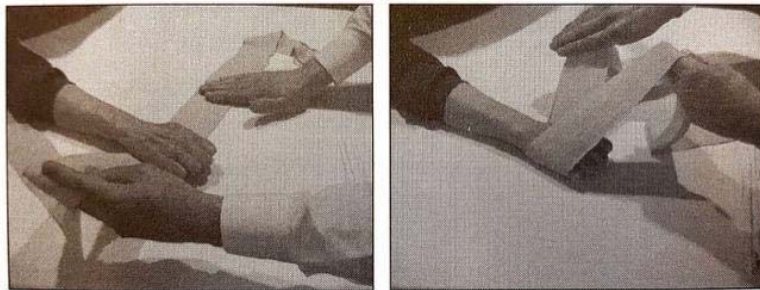e communicative and psychological functions of the images. The external form (video, animation, photography, design, etc.) must be chosen according to what one intends to communicate. It must serve to combine a series of codes (verbal, visual, sound) to produce meaningful processes consistent with the objective teaching. Below we report a taxonomy of the communicative and psychological functions identified by Clark and Lyons (2004, 2011) very useful to anyone who wants to deal with learning supported by visuals (teachers, communicators, instructional design).

III.4.2. COMMUNICATIVE FUNCTIONS

The communication functions are linked to the intrinsic characteristics of the images functional to the transmission of information (table no.2.III). The taxonomies identified by Clark and Lyons, adapted from the previous work by Carney and Levin (2002) and Lohr (2003), are 7: decorative, representative, mnemonic, organizational, relational, transformational, interpretative. Following is the summary (Clark & Lyons, 2004, pp. 19-23).

Table no.2.III. *Communication Functions of Graphics* (Clark & Lyons, 2004, p. 15)

Function	A Graphic Used to	Examples
Decorative	Add aesthetic appeal or humor	- Art on the cover of a book - Visual of a general in a military lesson on ammunition
Representational	Depict an object in a realistic fashion	- A screen capture of a software screen - A photograph of equipment
Mnemonic	Provide retrieval cues for factual information	- A picture of a stamped letter in a shopping cart to recall the meaning of the Spanish word, Carta (letter)
Organizational	Show qualitative relationships among content	- A two-dimensional course map - A concept map
Relational	Show quantitative relationships among two or more variables	- A line graph - A pie chart
Transformational	Show changes in objects over time or space	- An animation of the weather cicle
Interpretive	Illustrate a theory, principle, or cause-and-effect relationships	- A schematic diagram of equipment - An animation of molecular movement

The visuals used for aesthetic, humorous or motivational purposes are indicated as *decorative images* and do not have a clear relationship with the objectives of the lesson content. The goal of decorative images is therefore not educational but of *visual appeal*. For this reason, the excessive use of a communication method focused exclusively on aesthetic aspects risks interfering with the cognitive process necessary for learning. Scientific analysis of the phenomenon discourages its use.

The representative function shows the information in a faithful way: a photograph of what you are talking about, the computer screen in the case of the explanation of the principles of operation of a software, etc. The visual representation in the direction of the representative function, reproducing faithfully (you can also eliminate details not functional to the educational objective) a process, a situation, an object of study, has its teaching effectiveness as a substitute for the experience.

The *mnemonic function* concerns the use of images associated with the concepts and information given to facilitate the memory: it has in practice a role of connecting bridge to the processes of signification. The use of this communication method is very effective (Carney & Levin, 2002, in Clark & Lyons, 2004) although obviously it can not have the same effect on a global scale due to cultural problems (the meanings of many images change according to of the geographical areas of the world).

The *organizational function* highlights the qualitative relationships between the information displayed, through tree representations, diagrams and knowledge maps.

The *relational function* is used to communicate quantitative relations between two or more variables and includes diagrams and graphs (pie, bar etc.). Despite this type of representation is used

a lot, the research in the indications of the two researchers is investigating the teaching functionality of this mode of communication only recently.

The *transformational function* is used to underline movements and changes that take place from a spatial and temporal point of view. The surface characteristics of the graphics with a transformational function can include animations, videos, or arrows with directional indications.

The *interpretative function* helps the construction of mental models of information or processes, abstract or invisible, as shown in Figure no.9.III in which the graphic illustrates the functions of a mechanical control panel. In the indications of Kieras and Bovair (1984, in Clark & Lyons, 2010) a lesson using this scheme determines better results in work performance, compared to lessons in which the same procedures are only told. The interpretive graphic helps students to build mental models of the process explained and determines both a more efficient use of the machines, and a greater ability in solving problems.

Figure no.9.III. *An Interpretive Graphic*
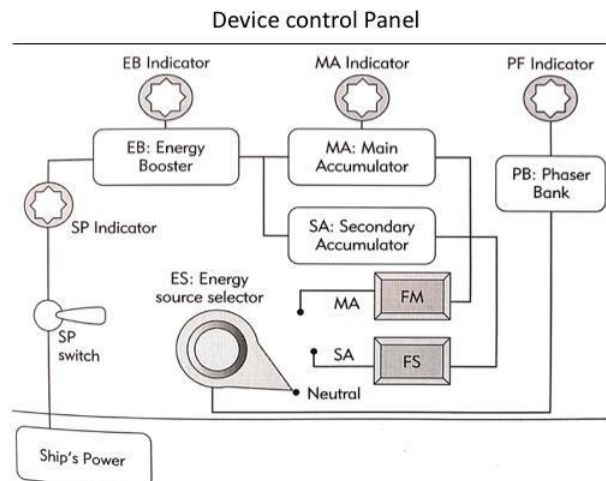
Source: Kieras & Bovair (1984)

III.4.3. PSYCHOLOGICAL FUNCTIONS

The communication functions of the images are not sufficient to improve the learning processes. The images must also have the purpose of helping the psychological functions related to cognitive processes, otherwise they could be counterproductive. For example, a series of researches (Harp & Mayer, 1998) show how the use of visuals and texts related to the topic of the lesson but not directly to the specific objective of the lesson compromise the learning. Harp and Mayer arrived at this conclusion through a series of empirical researches on lessons related to the formation of lightning (see previous paragraph): learning was better than 30% in the case of lessons without using elements extraneous to the objective teaching.

To help the visual design that can facilitate learning processes, the two authors point out a third model of taxonomies (after Sweller and Mayer) concerning the way in which images can support six psychological functions: *support the attention, activate the existing knowledge, minimize cognitive load, build mental models, support knowledge transfer, support student motivation* (table no.3.III). The table below, referring to the 2004 publication, was subsequently integrated by the two

authors with a new Instructional event defined. Plan the graphics according to individual differences (see below).

Table no.3.III. *Funzione psicologica dell'immagine* (Clark & Lyons, 2004, p. 16)

Instructional Event	Definition	Example
Support Attention	Graphics and graphic design that draw attention to important elements in an instructional display and that minimize divided attention	- An arrow to point out the relevant part of a computer screen - Placement of graphic close to text that describes it
Activate or Build Prior Knowledge	Graphics that engage existing mental models or provide high-level content overview to support acquisition of new information	- Visual analogy between new content and familiar knowledge - Graphic overview of new content
Minimize Cognitive Load	Graphics and graphic design that minimize extraneous mental work imposed on working memory during learning	- Line art versus photograph - Relevant graphic versus decorative graphic
Build Mental Models	Graphics that help learners construct new memories in long.term memory that support deeper understanding of content	- A schematic diagram to illustrate how equipment works - A visual simulation of how genes are transmitted from parents to offspring
Support Transfer of Learning	Graphics that incorporate key features of the work environment; graphics that promote deeper understanding	- Use of software screen simulation that looks and acts like actual software - Use of a visual simulation to build a cause-and-effect mental model
Support Motivation	Graphics that make material interesting and at the same time do not depress learning	- A graphic that makes the relevance of the skulls to the job obvious - An organizing visual that clarifies the structure of the material

Support for attention. The principle states that it is important to draw attention to the visually important elements, in terms of teaching objectives, especially in the case of the use of complex visuals. This is especially true when students can not control the presentation flow as they can in the case of video lessons. Since the capacity of the working memory is limited, every expedient that helps the student to focus on the important aspects of the lesson leads to better learning. Clark and Ruth (2004, pp. 69-84) show how this is possible through the presentation of examples based on empirical research and on the basis of the identification of the following guidelines:

- use visual signals to direct the attention to important didactic aspects when visual is complex, especially in cases where personalized fruition is not possible;
- use colors for better work performance based on tasks involving visual research;
- place the words (captions) near the visual information they describe;

- avoid using visuals that distract students from important educational content.

Activation of previous knowledge. Students must integrate the incoming content into the working memory with the related knowledge held, stored in the long-term memory. This allows the construction of new mental models. In order for the integration to take place it is necessary that the scheme of knowledge possessed in the long-term memory is transferred (recalled) into the working memory. In some situations the students do not possess relevant previous knowledge: in these cases, offering the general framework of the lesson can improve the learning. Clark and Lyons give indications on how to use the graphics to activate the previous knowledge, in particular on how to use visual summaries (comparative advance organizers) of the contents of the lesson (by visual analogy). The use of analogy that uses visual information familiar to students is useful for linking new knowledge to those already possessed: the graphic representation that combines the information that is to be transmitted with a known image goes in this direction.

The two authors also indicate how to avoid the activation of the knowledge that is not relevant: for example, avoiding using at the beginning of the lesson (to get students' attention) visuals emphatic but unrelated to the educational objective.

Minimization of the cognitive load. It has already been said that it is important to minimize the extraneous cognitive load imposed on the working memory during learning processes. The use of the image can play an important role in this sense.

When the contents are complex and the students begginer, the presentation flow can not be managed in a personal way: learning in this case can be improved by using visuals to reduce the irrelevant cognitive load. According to Clark and Lyons (2010, p. 97) the cognitive load can be reduced: substituting text with images, from visual design activities and content modularization techniques, from the use of audio rather than written text to explain complex visuals . The two authors report a series of examples to support the 6 guidelines identified (pp. 97-112):

- use of graphics in sostitution of written text
- use simple graphics to make the insights deeper;
- use animations to teach motor skills;
- illustrate complex graphs with text narrated in audio;
- use lettering or graphics without anything else if the information is understandable;
- use presentations and overlays in the case of complex visuals

Construction of mental models. The integration of the contents of the lesson with previous knowledge determines the construction of a new mental model. The mental model is stored in the long-term memory and is the basis of the processes of understanding and problem solving. Visuals that show relationships are more functional to the construction of models rather than visuals that represent contents. This visual modality functional to the construction of relationships is called explanatory graphics. The two authors report a series of examples to support the identified guidelines (pp. 115-134):

- use organizational images to show qualitative relationships;

- use relational images to highlight quantitative relationships;
- use transformational images that illustrate spatio-temporal changes to construct mental models of cause and effect;
- use interpretive images to illustrate rules and principles;
- use online characters to foster the integration of mental models and problem solving.

Mental models are internal representations, the psychological foundation of understanding in relation to the learning of scientific concepts and theories: "If we understand what inflation is like, how does a certain mathematical demonstration take place, the way the computer works, DNA or divorce, then you must have a mental representation of the entities considered, that is, an internal mental copy that has the same structure of relationships as the phenomenon it represents" (Johnson-Laird, 1983, pp. 37 and 49). Clark and Lyons indicate schematic and organizational images, as well as visual simulations as fundamental for the construction of mental models.

Support for the transfer of learning. The transfer is the bridge between the skills acquired during training and the skills applied in working environments. It is therefore a very important characteristic because without transfer the investment in training does not find concrete application. The fusion between the working environment and the educational context, on the one hand, and the construction of mental models, on the other, there are two fundamental ways to allow the transfer of learning. Clark and Lyons (2010) report a series of examples to support the guidelines identified on the use of visuals to facilitate the transfer:

- use dynamic visuals that reflect the work environment to facilitate a close transfer (transfer of information to very similar situations);
- design 3D training environments that can incorporate working contexts;
- for remote transfer (need to modify learned patterns) it is important to build mental schemes using: static images with interpretative and transformational function to explain processes; dynamic images to illustrate interpersonal skills; different visual contexts to build more transferable mental models; visual interfaces to promote immersive learning.

Designing graphics to support motivation and learning. The research suggests that the lessons using graphics are more interesting than the lessons that only use texts. It is now very common to see the graphics widely used in slides, books, multimedia to increase motivation. But not all visuals added for motivational purposes are compatible with the learning. Below is a set of guidelines on how to support motivation without hindering learning (Clark & Lyons, 2010, pp. 153-166):

- use visuals to show work contexts or concrete cases;
- to determine effects of social presence through the use of characters (learning agents) in asynchronous multimedia lessons;
- to motivate students with little interest, to use visual expedients to generate motivation;
- minimize the use of graphics to "sweeten" the eye.

Plan the graphics according to individual differences. Contrary to what many trainers think, namely that some people benefit more than others from the visuals (visual learners), in this chapter the authors report rather a series of evidence related to individual differences that influence learning through visuals, spatial ability and previous knowledge (Clark & Lyons, 2010, p. 169). The two authors have identified the following guidelines based on the evidence related to individual differences that influence learning through images (pp. 169-178):

- we must not follow the myth of visual learning;
- emphasize the use of visuals for beginners;
- provide just-in-time training (to increase knowledge about the concepts of the study) to help students interpret visuals;
- encourage all students to study visuals effectively.

In reality, all the beginners can be considered visual learners, individuals who can benefit from learning processes both from images and words. As the specific knowledge of a certain disciplinary field increases, the benefits obtained through the use of explanatory visuals decrease. The two authors based on the state of the art in this field recommend to pay close attention to previous knowledge to guide the use of visuals:

- "First, invest most effort in explanatory visuals for low prior knowledge learners.
- Second, when your goal is to teach interpretation of a complex visual such a weather map, provide brief just-in-time training. A mini-lesson to build domain specific knowledge related to the relationship expressed in the visual will greatly improve learners ability to interpret it.
- Third, to encourage deep processing of an important visual, make in interactive by asking questions that require the learner to attend and to interpret the visual" (Clark & Lyons, 2010, p. 178).

Obviously the general indications provided, related to the communicative and psychological support through the use of visuals in the learning processes, must find concrete application through a graphic and multimedia design and production activity. In the following parts of the text there are very useful indications for the creation of visuals based on the contents of the lessons that refer to: procedures, concepts, facts, processes and principles. Finally, the authors describe the visual planning and communication process in order to contextualise the information and guidelines indicated in the previous parts. Clark and Lyons provide the key elements to be known for the creation of graphics that can support learning processes, without expiring in unnecessary simplifications: "graphics design and production is a subject worthy of an entire library or curriculum" (2010, p. 265).

In the representation of didactic contents through the use of multimedia the new communication elements, compared to the consolidated tradition of writing, that come into play refer to what in the chapter was referred to as "images" or "visuals". The two terms in this interchangeable work indicate the use of photographs, graphics, drawings, lettering, animations, videos in educational processes. Any form of visual communication, with the appropriate differences that we have seen, falls within this large category of visual materials used in an attempt to improve learning processes. It is evident how within this work we have worked on the general principles and not all the images for teaching

have been treated. I refer in particular to the field of graphic organizers such as tables, diagrams, maps, etc. (a summary can be found in Bonaiuti, 2011).

Each visual element can have a precise meaning, but it is important to understand how the relationship between all the communication materials used is fundamental to convey the overall sense of multimedia presentation. The combinatorial possibilities are endless and there are no rigid taxonomies, universally valid guidelines, to be used if necessary in order to be effective. The overall direction in terms of effective organization of communication with learning purposes must therefore consider elements of visual design, multimedia teaching design, didactic planning according to the context, the training objective, the previous knowledge of the students. We also like to remember in conclusion how learning by students through multimedia presentations does not depend on the presentation of the necessary information, but on the presentation of the necessary information provided according to the functioning mechanisms of the students' mental and cognitive processes.

Chapter IV
EDUCATIONAL PARADIGMS, COGNITIVE ARTIFACTS AND MULTIMEDIA DESIGN

The introduction of technology into teaching and learning processes does not automatically imply educational innovation. Frequent are situations of mediatised teaching 2.0 in which the classic models of transmissive teaching are moved. They use video lessons, teaching units in pdf, other materials, without exploiting the true potential of the latest technologies towards paradigms of more participation, collaborative and relational. Equally frequent are cases in which multimedia documents are a support of their teachings, without considering the impact, in terms of significant learning, that these materials will have on the acquisition of knowledge by students. Our idea is that learning processes are not improved when teaching is supported by recent technologies.

For an objective vision it is important to consider the results of various international empirical studies made over the last 50 years on the relationship between technologies and processes, within the disciplinary sector of the *Educational Technology.*

It is known for certain that cognitive technologies play a fundamental role in the cognition of the individual, favoring that exchange relationship that defines the teaching-learning action (Rivoltella & Ferrari, 2010). It is no coincidence that the history of teaching is deeply linked to innovation and the use of technology. But only a correct use of them can bring to a significant learning, intended as "a change in the human situation or capacity that persists beyond a period of time it is not simply ascribable to the growth process" (Gagné, 1985, p. 2).

We therefore consider it useful to summarize in this chapter, the role of technologies as cognitive artifacts, and above all, the main learning theories that have shown the way for a conscious and meaningful use of technologies. The theories we will refer to are behaviorism, cognitivism, constructivism, and connectivism.

IV.1. TECHNOLOGIES SUCH AS COGNITIVE ARTIFACTS

Artifacts, both material and symbolic (for example, writing), were created with the aim of improving the life of the human being and making it more and more powerful in relation to the environment in which he lives. Every technological progress has therefore brought advantages to the communities in which it has been employed: much of the intelligence of the human being derives, in the indications of Norman (1995), precisely from his ability to create artifacts. Therefore, cognitive technologies have also been developed to enhance our capabilities, both material and symbolic (Calvani, 2007). Think of the role of paper and pen in enhancing our limited memory capabilities, thanks to the ability to transcribe a range of information on media.

From this derives one of the main characteristics of educational artifacts: they must be used to avoid repetitive tasks, thus leaving free cognitive resources to enhance other mental abilities (Calvani, 1999). So not the disuse of a cognitive function but its empowerment.

Another characteristic of the technologies is that of guaranteeing the so-called *optimal flow*, a kind of absolute absorption that determines the maximum concentration in the activity in which the student is concentrated (Norman, 1995). This concentration is evident in the practice of recreational activities, as in the case of video games, less in those related to the study. It is no coincidence that some have investigated the practices used in video games and their transfer to learning processes (Gee, 2013).

More generally, the practices that facilitate the optimal flow are those with clear objectives, precise rules, continuous feedback, motivating, able to transmit continuous feelings of challenge, those that limit at most the disturbing factors that could interrupt the experience. This last point is often determined by the characteristics of the same technology used (think of those programs that send continuous messages to the user).

This shows another of the characteristics that must be possessed by educational technologies: they must be invisible, the attention must be placed on the task, not on the instrument (Norman, 2015), as it happens today with the technologies of the pen or the book, now consolidated and metabolized for some time. This standardization process is not yet evident with the latest generation technologies and tools, characterized by forms of digital communication. This characteristic, together with the certain communicative advantages that it has determinate, which can be summarized in the transition from the *Gutemberg society* to the so-called *information and knowledge society* (Castells, 2002, 2009), has also determined very complex methods of use. This complexity is highlighted in a new teaching method in the direction of what is called *pedagogy* 2.0 (McLoughlin & Lee, 2011).

The invisibility, we believe, must go in the direction of the creation of technological environments and interfaces centered on human being, and not on the machine, then away from technocentric attitudes, which impose on the user rigid and difficult rules to follow (Norman, 2011) .

IV.2. EDUCATIONAL PARADIGMS

IV.2.1 BEHAVIORISM OR OBJECTIVIST PARADIGM OF TEACHING

Compared to the dynamics of learning investigated during the twentieth century by the psychology and pedagogy sectors, different models of interpretation have been used. The first theory that has foreseen within the didactic design the use of technologies is that of behaviorism, influenced by the studies of John Watson, those of Ivan Pavlov on *classical conditioning*, and works of Skinner[8]. Behaviorism was the main school of thought in this area throughout the first half of the last century. The behaviorist theories, born in North America in the first twenty years of the twentieth century[9], study the adaptation processes of human beings with the surrounding environment: "according to behaviorism, man is the product of his experiences and interactions with the environment, while behavior is the result of the stimulus-response mechanism" (Pizzaleo in Eletti, 2002, p. 30). Explicit behavior is considered by this approach as the only scientifically investigable analysis unit (Legrenzi,

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[8]The 1954 Skinner article *The science of learning and the art of teaching*, on the relationship between animal behavior studies and teaching practices, is indicated as the first work in the field of *Educational Technology* (Olimpo, 1993).

[9]The conventional date of birth of behaviorism coincides with the release, in 1913, of the article by John Watson, *Psychology as the Behaviorist views*.

2002). Its main characteristic lies in the "reductionist" hypothesis for which the study of learning psychology coincides with the study of observable behaviors.

One of the main assumptions of this paradigm revolves around the concept of conditioning that acquires a central role in the experiments of Pavlov (1849-1936), of Ernest Thorndike (1874-1949) and later in those of Skinner (1904-1990). The central element in Pavlov's experiments was, as is known, the association of a conditioned stimulus (and neutral, such as the sound of a bell) to a conditioned learnt response (the salivation of a dog for the arrival of food). He deduced that the repeated association of a stimulus with a response not directly related to it, causes, after a certain period of time, the follow of a conditioned response to that stimulus. This type of conditioning is called classic or responsive.

Ernest Thorndike dealt with the observation of the behavior of cats: they must learn to open the cage in which they are locked up, to reach the food located outside. The scholar formulates a theory according to which learning is a gradual process that occurs through trial and error. The achievement of food, or the mechanism of reward, determines a faster learning of information.

The concept of reinforcement is investigated, starting from the 1930s, by Burrhus Frederick Skinner (1954, 1958), according to which every form of learning depends on this strategy.

In practice the behaviorist paradigm, born from studies on the conditioning of animal behavior, considers the positive reinforcement (reward through good judgment) an important incentive to learn. In light of this principle, in the instructions of Skinner, the traditional teaching methods had a series of limitations: teacher feedback temporally very far from the student's response, little attention to the individual student due to the number of classes, low frequency with which they occur positive reinforcements (Ranieri, 2011, p. 118).

The idea that learning can be designed and therefore an artificial factor leads Skinner to the realization of machine-based teaching systems, from *Skinner Boxes* to programmed *instruction techniques* (application that determines the birth of the disciplinary sector of "teaching technologies") and centered on an *operating conditioning model*: a cognitive path provides certain responses that, appropriately reinforced, can manifest themselves more effectively later, in the face of similar problems. Basically every assimilated learning when appropriate responses are given to certain stimuli prepares the next one, thus attributing linearity characteristics to the didactic model. The programmed instruction of Skinner (1954, p. 95) is based on the following principles: use of short content units, student responses, immediate communication of results (feedback), reinforcement and individualization (Saettler, 1990). In Skinner's indications are already evident advantages of the technologies in the learning processes: the immediacy of the reinforcement, the class control from the teacher, the personalization of the learning process ("the gifted student will advance rapidly"), the structuring of teaching materials more and more complex.

It is the first time that psychology systematically reflects on the possibility of using computers as an educational tool and begins to question the cognitive effects of technology-mediated learning: "these machines were developed on the basis of a clear theoretical hypothesis about the way in which someone learns (by reinforcement) and on the principles of effective education (for example, the importance of feedback and individualisation) and, between the 50s and the 60s, they had some success" (Ranieri, 2011, p. 119). Skinner later develops these theories in one of his most important works, *The technology of teaching*, published in 1967 (Pizzaleo in Eletti, 2002, p. 33).

Within this context is developed a method centered on a sequence of nine *educational events,* shown in Table no1.IV, used in the design of CAI systems (*Computer Aided Instruction*), the first self-learning programs on computer supports that replace from the sixties the expensive *machines for teaching*.

Table no.1.IV. *The nine educational events of behaviorism* (in Giacomantonio, 2007, p. 52)

External educational event	Internal process
Gaining attention	Awakening of attention
Inform the student about the aims of the lesson	Wait
Stimulate the recall of previous learning	Research on working memory
Propose different stimuli with different characteristics	Selective perception
	Semantic encoding
Lead learning	Research and reaction
Perform the activity	Reinforcement
Provide an informative feed-back	Sequential search
Verify the execution	Generalization
Amplify the memorization and the learning process	

The CAI allows to perform exclusively sequential operations, the information is organized in a hierarchical way, according to a flowchart that determines a rigid learning path. As can be seen, operanting conditioning is the most important form of learning and through the methodology of planned education it proposes a systematic approach to didactic planning.

More generally, the behavioral paradigm (also called objectivist or rationalist-informationist) sees as central in the teaching processes the transfer of information to the student according to a transmissive and technocentric model, centered on the figure of the teacher (Galliani, 2004). In teaching practices, the result of this mechanistic understanding of learning is the definition of a series of methods that determine: a) the structure and timing of the presentation of contents; b) a rigid schedule that defines in advance the objectives to be reached. In addition to the phases of the teaching activity, the model also included the control procedures and the methods for assessing the results to verify the achievement of the individual objectives by the students. The teaching and learning process can be summarized in the teaching information propose and in the subsequent verification activity, reinforcing the positive performances. The didactic model appears as a closed system (contents, objectives and education strategies are predetermined), within which the transmission of contents takes place collectively (from the teacher to all those present in the classroom). The book, due to its linearity and sequential characteristics, appears as the suitable artifact for conveying didactic communication. Knowledge remains declarative even when the book is flanked by other technological resources such as the video lesson, a power point presentation, a document that can be consulted on the web.

As a result of this model, the computer programs implemented have been characterized by technocentric methods and lack of flexibility: closure, little didactic interaction, no dialogue between the student and the system, reduction of the complex mechanisms of learning to strict rules. This approach based on technological functionality appears to contrast with those paradigms (for example of psycho-cognitive derivation) focused on the design of models and instruments on a human scale.

IV.2.2. COGNITIVISM OR SYSTEMIC-INTERACTIONIST PARADIGM

Starting from the 60s and 70s, more than the investigation of observable behaviors (external), it becomes important to investigate the cognitive and mental processes (internal) that come into play in the learning processes[10]. The idea is that the knowledge of such cognitive mechanisms can give rise to teaching methods able to exploit the functioning mechanisms of the mind. A recent orientation in this sense is constituted by the theory of cognitive load that deals with the limits of the human cognitive system, in the relationship between contents, students, and learning contexts (Sweller, 1988). These studies focus on the analysis of cognitive resources used during learning and how they can be directed towards specific teaching objectives (Chandler & Sweller, 1991).

Cognitive load theory has references to educational and psychological literature and to the working memory concept treated by psychologists Alan Baddeley and Graham Hitch since 1974. But Jhon Sweller was the first to investigate the role of memory of work in reference to the learning processes and didactic planning methods (see chapter 3).

The teaching of cognitive inspiration in addition to the achievement of established educational objectives takes into account therefore the cognitive factors that favor the achievement. The distance from behaviorism is clear: to explain the mechanisms of learning, the accent is no longer placed on the stimulus-response function, rather on the analysis of cognitive processes and on the study of the possible forms of representation of knowledge that our mind is capable to operate.

Not only the cognitive processes, but also, the dynamism of the learning process, the motivations of individuals, cooperation and collaboration that determine relationships and communication exchanges, are the basis of the model. Model that determines big changes on teaching practices and on the role of the teacher. "His role is no longer transferring declarative knowledge or explaining it better to ensure correct decoding-interpretation, but rather helping to choose the correct method to solve problems, also proposing operative ways to" practice "(not exercises!) and using communication media able to create friendly and emotionally involving contexts" (Galliani, 2004, p. 22). In cognitivism the student is an active subject, no longer a receiver of messages, but an actor participating in the educational process. Of course, not all individuals react in the same way to environmental stimuli, these will be interpreted according to individual cognitive structures. The learning mechanism is therefore more complex, it is characterized by a less linear, more open, nuanced attitude that does not include processes, reality, information, in a single interpretative line.

The theoretical bases of this paradigm derive from *Gestalt Psycologie* and from the works of Lev Vygotsky and Jean Piaget. Piaget took care of the psychology of the evolutionary age and above all of the development of intelligence in human beings. According to the scholar, the cognition of a subject changes through a process of adaptation: assimilation of new inputs, then integrated into the cognitive schemes already possessed by the subject (accommodation phase). Also according to David Ausubel (in Varisco, 1995) to obtain meaningful learning the new contents had to be anchored to the already acquired knowledge.

The scientific domains of cognitivism are naturally interdisciplinary: in addition to psychology, they affect philosophy, linguistics, neuroscience and the information sciences. When cognitivism meets teaching technologies, the main object of study becomes intelligent systems. It is no

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[10]The so-called "cognitivist revolution" was being prepared in the United States at the end of the 1960s, but it is with the essay *Cognitive psychology (*1967) by the psychologist Ulric Neisser that cognitivism was officially born.

coincidence that the evolution of the discipline has been accelerated by studies on artificial intelligence favored by the development of cybernetics and computer science, as in the case of *intelligent tutoring systems*, able to return personalized feedback.

Technologies are no longer seen as tools for distributing information, but they become perceptive-cognitive extensions of the human being, functional to the representation of the world but also to its understanding and exploration. This technically means the non-centrality of predefined and rigid didactic paths, but flexible paths, generated ad hoc basing on the attitudes of the students. We speak then of educational environments, open and dynamic, functional to achieve goals, but of higher quality because they are the result of clear reasoning. The areas in which the expert systems have become more widespread are those of adult education and vocational training: the most known examples are those that refer to simulations to train pilots in the military field. At the base of expert systems there is problem solving: in the indications of Gertner and Van Lehn (2000, in Ranieri 2011, p. 122) "these systems stimulate the user to build new knowledge through the solution of problems to be addressed in an autonomous way. As with teaching machines, the system returns immediate feedback for each action, and allows students to move progressively basing on the mastery that is being developed - unlike the machines for teaching, however, the student who interacts with a expert system *learns doing* more than *getting instruction* ".

Starting from the seventies of the last century, the concept maps, developed by the American biologist Joseph Novak, have been often used in the relationship between cognitivism and educational technologies. Assuming that meaningful learning implies the assimilation of new concepts into an individual's existing cognitive structures (Ausubel, 1988), Novak has elaborated the concept mapping system with the aim of formalizing knowledge. The maps graphically represent the interconnection of the concepts possessed within a given domain of knowledge, making explicit what is implicit (Novak, 2002). The cognitive map represents the mental structure of the individual, whose behavior is organized through conceptual schemes, gradually more complex, in which place the acquired knowledge. It is then evident that "maps are part of those cognitive artifacts that support and extend the thought process of those who use them, since it is very difficult to construct meaningful representations without deeply reflecting on the information possessed. (...) In the students, maps can promote metacognitive learning, help to focus on key ideas, summarize what has been learned. Students who learn to create maps improve their understanding of the subject and learn "to learn". To the teachers, the maps allow to identify the wrong knowledge and previous one of the students. In addition, teachers who prepare maps to plan their lessons acquire greater skills in guiding learning" (De Piano, 2016). These reflections have also generated computer programs that allow the construction of concept maps that encourage interaction between students and collaborative processes. This is the reason for their use as teaching technologies.

In conclusion, it is evident that the cognitivist paradigm considers inadequate the traditional practice of the teacher who explains, and of the pupil who takes notes and memorizes; and recognize to students the responsibility of the meaning creation, aided by the teacher "tutor", "coach", "guide". This is reflected in the design of educational software based on concepts of openness and interactivity, able to complete (and not compete with) human skills.

IV.2.3. CONSTRUCTIVISM AND LEARNING ENVIRONMENTS

The basic principle of constructivist epistemology, developed from cognitive theories in the last 20 years of the last century, is that knowledge is not transmitted but constructed. Despite behaviorism and cognitivism continued to exert their influence, constructivism assumes, since the 80s and 90s, centrality in the field of educational technologies (Ranieri, 2011). This general paradigm in which different trends develop, means the learning process in more active terms than the previous paradigms. The student is not a passive subject who receives only information from the outside world, but through a personal exploration and his previous knowledge, he builds his own representation of the world (Von Glasersfeld, 1989).

In this perspective, then, the process of reflection on students' learning paths, guided by the teacher, appears fundamental. It is evident how this paradigm attributes centrality to the individual, as an alternative to an approach based on the centrality of the teacher as the depositary of universal knowledge, abstract and independent from the context. The aim of the educational process is not therefore the acquisition of content that has been pre-structured and permanently cast, but the development of skills, of a personal methodology, which progressively makes the subject autonomous in his cognitive processes. So learn to learn. A very current and functional methodology for a society like the present one that requires the acquisition of cognition and knowledge throughout life.

Naturally some of these principles, as seen, have also been developed by cognitivism. In constructivism, the cultural dimension takes the field the cultural dimension in knowledge acquisition processes, neglected by cognitive scholars, capable of influencing the development and learning of a subject (Varisco, 1995). The cultural data functional to the acquisition of knowledge is evident, as indicated by Bruner (1992): "it is not exclusively located in our mind, but also in the notes we take on our notes (...), in the manuals we have learned to consult, in the sources of information that we have uploaded on the computer, in the friends that can be traced to ask for a reference and so on, almost to infinity". The meanings are not clearly identified at the beginning (objectivist approach), and are not exclusively mediated by interaction (interactionist paradigm), but built by the individual through a network of experiences and associations, which determine a personal interpretation of the world (Galliani, 2004). This socio-cultural approach that sees learning as a socially shared process and mediated experience (centrality of intersubjective relationships and available cultural resources, a social and situated dimension of learning and knowledge) is scientifically inspired by the work of Vygotsky, and subsequently by those of other authors such as Brown, Collins and Duguid, Pea and Salomon. This paradigm, which is therefore focused on less individual and more social and collective models of knowledge, has led to concrete applications in the experiences, cited by Maria Ranieri (2011), of *community of learners* (Brown and Campione, 1990), *cognitive apprenticeship* (Collins, Brown and Newman, 1995), *mutual interactions* (Salomon and Almong, 1998), *community of practice* (Wenger, 1998). This last concept, related to the communities of practice, highlights the centrality of the social and cultural dimensions of learning: "it consists of active participation in community life and is based on forms of apprenticeship that see the gradual and progressive involvement of the less experienced trainee in knowledge co-construction activities. In this process the novice is accompanied and supported by more experienced peers, able to account for the competences placed in their performance. The learning of a particular skill or the understanding of specific cultural and social practices consist in a fundamentally tacit process that involves mainly imitative behavior based on the observation of expert behavior" (Ranieri, pp. 125-126).

Therefore in teaching/learning contexts, considered as a social process, the role of the student is fundamental, is an active subject and protagonist of the educational process, participates in the construction of his knowledge by combining cognitive activity and social interaction/negotiation inside a community of interpreters. The "objective" knowledge leaves room for the observer's point of view, which creates his own reality determined by the personal disposition to observe and know it. Past experience, interaction and social collaboration play a central role in learning processes. Each individual builds his own "map of meanings" within an environment considered as a place for relationships and experimentation. Within this paradigm, a clear distinction between the observer and who is observed is impossible, because they both define themselves as such through mutual interaction.

Following are the fundamental principles of constructivism, the result of the theoretical contributions of its main exponents (George Kelly, Ernst von Glasesfeld, Heinz von Foester, Humberto Maturana, Francisco Valera, Jean Piaget) and summarized by David Merril (1991):

- *Knowledge as a personal construction*. A knowledge built on one's own experience is opposed to an objective and generalizable knowledge.
- *Active learning*. Learning does not take place through a transmission system (from the teacher to the learner) but thanks to the active participation of the learner and the role of the teacher as a facilitator of a process. The *being able to do* is preferred to *knowing how* from cognitivism derivation and *knowing what* a behavioral derivation is.
- *Collaborative learning*. Central in the processes of learning is the activity of interaction and collaboration that allows the negotiation of meanings. The educational process then highlights the differences and multiple perspectives on a certain theme within which the individual must move to get his own vision.
- *The importance of the context*. The so-called *situated learning* that takes place in a realistic context, therefore connected, anchored to reality and its complexity. For example through the creation of a community of practice.
- *Intrinsic evaluation.* The moment of evaluation must be seen as an activity integrated into the task, it must be part of the process of constructing knowledge and how learning cannot be taken out of context.

Naturally in this learning model the student can't be left alone but needs the guidance of a *mentor* or a *coach,* expert in teaching strategies with the task of managing collaborative activities, of assigning specific tasks to individuals. The teacher's role is no longer to transmit knowledge but to contextualise, to orchestrate the exploration of the student's world.

Within the paradigm it is possible to distinguish different attitudes, some extremes, other moderates. In this regard, we follow Angela De Piano (2016, pp. 29-30): "On the one hand there are those who believe it is impossible to establish the content to be transmitted by default, because each learning task is unique and the contents can't be separated from the context and the concrete use. It is therefore not possible to carry out any external control on educational events and there can't be any category of objectives. It is understood that this approach is likely to make the paradigm itself impracticable, if interpreted so rigidly.

A more moderate attitude recognizes the existence of an external knowledge characterized by a universal syntax and disclosed through the known domains. This less rigid position has its basis in the Russian psychological school: learning has a social nature and interaction takes place thanks to tools and signs that are products of culture and that mediate the action of the subject on reality (Goussot & Zucchi, 2015). Individual processes and social processes are therefore involved in learning. In this perspective, the acquisition of knowledge becomes an act of responsibility while the class becomes a community that shares knowledge. In this way is formed a class characterized by a climate of discussion and constructive criticism".

An optimal teaching strategy is considered one in which the teacher gradually fades to favor the student's autonomy (Collins, Seely, Brown & Newmann, 1995): a first phase in which the expert performs his performance, shows all the necessary steps to complete a work, and the student tries to imitate him (*modeling phase*); a second phase in which the expert gives the student the support he needs (*assistance phase*); a third phase in which the progressive *elimination of expert support* takes place[11].

In this perspective cognitive technologies are used as means to improve knowledge sharing, communication, integration and cooperation, to facilitate exploratory activities and of active construction of knowledge. The technological resources become tools able to promote contextualized learning and to enhance and respect the differences of each one by encouraging everyone's participation. This use of technology has been reflected in various experiences already in the '80s and' 90s, from the LOGO of Papert (1994), to the *Hypercard* of Jonassen (1989).

Papert's work sees technologies as tools *with which* learn rather than tools *from which* learn, and the student must be encouraged to converse/dialogue with the artifact. The famous LOGO reflects this philosophy: by giving instructions to a turtle and guiding its action, children learn to think and solve problems (Ranieri, 2011, p 124). For Papert, the learning process is an activity of constructing representations of the world with which one interacts. He introduces the concept of constructionism that, comparing to constructivism, directly brings into play cognitive artifacts, namely devices that facilitate the development of specific learning (Pomes, 2009). Constructionism implies the centrality of the set of constructions through which implement the learning process: in Papert's indications the construction of knowledge is directly connected to the constructed product. In his learning machine the child has to program the machine, and not the machine to program the child (Papert, 1994): contrasting the didactics based on *learning to use* (prevalence of teaching on learning), a didactics founded on *using for learning* (prevalence of active learning on teaching) (Varisco, 1995). The ideas of Papert in the late seventies revolutionized the use of computers in teaching, making it a tool manageable entirely by the user and so enhancing the operational autonomy of the latter and the pure reactivity (executive) of the machine "is the student that programs the computer and is not programmed by it".

Active, critical, interactive, constructive and social use of teaching technologies determine the transition from teaching design to objectives to learning for projects and meanings. Meanings that make sense through artifacts, from which use derives a structuring of socially situated knowledge. A

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[11]This procedure sees the teacher as a figure that gradually fades: in the modeling phase he shows all the steps necessary to complete a work; in the scaffolding phase it offers support in carrying out the task, until the student completes the work; in the third phase of fading his contribution slowly decreases favoring the student's autonomy (Zecchi, 2006, with reference to Collins, Seely, Brown, Newmann, 1995).

virtual learning environment should, in this sense, become a space for collective production and dissemination of knowledge, based on the collective action of users (Agostinelli, 2007). The virtual communities so structured become environments of social equality and diversity: here are built social nucleuses in which all individuals can participate with confrontations and discussions and in which everyone can express himself spontaneously in his uniqueness (Ferrarini, 2008).

Today the characteristics of the new technologies favor the teaching paradigms based on collaborative activities and contextualised in real situations: from researches on *Computer Supported Collaborative Learning*, at the beginning of the 90s, based on environments able to favor dialogic processes of collaborative construction of the knowledge (Scardamaglia & Bereiter, 1994); up to the latest logics of the web 2.0. The latter are linked to aspects of participatory culture (Jenkins et al., 2009), activities within online social networks (social networking), collaborative forms of knowledge construction (wiki) etc.

IV.2.4. CONNECTIVISM

The fourth paradigm investigated is that of connectivism, naturally linked to the latest generation of web environments. This is evident from the indications of his major exponent, George Siemens (2005), who assumes that the main theories to which refer when creating virtual learning environments - behaviorism, cognitivism, constructivism - were not born with the intent to investigate and guide the relationship between technologies and teaching/learning processes. They have been rather adapted to the educational technology sector. Moreover, these paradigms are not functional, to investigate the new relationship that has been created, in the era of web 2.0, between the technologies and the communicative, social, educational aspects of everyday life.

More in detail, Siemens supports how digital technologies need new paradigms that are more functional to the characteristics of information and knowledge society. Company characterized by the affirmation, in particular from the 90s of the last century, of the digital revolution and the consequent information paradigm. Following are the salient points:

1. contemporary society, naturally with differences according to geographical areas, is characterized by the pervasiveness of information and communication technologies (ICT), which are now central to all the processes that regulate human action;
2. it is clear how the use of technologies in the working, educational, social activities and the consequent transition from the *Gutenberg galaxy* to the *Internet galaxy* (Castells, 2002, 2009), has led to profound changes in communication processes and in the methods of acquisition and construction of knowledge;
3. the new relationship that individuals and therefore also the students have with the information is determining epistemological and methodological challenges for the social sciences, as well as for the humanistic and pedagogical ones.

It is the concept of Web 2.0 that has catalyzed the attention of the connectivist scholars, as has already happened for constructivism: in particular the definition of the new paradigms of collective intelligence (Lévy, 1994; 1999) and connective (Siemens, 2005) that have made an important contribution to networking formation. Blogs, wikis, social bookmarking, social networking sites

increase the ability of individuals to connect, to get in touch with experts, with information and so on.

Therefore a peculiar aspect of connectivism is the centrality of the network, the nodes and connections are used as a metaphor to explain how learning takes place. In this metaphor, a node is anything ranging from: information, data, images, feelings. Learning is a process that creates connections and develops a network. "In the indications of researchers in the connectivist area, the ability to connect to information sources and networks of people through digital technologies is more important than the knowledge actually possessed: learning means ultimately remaining connected" (Ranieri, 2011, pp. 129- 130). In light of this, according to the hypothesis of some researchers, "the influence of digital technologies on learning does not consist in improving learning in itself, but in modifying the relationship of the individual with knowledge and information" (Ranieri, 2011, pp. 128). At the center there is no longer the impact that technologies have on cognitive processes, but the functioning mechanisms at the base of the relationship between the subject and the information in the new virtual environments dominated by networking logic: learning depends on the way of connect, operate, increase your network (Siemens & Tittenberger, 2009; Chatti et al., 2010).

Listed below are the basic principles of connectivism, identified by Siemens (2005):

1. learning and knowledge are based on difference of opinion;
2. learning is a process of connecting nodes or information sources;
3. learning can reside in non-human devices;
4. the possibility to increase one's knowledge is more important than how much someone knows at the moment;
5. powering and maintaining connections is necessary to facilitate lifelong learning;
6. the ability to identify connections between areas, ideas and concepts is a crucial skill;
7. validity (exact and up-to-date knowledge) is the goal of all connectivist learning activities;
8. making decisions is a learning process;
9. the choice of what to learn and the ability to make sense of incoming information take place according to the changing reality. If there is now a right answer, it may turn out to be wrong tomorrow due to changes of the climate of information that influence decision-making.

One of the most known applications of the connectivist paradigm concerns the MOOC (massive Open Online Courses) educational environments. The term MOOC is coined by Dave Cormier and Bryan Alexander in reference to the initiative promoted by the theorists of connectivism, Stephen Downes and George Siemens in 2008, in an open course called *Connectivism and the Connective Knowledge* (CCK08) (Cormier, 2008; 2012). Downes and Siemens structure their course (*Connectivism and Connective Knowledge*) on a connectivist approach as evidenced by the presence of the "c" in the acronym (cMOOC). In the title of the course is already clear the goal of educational experimentation of Siemens and Downes and their cultural reference in Ivan Illich (1971) according to which the training must "provide all who want to learn with access to resources at any time in their lives; empower all who want to learn what they know and, finally, furnish all who want to present an issue to the public with the opportunity to make their challenge known". According to this perspective all the contents of the course were made available through RSS feeds, and students could participate

through various communication environments: Moodle, blog, Second Life and other networking systems (Daniel, 2012).

Obviously, we must always be aware of the lack of scientific evidence, especially when we talk about the effectiveness of "open" technological environments in the autonomous construction of knowledge by students (Calvani, 2007, Calvani and Vivanet, 2014). Antonio Calvani warns against easy enthusiasm, especially when in these theories we try to involve the school world by demanding that it adapts to the new principles by underestimating the complexity of technical and cognitive operations that are only achieved after a long and articulated training path, path based also on the contribution of traditional culture: "A wild transfer of connectivism to the school can lead one to believe that it is enough to put students on the net to produce knowledge, consolidating that famous widespread stereotype, according to which, the more technologies that are in any way used, the better it is for learning" (2008).

Connectivism has also been subject to criticism from many parts. Pløn Verhagen (2006) has claimed that this paradigm is not a theory of learning, but rather a "pedagogical vision": learning theories should deal with the educational level (how we learn), instead connectivism is aimed at the curricular level (what we learn and why we learn.) Bill Kerr (2007), another critic of connectivism, believes that although technologies influence learning environments, pre-existing theories are sufficient to explain how knowledge is built in the digital era.

Part II
Experimental research

MULTIMEDIA TEACHING SITUATIONS
**CASE STUDY AT UNIVERSITY OF FERRARA**

THE DESCRIPTIVE-CONSTATATIVE RESEARCH:
FAD MODEL AT UNIVERSITY OF FERRARA

This research project born from the need to ponder on the training practices and their models (in global terms), and eventually on the consequences that both have on behaviors and learning abilities. In particular, the purpose of this research is to analyze the main epistemological paradigms that guide university teachers to use cognitive artifacts, with particular emphasis on web conference. In order to have a significant impact on learning processes, each cognitive artifact must be designed and used following precise theoretical paradigms binding its use. The methodology is therefore intended as cognitive epistemology.

The intent of this research project is to verify through scientific evidence the teaching attitude of the University professor of Ferrara towards multimedia learning: the analyzed teaching experience is called *FaD To attend at distance* (within the text we will use the term "FaD model" or just "FaD") (Figure no.1.V), not to be confused with the acronym *FaD Distance learning*. In particular, the use of the web conference educational tool as support for the classroom lesson will be analyzed.

The final aim is naturally to make a contribution to the improvement of learning processes in media teaching situations.

Figure no.1.V. *Fad Model (presence and telepresence)*
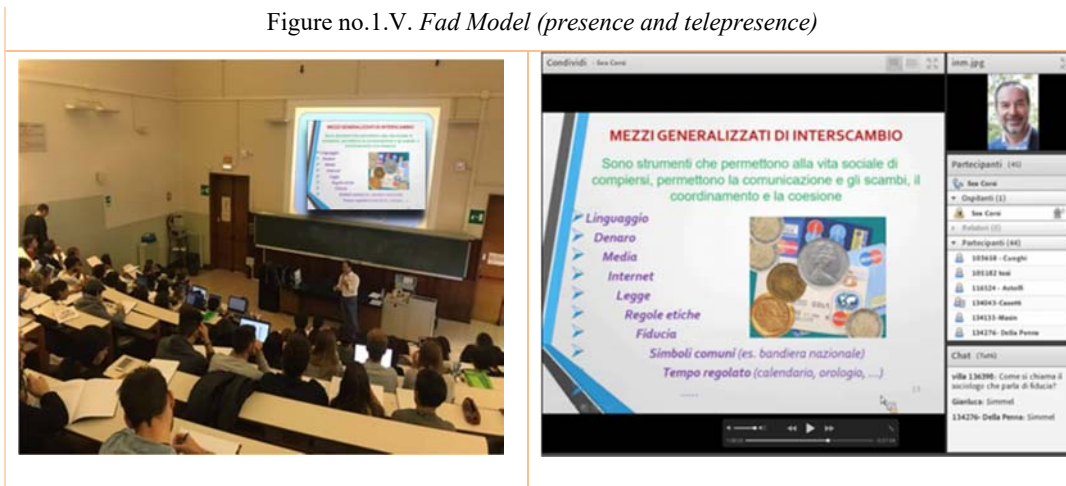
Key concept and background

The field of reference is "teaching with the media" and in the theoretical part of this thesis we have critically examined a series of themes and some key concept that form a conceptual background for the experimental part. Let's summarize the main one: visuals, video pedagogy, cognitive artifacts, multimedia learning, web conference.

- *Visuals*

In the representation of didactic contents through the use of multimedia the new communication elements, compared to the consolidated tradition of writing, that come into play refer to what in this thesis was referred to as "images" or "visuals". The two terms, in this work interchangeable, indicate the use of photographs, graphics, drawings, lettering, animations, videos in educational processes. Any form of visual communication, with the appropriate differences that we have seen, falls within this large category of visual materials used in an attempt to improve learning processes.

Each visual element can have a precise meaning, but it is important to understand how the relationship between all the communication materials used is fundamental to convey the overall sense of multimedia presentation. The combinatorial possibilities are endless and there are no rigid taxonomies, universally valid guidelines, to be used if necessary in order to be effective. To understand better how using visuals we can improve students learning we have carried out the following theoretical path: *The role of visuals in the construction of the knowledge: a historical path between cinema and television*. Specifically we have investigated the use of audiovisual mass media in educational processes (from school cinema to didactics and integrative television), trying to identify the actual results in light of initial expectations. Experience with a number of obvious limits is found in the scientific debate, but it is important to better understand the *current relationship between visuals and didactic technologies*.

During the chapter we describe all the features of the visuals used in the investigated experience, externally or internally in the web conference environment: instructional videos, video lessons, multimedia presentations.

- *Cognitive artifacts*

Artifacts, both material and symbolic (for example, writing), were created with the aim of improving the life of the human being and making it more and more powerful in relation to the environment in which he lives. Every technological progress has therefore brought advantages to the communities in which it has been employed: much of the intelligence of the human being derives, in the indications of Norman (1995), precisely from his ability to create artifacts.

According with Norman two are the most important characteristic of cognitive artifacts: *optimal flow* and *invisibility*. The technological cognitive artifact must guarantee the so-called *optimal flow*, a kind of absolute absorption that determines the maximum concentration in the activity in which the student is concentrated (Norman, 1995). This concentration is evident in the practice of recreational activities, as in the case of video games, less in those related to the study. It is no coincidence that some have investigated the practices used in video games and their transfer to learning processes (Gee, 2013). More generally, the practices that facilitate the optimal flow are those with clear objectives, precise rules, continuous feedback, motivating, able to transmit continuous feelings of challenge, those that limit at most the disturbing factors that could interrupt the experience. The second characteristic that must be possessed by educational technologies is the invisibility: the attention must be placed on the task, not on the instrument (Norman, 2015), as it happens today with

the technologies of the pen or the book. The invisibility, we believe, must go in the direction of the creation of technological environments and interfaces centered on human being, and not on the machine, then away from technocentric attitudes, which impose on the user rigid and difficult rules to follow (Norman, 2011) .

- *Multimedia principles*

Students learnings through multimedia presentations does not depend on the presentation of the necessary information, but on the presentation of the necessary information provided according to the functioning mechanisms of the students' mental and cognitive processes. There must be awareness of the effectiveness of the principles of multimedia only if these are used appropriately, the visual elements are not all equally functional to the learning processes. Countless examples have been reported to support these indications. The third chapter, *Multimedia learning and cognitive processes*, examines the theoretical models - cognitive load, psychological functions of images, functioning of memory, etc. - which explain how to encourage meaningful learning processes. The most interesting studies are those related to cognitive psychology and the principles of Instructional design (Paivio, 1971; 1990; Sweller, 1988, 2010; Mayer 2003, 2009; Clark and Lyons, 2010).

- *Video pedagogy*

The introduction of technology into teaching and learning processes does not automatically imply educational innovation. Frequent are situations of mediatised teaching 2.0 in which the classic models of transmissive teaching are moved. They use video lessons, web conference, teaching units in pdf, other materials, without exploiting the true potential of the latest technologies towards paradigms of more participation, collaborative and relational. It is clear then how any approach to the relationship between technology and teaching should be based on reflections that are meditated on didactic, methodological and normative aspects. As Maria Ranieri stresses (2011, p. 59), some cautious realism has to be maintained: in front of the "magnificent and progressive ways" praised by some authors, the history of technology in education is much more controversial. Even though over the last twenty years technology facilities of schools and universities have increased dramatically, much of the promises of transforming processes and educational practices have not materialized and the potential for learning technology seems to have been realized only occasionally". Says Laurillard (2008, p.1): "Education is about to be transformed by technology to learn, but it has remained stuck on that point for a few decades now."

For these reason we examined two other fundamental themes for analyzing the Fad model and specifically the web conference: the principles of video pedagogy (II chapter) and teaching paradigms functional to the use of technologies (behaviorism, cognitivism, constructivism, and connectivism) (IV chapter).

- *Web conference*

Didactic with media increasingly uses the web conferencing tool in its own setting for its effectiveness and ease of use. In e-learning contexts about setting of this kind, we also talk about

virtual classroom lessons, webinars, or online seminars. Apart from their use, as a transmissive lesson with relational moments, seminar, debate, etc., web conferencing sessions determine communicative processes characterized by "rich information" (Daft & Lengel, 1984, 1986), thanks to the possibility of reducing the risks of misunderstandings in asynchronous communication. Thanks to its interactivity potential, the use of various modal channels, the variety of usable languages, and especially the presence of social indicators, the web conference is secondary only to face-to-face communication. According to this model, in our experimentation, teaching communication using web conference must consider the simultaneous presence of two different audiences: the students in the classroom and the students in the virtual classroom. With all that comes with it. A different relationship between the participants in the educational process (on a double layer) and a new geography of the lesson, which both influence the perception of the subjects and, consequently, the way in which the knowledge is acquired/constructed. Other important aspect in using web conferenze as an educational tool is the use of the visuals.

V.1. THE FAD MODEL AND ITS CHARACTERISTICS

At the Humanistic Department of the University of Ferrara, a part of the university lessons, starting from the academic year 2013-14, was structured according to a new didactic model: this model is based on the integration of the classroom lesson with the distance learning methodologies (Ganino 2015, a, b). The model has been called *FaD to attende at distance* model, not to be confused with *FaD distance learning*. This is an educational model that involves the attendance of a classroom lesson with a series of technologies (*technology enhanced learning*). The previously mentioned technologies are the same that have been used in either distance or blended educational models at the University of Ferrara since the end of the nineties. For this reason, the Se@-*Center of Technologies for Communication, Innovation and Distance Learning of the University of Ferrara* has been entrusted with the management of the project[12].

The declared objective of the University of Ferrara at the beginning of the experimentation was to apply the FaD model to all the University courses over time, in order to:

- enrich traditional teaching methods using technologies and related paradigms;
- build more flexible university courses to allow a personalization of the educational path, especially for workers or off-site students;
- erase the concept of non-attending students;
- reduce the number of students enrolled for supplementary years;
- foster the management of inter-university courses;
- improve student's performances;
- make the educational offer of the University of Ferrara more interesting and closer to the new learning "styles" of the young generations.

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[12] An initial part of the experience, reported in this text, has been described in some paper (Ganino, 2015 a, b).

Basically, two different methods have been developed in addition to the classroom lessons: basic and advanced (Table no.1.V).

V.1.1. BASIC MODE

The lecturer's lesson, recorded with both audio and video, is broadcasted via live streaming allowing students to make use of it also in the virtual classroom on any devices connected to the internet (Figure no.2.V). The properly trained teacher uses a radio microphone to transmit and record his speech; he gets recorded by a camera or webcam pointing at/directed towards his usual work space; the appearance of the teacher can be replaced by a photograph; his computer screen (which usually shows a power-point presentation, but not limited to that) is shared with the virtual classroom screen.

FaD students have a continuous support by a technological tutor and they have access to a virtual learning environment (Moodle and Adobe Connect) within which they can partake in lessons: live and on demand.

The basic mode was design with the purpose of:

1. to avoid to create any difficulties for lecturers not used to using advanced teaching technologies; the web conference was provided through non-invasive procedures with the aim of making the technologies invisible within the didactic setting. To overcome resistance to technological innovation in work practices (Rogers, 2003; Bauer, 1995) a highly technological environment was created, to be experienced naturally.

2. assisting lecturers in the use of educational technologies in order to give them enough time to get used to a conscious and methodologically correct use of technological tools. The original idea was to involve lecturers little by little in the use of these potentialities allowed by the new educational setting to make them gradually reach the advanced mode.

Figure no.2.V. *Virtual classroom*
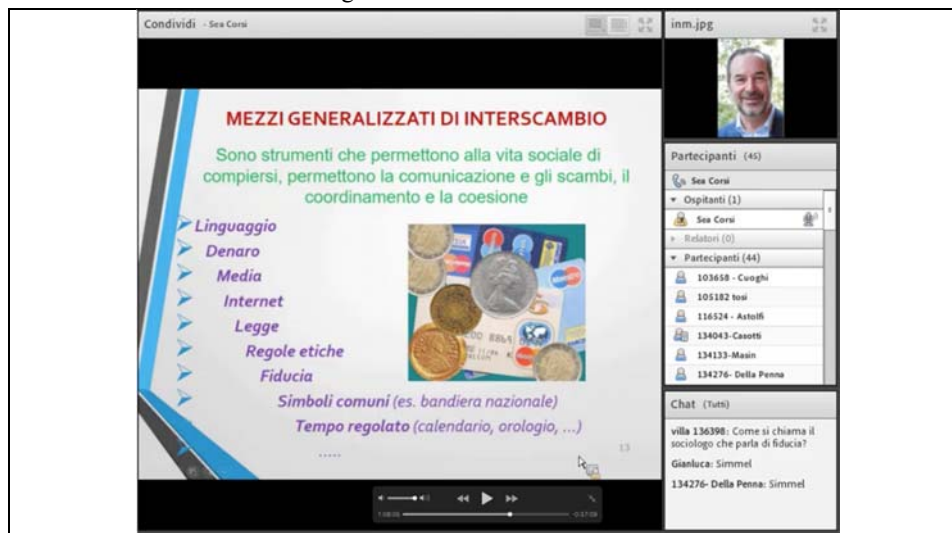
V.1.2. ADVANCED MODE

In the second method, alongside the basic teaching methods, the lecturers were asked to use a series of didactic strategies functional to distance learning, on an intentional and non-compulsory basis, in line with practices used internationally (Table no.1.V. Advanced mode): implementation of live streaming activities through the use of video lessons and educational videos, employment of relational, social and collaborative activities, self-assessment test.

Basically, this mode has a dual purpose:

1. to allow "technologically advanced" teachers to use/experiment those 2.0 educational methods that are drawing the attention of both political decision makers and educators, trainers and pedagogists. Also in line with the indications of the *National Digital School Plan* (PNSD, 2015). The plan born with the purpose of "altering the learning environments with changes in the knowledge society and the necessities of the contemporary world" underlines: a) on the one hand, the need for a transition from a transmissive paradigm to collaborative/cooperative and experience-based learning paradigm. b) On the other hand, the need to turn the teaching paradigm, based on verbal and written language, into a learning paradigm based on new multimedia languages, network logics, multiple contributions and shared responsibilities.
2. to avoid penalizing long-distance students (taking into account the educational limits of the basic model for those who attend exclusively in FaD mode).

Table no.1.V. *Teaching tools used in FaD courses*

Basic mode	Advanced mode
Web conference live streaming	Web conference live streaming
Web conference on demand	Web conference on demand
Tutor technical	Tutor technical
	Video lectures
	Multimedia didactic material (e-books, videos, MOOC)
	Online collaborative activities
	e-seminars
	Forums
	Wiki
	Blog
	Self-assessment test
	Contents and motivational tutor

V.1.3. THE NUMBERS OF THE FAD MODEL TRIAL

It seems opportune to point out the importance, in quantitative terms, of the course that have used the proposed model: this in order to underline the necessity of a didactic approach based on scientific evidence.

During the first year of activation (2013-14) the courses involved, belonging to 2 degree courses and two master's degree courses, have been 43 (Table no.2.V), while the students enrolled in FaD

mode were 737 (Table no.3.V), and the total hours of lessons supplemented by the use of technologies 1720 (Table no.4.V). In its second year of trial (2014-15) the model has been applied to 90 courses (Table no.2.V), belonging almost exclusively to 6 degree courses and master's degrees; the hours of lessons, supplemented by the use of technologies have been 3600, the students involved 111. During the third (2015-16) and fourth year of application (2016-17) the number of university courses has stabilised 120 in the third, and 146 in the fourth. During the current academic year at the Humanistic Department, there has been a slight decrease essentially due to the decrease of university courses within the Department. Always during the current academic year there has been a very considerable increase due to the application of this methodology within the *Department of Life Sciences and Biotechnologies*.

Table no.2.V. *Number of FaD courses - Humanistic Department*

Degree course	Academic years				
	2013-14	2014-15	2015-16	2016-17	2017-18
Science and technology for cultural heritage	18	19	13	7	X
Philosophical and educational sciences	X	11	17	17	18
Communication sciences and technologies	6	18	18	20	18
Quaternary, prehistory, archeology	10	26	21 10 (lab.)	31 11 (lab.)	31
Cultures and traditions in the Middle Ages e in the Renaissance	9	7	9	9	9
Letters, arts and archeology	X	X	11	31	29
Modern and classic languages and literatures	X	9	11	10	10
Modern Languages and Literatures	X	X	10	10	3
Total	**43**	**90**	**110 + 10**	**135+11**	**118**

As shown in Table no.3.V, the student population involved in the experience is very high: if we consider only active students (A), ie those who regularly enter the platform, it has gone from 737 (academic year 2013-2014) to 1702 (academic year) 2017-2018). Students seem to greatly appreciate the possibility of seeing or reviewing live and recorded lessons for study purposes. Above all, we think, those students unable to be in the classroom for personal problems or because student workers. We have not investigated this aspect.

Table no.3.V. *Students enrolled for the Distance attendance method (Humanistic Department): T (total number of students enrolled in the degree course); A (number of active students).*

Degreee course	Academic years									
	2013-14		2014-15		2015-16		2016-17		2017-18	
	T	A	T	A	T	A	T	A	T	A
Science and technology for cultural heritage	84	54	91	56	64	39	45	29	16	11
Philosophical and educational	X		480	291	578	340	684	440	816	491

sciences										
Communication sciences and technologies	42 3	26 1	449	273	483	294	565	339	674	421
Quaternary, prehistory, archeology	86	84	138	131	151	47	151	140	148	138
Cultures and traditions in the Middle Ages e in the Renaissance	51	34	53	33	53	33	51	34	54	35
Letters, arts and archeology	X		X		75	45	129	79	214	140
Modern and classic languages and literatures	X		557	335	392	239	257	159	94	58
Modern Languages and Literatures	X		X		236	142	435	264	675	408
Total enrolled students (T)	**1564**		**1768**		**2032**		**2317**		**2691**	
Totale active students (A)	**737**		**1119**		**1179**		**1484**		**1702**	

As shown in Table no.4.V, the hours of registration are thousands. It has gone from 1720 during the academic year 2013/14 to 4860 during 2017/18.

Table no.4.V. *Hours of lessons transmitted in live streaming (Humanistic Department)*

Degree course	*Academic years*				
	2013-14	2014-15	2015-16	2016-17	2017-18
Science and technology for cultural heritage	720	760	520	280	X
Philosophical and educational sciences	X	440	680	600	720
Communication sciences and technologies	240	720	710	780	820
Quaternary, prehistory, archeology	400	1040	840	1160	1240
Cultures and traditions in the Middle Ages and in the Renaissance	360	280	360	330	390
Letters, arts and archeology	X	X	440	1140	1160
Modern and classic languages and literatures	X	360	440	400	440
Modern Languages and Literatures	X	X	400	380	320
Total	**1720**	**3600**	**4390**	**5070**	**4860**

In the accademic year 2017/18 the basic mode of the FaD model was also applied to two degree courses - *Biotechnology* and *Biological Sciences* - belonging to the *Department of Life Sciences and Biotechnologies*. The two degree courses had respectively 1848 and 1023 students following the decision to abolish the maximum number of students (Table no.5.V). The University's governance, in agreement with the presidents of the two degree courses, opted for the use of the streaming mode according to a dual mode, after taking note of the insufficient suitable space to host such a high number of students:

- a connection between the lecturer's classroom and different department's classrooms where students are able to attend the lesson transmitted on a monitor (one-way closed-circuit television, without possibilities of interaction);

- live streaming allowing students to make use of the lesson through any device connected to the Internet, with the possibility of interaction via chat.

Students are not given any opportunity to see the recorded lessons again.

Table no.5.V. *Live streaming activity at Department of Life Sciences and Biotechnology* (academic year 2017/2018)

Degree course	student	First semester courses	Live streaming houres	Second semester courses	Live streaming houres
Biotechnoloy (First year)	1848	Mathematics with statistical elements	48	Analytical chemestry	48
		Chemistry: general and inorganic (a)	40	Phisics	48
		Organic chemistry (b)	48	Genetics	64
		General biology	40	Biochemistry	48
		English	48	Business management	48
Biological science and natural (Second year)	1023	Botany	56	Comparative anatomy	64
		Cytology and histology	40	Chemistry: general and inorganic	64
		Maths	40	Phisics	56
		Zoology	56	English	48
TOTAL	**2871**		**328**		**488**

V.1.4. SUMMARY

Metabolisation of technologies. A first indication, solely technological, that we can derive from reading these data, shows how the technologies supporting teaching in attendance at the University of Ferrara are becoming central. The hours of lessons broadcasted via streaming and the student population involved are very high from a quantitative standpoint. This highlights a process of metabolisation of the educational technologies, which was within the exclusive domain of distance learning universities up until a few years ago.

Necessity to delve deeper into the problem of teaching quality. It is of course necessary to understand whether the use of the technologies is supported by a methodologically correct use of them, that is able to have a significant impact on the learning processes (Ausubel, 1968): namely, to allow information, notions and concepts to pierce deeply through the student's mind, to settle and to be used and possibly modified in the long term. This type of analysis will be carried out in this chapter.

Technological infrastructure. These data also highlight the problem related to the University's technological infrastructure. The Net has now become the infrastructure that supports the so-called Knowledge Society, a society on which all human actions, of an economic, social,

cultural, political, communicative and interpersonal nature pass. In universities the conversion to digital commits the three macro-sectors: administration, communication, teaching. The massive use of technology must include a plan to improve: a) the technologies present in the classroom; the network infrastructure; the storage and distribution technologies of teaching materials.

V.2. DISTANCE LEARNING AT THE UNIVERSITY OF FERRARA: MAIN APPROACHES

To guarantee an objective evaluation of the experimentation of the FaD model, it seems appropriate to retrace the overall experience with distance learning at the University of Ferrara. A comparison, even considering the difference between the models in use, is necessary for a better identification of strengths and weaknesses and possibly intervene with improvement operations.

Distance learning began in Ferrara around the mid-nineties as an experiment, a period during which training courses for teachers and school managers were activated. Thousands of students have been enrolled in these courses. It appears evident how a formative request of this magnitude could not be considered a random occurrence; rather it represented a sign of new training demand requested by an audience professionally engaged in full time occupation and unable to attend a professional update, especially women. This convinces the University of Ferrara of the need to have a Technology Center with the purpose of "designing and experimenting innovative teaching methodologies, conceiving and producing materials, promoting, organizing and coordinating and evaluating long-distance teaching activities (…) carry out research in the areas of learning, teaching and education".

As proved by the practical experience, distance learning at the University of Ferrara has gone through two phases, each representing a different methodological approach. At the end of the nineties, the educational practice consisted in the transmission of contents through paper and multimedia documents (teaching units, pdf, educational videos distributed in VHS and then DVD, hypertexts and hypermedia). The limitations of this model appeared evident due to the lack of socio-relational and interactive processes to support learning, partly limited by the work of system and content tutors (work that took place via telephone and e-mail). The courses, despite the important results, from the point of view of adult training and the lowering of the barriers to university access for disadvantaged users, reproduced a teaching model of a transmissive and behavioral nature.

During the second phase, the evolution of 2.0 technologies towards social, participatory and collaborative activities allowed to modify the methodological approach, as shown by the research activities of the center: use of educational environments based on a synchronous and asynchronous interaction and on the use of dynamic documents created upon request by the users (Frignani, La Vecchia, Pedroni & Poletti, 2007); use of concept maps (La Vecchia & Poletti, 2009; Pedroni, 2004); the redefinition of the tutor figure focused on collaborative activities; the use of multimedia supports and advanced digital documents to build contents (Ganino, 2009; Pedroni, 2006); the use of tools that promote collaborative activities and the implementation of socio-constructivist teaching methods (Ganino & La Vecchia, 2013). In short, the educational model has evolved towards a constructivist approach over the years, aimed at overcoming the individual and passive study of educational materials provided on the web (e-content), and the use of those paradigms focused on the social and cooperative dimension of learning.

More in general, the *Center of technologies for communication, innovation and distance learning,* within a sustainable e-learning model (Trentin, 2008), interpreted as a correlation between economic, organizational, technological and educational aspects, has always given particular attention to the didactic-pedagogical dimension rather than to the cost reduction or to the overcoming of logistic-organizational problems, albeit still important. In the overall assessment of the FaD model trial, one can't fail to consider the substantial difference between e-learning as facilitated access to teaching materials (centrality of the transmission model), and an e-learning based on the principles of constructivism and the active role of participants in the educational process (centrality of social connotation). According to the practical experience of the University of Ferrara the teaching paradigms we referred to have been applied to three distance learning degree courses, in dozens of masters and advanced courses, and continue to be employed in the postgraduate sector.

The one just described is the cultural reference scenario of the FaD model trial. It seemed useful to briefly retrace this path to highlight how the FaD model experience was born in an academic context, that of Ferrara, with a good tradition on the use of educational technologies.

V.3. ORGANISATION OF MULTIMEDIA TEACHING SITUATIONS

The aim of this paragraph is to introduce concretely the most frequently used multimedia artifacts at the University of Ferrara, which are the background of the analyzed experience:

- the instructional video;
- the video lessons;
- the web conference;
- the video annotation tools.

We also insert a series of guidelines produced by the Se @ (*Center of Technologies for Communication, Innovation and Distance Learning of the University of Ferrara*) functional to a didactically effective realization of these artifacts:
- some guidelines on how to produce an educational video;
- others on how to create a multimedia presentation to be included in video lessons and in the web conference.

Naturally, these are not the only educational tools used in e-learning activities at the University of Ferrara. As the objective of this thesis is to work on audiovisual teaching resources, we only deal with educational tools based on the use of visuals. For greater completeness we insert a paragraph on Moodle, the educational environment used to carry out all activities in e-learning.

V.3.1. USING OF EDUCATIONAL VIDEO

In the theoretical part we have described the teaching potentials and the methodologies of use of this tool. In this part we give concrete indications on how to make these artifacts in such a way as to make them effective in terms of teaching.

V.3.1.1 GUIDELINES FOR THE CREATION OF THE EDUCATIONAL VIDEO

As a summary of the path on the educational video covered in the first part of this text we report a series of guidelines regarding its implementation. Used a lot in the first experiences of distance learning at the University of Ferrara, the educational video is now used as an integrative methodology for the web conference and/or video lessons. In the awareness of the integrative (and never substitutive) function of the lesson using the instructional video, we provide a series of indications for its effective use and for a design plan in line with the principles that are used the most in this field.

- In order to foster meaningful learning, the student's emotional involvement must be accompanied by critical reflection. The teacher's intervention is recommended to help systematize the experience, starting from the indications to be given on the teaching objective, and on *what and how to watch*. It appears useful for teaching purposes to ask questions aimed at the verification of the comprehension (self-assessment of the student) at the end of each audiovisual module.
- Introduce the video content by proposing some questions and creating expectations in the students who must be invited to participate in a journey that will lead them to discover something. It is also important to emotionally involve the student in order to boost his interest in the subject and his active participation in the educational process. For this purpose we recommend the use of a colloquial language.
- It is important not to underestimate the *attention time* that depends on the duration of the video, on the characteristics of the users and on the complexity of the content. In this regard, the presentation rhythm must be well studied: it is important to pay attention to the elocution speed, the teacher shown on video must adapt his diction speed and the pauses between each sentence to the characteristics of the recipients and the complexity of the content, both audio and video (even images must be "read").
- An audiovisual text (identical in quality and quantity of information and for the terminology used) obtains greater learning effects if the sound version (the comment) is simplified. In order for this to happen without impoverishing the content, complex periods must be broken down into simpler ones through a syntactic construction based on a *parataxis criterion* rather than an *hypotaxis*. A text based on a parataxis or coordination criterion, typical of the spoken language (short sentences, independent from one another, connected by a comma or a conjunction) can determine a fast and concise pace. A text based on a criterion of subordination or hypothesis typical of the literary expression, (long and complex sentences, constituted by main propositions on which the subordinates linked together by conjunctions depend) implies a greater commitment on the user's part and a slower narrative pace because it involves analytical reflection and deeper reasoning. We recommend a strategic planning of the text that also allows: the elimination of repetitions, a more objective and synthetic structure, a greater richness and appropriateness of the vocabulary, an informative completeness.
- The video structure must be segmented and modular (as one-conceptual as possible). This structure allows for a better use and the possibility to apply content/visual changes more easily

and a re-use in different contexts. The educational videos can be used in different contexts: as an integrative material for the lesson in attendance as teaching material in a MOOC or in courses in "e-learning", "flipped" or "blended" mode.

- The Video allows the personalization of the learning processes. Personalization can be double: *internal to the video*, through the possibility to pause to reflect and take notes on what you are studying or through the possibility of reviewing parts of the video; *external to the video*, which is a fruition free from spatial and temporal barriers.
- The effectiveness of the video is not determined solely by the performance of the teacher/expert of the content, but also by the multimedia component. The simultaneous use of several communication codes makes teaching communication more effective. The oral language, immediate, spontaneous and transparent, determines the involvement and possibility of codifications that specify the meaning of the exposure (one must also pay attention to non-verbal forms of communication such as facial expressions, tone and rhythm of the voice, etc.) The reader's attention must be visually guided by the use of graphic elements and visual descriptors (synchronized lettering, use of graphics, photographs, animations, drawings, etc.), and possibly by the use of music, sound effects and a voice voiced by a professional.
- The possible use of annotation or interactive tools can be useful (see later about video annotation tools).
- Summarize the topics addressed and pose any questions (useful for self-assessment processes of learning) in the conclusions.

Three in practice are the important elements in this audio-visual genre, the role of the teacher, the verbal commentary, the relationship between sound and images.

The teacher. The subject expert in this mode is a constant presence, interviewed at the studio, in his workplace as a researcher, through his voice over. His presence has a function of "authority", confirming the support of the statement text of the information text, and represents the endorsement of science to the content of the educational video. Also his language is functional in clarity and simplification of contents: from the universal to the particular, connecting the great concepts to the daily, showing the relapse of science and technology in what each of us does every day, introduces science starting from daily facts.

The verbal comment. The formal and preferential solution is descriptive-informative, audio-visual elements are kept together by a school structure and rhetoric. Among available materials, real or computer-generated images (animations), sounds, and lettering, special attention is given to speech (voice over): the voice comments, describes, judges, organizes all other communicative elements. This exhibition mode in the direction of the impression of objectivity is usually supported by the teacher's first-person intervention: through the formula of an interview (lecturer as an expert interviewed), of the conference (the teacher in his most traditional role), of the debate, (the teacher participates as an expert in a discussion with other experts).

In the previous chapter, we have already mentioned the problems with the maximum number of words per minute of video defined by Carpenter (in Nozet, 1955) as the *optimum verbal comment density* (Carpenter, in Nozet, 1955); on *elocution speed* (Mialaret, 1976) and therefore on the need to consider the reading time necessary for understanding the didactic message based on the age of the recipients

and the complexity of the information given; on the structuring of the text in the direction of its functional adaptation to the characteristics of audio-visual media (Graziani & D'Orsogna, 1976), of a breakdown of complex periods in simpler ones, and the use of active form rather than passive.

Christina Amplatz (1986) investigated the best criteria to build the commentary in an audio-visual message for educational purposes. In her analysis, she quotes several scholars who, in order to make the information as explicit as possible, pose the issue of the centrality of the verbal style. Garroni (1972, in Amplatz, 1986) in particular, despite emphasizing the important function of all the expressive elements present in the audio-visual language, stresses that this should not result in a verbal language resizing to avoid losing the critical function of the didactic message. Knowing the difference between live communication, in a classroom, and screen-mediated communication, it is important to think about some technical aspects as well. Some experimental analysis (Carpenter, 1955, in Nozet) have highlighted the need for an *optimal verbal comment density,* and in some situations, even calculating the number of words per minute of the product. A high density could lead to difficulties in understanding and memorizing due to the overload of the cognitive system, which also has to connect the auditory system to the visual one. To facilitate this process, we refer to the theme of *elocution speed*, from which valuable information can be obtained for the speaker, which has to adjust its speed of dictation and the breaks between periods according to the characteristics of the recipients and the complexity of content.

An audio-visual text (identical to the quality and quantity of information and terms used) gains greater learning effects if the sound version is simplified (Graziani & D'Orsogna, 1976). In order to make this happen without impoverishing the text, it is necessary to break down the complex periods into simpler ones through a syntactic construction based largely on a co-ordination criterion (*parataxys*) rather than subordination (*hypotass*) as well as playing on active form rather than on passive (Amplatz, 1986). This information has been disclosed in the so-called "Hamburg model" for greater intelligibility of informations (Langer et al., 1974, in Amplatz, 1986), which provides: *simplicity* in word usage and syntactic structure of sentences, regardless of the level of difficulty of the content to be transmitted; the internal *articulation order* (single sentences and related information according to a clear logical sequence) and external (clear explanation of the structure of communication); *brevity-pregnance* (concise forms of communication, avoiding superfluous words); the *stimulation* (use of words or incidental sentences, stimulating attention, interest, participation, and the pleasure of listening).

Image-text relationship. Of course, even images next to the speech can play an important role, central sometimes, and not just decorative. It should be remembered, however, that video viewing is always mediated by a screen and the lack of direct contact with the user may be a cause of misunderstanding. To reduce this risk as much as possible, Ellington (1987) recommends a linear exposure that avoids any digressions that might lead off the road, in line with the principles of multimedia learning. For the same principle, attention should be paid to the overall structure of the video (text, images, soundtrack): a high cognitive load determined by many information presented simultaneously and in a short time could reduce the learning potential (Tversky, Morrison & Betrancourt, 2002).

Syncretism word-image is a recent phenomenon, before the birth of sound cinema, the two communicative elements have been considered antithetical to each other, an expression of two different ways of representing thought and knowledge of reality. The word is more rational, logical,

objective, employed for this reason in communicative function through writing and printing; the image is emotional, suggestive, subjective, used in artistic function. As Maddalena Bernardinis recalls (1986), it is only from the last century that the image invades the field occupied by the word, creating new communicative modes, and that it is therefore possible to speak of a word-image relationship as a communicative function. At the linguistic level, therefore, the situation that was analyzed by scholars of audio-visual communication is as follows: a verbal language strongly encoded, evaluated and analyzed in its most different aspects, in contrast to an iconic language for which it had to be found a grammar and a syntax, in practice a working and usable structure in order to obtain the language status, since the evaluation canon used in the art industry were often not conforming if applied to the field of communication. Several scholars of semiotics have dealt with the way in which the correlation between iconic and visual messages occurs in terms of code operation and signification processes. As already mentioned, in general, three modes of relationship between image and word can be identified in audio-visual text (Jacquinot, 1978): the case where the image occupies the entire perceptual space and the verbal element is therefore subsidiary; the case where the word has a driving function and the image is purely illustrative; the case where image and word work simultaneously with their own functional space.

Other experiments have evaluated the relationship between synchronism and asynchronism between image and word in relation to effects on learning, for example establishing that the use of the early verbal comment on the image represents the most advantageous choice when it is necessary to draw attention of the viewer on a precise point of the image itself (Mialaret, 1976).

In the analysis of the relationship between visual communication and verbal communication, as discussed in the introductory part of the chapter, semiotic studies are now supported by studies on theories of multimedia learning and on the theories of cognitive load, discussed in the following chapter (Sweller, 1988; 2010; Mayer, 2008; Clark & Lyons, 2010). A contribution although not directly related to teaching communication can come from studies on the forms and taxonomies of the director (combination of images and sounds in order to create signification processes in different fields and application areas) in the field of communication sciences.

V.3.2. VIDEO LESSON AND DIDACTIC[13]

The video lesson as its name implies is a video lesson and can therefore be used in teaching and learning contexts, in formal or non-formal situations, as teaching text to support or replace the lesson or part of it. It is evident that the natural area of application is that of e-learning, but more and more often these texts are used in secondary education as supplementary material or in flipped classroom teaching situations. Our field of reference is formal university education.

In this context, video lessons and web-conferences introduce a change of paradigm towards the uses of the video seen so far: compared to the didactic audio-visual one, video lesson or web conference are no longer used as supplementary material but replace part of the lesson in the classroom, usually the most transmissive, and thus gain a weight in terms of training credits, thus becoming central element in the process of teaching and learning.

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[13] This paragraph has been published in Italian (Ganino, 2018).

These considerations appear even more urgent to the light of the introduction in Italy of the use of teaching communication in the form of video lessons in all the types of university didactic paths, with different percentages. The ministerial guidelines in direct of the planning for the academic years 2016-18 (DM8 August 2016, n. 635) report in annex 3 a distinction among 4 different typologies of courses of study and in all the methods it's laid down the use of telematics in percentages that range from 10 to 100% of the entire offer.[14] And in parallel ANVUR guidelines (National Agency of the University system and Research) specify how to use video lessons in terms of hours/ CFU inside educational telematics. The didactics disbursed by telematic form can be divided, for each teaching, in two typologies: *disbursed didactic* (50%) in the form of video lessons, and *interactive didactic* (50%), to complement the disbursed didactic, in the form of *e-tivity*, interactive and collaborative activities (ex.: interactive video lecture, group works, formative evaluations, etc.). You can deduce, therefore, how the video in the form of video lesson is now an important educational tool in quantitative terms in all university paths.

In informal environments the use of the video is even more evident: tutorial and courses realized by teachers, educators, specialists, passionate individuals, students, about various thematics: learning of languages, mechanics of any type of service/product, software and video games operation, learning of a musical instrument etc. Everything published for free on video sharing platform, or on enterprises sites that operate online, (YouTube, Vimeo, Europeana, ExploreLearning, HowTo, Meditates etc.) with objective at times connected to the pure sharing of the knowledge, others to precise economic models.

V.3.2.1. USING VIDEO LESSONS IN E-LEARNING AND BLENDED-LEARNING

With the birth of video recording, it has become technically possible to record lessons in the classroom or in a television studio, and then distribute them on different devices. This habit has increased since the end of the eighties of the last century thanks to the development of telematic university education, which determined the *substitute use* of these resources.

The advantage of this multimedia educational format appeared evident from the beginning by putting together the authoritativeness of the content (thanks to the teacher's video presence), and the visual exemplification of the concepts treated that reinforces the educational communication. Equally evident are the limits of video lessons if they are not carried out according to clear methodological principles based: a) on overcoming the recording of the classroom lesson; b) surpassing the technological fashion suggestions; c) and on the ability to exploit the indications coming from research activities in this area, in particular those based on principles of Multimedia design and Instructional Design.

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[14] Below 4 typologies: *Conventional courses of study*. Courses of study entirely disbursed with attendance that provide - for the activities different from practical or lab ones - a limited didactic activity disbursed with telematic procedures, not in a superior measure to a tenth of the total. *Courses of study with mixed formality*. These are courses of study that provide the disbursement with telematic procedures of a meaningful part of formative activities, however not greater than two thirds. *Courses of study mainly remotely*. It deals with courses of study disbursed with telematic formality, by more than two thirds of formative activities. *Courses of study integrally remotely*. In such courses all the formative activities are conducted with telematic ways, is stationary the carrying out in presence of profit tests and final test discussion.

Lastly, consider how the continuous evolution of technology, in terms of increasing the internet bandwidth, of interactive and relational potentials, the increase of tools/applications, can offer increasingly greater teaching potential to the use of video lessons.

Considering the "substitutive" nature of the video lesson, one of the methods used to verify its teaching effectiveness is to compare it with the mode in which the teaching communication in person takes place. The bidirectional teaching communication of the classroom is characterized by a series of characteristics that determine the continuous and permanent reformulation of the knowledge building process through the feedback coming from the classroom environment. The unidirectional teaching communication typical of the video does not allow *error handling* in the absence of comparison while the transmission of contents takes place, therefore the teacher thinks on the basis of assumptions. This would seem a disadvantage at first glance.

According to some studies (Garito, 2008), what may seem an educational limit in the media processes can determine a series of advantages, summarized in the possibility that the student has to reflect better in the absence of an immediate interaction. Bi-directional communication based on comparison, clarification, feedback moments, which occurs after the information transmission phase, can be prepared better by the students. He autonomously processes the knowledge and information of the lesson and then participates in a safer and more conscious way to relational and interactive moments. Consider how in the university classrooms where highly formalized communication rules are followed, the authority of teachers does not stimulate interactivity, especially the most shy students are less likely to intervene. As demonstrated in a series or researches (Garito, 2008) the interactivity during a lesson in presence is very low, only 5% of the lesson consists of students' interventions.

V.3.2.2. THE GENERAL STRUCTURE OF THE VIDEO LESSON

Normally, the video lessons of an educational path (degree course, master, training course, etc.) provide a common structure, with slight differences depending on the methodology used by the teacher, or the characteristics of the different disciplines. The template resembles a digital adaptation of the classic educational setting, replicating the teacher's image with a screen next to it that acts as a multimedia whiteboard. The teacher can be filmed in a television studio or sitting behind a desk, improvising the speech, with the help of a teleprompter, or using a mixed technique that includes a speech prepared by default with moments of free comments (that involve the user much more). The template may include the insertion of the teacher's name, the title of the lesson, the logos of the university or institution, the titles of any section etc. It is recommended a moderate and well thought out use of these elements from a graphic standpoint to avoid excessive cognitive load, or visual distractions. The video lesson can provide an initial lettering in which some of the elements just described can be found, and an lettering at the end in which to report any other useful information to the students.

The video lesson can be accompanied by other teaching materials, object enhanced that allow in-depth analysis: video annotations, teaching units in pdf, articles, book chapters, hypertexts, uniconceptual videos, interviews, educational videos, links to Internet sites, learning objects, self-assessment, virtual laboratories, forums and all the tools currently used in e-learning platforms. The "object enhanced" can be highlighted during the scrolling of the indexed video, in order to inform

the user of the possibility to examine in depth a certain content. This method can be useful when the teacher wants to scan the time required to transfer information to by checking the evolution of the reasoning and guiding the student through the understanding of the concept debated. Naturally, this guided vision mode does not exclude the possibility of autonomous and personalized paths.

V.3.2.3. METHODOLOGICAL ASPECTS AND ADVANTAGES OF THE VIDEO LESSONS

The video lesson normally has an introductory function, while the other documents have an in-depth role and exhaustive features with regards of the subject matter. In the indications of Giovanni Bonaiuti (2010, p. 37) video lessons, "are particularly effective to allow a first approach to new knowledge domains in training sequences in a typical top-down mode". The video lesson can be effective in the transmission of contents if properly realized within a teaching intervention design. Below are the advantages identified (one can also refer to the multimedia design logics shown in paragraph 1.4.1).

- *Personalization of learning processes*. Personalization can be dual: inside the video lesson, through the different levels of interactivity, pausing the video to reflect on what is being studied, the possibility of reviewing parts of the lesson, the possibility of hyper textual and participatory paths; external to the video, which is a fruition free from spatial and temporal barriers. These possibilities allow to preserve the authority of the professors, but they make them lose the authority that often inhibits the students' interventions (Garito, 2008).

- *The teacher's planning*. The communication activated through the video lesson (in its transmission part) is unidirectional like a textbook. The advantage of this communication mode is the possibility of its complete planning that allows the elimination of repetitions, a more objective and synthetic structure, a greater richness of the vocabulary, an informative completeness.

- *Reduces exposure times*. A good teaching communication in the presentation of the lesson's contents (indication of the educational objectives, application of the principles of multimedia learning), combined with the student's higher focus level, allow to shorten the time of knowledge transfer: a 45- 50 minutes lesson can normally be reduced to about 15-20 minutes. Of course, there is a legislative issue regarding the duration of the video lessons alongside an educational-communicative problem.

- *Helps the memorization.* The study strategy is based on: a) watching the video lessons several times according to one's needs, so as to acquire the information in the working memory; b) pausing to reflect, take notes, summarize, delve deeper into the consultation of other sources; c) reviewing for a first and personal self-evaluation process. These techniques are strategies that can facilitate both the self-assessment of content understanding and the transfer of information from work memory to long-term memory. It has been proved that that the visual media synchronized to the teacher's explanation according to the principles of educational multimedia design, along the video-editing personalization processes, allow a significant improvement in the storage of contents.

- *Helps the focus*. Video lessons are followed very up close and require physical involvement (to browse, listen, take notes, elaborate further what you have heard) and a high degree of participation. The screen covers most of the field of view as the fruition happens at a distance of about 50-70 cm. This desk-use, particularly with the aid of headphones, helps the focus and eliminates many disturbing elements occurring in the classroom, especially if crowded.
- *Multimedia and educational communication*. The effectiveness of video lessons is no longer determined solely by the teacher performance, but also by the multimedia component. The blackboard can be implemented with multimedia presentation, graphics, texts that can be written on the spot using a tablet, videos, pictures, the desktop of your own computer and so on. Sometimes, if not used with visual resources, the blackboard may disappear, making room for the entire template available to the teacher (visible in the foreground in the middle of the screen). In the same way, the image of the teacher can disappear to allow a higher focus on multimedia contents. The simultaneous use of several communication codes makes teaching communication more effective. The oral language, which is immediate, spontaneous and transparent, determines the involvement and the possibility of codifications that specify the meaning of the exposition (non-verbal communication forms such as facial expressions, tone and rhythm of the voice, etc.). The visual exemplifications of abstract concepts, the underlining of said concepts with the use of synchronized lettering, the visualization of concrete examples, using graphics, photos, videos, drawings, etc., increase teaching communication if used properly. The image, as seen here, has such a clear teaching potential that no one can doubt it.
- *It allows modifications and re-use in different contexts*. Depending on different target audience or to update or implement content, modular and short-term video lessons have the advantage of the possibility to be modified. Video lessons can be used in different contexts: as a supplementary material for the lesson in attendance, as teaching material for a MOOC or for courses in e-learning mode, for "flipped" or "blended" teaching methods.

Basically, a well-planned video lesson allows original and peculiar ways of learning through the connection of: a)linearity and organization of the written text; b) subjectivity and personal involvement typical of oral communication (Garito, 2008); c) and the potential in terms of further reflection and critical thinking ability determined by hyper textual tools.

Below is a series of methodological indications on the use of video lessons:

A - *Video lesson (introduction)*

The teacher introduces himself to the student and introduces his course. The objective of this presentation is:

- emotionally involve the student in such a way as to boost his interest for the subject and his active participation in the educational process. For this purpose, we recommend using a colloquial language;
- provide detailed information on the objectives of the course and any pre-requisites; in this case we recommend the synchronized use of the lettering with teacher's speech. While listing the objectives it is also important to communicate study strategies to handle the topics of the

course. The communication of the teaching objectives allows to send the student's energies towards a defined task, offering the possibility to verity the skills acquired through self-assessment tools;

- introducing the course by advancing some questions and creating student expectations. Contextualize the study of reference texts and possible educational materials for further study within a general framework. Directing the student towards a correct method is more important in a distance learning course rather than when they are physically attending. The initial presentation also makes it possible to prepare the student's cognitive matrix for the learning process;

- in conclusion it is important to introduce the teaching units that make up the entire course.

B- *Subsequent video lessons*

1. Teacher's introduction to the objectives and contents of the lesson, also indicating the right method of study and references to bibliographic and/or in-depth material;
2. discussion of the lesson's topics including the possibility to view the general structure of the lesson. While introducing contents, it is important to refer to the principles of multimedia design and cognitive load theory;
3. highlight the transition from one topic to another in a conceptual and graphic way;
4. summarize the topics covered and advance any questions for learning self-assessment in the conclusions.

V.3.2.4. VIDEO LESSONS TECHNOLOGIES

Video lessons can be recorded and subsequently published independently by the teacher, with the aid of applications easy to use from a practical standpoint (internet connection, web cam, microphone, use of open source software). Many are the software that allow the creation of video lessons. Among the most popular commercial products are: Adobe Captivate, Camtasia Studio, Loom, Screen flow, Articulate Presenter, Producer (PowerPoint plug-in).

Some platforms offer online services: VCASMO, WebSlides, Zentation, Zoho Show, knovio, 9slides, Wink (for tutorial videos).

A second solution, the one that involves recording in the studio, can give better results from a qualitative point of view but needs more complex and expensive equipment: professional camera, lights, studio microphones, video mixer, more advanced software, like Wirecast, possible use of an electronic teleprompter. This second solution can also include post-production operations for the incorporation of music and animations and it obviously involves teamwork.

V.3.3. WEB CONFERENCE AND CLASSROOM LESSONS' STREAMING

Didactics with media uses the communication tool of the web conference more and more often within its setting, for its effectiveness and ease of use. In e-learning contexts about settings of this kind, we also talk about virtual classroom lectures, webinars or online seminars. Regardless of their use, as a transmission lesson with relational moments, seminar, debate, etc., web conference sessions determine communication processes characterized by "rich information" (Daft & Lengel, 1984; 1986)

thanks to the possibility of reducing the risks of misunderstandings existing in asynchronous communication. Thanks to its interactivity potential, thanks to use of different modal channels, variety of languages that can be used, and above all the presence of social indicators, the web conference is second only to face-to-face communication. The concept of social presence, that is the feeling of actually being applied to mediated communication is generally attributed to Short (Short, Williams & Christie, 1976): this concept indicates the ease with which the medium can favor the perception of the presence or absence of the participants. Although social perception also depends on factors exogenous to communication (such as the psychological attitude and the motivations of individuals) it is clear that the medium plays a decisive role in the possibility of allowing it (Bonaiuti, 2010, note 3, p. 84).

The web conference is the web equivalent of video conferencing: the video conference allows a two-way audio-video communication, synchronously, between a series of physical locations, distant from each other and equipped with particular infrastructures, through the use of telephone lines; the web conference allows the same thing but through an Internet connection and the use of a webcam, microphone and specific software. It appears evident that through the continuous improvement of the infrastructures, the accessibility of this system offers interesting opportunities to the didactics with media sector. Although there are several applications that allow the creation of web conference environments, each with different functionalities, the general characteristics fall within the possibilities indicated in the following definition: "virtual environment with variable configuration, in which it is possible to share only the audiovisual channel, or different types of work tools, such as blackboards to work on and interact with (uploading documents and processing new ones), instant messaging, chat, archive and document exchange, application sharing, etc." (Cattaneo, 2009, p. 95).

The web conference systems allow different applications according to the contexts of use, both professional and didactic; applications functional to the process of presentation of information, collaboration, interaction with a large number of participants on the Internet through personal computers or mobile devices, without using specific hardware devices (albeit preferable where the quality and stability of audio and video transmissions are fundamental requirements). They are used in fields like project meetings, product demonstrations and presentations, large-scale online conferences and they incorporate advanced submission functionality for questionnaires, chats and surveys. Here we intend to restrict the field of investigation to focus our attention exclusively on the use of the web conference to allow the fruition of a university lesson in attendance for students who cannot physically attend University for various reasons. The classroom lesson is recorded with both audio and video and broadcasted via streaming in such a way as to be followed from afar using any device connected to the Internet.

According to this model, teaching communication must consider the simultaneous presence of two different audiences, the students in the classroom and the students in the virtual classroom. With all that comes with it. A different relationship between the participants in the educational process (on a double layer) and a new geography of the lesson, which both influence the perception of the subjects and, consequently, the way in which the knowledge is acquired/constructed.

The correct use of technologies, functional to the creation of environments ergonomically adapted to this new didactic setting, is the only guarantee for the success of this experience. The technological and methodological procedures that allow to record a classroom lesson without altering its educational function are different today. The best choice is to carry out the web conference with

minimally invasive procedures, almost invisible: to overcome resistance to technological innovation in working practices (Rogers, 2003, Bauer, 1995) we need to create a highly technological didactic set to be experienced in a natural way and not as a foreign body to be afraid of (technophobia).

After all, technology must be invisible (Weiser, 1991; Norman, 2015), appear natural and remain in the background. The attention of the students must be directed towards the task, not on the instrument, as it happens with a pen, a book, a blackboard. It is evident that the normalization process of a technology is quite long and depends on the various degree of complexity of the functions allowed. Consider, for example, how the complexity of film and then television technology made it difficult to use them in the educational field, even if there is evidence of isolated examples of their effective use, especially regarding television.

In a situation of simultaneous face-to-face and distance learning, it appeared fundamental to think about the role of the interfaces and the concepts of *presence*, defined as an experience of one's physical environment, and *telepresence*, an environment perceived through the mediation of the medium (Steuer, 1992). In order to make the distance attendance method effective the distance inside the multifunctional classroom environment needs to be eliminated as much as possible (physical place and place mediated by the screen) to make the didactic space natural. Thus the illusion of not experimenting with any form of technological mediation in the communication process is created (Lombard & Ditton, 1997), to the extent that people are induced to think that the physical environment is decontextualized or people's bodies are dephysicalized. The effective use of this mechanism, the naturalization and disappearance of technology, on one hand, and the centrality of the application of the principles to participatory culture and social networking, on the other, would allow the distance attendance students to *enter the classroom*.

More generally, the three main characteristics of this environment are:

- multimedia presentation;
- the new relationship that grows in an educational setting with a multi-purpose geography (the double classroom);
- the use of technologies (audio and video signals, streaming, interaction technologies).

V.3.3.1. THE MULTIMEDIA PRESENTATION AND DESIGN OF LESSON WITH WEB CONFERENCE

The multimedia presentation in a teaching process mediated by the screen interface takes on a priority aspect, it must therefore be subordinated to clear design lines (the indications given are also suitable for video lessons).

The multimedia presentation, a new graphic esperanto, if well prepared and supported by didactic design logic (Ganino, 2009) allows students to keep the focus and memorize the fundamental points of the lesson in the Media teaching/learning processes, and allows teachers to structure their intervention. As an example, it is worth recalling the use of relevant visual resources can lead to an improvement in learning processes, compared to communication methods based on the exclusive use of the word; on the contrary, the effects of redundancy can instead determine the opposite effect (on these issues, see Chapter III of the theoretical part, *Multimedia Learning and Cognitive Processes*).

In the awareness of communicative impoverishment in a screen-mediated setting, it is conceivable how the *image of the participants* in the classroom, both lecturer and students, can be

fundamental to convey the sense of social presence (Cattaneo, 2009) and facilitate the teaching processes.

In this audiovisual extension of the teaching experience through the use of the web conference, the role of the teacher is central: he must be able to combine teaching skills, communication skills (correct use of voice, non-verbal language, etc.) required, on the one hand, by the presence of a double audience, on the other hand, by the presence of audio and video technologies (like talking on the microphone). The same applies to the image of online participants at the lesson: these can convey the sense of their presence in the classroom, either via chat, or by making an intervention according to the procedures shared in audio and video.

Principles and guidelines of multimedia design

Seeing is not perceiving; to perceive is not to understand; to show is not to explain (Tversky et al., 2008). We like to remember the quote from Tversky to emphasize once again how the use of images, static or dynamic, realistic or reconstructed, with an educational purpose, must be guided by principles that are a result of research activities on multimedia learning. If one wants to promote learning processes, visual representations, in every shape or form, they must be functional to the cognitive processes that one intends to activate. The image must therefore be considered, as Calvani stated (2011, p. 29), "as an integrated component in a more complex learning ecology, and its usefulness must be evaluated in relation to the role it can play in this system".

When entering the teaching field, it is necessary to adopt a different point of view from the one that generally prevails in the guidelines that deal with visual communication. Here, an analysis on the formal, structural, stylistic level is not the only thing that matters; principles such as clarity, consistency, persistence of the visual message dear to *Graphic Design*, undoubtedly remain worthy of consideration when considering visual communication in its transmissive aspect, but in this case *the rules of the game basically change*: from a static and classificatory conception we must move on to a contextualized, dynamic and constructive conception as well. (…). In this regard, classical cognitive psychology, in particular represented by authors such as Piaget, Rumelhart, Ausubel, has provided some general references that give us an overall framework that no educator should disregard. The fundamental concept, common to the authors mentioned above, consists in the consideration of learning as a process of cognitive structuring and restructuring that always begins from *what we already known.* There is no learning except in relation to something already present within the mind, in other words by connecting to a set of previous knowledge to which the new information relates, whether to modify it or to request a reformulation.

These systems of knowledge already possessed by the subject can be called *schemes*, *frames*, *mental models*, *scripts*; in any case, they represent a predisposed structure through which our mind selects and elaborates the new data and phenomena that need to be understood" (Calvani, 2011, pp. 29-30).

As previously told, the visual component assumes teaching relevance and effectiveness when it comes to build a support in the process of structuring schemes, concepts, meanings that are already active within the individual that's in the middle of the learning process. Most of all, It is created within the game in relation to the subject's preconceptions, to the objective to be achieved, to the complexity of the problem (or delivery) to be faced that a visual communication can assume an educationally relevant function or not.

A summary of the indications of multimedia design principles, that should not however be understood as precepts to be followed mechanically, is given below; they are quite useful to understand the point of view that needs to be adopted according to the different teaching situations.

Principle 1. *Integrate words and images into a complementary mode*

Generally speaking, we can identify three ways to relate between image and word in the multimedia teaching text:

1. the case where the word has a driving function and the image is purely illustrative;
2. the case where the image occupies all the perceptual space and the verbal element is therefore a subsidiary function;
3. the case where image and word operate simultaneously with their own functional space.

The starting point of all reasoning on the relationship between narrated text and images can only be the substantial difference between visual language and verbal language: the visual language is characterized by codes that have a similarity with the represented object; verbal language is more symbolic without any resemblance to the object represented. From a cognitive process standpoint, the difference concerns the reading mode, sequential for the word or in general for the verbal system (first there's some information, then the next, etc. one piece of information at a time); parallel or synchronous for the non-verbal system (many visual information presented simultaneously within the same screen or page). The following indications have been obtained:

- the use of images and words in a complementary perspective facilitates the learning process compared to information transmitted only through words;
- visual communication and verbal communication are two qualitatively different systems of knowledge representation and the combined and complementary use of the two modal systems take advantage of the characteristics of our cognitive system.

Principle 2. Overcoming the myth of reality in favor of visual highlighting "to see better"

The image is the most direct way between the external world and our perception, and has the advantage of showing things as they really are and not through conventional signs compared to the spoken and written word. The image, especially while moving, is able to bring learning to life in an extraordinary way: allowing on the one hand to represent reality through images and, on the other hand, to inject life and emotion in what was previously inanimate, that is written and printed. Aniway, we need to be careful with the myth of realism: it is important to have a more critical attitude with regards of the belief that realistic images, especially the dynamic ones, are more functional to learning processes.

Many studies have disproved this belief. Just think of the perceptual difficulties of moving images, especially if they are very complex, full of details that must be read, integrated with a spoken commentary, with music and noises: a second of video consists of 25 frames, a few minutes of video can be composed of dozens of shots; the presentation rhythm (not controlled by the reader) can make the analysis of simultaneous changes and the right perception hard. The concept of plausibility towards the respect of spatial and temporal coordinates is somewhat misleading. So if we want to

facilitate understanding, we recommend to take action with construction operations on the images: to highlight and make the important things look better, to hide and omit irrelevant elements. In other words we need to overcome the concept of realism in favor of representation.

Principle 3. Use visual representations in movement sparingly

In addition to what has been said above, we recommend the use of motion visuals with representative function (a real object, a realistic situation or a process) or transformative function (showing changes in space and time) only if they are truly functional to build the information. Especially in situations of educational communication characterized by multiple levels of reading: a video lesson, a web conference composed of the teacher's image, screen sharing, any chat, graphic elements not directly related to the educational content. The visual representations in movement of complex processes can be slowed down, accelerated, stopped, repeated, integrated with visual indicators to make them easier to understand.

Principle 4. Avoid using images thinking to simplify the teaching process

Do not use images thinking that these can simplify the educational processes, made complex by the word and the concepts. There can be no actual learning through the reduction of the "effort to learn". The image can be effective if used in a complementary way alongside text, or on its own if it is self-explanatory; in any case it must be read and correctly interpreted according to the educational objective.

Think of how the propagation of cinema at the beginning of the last century, which also allowed people with a low educational level to have greater knowledge of the world, made us think about the birth of a post-alphabetic age. In reality, as pointed out by Mauro Laeng (1980), the "civilization of the image" is not based on an immediate and primitive form of communication. The audiovisual is characterized by a complex structure, based on precise grammatical rules, its narration is drawn by the author, and it is addressed to a recipient. The user interprets the grammar, the language used and constructs/reconstructs the meaning giving rise to a dialogic process. The audiovisual text therefore requires a process of production of the meaning and of the construction of the knowledge through a high-capacity metacognitive reflection, even higher than the one necessary for reading a written text. In this regard, we stray very far from the post-alphabetic civilization evoked by the detractors of the audiovisual language.

Principle 5. Use functional images in order to achieve the educational objective, not with decorative and accessory functions.

The use of visuals with decorative function distracts from important information. The accessory elements used to catch the student's attention make the process of knowledge building less effective. The cognitive interest must prevail over the emotional one; there is no correlation between attraction and learning; on the contrary, decorative images can activate misleading preconceptions. Students learn better if the foreign material not relevant to the content that they must learn is excluded from the multimedia presentation. Similarly, learning environments must appear sober, the abundance

of information, animations, is not only useless but becomes harmful. The graphics must be meaningful and comply to specific educational and communicative needs, not purely ornamental.

Principle 6. *Use sound effects, music and words only if complementary to the information necessary to achieve the educational objective.*

Communicative elements used with an emotional function, especially music, involve students but distract them from information and concepts that need to be learned.

Principle 7. *How to present exclusively textual information (spoken and written)*

In cases where there are very long texts next to the verbal comment in the multimedia presentations, we need to find a different solution. Below is a series of tips on how to manage this kind of presentation:

- splitting the text into self-consistent paragraphs (key steps, individual concepts);
- use indicators to underline the important phrases from an educational standpoint: for example, writing a title in italics for key passages, giving voice emphasis to key words (written in bold or with different colors or with a larger font).

If the texts are short and concise we recommend the use of:

- bullet-pointed or numbered lists to help understand and organize information, they avoid loss of attention while listening and signal moments of passage in the speech;
- synchronous submission mode, i.e. the bullet-pointed lists must appear in sync with the corresponding spoken comment;
- visual indicators if the bullet-pointed list is always shown. In case you want to keep the overall picture, you need to insert indicators to focus the attention on the point of the discourse you are referring to.

Principle 8. *Written texts and corresponding images must follow the principle of composition of proximity spatial integration.*

While using written texts and images in complementary optics, the two pieces of information (both visual) must be composed according to the spatial integration logic, not of separation. The integration of information reduces cognitive effort because it allows to immediately identify the relationship between text and image: it is not necessary to analyze the image, then read part of the text and keep both information in memory using in this process your own cognitive resources, to identify the multimodal integration.

Principle 9. *Integrate animations and words according to a synchronous mode*

When it comes to an animation, a synchronous, simultaneous (audio and video together) form of communication is preferable, rather than asynchronous or sequential (first audio and then video or vice versa). It is better to verbally describe a process as you show it, perhaps even using visual descriptors if the process is complex, rather than presenting the process before showing it.

Principle 10. Avoid redundancy effects

Redundancy occurs when the same information is conveyed through two different communication systems. For example, when using spoken text to read a long written text, or when self-explanatory images are linked to a written text or a spoken text describing them.

Principle 11. Use a modular logic and allow a personal rhythm of use

A multimedia text presented according to principles of modularity and segmentation compared to a continuous structure helps the learning process. Especially if a multimedia text is very long and complex, we recommend to: a) divide it into different modular and self-consistent parts; b) introduce the possibility to manage the use rate by inserting an action button (this allows the customization of the right time to process the information).

Principle 12. Use graphic organizers to explain relationships and organize knowledge

The graphic organizers (maps, tables, diagrams and networks) organize information and ideas or explicit relationships between concepts, events, facts, processes through the use of symbolization. They are very useful to visually organize knowledge, to activate preconceptions, to build mental models, to focus attention on the important aspects that need to be learned.

Principle 13. Use visual indicators to simplify reading

When it comes to complex images full of information, we suggest the use of an explanatory graphic that guides the student's attention through the elements they need to read: arrows, numbers, highlighting parts of the image, graphic effects.

Principle 14. Use a colloquial style

People tend to learn the contents of a multimedia presentation better when they speak in a colloquial, spontaneous, less formal way typical of conversations. The colloquial verbal register is preferable (naturally avoiding the impoverishment of contents) to favor the relationship that can be created between speaker and listener and therefore to increase the student's participation in the educational process. Technically, using a colloquial style with a narrated animation can mean:

- saying "your nose" rather than "the nose", or "your throat" rather than "the throat"; address the students in a straightforward manner.
- to make continuous use of discourse markers (excuse me, listen, got it?) In order to keep the listener's involvement and attention high;

- a spoken text (identical for quality and quantity of information and for the terms used) achieves higher learning effects if the sound version (the comment) is simplified. In order to make this happen without impoverishing the content, it is necessary to break down complex periods into simpler ones through a syntactic construction based on a *parataxis criterion* (short sentences, independent of one another, connected by a comma or a conjunction) rather than that of *hypotaxis* typical of the literary and well-read expression (long and complex sentences, consisting of principal propositions on which the subordinates united by conjunctions depend).

V.3.3.2. RELATIONAL ASPECTS

The second aspect revolves around the new relationship that is created, at a dual level: inside the classroom and at distance, through the mediation of the screen interface. Reading the didactic programs of most of the university courses one can understand how in the majority of cases the courses are structured in three parts: first, an institutional part, concerning the logical structure of the discipline; then a monographic part, most of the time coinciding with the scientific interests of the teacher; and then the third part, a "practice" that deals with specific subjects of teaching in a workshop. The teaching methodology is based on three fundamental phases: transmission of concepts, problematic discussion of contents, exercise activities that can be personal and/or in groups, in the library, on the field, in equipped laboratories, etc. The relational aspect, central in the training in attendance, becomes even more important in the training mediated by technologies, so it is important to avoid the reduction of contact and increase the interaction between teacher and learners and between learners. When it comes to the web conference lesson, the dynamics of synchronous and interactive communication, if well exploited, allow students at home to virtually enter the classroom and fully experience the teaching process. The management of the relationship with the students can take place as follows:

- communicate the modalities and moments of the discussions on the relevant topics at the beginning of the lesson;
- check the degree of interest and the attention span of the students in the virtual classroom from time to time and allow them to intervene (in audio and video or only via chat);
- create forms of work and online exercises.

Personal responsibility is required to better manage the relational part. It is evident how distance learning can not fully replicate teaching in attendance; they are two very distinctive modes to operate, however complementary and strongly interacting with one another. As Alberto Cattaneo (2009) recalls, both require the student to behave autonomously and responsibly, to be negotiated with the institution that manages the teaching activity. This assumption of responsibility in the didactic with media processes is essential to overcome the obstacles related to the mediation of the screen interface, and the feeling of isolation that can be created. Therefore, the training agreement that can refer to the expected forms of work, to the rules of behavior and communication, to mutual commitments between learners and teachers/institutions must be clearly established (Cattaneo, 2009).

It is important to remember how it is unanimously believed by the international scientific community that the transmission of information, without feedback, control, discussion of problems, exercise, application of the inductive method, does not produce meaningful learning.

V.3.3.3. WEB CONFERENCE TECHNOLOGIES

The last aspect concerns technologies whose use must contribute to eliminating the distance within the multipurpose educational environment: the communication process must work without technical problems (poor readability of visual materials, insufficient Internet connection, disturbed audio signal, etc.). Basically, the technology must be transparent to make the communication space natural. In this regard, a technological help desk is also recommended during the sessions, both for teachers and students. Technically, a web conference session requires technological support, both hardware and software, and a network infrastructure that allows, on the one hand, an optimal passage of audio-video-textual signals, and on the other hand, to support all users connected at the same time. In addition to the infrastructure it is important to take care of all the technologies used. Audio: from the microphones that must provide excellent sound quality, the management of different audio channels to avoid annoying signals of return (when not talking, for example, it is good to turn off the microphone). Video: the choice between using a computer webcam, camera webcam, camera controlled by an operator, using multiple cameras, etc. The choice depends on the result you want to achieve, in terms of visual communication (to implement the virtual classroom only with the image of the teacher or even with the image of the students in the room), and has repercussions on the teaching methodology of the teacher (they can lecture, sitting in front of the computer, have some room for movement, or freely walk among the desks).

It is better not to underestimate any of these aspects, including the control of the projection, lighting and acoustic systems of the classroom, to avoid technical interventions during the web-conference sessions with inevitable repercussions on the successful teaching. Such interventions and/or the noises created by different problems compromise the fluidity of the lesson and inevitably the concentration of the users.

All these elements - multimedia design, new relationship, use of technologies - must be correctly applied in compliance with precise procedures and guidelines if the web conference tool needs to be effective for the teaching process and thus contribute to the cancellation the difference between the concepts of attendance and virtual presence. This is fundamental for the success of experiences involving the simultaneous use of university classrooms and virtual classrooms.

V.3.4. VIDEO ANNOTATION

The video annotation for its interactive potentials can be used in all multimedia artefacts used in on demand mode: in videos, in video lessons, in web conference recordings.

This technology has only recently been used experimentally at the University of Ferrara. Therefore no precise guidelines have yet been developed. For this reason we give a series of indications on the general potential of video annotation.

The video annotation is an online and offline technology, widely used in North America, enabling you to integrate in a simple and intuitive way the classic use of video, passive and

broadcasting, with an active, participative, reflective mode, by adding hypertext features temporarily synchronized. This didactic environment allows the student to have a *desk view*: images can be explored and analyzed through different levels of involvement, both cultural and physical (to navigate, deepen, choose, intervene, build, collaborate, verify the achievement knowledge).

Below are a number of obvious advantages. The ability of feedback allows students to understand strengths and weaknesses, to reflect on their actions to face challenges in every professional field (Schòn, 1993), also allows to evaluate the levels achieved and to develop strategies for operational, cognitive, emotional improvement (Jonassen et al., 2008). It is believed that video annotation improves observation ability, stimulates reflective thinking, and promotes awareness of what is happening in the classroom (Wright, 2008).

Rich and Hannafin (2008) have produced a critical review of tools in this field aimed at supporting teacher training, but the application areas are multiple and the phenomenon is just beginning. Think, for example, how the commented analysis of your recorded performance (in sports, in artistic and professional contexts) can be effective in improving skills.

Instruments

From a technological point of view, applications allow you to perform a number of functions: inserting overlapping objects (arrows, geometric shapes, text pop ups), synchronizing comments on the text, inserting auto evaluation activities, allow discussion. Functions are designed for an individual or group use with different levels of privileges basing on roles (lecturer, tutor, student). One of the most interesting aspects of these applications is their use, as well as in self-produced videos, within open-access network resources (archives, video hacking platforms, etc.), allowing them to be customized, edited, integrated, for precise didactic goals. Below is a series of possibilities:

- *Subtitles*. Subtitling is a practice that comes from television production and allows speech transcription (voices characters and narrative voices) in the same language or in other languages. Generally, the texts are placed at the bottom of the frame so they interfere the less possible with the background images. The text can also be used to promote video accessibility to hearing impaired people.
- *Cartoon*. Annotations can have the form of a *cartoon bubble* (full text popup) strategically positioned according to the didactic goals. As in comics you can make the content seem to be pronounced by one of the characters in the video.
- *Highlighted area or note.* In highlighted areas in a video, you can insert hypertext buttons or short texts and keywords.
- *External annotations (text)*. Texts in the form of annotation can also be external to the video and appear in windows, next, or under the video. Depending on the learning objectives, they can be written by teachers and / or students and have the function of commenting, analyzing, deepening, highlighting, debating. This feature allows to better understand the information, techniques, procedural, of content, present in a video.

The advantage, as said, of this technology is the simplicity of use that guarantees its use also to users with low technological skills. Below is a series of these applications.

YouTube. In YouTube videos, you can insert links to other videos, channels, playlists, or other sites using interactive elements such as tabs and annotations that can be viewed in standard YouTube players and embedded players. On YouTube, you can insert 5 different types of annotations: comic, highlighted areas, note, title, label.

dotSUB. dotSUB is a web-based platform with collaborative addressing used for multilingual online video subtitling. The platform is known for its use in the *Open Translation Project* TED TALK where, since 2009, volunteers have begun to transcribe and translate TED conferences videos in over 80 languages. The platform in practice allows anyone to upload their own videos and subtitle them: for a controlled fruiction (only a small number of people, a class, a school, etc.), or open. Creating subtitles offers interesting educational opportunities. The most obvious thing is about the teaching of foreign languages: to watch videos in different languages (you can work on understanding the spoken language); or you can allow the same students to translate and transcribe texts (motivate students through active didactic practices). Subtitling can also be very helpful in making accessible video to hearing impaired people, or more generally, to facilitate the use of open video resources on the Net for teachers and students.

Amara. Another subtitling application, with an intuitive interface. Three windows, one on the left, from which you can select the original subtitle language, the center section allows you to place the subtitles in the desired language, on the right you can finalize the operation by verifying the correct text / video synchronization. Once you have completed the job you have the opportunity to acquire the insertion code, to incorporate the video with new subtitles on personal or class blogs, sites etc .

VideoANT. VideoANT is a free web application developed by the University of Minnesota with the purpose of synchronizing textual comments in video scrolling (functional annotations for discussion, tutoring, etc.) in a window outside the images. The application consists of an interface based on some elements: the video, a timeline that lets you identify the points where entering normal annotations or annotation's list with the related texts. This simplicity of use supports the utilisation of VideoANT by those users who do not have advanced skills in managing web based tools and applications. Modified videos can be exported, shared (with different privileges, read-only, collaborative activities, etc.), embedded in external sites, sent by mail. Fields of use in teaching area are different. As a general rule, such an application allows you to broaden and better contextualize the numerous information within a single video frame, depending on the learning objectives (textual analysis of audio and video, observation and reflection of the shooting actions , behavioural analysis, phenomena analysis, etc.). Basically, all disciplines, humanities, sciences, and techniques can use such a tool to create video lessons from synchronous texts. In pedagogy area, this application is very used in the field of microteaching.

Vialogues. Vialogues provides teachers and students with tools to develop and manage chat discussions from viewing a video. Vialogues also offers the possibility to submit comments, surveys, open response questions. The video can be incorporated and shared on blogs, websites, and so on.

VideoNot.es. Allows viewing a video to make a series of useful steps to the study, especially the ability to take notes by synchronizing them, in an external window, with precise moments of vision. The system can be integrated with *Google Drive* (you can create and manage video footage directly from Google Drive and access it from anywhere) and *Evernote* offers the ability to share the video.

EdPuzzle. Allows you to select a sequence of the video (crop), insert an audio track using the Voice Over (audio track) technique, insert synchronized sound notes (audio notes), enter questions with closed or open response at any quiz step (quizzes) . The application lets you transform any YouTube video into an interactive resource that supports evaluating activities and gathering feedback.

Zaption. Zaption can enrich videos with questions, drawings, images and texts. The free version allows you to create an unlimited number of videos but with up to six interactive content for each. Once you upload videos to the platform, these can be edited through simple editing passages: the "text slide" or "image slide" feature allows you to overlap a text or an image to the video and eventually interrupt the video stream; "drawing" for inserting a freehand design. Videos can also be integrated with adding questions, answering open, or multiple-choice questions with compensating messages.

The TEDEd model. *Ted Talks* has a section dedicated to the education sector (TED Ed), whose aim is to stimulate and disseminate innovative ideas of lecturers and students around the world, providing services and resources to support teaching and learning processes for teachers and students: repository of video lessons and video animation of an educational character; a platform to allow interactive video lessons to be made.
Through *TED-Ed Lessons Worth Sharing* you can create lessons using the videos provided by the platform (you can make a research by a disciplinary area, contents, educational level), customizing them according to your needs and enriching the vision with interaction, management and evaluation tools:

1. *Whatch*: is the interface through which video lessons can be viewed, the lecturer can enter a title and a text in which specify additional information (goals, tasks, topic, etc.).
2. *Think:* Students are invited, after viewing the lesson, to answer questions in the form of multiple choice or open-answer questions. Responses are saved and can be monitored by the teacher who can verify completed questions, questions to which a correct answer was made at the first attempt , the total number of attempts made by the student, open-response questions completed.
3. *Dig Deeper:* Additional resources that the teacher can add to further the topics in the video: text, links to various resources, tips, more information, a web path, etc.
4. *Discuss:* For each video you can open discussions similar to forum ones where you can exchange opinions, ask for clarification, answer questions, ecc.

V.3.5. MOODLE, OPERATING PRINCIPLES

Moodle, the virtual teaching environment used by the University of Ferrara, is an LMS (Learning Management System), a system for the management of online courses that is functional for online

learning experiences[15]. It is internationally used for educational and training projects that require the active involvement of learners and allow collaborative learning, group work and the exchange of knowledge. The main feature of moodle is to rely on very solid pedagogical principles, on the paradigm of social constructionism, adapted and interpreted to enhance the educational potential of the network. The word moodle stands for Modular Object Oriented Dynamic Learning, which is an object-oriented modular dynamic learning environment. Moodle is distributed under the Open Source GNU / GPL3 license. The license allows you to copy, use and modify the software freely provided that it gets redistributed using the same license. Moodle can be installed on any computer that has PHP and an SQL database (for example MySQL). From an operational standpoint he most important operations that can be carried out on moodle are: the insertion of teaching materials in different formats (resources) usable via on demand mode; the possibility of collaborative, relational, workshop activities, chats, forums, etc., within which the student and the teacher must actively participate (activities); self-assessment and evaluation activities.

V.3.5.1. RESOURCES: USING MOODLE AS COURSE'S LIBRARY

In moodle, the following types of resources are available.

Folder. The folder module allows the teacher to display a set of related files in a single folder, reducing the size of the course's home page.

Label. The label module allows you to insert images and text on the course's home page, along with links to activities and resources.

File. The file module allows the teacher to insert files among the resources of the course.

IMS content package. An IMS content package is a collection of files packaged according to a recognized interoperability standard.

Book. The book module allows a teacher to create multi-page resources by composing them, similarly to a book, in chapters and paragraphs.

Page. The page module allows the teacher to create web pages using the text editor.

URL. The URL module allows teachers to insert web links as course resources.

V.3.5.2. ACTIVITY, ASSESSMENT: USING MOODLE AS DIDACTIC ENVOINROMENT

In moodle, the following types of activities are available.

Chat. The chat activity module allows participants to perform synchronous text discussions in real time. The chat can be a single activity or be held at the same time every day or every week. Chat sessions can be saved and made available to anyone or to small groups. They are particularly useful for online group meetings, such as:

- periodic meetings between students of online courses that live in different cities or countries, allowing them to exchange opinions and experiences;

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[15] The intention of this part is not to be exaustive about moodle, we simply summarize some information from open access tutorials available on the Internet.

- student-teacher meetings for those who are unable to meet in person;
- question and answer sessions with guests from different places.

Task. The task module allows the teacher to evaluate students' learning by assigning him a job that he can then evaluate and comment on. Students can deliver any type of digital content, such as text documents, images, sound clips and video clips. The task can also include an online form to fill in. Students can deliver jobs individually or as members of a group. Teachers can comment on student deliveries and upload files, such as corrected homework audio files with a comment. The tasks can be assessed using both numerical and advanced evaluation methods like rubric. Evaluations are stored in the evaluator's register.

Feedback. The feedback form allows the teacher to create personalized surveys useful for gathering feedback from participants. It is possible to use various types of questions, such as multiple choice questions, yes / no, free answers, etc. It is possible to make the answers anonymous, just as it is possible to decide whether or not to make the results of the survey public or not. The feedback activities on the home page of the site can be configured to be filled in even by unauthenticated users. Feedback can be used to:

- evaluate the courses, helping to identify areas of improvement for future editions;
- allow participants to book course modules and events;
- receive courses and policies preferences that can be adopted by unauthenticated users;
- obtain information in anonymous form on different topics.

Forum. The forum module allows to have asynchronous discussions between the participants, whose duration is prolonged over time. There are different types of forums to choose from, standard forums where anyone can start a discussion, question and answer forum, forum where the student must make an intervention before being able to view the interventions of other people etc. It is possible to insert attachments. If the attachments are images they will be displayed directly in the body of the intervention. Participants can subscribe to the forum to receive notifications of new interventions. The teacher can set the subscription to the forum as optional, mandatory, automatic. If necessary, it is also possible to block students who have posted more than a certain number of interventions in a given period of time, reducing the risk of someone dominating the discussion.

The interventions in the forums can be evaluated by the teacher or by the students themselves (peer evaluation). The scores obtained are aggregated and stored in the registry of the evaluator. It is possible to use the forum for:

- a social space to allow participants to get to know each other;
- course announcements (using the subscription news forum);
- discuss the contents of the course;
- give continuity to a problem encountered during sessions in attendance;
- having discussions between teachers (using a hidden forum);
  general online support area between teachers and students.

Glossary. The Glossary module allows participants to create and manage lists of entries, such as a dictionary or a collection of resources and information. A teacher can allow you to attach files to item definitions. The attached "image" files are displayed together with the definition. By default the entries and definitions entered are considered approved, however, before making the item visible to all participants, it is possible to change setting for the approval by a teacher. The teacher can also allow comments to be added to the entries. The entries can be evaluated by both the teacher and the students (peer review). The scores obtained are aggregated and stored in the registry of the evaluator. It is possible to use glossaries for:

- a collaborative collection of keywords;
- a space to allow students to enter information about themselves to get to know each other;
- useful suggestions or good practices on a given topic;
- a space to share videos, images, or music files;
- a series of topics to remember.

Lesson. It is possible to use the lesson to create pages to be used sequentially or according to paths of your choice. It is possible to include on the pages various types of questions such as multiple choice questions, short answer and correspondence questions. Based on the answer given, the student can continue the lesson, be brought back to the previous page or directed towards a path made up of other pages. If you want, the activity can be evaluated and the score obtained will be stored in the evaluator's register.

SCORM package. A SCORM object is a set of files packaged according to a recognized standard for the creation of learning objects. The SCORM activity module allows the use of packages in .zip format based on the SCORM and AICC standards. Generally, the contents of a package are displayed on several pages, with the possibility to browse them. It is possible to set the package in order to display the content through pop up windows, with the contents index, the navigation buttons, and so on. SCORM objects can also present questions whose results will be stored in the evaluator's registry. It is possible to use SCORM activities to:

- present multimedia contents and animations;
- evaluate student activities.

Quiz. The quiz module allows the teacher to create questionnaires with different types of questions: multiple choice, true / false, correspondence, short answer, calculated, etc. The teacher can set the quiz so that it can be tried several times, with questions that change randomly with each new attempt. It is also possible to set a maximum run time. Each attempt is automatically evaluated (except for open questions) and the evaluation is stored in the evaluator's register. The teacher can decide when and how to show students the correct answers, feedback and suggestions. It is possible to use the quiz for:

- course exams;
- short tests on study notes or at the end of an argument;

- practice of exams using questions included in exams from previous years.
- give feedback on the performance;
- self evaluation.

Choice. The "choice" activity module allows the teacher to formulate an application offering a series of alternatives. The results of the choices can be published after the students have responded, after a set date, or they can remain private. The results can be published together with the name of the student, or anonymously. It is possible to use the choice for:

- quick polls to encourage reflection on a given topic;
- quickly evaluate what the students understood;
- facilitate the decisions of the students, for example by allowing them to express preferences about the course.

Wiki. The wiki module allows participants to enter and edit a collection of web pages. A wiki can be either collaborative, where everyone can work, or individual. The wiki includes an archive with all the changes, listing each change next to the respective author. It is possible to use the wiki for:

- group handouts or study guides;
- collaborative writing of texts on topics established by the teacher;
- collaborative writing of stories and poems, where each participant can write a paragraph or a verse;
- personal diary of the participants and exam notes (using individual wikis).

Workshop. The workshop module allows for the collection, review and peer review of the work performed. Students can deliver any type of digital file, such as text documents or spreadsheets, and can even write text directly online. Deliveries are evaluated according to the different criteria defined by the teacher. Students can evaluate one or more deliveries of other students, even anonymously. The evaluation received by the students consists of two parts, an assessment for their delivery and an evaluation for evaluating the deliveries of the other students. Both evaluations are stored in the evaluator's register.

Chapter VI

THE EXPERIMENTAL RESEARCH:
THE IMPACT OF REGARDING VISUALS ACTIVITIES
COMBINED WITH CHAT ACTIVITIES
ON THE LEARNING OUTCOMES IN THE FAD MODEL
EXPERIMENTATION

VI.1. THE MAJOR PREMISES OF THE RESEARCH

The objective of this experimental research is to monitor the effects of the teaching innovation described through strict procedures. In particular, as we said in the introduction, the purpose of this research is to analyze the teaching attitude of the University professor of Ferrara towards multimedia teaching, within *FaD model*.

Our starting point is the result of the survey observational, a mapping carried out in the second semester of the 2016/17 academic year (February 2017-May 2017) on the *FaD model*. This mapping, made with the support of a grid (see annex 1), provided for the consultation of the teaching activities explored in the virtual classrooms within the moodle platform (Figure no.1.VI) of all the courses involved in the Humanistic Department (135 courses). The intent was to identify the teaching tools, provided by the advanced mode, actually used: teaching material usable individually, complementary to the lessons (special teaching units video lessons, instructional videos, mooc, e-books etc.), collaborative activities usable with moodle (wiki, forum, chat, etc.), synchronous seminar meetings, aimed primarily at those students who have followed in distance learning (e-seminar), self-assessment and tutoring activities. This work was carried out with the support of a methodological tutor working for Se@.

Figure no.1.VI. *Moodle didactics setting*
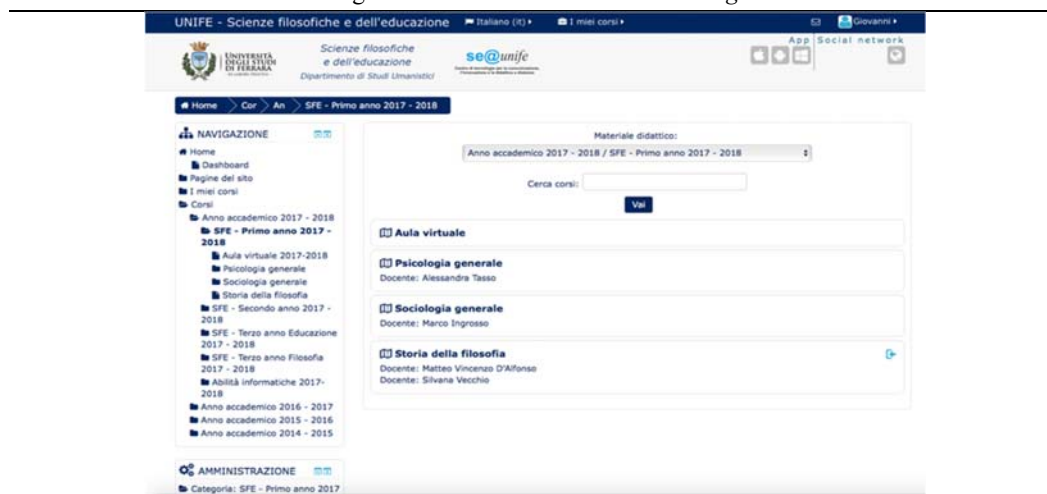
The results of the mapping

From this analysis we obtained some important data; the most significant one, which can be considered the starting point of the experimental research is the following:

In almost all cases, the teachers involved in the experience have used exclusively the web conference, despite the tradition of the University of Ferrara in digital education area. The teachers have completely neglected all the teaching tools 2.0; the percentage of teachers who used 2.0 tools is negligible.

The data collected from the analysis of all the virtual classrooms within moodle, for the *FaD model* (at Humanistic Department) showed that these tools have been hardly ever used (131 out of 135 moodle areas have been unused): very few exceptions (only 4 areas include advanced modalities) revolved around the activities of "already experienced teachers" (applications included in the platform by themselves have been used in two cases out of four), i.e. teachers directly interested in educational technologies for their personal and professional interests.

We describe below the tools related to the advanced mode used in the 4 cases already mentioned. Wiki was used in the teachings of *New Media for Teaching* (Degree in Communication Sciences and Technologies) and *Roman History* (Degree in Literature, Arts and Archeology). In the first case the educational purpose was to encourage a collaborative-constructivist path through the development of a series of themes (case histories on the topics addressed during the course) to complement the course topics. In the other one, to elaborate a series of general key concepts on the topic with the aim of "speaking a common language". In the *Foundations of Computer Science* teaching (a degree in Science of technologies and communication) the teacher used a tool created by himself, called *Tagged book*, which allows to have a dialogue in a structured way. The teacher made a multimedia text available to the students, in the Tagged book format, about the topics discussed during the course: this tool allowed the formulation of questions, answers, insights, examples, directly related to each sentence of the text (or to the individual concept). This way, the multimedia didactic text, based on the interventions of students, teacher and tutor, has become a "highly appreciated" teaching tool, according to the teacher of the course, "with a simple and functional use aimed at solving the students' question very fast, without any problem of redundancy or uncertainty in placing the interventions". Finally in the *Information and Multimedia Technologies* (Communication Sciences and Technologies) the course teacher made the students work collaboratively using two applications: *Aurasma* and *ThingLink*, the first functional to the realization of augmented reality works, the second one for interactive images.

The consultation of the areas linked to the activities described above shows how the students actively participated to all four courses in quantitative terms. There are numerous interventions, many of which are aimed at helping colleagues that are less experienced in the problem-solving ability, from a *collaborative and cooperative learning* point of view. It's interesting to note how the activity continued, in some cases, spontaneously even after the end of the lessons.

Compared to the overall analysis, what emerges is that in the fifth year of activation of the FaD model, the almost complete absence of educational elements 2.0 continues to appear evident. The transmission-based frontal lesson is predominant. The interactive, relational, constructive tools

allowed by the moodle learning environment are not taken into consideration at all. The professor of the Humanistic Department of the University of Ferrara looks like a teacher 1.0.

In addition to that, during the last experience originated at the University of Ferrara, at the Earth Sciences Department, there was an impoverishment of the educational use of the basic FaD model: the virtual classroom lesson is provided exclusively via live streaming; the student is not allowed to review the lesson through on-demand mode (read ahead).

VI.2. THE PURPOSE AND OBJECTIVES OF THE RESEARCH

In light of the mapping carried out on the instruments used in the FaD model, we have defined university professor like "professor 1.0". This makes clear what had previously been said in the theoretical part: the introduction of technologies in the teaching and learning processes does not automatically entail educational innovation. Educational transmission paradigms are often applied in advanced technological environments. The true potential of the latest technologies is not exploited towards the most participative, collaborative and relational paradigms.

Our analysis can therefore be directed towards the only tool used by all the teachers, *the web conference used as support for the classroom lesson* (basic FaD model). The intention of this experimental research is directed towards the analysis of the way the cognitive web conference artifact is being used, to understand:

- the teaching attitude (correspondence between teaching practice and technological and epistemological paradigms of reference) of the University Ferrara's professors who use the web conference within the FaD model. Only one course will be considered: the choice was addressed, in a discretionary manner by the researcher, on a teacher who showed interest in the research topic (Prof. Anita Gramigna). As seen in the theoretical part of the thesis, the international research on multimedia learning (text images relationship) has always focused on brief conceptual nuclei of the subjects studied. In Italy this type of research is non-existent. For this reason it was preferred to focus attention only on a part of a single course.
- a second objective of the research is to go beyond the limits of the laboratory to offer operative indications to both, university teachers and Instructional designers, in order to make a media teaching communication more effective, in terms of significant/authentic learning (Ausubel, 1968). Certainly not the formulation of rules, much less of "recipes", to be applied to the situations as a whole: rather, the offering of guidelines, or even statistical data, that must be subjected to interpretation way before application.

The final aim is naturally to make a contribution to the improvement of learning processes in media teaching situations.

VI.3. THE RESEARCH QUESTIONS

The main question that the research wants to give an answer to is the following:

Does the university professor involved in the "FaD model" experience, use effectively the web conference (audiovisual cognitive artifacts) in a media teaching system? More precisely, the teacher uses well the educational communication rules of the multimedia learning principles that come into play in the case of the use of web conference: visuals and relational activity?

In the didactics with the web conference the fundamental aspects from a teaching communication standpoint are two, beside the teacher's speech:

- *The use of visuals to support/integrate verbal communication (multimedia presentation).* Does the use of visual elements allow deeper learning? Which visuals are more effective? How can we evaluate how appropriate the visual materials are? How is it possible to design a correct use of images? How can we adapt visuals to student characteristics? How can we use them to increase the student's motivation?
- In the theoretical part we have answered these questions through the study of international research: we refer to the identified principles to give an answer to the research question.
- *The teacher/student relational activity.* The relational aspect, as previously stated, assumes great importance for education mediated by technologies. When web conferencing tools are used to stream the classroom lesson, the synchronous and interactive communication dynamics, if well exploited, allow students at home to "obtain the keys to enter in the classroom" and fully living experience the teaching process. In practice, continuous and feed-back activity is, as indicated by pedagogical research, indispensable for the success of teaching processes (the teacher can intervene based on the students' response) and learning processes (students can improve the performances if they are aware of their didactic criticalities) (Domenici, 2016).

VI.4. THE HYPOTHESIS

In terms of learning the effects of a lesson built using the web conference are different depending on the way the teaching communication is structured. There are two important aspects of educational communication with the web conference: the use of visuals to support speech (multimedia presentation), a constant relational and feedback activity.

Our idea is that there can be a better level of learning when in multimedia presentations the material is presented in multiple formats (multimodal) rather than in monomedial mode (verbal only). Naturally, provided that there's an appropriate didactic design: for example using images with learning functions means to move away from the decorative use and seductive details; it is essential to refer to principles and guidelines on multimedia learning resulting from research activities.

The same is true for the relational activity, there can not be teaching without teacher-student relationship, especially when the process is mediated by technology. As already mentioned, the continuous relationship and the feedback are essential to the effectiveness of teaching processes (the teacher can intervene based on the user response) and learning processes (students can improve performance if they are aware of their critical issues).

Cognitive artifacts like web conference characterized by multimedia presentation and relational activity, as well as by the teacher's speech, can have an important rule in the didactis design in higher education.

The hypothesis is therefore the following:

The valorization of the didactic content presented by the professor of higher education using web conference in according with multimedia learning principles, regarding visuals and visuals combined with chat activities, increase the learning outcomes in the FaD model experimentation.

VI.5. THE VARIABLES OF THE RESEARCH

In experimental research, the researcher controls and manipulates the conditions that determine the events he intends to study: an experiment involves changing the value of one of the independent variables and observing the effect of that change on another variable, so-called dependent variable. Among the many aims that a research is aimed at, it is important to examine the relationship between two or more variables and to measure this relationship at a correlational level (Zammuner, 1998). The dependent variable can vary based on the intervention of one or more independent variables.

Independent variables

The independent variables in this research project, as before mentioned, consists in visuals and in chat activities.

The use of visuals to support speech (multimedia presentation) and a constant relational and feedback activity (chat), as mentioned before, are the two most important aspects of educational communication with the web conference. Of course, visuals and chat can be used separately, just visuals or visuals combined with the chat.

This dual mode of use constitutes our independent variables: a) visuals; b) visuals combined with chat.

The independent variable 1 consists in the visuals inside web conference tool. We will use the same contents of the lesson (the teacher's speech), and we will intervene on the modification of the visuals through the intervention of the researcher. The visuals will be modified through compliance with the guidelines identified in the theoretical part (Chapter III, *Multimedia learning and cognitive processes: for design in education*) and summarized in paragraph V.3.3.1. (*The multimedia presentation and design of lesson with web conference*). This is the general principle that has guided our work: learning by students through multimedia presentations does not depend on the presentation of the necessary information, but on the presentation of the necessary information according to the functioning mechanisms of the students mental and cognitive processes.

The independent variable 2 consists in the visuals combined with relational activities (Chat). Researcher will help the teachers to use 25 minute session of chat as integration of the modified visuals (through compliance with the guidelines identified in the theoretical part).

The experimental groups will be subjected in different ways to the two independent variables.

The dependent variable

The dependent variable consists in learning outcomes. More precisely, in the measurement of some learning elements that can be highlighted by the results of the verification tests: the level of knowledge which was measured using a Multiple choise question tests; the level of learning skills, which was measured using an Open-ended question tests.

Our goal is to verify the activation of metacognitive behaviors, the result of which, obviously, can be fully evaluated in the medium and long term. Naturally, we know that to measure learning we must evaluate the results of the tests in an integrated way with the cognitive processes activated by the student to learn: the result of the test, alone, is random and contingent; the process put in place by the student, especially if supported by results, is consolidated in competence. For this reason our goal, as mentioned, is to verify the activation of metacognitive behaviors, the result of which, obviously, can be fully evaluated in the medium and long term.

Practically *the dependent variable* consists of learning outcomes which are operationalised through:

1. the level of knowledge, which was measured using a *Multiple choise question tests* (Test_01);
2. the level of learning skills, which was measured using an *Open-ended question tests* (Test_02). This second test is useful to understand if metacognitive processes have been activated. The activation of these processes is already a good indicator of the learning process.

The results of groups 3 and 4 (experimental groups) will be compared with those obtained from the control group (group 2). To get a more objective picture the results obtained will be compared with the pre-knowledge of the students involved, measured with a an entry multiple choice test questions (test_0).

Some considerations

As mentioned previously the variables that come into play are multiple. We have considered as independent variable the multimedia teaching communication, consisting of visuals and chat. We said that to go deeper we have divided this independent variable into two different variables: one related to visuals, the other to visuals combined with chat. So to get some more precise information.

Naturally, even this type of subdivision does not satisfy all the real components that come into play. In Table no.1.VI we have summarized all the principles of multimedia communication that have been really applied (a summary of the results is in tables no.10.VI and no.12.VI, the full version can be consulted in annex no.3 and no.4). These principles are the result of the theoretical studies carried out in the first part of the thesis (chapter *Multimedia learning and cognitive processes: for design in higher education*) and summarized in paragraph V.3.3.1 (*The multimedia presentation and design of the lesson with web conference*).

As we can see, the independent variable 1 includes 6 other parts, each corresponding to a precise principle of multimedia communication: Principle 1. *Integrate words and images into a complementary mode;* Principle 5. *Use of images with a decorative function; Principle 7. How to present exclusively textual information (spoken and written);* Principle 10. *Redundancy effects;* Principle 12. *Use graphic organizers to explain relationships and organize knowledge;* Principle. *General technical principle.*

The same reasoning we could do it for the Chat (we could break it down in many other subparts).

Table. No.1.*VI.Independent variables*

Independent variable 1	Independent variable 2
Principle 1. *Integrate words and images into a complementary mode.*	Principle 1. *Integrate words and images into a complementary mode.*
Principle 5. *Use of images with a decorative function.*	Principle 5. *Use of images with a decorative function.*
Principle 7. How to present exclusively textual information (spoken and written).	*Principle 7. How to present exclusively textual information (spoken and written).*
Principle 10. *Redundancy effects.*	Principle 10. *Redundancy effects.*
Principle 12. *Use graphic organizers to explain relationships and organize knowledge.*	Principle 12. *Use graphic organizers to explain relationships and organize knowledge.*
Principle. *General technical principle.*	Principle. *General technical principle.*
	Chat

If the overall objective of the research were to evaluate the relationship between all the variables involved, we would have worked and develop a very advanced software/ questionnaire to evaluate the role of each additional sub-variable (the six principles mentioned in Table no.I.VI) on learning processes, their relationships, etc.

Our goal is instead to understand if the teaching practices, teaching methods, of professors involved in the FaD experience are functional to a technological educational environment. So we are interested in having a more general evaluation.

As mentioned in the previous point (VI.3. *The research question*), the main question that the research wants to give an answer is the following: *the teacher uses well the educational communication rules of the multimedia learning principles that come into play in the case of the use of web conference: visuals and relational activity?* So if the independent variables had a positive effect on learning processes, this means that the teacher does not use well the principles of multimedia

communication functional to learning. Naturally every single principle could be studied and deepened but as we said this is not our goal. This could be the way to other more refined research trails.

Type of analysis

Through an analysis of the results of the tests we will try to understand if the independent variables had positively influenced the dependent variable (in terms of acquired knowledge, acquired skills and activation of metacognitive behaviors).

In Table no.2.VI we summarize the general framework in terms of tools, variables that come into play, possible relationships between variables and groups. Based on this, a series of checks will be carried out:

1. the test_01, comparing the results of the two experimental groups (both exposed to independent variable 1) with those of the control group, will tell us if the independent variable 1 has worked;
2. the test_02, comparing the results of the experimental group 4 (exposed to independent variable 2) with the control group, will tell us if the simultaneous use of visuals and chat has worked;
3. the test_02, comparing the results of the control group with those of the experimental group 3 (still exposed only to independent variable 1) will tell us if the independent variable 1 has continued to work. It is a verification test of the functionality of the visuals (independent variable 1), with the same sample (control group and experimental group 3) but with different contents (validity indicator);
4. the comparison of difference of increase between test_01 and test_02, of experimental group 4 and control group 2, will tell us if the independent variable 2 has had an impact on learning outcomes: in test_01 the experimental group 4 is exposed to independent variable 1, in test_02 experimental group 4 is exposed to an independent variable 2. The difference in increment can be significant. If the increase of the experimental group 4, in test_02 with respect to the control group is higher than that obtained in test_01, then the independent variable 2 has certainly worked;
5. the comparison between the differences of increase (between the two experimental groups) will give us some other information on the weight, on the importance, of the two independents variables.

Table no.2.VI. *General pictures: variables that come into play, possible relationships between variables and research groups, measurement of the level of knowledge, tools (questionnaires and valuation grids)*

Tools	Independent variables	Dependent variable	Group 2	Group 3	Group 4
Test_0		Pre-knowledge	X	X	X
Test_01 (a)		Knowledge	X		
Test_02 (a)		Skills	X		
Test_01 (b)	Visuals	Knowledge		X	X
Test_02 (b)	Visuals	Skills		X	
Test_02 (b)	Visuals and chat	Skills			X

The tools used were:

1. a multiple choise questions test to mesaure the level of pre-knowledge (test_0);
2. a multiple choose question test to mesaure the level of knowledge (test_01): two different tests, one for control group (a), one for the two experimental groups (b);
3. an open question test to mesaure the level of skills (test_02): two different tests, one for control group (a), one for the two experimental groups (b).

The control group and the experimental groups will do the tests at different times: the control group immediately after the frequency of the conventional lessons, the experimental groups after the modification of the lessons by the researcher. To avoid interference factors that could void the reliability of the research, two different tests will be prepared, one for the control group, one for the two experimental groups. The tests will be prepared keeping the same educational objectives, we will only intervene on the formal structure. In this way the passage of information from the control group to the experimental groups is avoided.

The process of preparing the questionnaire and the subsequent evaluation, for a greater scientific guarantee in terms of validity, was followed by Prof. Gramigna (see paragraph VI.8.2.1. *Measurement of learning outcomes).*

VI.6. THE SAMPLE OF SUBJECTS

The students enrolled in the *Children's literature* course, by Prof. Anita Gramigna, are involved in the experimentation (First semester of the academic year 2017-2018). The students are a total of 127 and have been divided into 4 groups on the basis of a *voluntary sampling of convenience* (thus through a non-probilistic methodology). The groups of students involved are showed in Table no.3.VI.

Table no.3.VI. *The groups of students involved in the experimentation*

Group	Students n.	Attendance mode	Groups tipology
1	72	Real classroom (AR)	Excluded from the research
2	18	Virtual classroom[16] (LMC)	Control group
3	18	Virtual classroom (LMV)	Experimental group one
4	19	Virtual classroom (LMVR)	Experimental group two

The characterisations of the research groups

Group 1: n. 72 students who attend the lecture in the *Real Classroom* (AR). These students were excluded from the study. We did not want to work on the comparison between presence and distance teaching. The students present in the classroom can eventually offer a reference parameter to verify the difference in learning between the students in the real

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[16] When we talk about virtual classroom we refer to the web conference environment.

classroom and the different groups of students present in the virtual classroom. But the main objective of this research is to evaluate the multimedia learning processes in relation to the multimedia teaching methodology of the teachers.

Group 2: n. 18 students attending online (inside the web conference envoinroment) that follow the Lesson in *Conventional Mode*. By conventional methods we mean the lesson taught by the teacher according to his normal didactic modality, then before the intervention of the researcher (LMC). <u>See Annex 3</u>.

Group 3: n. 18 students attending online (inside the web conference envoinroment) that follow the *Modified Lesson from the Researcher*. This change concerns a substantial work on the Visuals based on the guide principles identified on multimedia teaching design (paragraph 1.4.2). The textual content (the teacher's speech) of the lesson remains unchanged (LMV). <u>See Annex 4.</u>

Group 4: n. 19 students attending online (inside the web conference envoinroment) that follow the *Modified Lesson from the Researcher*, as for group 3, and that at the end of the lesson have 20 minutes in which they can dialogue with the teacher, then integrated by the *Relational aspect via chat* (LMVR).

The researcher's attention is directed only to the groups that follow the lessons in the web conference envoinroment (LMC, LMV, LMVR). The study did not include the 72 students in group 1 as they were not beneficiaries of the web conference service, so the sample object of the study went from 127 subjects to 55.

We have defined this distinction:

A – *Control group (group 2)*

The control group consists of the virtual classroom students who follow the lesson, inside the web conference envoinroment, in conventional mode: the group maintains the initial characteristics for the duration of the experiment. Students attend online through access with their credentials in the virtual classroom; the lesson is followed during its real development, in live streaming.

B – *Experimental groups*

In order to keep under control the effects generated by the intervention of the researcher on how to use the web conference (visuals and relational activity) used in the teaching session, we work on the experimental groups (3 and 4).

Experimental group (group 3)

The first experimental group consists of a sample with the same characteristics as the control group. The group uses the lesson, inside the web conference envoinroment, modified by the researcher: the researcher modifies the visuals leaving unchanged the verbal speech of the teacher.

Experimental group (group 4)

The second experimental group consists of a sample with the same characteristics as the control group. The group uses the lesson, inside the web conference envoinroment, modified by the

researcher, as for group 3 (intervention on visuals), plus the possibility of interacting with the teacher for 20/25 minutes at the end of the lesson (intervention on the relational part).

VI.7. THE CONTENT SAMPLE

The experimental phase takes place on a part of the teaching. The module used for experimental research is *Children's Literature and new digital technologies*, lasting 2 hours, while the overall teaching lasts 30 hours (see diploma supplement, Table no.4.VI).

The diploma supplement is taken directly from the Ferrara website university. Naturally, especially for what concerns the module of experimentation, the contents reported should be integrated with what was said in the presentation of the course by Professor Gramigna. Most likely, something could have changed in the original program, in light of the relationship between the researcher and Professor Gramigna.

The precise content of the lesson has been completely transcribed (Annex 3 – *Original speech text and original visuals of multimedia presentation*).

Table no.4.VI. *Diploma supplement - Children's literature*

Academic year: 2017/2018
Teacher: Anita Gramigna
Credits: 6
SSD: M-PED/02

Transversal skills	It is a study that regards the creative and reflexive space of each person, which seeks the objective of building a highly specialized expertise in relational and emotional capabilities that the narrative, applied with pedagogical sensitivity, can and must activate. For this purpose, we will not forget to provide lexical coordinates and the discipline's epistemological framework, for critically orientating in a theoretical-practical sense inside the horizon of the themes faced. Educational intervention involving new digital technologies (e-books mainly).
Knowledge	The theories are based on the principles of Pedagogy Narrative. To this end, we will propose the analysis and the application of a specific series of principles, strategies, techniques, and educational intervention's praxis: narrative pedagogy in comparison with children's literature; children's imaginary and narrative logic. The course aims to build - along with the students - a highly specialized expertise, about the capability of educational intervention:
Skills	Starting from the application of the most innovative methods in the field of children's narrative. They will offer experiences of text analysis and creative writing: classic or through the principles of digital media.
Prerequisites	Knowledge of the basic conceptual and linguistic instruments.
Course programme	

	Organization and specialized formative planning in the following significant situations: The pedagogical analysis of examples of meaningful narrations on the formative point of view; Elaboration of materials and worksheets; The children's novel and the metaphor as a cognitive instrument; The role of emotions in learning processes; The valorisation of human resources between equals; The aesthetic dimension of education; Characteristics and paradigms of digital media; Author concept and User Generated Content; Technologies for digital books. In the first meetings – of introductory character – we will discuss the general coordinates of the discipline, its role in the world of childhood, the new frontiers of educational research.
Didactic methods	After the first meetings, of introductory character, all the lessons will have a mainly laboratorial character: case analysis. Streaming of the lessons for Students who works or who cannot attend them, available through Se@ services.
Learning assessment procedures	In each module there will be a multiple choice test. The test consists in the writing of an elaborate on one of the program's topics. Evaluation parameters: we will evaluate the capabilities of critical, propositional and planning orientation, between the themes faced during the course. The *Children's literature and new digital technologies* module will provide for different assessment procedures.
Reference texts	Anita Gramigna, *Lo straordinario e il meraviglioso*, Roma, Aracne, 2015. Luis Sepulveda, *Storia di una gabbianella e del gatto che le insegnò a volare* (qualsiasi edizione).

In agreement with Prof. Gramigna the course was divided into several modules and the *Children's literature and new digital technologies* modul (2 houres) had been used for the experimental verification (Table no.5.VI).

Table no.5.VI. *Children's literature (5 credits), 30 hours of lectures, I semester of the academic year 2017-2018. Start time for all lessons: 10.00.*

Module title	Houres module	Lessons time table		
Course presentation	2	26/09		

Children's literature 1	5	28/09 (2 h)	03/10 (2 h)	05/10 (1 h)
Children's literature 2	5	10/10 (2 h)	12/10 (3 h)	
Children's literature and new digital technologies (for groups 1 and 2)	2	17/10 (1 h)	19/10 (1 h)	
Children's literature and new digital technologies (for group 3)	2	24/10 (1 h)	26/10 (1 h)	
Children's literature and new digital technologies (for group 4)	2h 20'	24/10 (1 h)	26/10 (1 h and 20')	
Children's literature 3	5	07/11 (2 h)	09/11 (2 h)	14/11 (1 h)
Children's literature 4	5	16/11 (2 h)	21/11 (2 h)	23/11 (1 h)
Children's literature 5	5	28/11 (2 h)	30/11 (2 h)	05/12 (1 h)
Course conclusion	1	07/12 (1 h)		

Compared to the objectives of the research, a two-hour module within a single teaching may not be sufficient to return a clear picture. Some considerations must be made about this.

The first of a conceptual nature. In the theoretical part, in the chapter Multimedia learning and cognitive processes, the most important international research in this field was examined, between cognitive psychology and the principles of Instructional design: Paivio (1971; 1990) on dual-coding theory, concerning the different coding of the information, verbal and non-verbal, from the human cognitive system; Sweller (1988; 2010) on the functioning mechanisms of the cognitive load (cognitive load theory); Clark and Lyons (2010) on the guidelines based on the communicative and psychological features of the different types of images; Mayer (2005; 2009) on the principles of multimedia learning (generative theory of multimedia learning). All these experimental researches took into consideration short conceptual nuclei (often lasting 3-5 minutes) to verify the principles of multimedia learning. This is to underline the difficulty of working in an experimental way, in this context, on very long contents. Consider how a course of 5 credits is equivalent to 30 hours of lessons.

The second consideration is of a more practical nature. Compared to the use of multimedia in teaching processes, as stated in the theoretical part of the thesis, the position of the major Italian scholars is very critical: according to many there is no scientific evidence on the effectiveness of multimedia on significant learning processes. If we had taken into consideration many lessons, we would have been able to see for sure how university professors misuse multimedia. Maybe through quantitative research, with the aid of a grid or through the use of questionnaires and / or focus groups.

To arrive at having scientific evidence, as requested by scholars in the pedagogical field, we believe, the only way is to go in depth, taking into consideration only some conceptual nucleuses. As was done by the research mentioned in the theoretical part. We were inspired by these researches. If the effectiveness of multimedia presentation is demonstrated in terms of significant learning, even on a two-hour module, new paths open to university teaching supported by technology.

VI.8. THE METHODS OF RESEARCH

VI.8.1. THE METHODS: EXPERIMENTAL, OBSERVATIONAL, SURVEY

Research can adopt several methods to study a phenomenon, among the most common we mention the experimental method, observational method, survey. Each of these methods has strengths

and negative aspects. The researcher must evaluate well the characteristics of the different methods to choose the most suitable one.

Experimental method. The experimental method allow the complete control of a factor or variable, and the control over the selection of the subjects that constitute both the experimental and the control group. It is important to select two identical groups - the experimental group and the control group - with the same characteristics with respect to all known variables. The experimental group is subjected to treatment and the control group no. The effect of the treatment on the experimental group is then measured and compared with the control group. This method usually lends itself to a laboratory situation where it is easier to control all the variables that come into play.

It is not however impossible to conduct an experiment in a real situation, the important thing is to be able to have a good control on the variables involved (dependent and independent), but its realization is certainly more difficult. When it is not possible to conduct an experimental research it is preferable to use other modalities, such as the observational method or statistical surveys.

Observational method. The observational method in comparison with the experimental one does not propose to intervene on independent variables: it is proposed to investigate the relationships that actually exist between one or more variables. This method plays an important role because the conditions for respecting the procedures of experimental research conducted in the laboratory do not always occur. For this reason observational research can be considered a valid alternative. Moreover, it can be carried out both to verify precise hypotheses and also for a merely descriptive purpose. Observational research can be structured according to the following models: the researchers' control is minimal, the researcher is hidden, or visible, but without interacting with the group or the observed phenomena; participant, when a relationship is created between researcher and observed subjects, the attitude should not be authoritarian; controlled, when the researcher performs a certain control of the dependent variable, without however intervening on the independent variable.

Survey. The term survey is derived from probing, so it is something that helps to identify what is not on the surface, an opinion, an orientation. for this reason, the survey has become an irreplaceable tool for social knowledge, and the media, companies, parties, etc. are more and more frequently used.

Often these surveys have no scientific value, because those who lead them lack adequate preparation. It is important to respect all the procedures provided for by that method of research. The surveys are considered scientific when they use the so-called probabilistic sample, a representative sample that is able to reproduce on a reduced scale the structure and characteristics of the reference population. Naturally, the questionnaire must also be structured according to characteristics of simplicity and unambiguousness.

VI.8.2. THE CHOOSEN METHOD

Experimental research with intentional manipulation of independent variable. In a nutshell, here is the path of our research with quantitative character:

- translation of the phenomenon to be investigated in a countable form: multiple choice questionnaires and open-ended questionnaires;
- to acquire data in numerical form;

- perform data analysis through a statistical program.
- This methodology provided a control group, two experimental groups, two independent variables, a factor that is measured as defined dependent variable (learning outcomes).
- Evaluation methods for measuring learning outcomes will be the written questionnaires: *Multiple choise question tests* and *Open-ended question tests*:
- a multiple choice questions (test_01) to test the learning outcomes of lesson 1: test_01 for control group (annex 5); test_01 for experimental groups (annex 7).
- a open-answer questions (test_02) to test the learning outcomes of lesson 2: test_02 for control group (annex 6); text 02 for experimentals group (annex 8).

Two different tests will be prepared (one for the control group, one for the experimental groups) to avoid cheating factors (the two tests were administered at different times).

To get a more objective picture the results obtained will be compared with the pre-knowledge of the students involved, measured with a an entry multiple choice questions (test_0) (annex 1).

The attempt is to control, as rigorously as possible, the effects of educational innovations through the systematic control of educational intervention and its effectiveness using experimental procedures. Naturally it is a research in real situation and considering that the students follow each one from their own home it is not possible to control all the possible variables.

The experimental part was proceeded by a mapping of the activities carried out within the Moodle educational environment, using a grid (Table no.6.VI). The aim of this mapping was to identify the teaching attitude of the teachers involved in the research. From this observation, as already mentioned, some important data have been obtained. The most significant that can be considered the starting point of the experimental research is the following: in almost all cases the teachers involved in the investigated experience used the web conference exclusively, neglecting all the other didactic elements defined "2.0". The percentage of teachers who used 2.0 tools is negligible.

Table no.6.VI. *Grid for mapping the tools used in the FaD model (by researcher)*

Course's title:_____

Didactics period: Second semester academic year 2016-2017

Didactics tool	Amount	Typology	Note
Video lessons			
Educational video			
Synchronous e-seminar			
Forum			
Chat			
Wiki			
Blog			
Glossary			
Feedback			
Assessment text			
Auto assessment text			
Other			

Softwares

The softwares used in the research activity was of different types.

Some softwares were used to observe what happened in the multimedia didactic setting (*Moodle* and *Adobe Connect*); others to edit the multimedia lesson (*Microsoft Power point*, *Adobe Premiere*); others to organize data (*Microsoft Excel*). The softwares for editing the multimedia presentation visuals (Adobe premiere) have been used by the technicians of the Multimedia Laboratory of the Se@ (*Center of Technologies for Communication, Innovation and Distance Learning of the University of Ferrara*).

The tools for the preparation and evaluation of written tests have been managed by the teacher and her staff of the course.

The researcher has acquired the final data by staff of professoressa Gramigna, the result obtained by the single student in the single test, and used a software to manage, investigate and analyze this numerical data. The software was "R" *Project for Statistical Computing*; in particular, in this software has been used *DPLYR packages* (for data management and processing), *GGPLOT2* (for graphics processing).

VI.8.2.1. MEASUREMENT OF LEARNING OUTCOMES (DEPENDENT VARIABLE)

The tool used for the misurement of learning outcome was the written questionnaire:

- *Multiple choise question tests* (test_0 and test_01) to mesure the level of knowledge;
- *Open-ended question tests* (test_02) to mesure the level of competence.

One of the advantages of written tests is to be objective. Naturally for this to happen, as already seen, we must proceed according to clear scientific criteria. The scientific discipline that can help in this path is the *Docimology*. This discipline has made available to those who want to understand the importance of evaluation all its statistical, psychophysical and psychometric instruments. The attempt to achieve an ever higher degree of objectivity in evaluation is pushing many universities to equip themselves with centers that operate in this field, especially when it comes to e-learning.

The concept of validity and reliability

The criteria of *validity* and *reliability* have been introduced to control the incidence of errors.

In the construction of the question the crucial point is the *validity*, that is the explicit reference to what one declares to go to evaluate. A measure is valid when it measures what it intends to measure. Expresses the level of accuracy. There are four main types of validity:

1. *Validity of the content:* the content of the Item must be appropriate for the purposes of the test. Therefore the precise definition of the objectives of the test serves to define this validity.
2. *Validity of criterion: able to highlight the levels behavioral of each individual student in relation to a specific one performance - the criterion - defined before the application of the tool evaluation.*

3. *Validity of construct: to adequately measure the type of competence that represents the object of the assessment.*
4. *Appearance validity: does the test appear congruent with its objective to the students?*

The items of a test must be able to produce representative responses of what the instrument aims to measure. In the profit tests a careful construction of the items represents the first step towards achieving this goal, the validity of content.

The same attention must be used to measure the scores of the answers. The problem of the treatment of answers is more complex: we must try to guarantee a sufficient degree of objectivity. In this case we are talking about *Reliability*. The reliability of codified and shared measures is a fact, the question is different when the tool we use has been built by ourselves and intends to measure constructs that are not always so well defined and definable. For these reasons, the reliability of a test is a very important characteristic of the measuring instrument we use.

Reliability must guarantee a stable measurement capability in the various evaluation situations, measures must be free from random error and must be stable over time. Here are some ways to monitor the reliability of a test:

- *test-retest reliability*: the same identical test is administered to the same identical sample at two different times (T1 and T2); therefore it misures the stability over time. The results obtained are then compared. It is enough to know how to calculate "r of Pearson" between two series of scores.
- *equivalent form reliability*: two parallel or equivalent forms of the same test are administered to the same sample at two different times (T1 and T2). The results are then compared**.**
- *internal coherence, Cronbach's Alpha*: it is evaluated through the application of mathematical formulas that indicate how the items of the same test consistently measure the same construct. The test is administered in a single time T1. Each item is considered a test stand alone. The average correlation between all items and the correlation between each item and total score is misured.

The achievement of these two objectives - validity and reliability - is never completely guaranteed. For this reason, the theory and technique of the tests has formalized measurable indices of reliability in a range between 0 and 1: in case of reliability *α of Crombach*, superior *.90* is optimun; between *.90* and *.60* is acceptable; inferior to *.60* is considered unacceptable.

Preparation of questionnaires

As we said the questionnaire is one of the most complicated and difficult to construct and manage research tools. For this reason it often involves very different scientific competences (pedagogical, cognitive psychology, statistics, communication). Writing some questions to receive answers seems like simple activities, but they hide numerous technical pitfalls: for example, you have to use filter or fullel questions; make sure that the terminology used has the same meaning for all respondents; it must be a perfect communication tool to transmit to the student the exact meaning of the information requested; we must know how to code the answers of open questions in mathematical

terms, we must evaluate their reliability.

The process of constructing the questionnaire and its correction grids, it has been said, for a greater scientific guarantee in terms of validity, was followed by Prof. Gramigna. The correct criteria for the construction and evaluation of written tests require: docimological scientific skills; in-depth knowledge of the subject; knowledge of the characteristics of the study sample[17].

The work carried out by the researcher concerned the analysis and intersection of data through a statistical program ("R" *Project for Statistical Computing*).

Below are some phases of the work for the preparation, somministration and evaluation of the questionnaires:

1. definition research objective and evaluation related to the choice of the sample;
2. clear and precise definition of the teaching objectives to be tested;
3. questionnaires' tipology;
4. item's content;
5. decisions on the verbalization of the items: terminology to be used, that is to say the use of a simple and clear language, with terms known to the students; avoiding negative sentences or double negation; it is important to check the student's ability to respond and not them ability to understand the question;
6. actions for the organization of the items in the test: number of questions, sequence of questions according to difficulty levels;
7. form and scale of measurement of responses (assessment grids);
8. execution tests' modality: explained to the students very thoroughly the structure of the tests, to avoid the possibility of copying, time for each tests, etc.
9. pre-test and subsequent revision.

Two different questionnaires

The assessment in our research project involved the use of different but complementary tools: *Multiple choise question tests* and *Open-ended question tests*. This is now a consolidated methodology at the international level. For example, in the Anglo-Saxon context, Asquini still remembers (2016), the use of open-ended questions is almost always used in conjunction with closed-ended questions: the advantages of open-ended questions in tests have been known for a long time: they solicit in the respondent the ability to self-explain, compared to closed questions that are addressed by focusing more on memory. In our case, multiple choice questions were used as a tool to measure the knowledge possessed (test_0) and the knowledge acquired with the first lesson (test_01); open-ended questions as a tool for measuring skills / abilities (transfer) to put knowledge into practice (test_02). In line with the educational objectives, in terms of knowledge / skills, indicated in the teaching program (objectives that refer to the descriptors of dublin): "the students must be able to apply their knowledge and understanding skills in order to demonstrate a professional approach to

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[17] The tests were not evaluated because we relied on the experience of researcher in the evaluation of Professor Gramigna.

their work; they have adequate skills both to devise and support arguments and to solve problems in their field of study". *Dublin descriptors* define the learning outcomes common to all european graduates and are built on the following elements: *knowledge and understanding*, *applying knowledge and understanding*, *making judgements*, *communication skills*, *learning skills*.

Based on the achievement of these objectives (explayned very well to the student) the questions were prepared. Therefore the related parameters of the final scores are also linked to these objectives. *Multiple choise question tests.* The entry test or entry exam (test_0) and the test_01 were multiple choice questions. Both consist of 15 questions; each question 4 possible answers. The answers could be right, inaccurate or partially correct, wrong. This type of test stimulates in the student a type of "recognition" memory: in the face of a certain number of alternatives (distractors) he must recognize the correct information. It does not require an effort to recover information from long-term memory.

For the questions'assessment the following scores were used (Table no.7.VI): *Correct*: 2; *Partially correct:* 1; *No answer:* 0; *Wrong answer:* -1.

To avoid that a student could choose a random answer (in the hope of guessing) it was decided to penalize the wrong answers (-1). A score of 2 was assigned to the correct answer, 1 to the partially correct answer, 0 to the non-answer.

Table no.7.VI. *Assessment grid: scores of the 15 questions*

Steps of the measurement scales		Questions														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Correct	2															
Partially correct	1															
No answer	0															
Wrong answer	-1															
													TOTAL	……/30		

Open-ended question tests. The test_02 was 3 open-ended questions. For the evaluation the teacher adopted the following parameters: topic adherence, content knowledge, ability (transfer). Each of these parameters has been assigned the following score scale (Table 8.VI): *Topic adherence*: invalid (0); incomplete (0,5); partial (1); coherent (1,5); *Content knowledge:* invalid (0,4); serious insufficient (0,8); insufficient (1); sufficient (1,2); Decent (1,4); Good (1,6); Top marks (2); *Ability/transfer:* invalid (1,3); serious insufficient (2,6); insufficient (3,3); sufficient (3,9); decent (4,6); good (5,2); top marks (6,5).

Table no.8.VI. *Assessment grid open questions, with rounding (+ - 4) on a discretionary basis*

Steps of the measurement scales		Score	Question 1	Question 2	Question 3
Topic adherence	INVALID	0			
	INCOMPLETE	0,5			
	PARTIAL	1			
	COHERENT	1,5			
	INVALID	0,4			

Content knowledge	SERIOUS INSUFFICIENT	0,8			
	INSUFFICIENT	1			
	SUFFICIENT	1,2			
	DECENT	1,4			
	GOOD	1,6			
	TOP MARKS	2			
Transfer test (ability)	INVALID	1,3			
	SERIOUS INSUFFICIENT	2,6			
	INSUFFICIENT	3,3			
	SUFFICIENT	3,9			
	DECENT	4,6			
	GOOD	5,2			
	TOP MARKS	6,5			
	Partial		……/10	……./10	……./10
	Total		……/30		

Execution tests' modality

Prof. Gramigna before the exam tests explained to the students very thoroughly the structure of the tests: "what I am going to evaluate and how I will do it". This is to control as much as possible the possibility of misunderstanding by the students (failing to interpret the information in the way the test author intended). To guarantee greater objectivity of results.

On all the tests the student wrote his/her name (without the surname) and the university registration number. The researcher subsequently wrote an ID number on each test.

Furthermore, the following methods have been put into practice:

- to avoid the possibility of copying (these tests are the easiest to copy) in the classroom there was the teacher and/or a tutor, and the researcher;
- the context was very well taken care of in order to allow the student's maximum concentration: interferences such as (interruptions, noises, etc.) were eliminated;
- the use of facilitating tools (books, notes, suggestions, etc.) was not permitted;
- in the multiple-choise question test the execution time was 1 minute per question, 15 minutes overall;
- in the open-ended question test the execution time was 15 minutes per question, 45 minutes overall.

Data analysis

Through an analysis of the results of the tests we will try to understand if the independents variable has positively influenced the dependent variable (in terms of acquired knowledge, acquired skills and activation of metacognitive behaviors). We report the type of analysis that will be carried out (VI.9.3. *The post-experimental stage*), which we have already seen in the previous paragraph

1. the test_01, comparing the results of the two experimental groups (both exposed to independent variable 1) with those of the control group, will tell us if the independent variable 1 has worked;
2. the test_02, comparing the results of the experimental group 4 (exposed to independent variable 2) with the control group, will tell us if the simultaneous use of visuals and chat has worked;
3. the test_02, comparing the results of the control group with those of the experimental group 3 (still exposed only to independent variable 1) will tell us if the independent variable 1 has continued to work. It is a verification test of the functionality of the visuals (independent variable 1), with the same sample (control group and experimental group 3) but with different contents (validity indicator);
4. the comparison of difference of increase between test_01 and test_02, of experimental group 4 and control group 2, will tell us if the independent variable 2 has had an impact on learning outcomes: in test_01 the experimental group 4 is exposed to independent variable 1, in test_02 experimental group 4 is exposed to an independent variable 2. The difference in increment can be significant. If the increase of the experimental group 4, in test_02 with respect to the control group is higher than that obtained in test_01, then the independent variable 2 has certainly worked;
5. the comparison between the differences of increase (between the two experimental groups) will give us some other information on the weight, on the importance, of the two independent variables.

Validity and reliability: Item analysis model

As mentioned previously the problem of the treatment of answers is very complex: we must try to guarantee a sufficient degree of objectivity. Each measure involves errors. To keep under control the incidence of errors, we have at the beginning of the paragraph referred to the concepts of validity and reliability.

Naturally, the methods used can change depending on the case. The type of our research for example did not need to proceed in such depth in the collection of scores and in the analysis of data. Some of the tools mentioned such as *Cronbach's Alfa* are used on standardized tests, therefore prepared for large samples.

In our research, because of the general objectives (verifying the teaching attitudes of the professors of FaD model more than the reliability of a verification test) and the low number of the sample, it was decided not to measure these indices.

A verification would be in every case possible. If we wanted to measure the index of validity and reliability, the best model could be the *Item analysis model*, based on the indices of difficulty and discriminativity.

The *difficulty index* expresses, in percentage terms, the share of errors (ie incorrect answers) committed by students for each individual item. Therefore the difficulty index increases if the percentage of errors grows.

With the *index of discrimination*, the best results are compared to the worst ones. This parameter allows to understand to what extent each single item is able to discriminate (to distinguish) those who possess the required competence with respect to those who do not possess it.

Interpretation of results, score classes

In order to rationalize the results obtained by the students, it was decided to group them into scoring classes. The criterion used to classify the test result was at the discretion of the researcher (Table no.9.VI).

Table no.9.VI. *Score classes*

Class	Score	Knowledge	Acronym
1	0-6	Gravely non sufficient	GNS
2	7-12	Non sufficient	MNS
3	13-17	Slightly non sufficient	LNS
4	18-22	Sufficient	SUF
5	23-26	Good	BNA
6	27-30	Top marks	OTT

VI.9. THE STAGES OF RESEARCH

VI.9.1. THE PRE-EXPERIMENTAL STAGE

The first analyzes of the FaD model experience that involved hundreds of teachings at the University of Ferrara highlighted, as already mentioned, a problematic situation. This problematic situation led us to define the university professor as a "teacher 1.0" and, at the same time, convinced us of the need for a didactic approach based on scientific evidence to improve the model. Among all the tools that the Fad model has made available to teachers (see Table no.1.V) the only one used was the web conference.

We have decided to direct our research activity to this tool. A sample check of the thousands of recorded hours showed that even the web conference in its main features (use of visuals to support the teacher's speech, use of the relational potential between teacher and students, chat in particular) was used in an instrumental way and not in its communicative-didactic function.

We subsequently identified the variables of the model and formulated a research hypothesis, identified a methodology and the relative tools to be used (see the previous paragraphs).

A course of the Humanistic Department has been identified that takes place according to the modality of the FaD: Prof. Anita Gramigna (degree course in Educational Sciences, Literature teaching for children) was made available to the collaboration. Finally, an operational plan was elaborated including times and places, of the sample concerned, of the method of analysis, of the type of qualitative analysis. This research operational plan is described in the next paragraph.

VI.9.2. THE EXPERIMENTAL STAGE

Phase 1 - *Entry exam (Test_0) to test pre-knowledge*

Professor Gramigna the day of the first lesson (of 26 September 2017), after explaining very precisely the objectives of her course, asked to answer an entry exam (test_0) to all the students present in the classroom. The aim was to test the pre-knowledge possessed by the students on a part of the course topics: those related to the module on *Children's literature and new digital technologies* (see annex 2).

The entry test was structured as multiple choice questions, which consist of 15 questions: each question has 4 possible answers, the answers can be right, inaccurate or partially correct, wrong.

In the construction of the question the crucial point was the explicit reference to what will be studied during the course (related to the module on *Children's literature and new digital technologies*).

Bar chart no.1.VI. Test_0. *Scores obtained from the 49 students in the study*
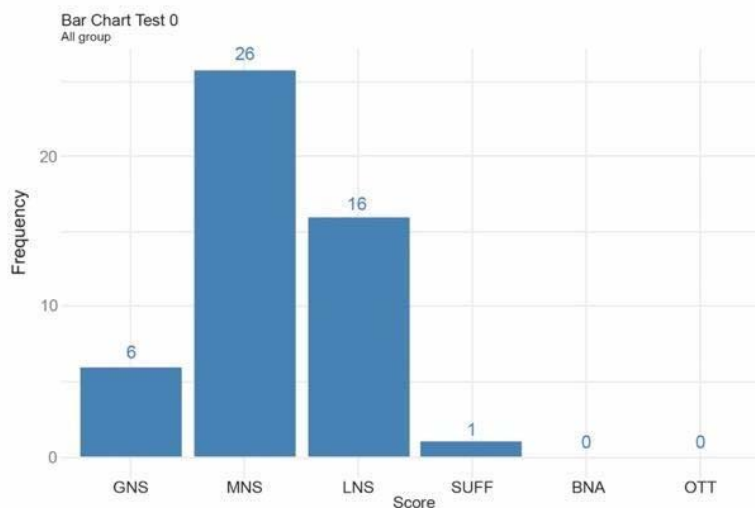
Bar chart no.1.VI shows the results of the students, grouped by scoring classes. The 72 students who attended the lecture in the classroom and the six students who did not do all the tests were eliminated from the study.

In total the students of the study are 49. As seen from the bar chart, the score is distributed to the right, highlighting how the scores obtained by the sample are mainly below the sufficiency, only in 1 out of 49 cases are found inbound knowledge deemed sufficient (SUFF). In 6 cases there were severely inadequate scores (GNS).

Analyzing average, minimum and maximum median, we note how the mean and median values do not differ much, just to indicate the normal distribution of the sample: the score of 42 students is between MMS (moderately non sufficient) and LNS (mildly non sufficient).

If we analyze the internal composition of the sample (Bar chart no.2.VI) we see how group 2 is more homogeneous in terms of prerequisites; group 4 is the one with the widest curve even if at the ends (GNS and SUFF) there are only two students. The average result is:

11.3 for group 2;

9.75 for group 3;

11 for group 4.

Phase 2 - *Sampling on a voluntary basis of the participants in the trial*

The teacher of the course during the first lesson asked the students present (127) to decide whether to attend in the classroom or in the virtual classroom (with web conference). As mentioned, the students chose on the basis of a *voluntary sampling of convenience*; therefore through a *non-probabilistic methodology*.

As said before, the experimental method allow the complete control over the selection of the subjects that constitute both the experimental and the control group. It is important to select two identical groups - the experimental/experimentals groups and the control group - with the same characteristics with respect to all known variables.

A limitation of this type of choice could be that of not having randomized the subjects to avoid factors of convenience. But since it is a study within a concrete case we did not want to interfere with the normal development of real processes.

72 students opted for classroom attendance (group 1), 55 opted for virtual classroom attendance. These were randomly divided into three groups, two from 18 (group 2, group 3) and one from 19 (group 4) (Table no.10.VI).

Table no.10.VI. *Students of the course in Children's literature*

Real classroom	Virtrual classroom (web conference)		
72 students (group 1)	55 students		
	18 (group 2)	18 (group 3)	19 (group 4)

As mentioned, group 1 was excluded from the study because it is not a beneficiary of multimedia teaching. The study population then went from 127 to 55. Of these 6 students did not complete the course, so the sample of our study is equal to 49 subjects.

Phase 3 - *Group 2 (control group) attends the virtual classroom lesson (lesson 1 and 2)*
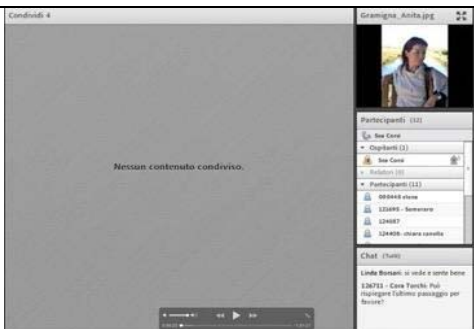
Group 2 attends the lessons of the *Children's literature and new digital technologies* module in virtual classroom, in live streaming. On October 17, 16 people were present in the virtual classroom (lesson 1); 19 October 16 (lesson 2). Access to registered lessons is not allowed to students. The lesson is prepared by the teacher in an autonomous way, the power point has been prepared with the usual style.

The lesson prepared by the teacher is available in <u>Annex 3</u>: we have reported the full text of the teacher's speech; we have matched the spoken text to the slides used; we reported the relational moments that occurred during the lesson.

In the Table no.11.VI we only report the initial part of the lesson one. This multimedia lesson will be modified by researcher - after having been analyzed and compared with the principles of multimedia communication - in its visuals part (independent variable 1) and in the relational part (independent variable 2).

Nella Tabella no.11.VI riportiamo solo la parte iniziale della lezione uno. Questa lezione multimediale sarà modificata dal ricercatore - dopo essere stata analizzata e confrontata con i principi della comunicazione multimediale - nella sua parte visiva (variabile indipendente 1) e nella parte relazionale (variabile indipendente 2).

Table no.11.VI. *Full speech text and visuals of the multimedia presentation*

Speech text	Visuals

Slide 1

Hello everyone, let's start today with the module on the relationship between technologies and children's literature. You remember we talked about it during the first meeting. We have said how important it is to tackle the theme of multimedia learning in school age in this teaching. I will not dwell on this aspect.

Why do we talk about children's literature in relation to technology? Because now you can not consider, for example, the relationship between children's literature, children, and digital devices, devices that you know very well and better than me, devices like smartphones and tablets that are used, not only for reading, but also for the social reading activities allowed by these tools, even for very young users.

Slide 2

Here it is. The main objective of this module, as already mentioned during the introduction of the course is to see how some aspects of communication technologies can find concrete application in teaching experiences based on the use of media, technologies and the web. Of course we can not make a 360-degree reasoning on educational technologies, so the aspects on which we will focus attention are related to participatory, authorial, social practices. Not technologies as tools, but as cognitive artifacts. Naturally ... a more specific objective is to see how these cultural practices can be applied effectively in the subject matter of this teaching. In primary and especially secondary schools, technologies such as LIM have been used for several years, and more and more often we hear about didactic 2.0, pedagogy 2.0 etc. Behind this way of working, there must be a methodological awareness on the part of the teachers.

Slide 3

It is clear to everyone how in recent years the diffusion of digital technologies has profoundly changed people's lives, in the way of communicating and interacting with others, so much so that they talk about the digital revolution. This revolution inevitably also affects the educational and training scenarios, forcing parents, educators and teachers to question their own role in relation to this phenomenon. Smartphones, tablets, notebooks, in fact, are now a widespread presence not only in the lives of adults and young people but also in that of children.

Slide 4

For the last ten years we have been referring to new generations of students, digital natives, in relation to their high media consumption: Net Generation, Millennials, Instant-Message Generation, Generation Y, and Gamer Generation Screen Generation. Many researches and international studies have dealt with the learning styles of the New Millennium Learners, the first generation whose life is marked by ubiquitous communication prostheses. But be careful. After a widespread enthusiasm about the positive role of technology in educational situations ... it is now clear that the digital skills of young people do not involve automatisms in learning processes: there are no scientific data to support the existence of a generational fracture. And the contrast between native and non-digital natives risks passing the idea of better learning through the use of digital media and web 2.0. That said, it is evident that the new generations of students grow in technological environments and live the Internet galaxy naturally, unlike adults. So, it is important to see what literature says or scientific research related to learning processes in the presence of multimedia technologies. It is enough for us to stress once again how there are no automatisms between the use of multimedia and the improvement of learning processes. And this must be the attitude towards the use of digital media in children's literature.

Slide 5

That said, let's go into the specifics of the relationship between book and digital technologies. In the meantime, there is a first positive data: it is a fact that thanks to the digital revolution, the production of texts for children and young people is greatly increased in quantitative terms; just as we know that this important increase lies outside the traditional production of books (paper publishing). Today, production for children can count on audio formats, audiobooks, multimedia products usable on the net or on CDs, on computer and tablet formats. This new situation of production and use suggests, as can be seen from a series of studies that we will be assisting, in a more or less long time, a profound change in reading and writing practices. It is not the case for the short time we dedicate to these questions to try to make judgments. Let's take what's happening as a matter of fact.

Slide 6

In fact, it is clear from how researchers who analyze the trends in the world of childhood have now moved their attention: their attention has shifted from television to the new media sector, trying to define the relationship between children and digital technologies. Among these, e-reading seems to be fertile ground for the debate: whether attention is focused on the new potential of the medium or that the usual (and probably sterile) question is asked whether it is "better" the paper or ebook. Also because I believe that these are different elements and proposals, not so much when we talk about the simple transposition of the text from paper to the digital instrument (first we read a paper book now we read a pdf on tablet or computer) but rather 'approach to enhanced ebooks, or those electronic books that integrate text with multimedia elements. They are certainly two different things.

Phase 4 - Assessment tests (group 2)

Assessment tests group 2:

1. on October 18th the first assessment test (Test_01) was carried out, at 18.30. It was a multiple choise question test;
2. on October 20th the second assessment test (Test_02) was carried out, at 18.30. It was an Open-ended question test.

The two tests were carried out in the late afternoon of the day following the lessons.

1. *Multiple choise question tests* (see annex 5) tested the knowledge acquired as a result of the first lesson.
2. The *Open-ended question tests* (see annex 6) tested the skill/ability to apply the knowledge acquired, through 3 open-answer questions.

In the Table no.12.VI is possible to see the learning outcomes of the control group 2:

- the average result for the test_01 is 24,6;
- the average result for the test_02 is 23,33.

Name (ID)	Test_0	Lesson 1 17th october	Test_01 18th october	Lesson 2 19th october	Test_02 20th october
Id2	10	Si	22	Si	26
Id6	9	Si	22	Si	21
Id10	9	no	X	No	X
Id14	14	Si	27	Si	25
Id17	8	Si	14	Si	20
Id28	14	Si	25	Si	24
Id44	14	si	30	Si	28
Id54	13	no	X	No	X
Id57	10	Si	24	Si	23
Id60	10	Si	22	Si	13
Id77	7	Si	23	Si	23
Id88	13	Si	24	Si	25
Id89	8	Si	23	Si	20
ID101	14	Si	26	Si	24
ID105	14	Si	22	Si	21
ID107	9	Si	22	Si	23
ID109	14	Si	25	Si	23
ID122	14	si	22	si	24
AVERAGE	11,33		24,6		23,33

Table no.12.VI. *Didactics path ot the Group 2 (control group)*

Phase 5 - *Analysis by the researcher of the visuals of the lesson*

The researcher analyzes the recording of the lesson (with the Adobe Connect software) to verify the communication-teaching functionality of the visuals and the relational part. The reference parameters, on the basis of which the verification was carried out, were the guidelines identified through the study of the theories of multimedia learning in relation to cognitive processes.

Despite the good communication skills of the teacher and his colloquial and persuasive style, in the relationship between the minutes and images, many aspects appeared not in line with the guidelines identified in the theoretical part (see chapter II).

Here are the most obvious:

1. use of words (teacher's speech) and images in a non-complementary logic;
2. use of images with a decorative function;
3. use of very long texts and absence of the principles of adaptation (division into paragraphs, highlighting key words or concepts, use of targeted lists presented in synchronous mode, etc.);
4. redundancy effects;
5. lack of graphic organizers to explain relationships and organize knowledge;
6. noise (visual and sound disturbances) due to lack of slides and some technical problems.

Phase 6 – *Visuals modification (by researcher)*

The researcher modifies the visuals of the lesson, in collaboration with the technicians of the audiovisual laboratory of the University of Ferrara and Prof. Anita Gramigna, on the basis of the guidelines identified to favor multimedia learning. The work lasted 3 days is available in Annex 4, the first part in the Table no.13.VI.

The modified power point was then used to replace the original one in the virtual classroom: a post-production operation was carried out to put the verbal commentary of the teacher in sync with the new multimedia presentation. The modified lesson can be used to be transmitted as if it were a real live streaming lesson.

Table no.13.VI. *Original speech text and new visuals of the multimedia presentation (by researcher)*

Speech text	Visuals
Slide 1	
Slide 2 Hello everyone, let's start today with the module on the relationship between technologies and children's literature. You remember we talked about it during the first meeting. We have said how important it is to tackle the theme of multimedia learning in school age in this teaching. I will not dwell on this aspect.	
Slide 3 Why do we talk about children's literature in relation to technology? Because now you can not consider, for example, the relationship between children's literature, children, and digital devices, devices that you know very well and better than me, devices like smartphones and tablets that are used, not only for reading, but also for the social reading activities allowed by these tools, even for very young users.	
Slide 4 (timed slide) 4a Here it is. The main objective of this module, as already mentioned during the introduction of the course is to see how some aspects of communication technologies can find concrete application in teaching experiences based on the use of media, technologies and the web. 4b Of course we can not make a 360-degree reasoning	

on educational technologies, so the aspects on which we will focus attention are related to participatory, authorial, social practices. Not technologies as tools, but as cognitive artifacts.

4c

Naturally ... a more specific objective is to see how these cultural practices can be applied effectively in the subject matter of this teaching. In primary and especially secondary schools, technologies such as LIM have been used for several years, and more and more often we hear about didactic 2.0, pedagogy 2.0 etc..

4d

Behind this way of working, there must be a methodological awareness on the part of the teachers.

Slide 5

It is clear to everyone how in recent years the diffusion of digital technologies has profoundly changed people's lives, in the way of communicating and interacting with others, so much so that they talk about the digital revolution. This revolution inevitably also affects the educational and training scenarios, forcing parents, educators and teachers to question their own role in relation to this phenomenon. Smartphones, tablets, notebooks, in fact, are now a widespread presence not only in the lives of adults and young people but also in that of children.

Rivoluzione digitale e scenari educativi

Slide 6-7 (timed slide)

For the last ten years we have been referring to new generations of students, digital natives, in relation to their high media consumption: Net Generation, Millennials, Instant-Message Generation, Generation Y, and Gamer Generation Screen Generation.

7 (animation)

Many researches and international studies have dealt with the learning styles of the New Millennium Learners, the first generation whose life is marked by ubiquitous communication prostheses.

NATIVI DIGITALI E NUOVI ABITUDINI MEDIALI

Net Generation
Millennials
Instant-Message Generation
Generation Y
Gamer Generation
Screen Generation

Slide 8 (timed slide)

But be careful. After a widespread enthusiasm about the positive role of technology in educational situations ...

8 a

it is now clear that the digital skills of young people do not involve automatisms in learning processes: there are no scientific data to support the existence of a generational fracture. And the contrast between native and non-digital natives risks passing the idea of better learning through the use of digital media and web 2.0.

Phase 7 - *Attend the lesson modified in the virtual classroom by group 3 (experimental group 1)*

The modified lesson was transmitted inside the virtual classroom by the laboratories of the Se@: a real live streaming lesson was simulated in a web conference session. Prof. Anita Gramigna was present in the laboratory of the Se@ during the transmission of the simulated lesson: she could intervene in case of some questions from the students.

Group 3 attend the lessons in the virtual classroom as follows:

- the speech is identical to the lesson attended by group 2;
- the multimedia presentation was modified on the basis of multimedia learning principles (Annex 4);
- the mode is like fake live streaming but equal to the "real live streaming". Students should not realize that they are participating in a fake direct;
- the lessons are attended on 24 and 26 October, there are respectively 17 and 16 students;
- the students only used the live, they were not given access to the material recorded in on demand mode.

Phase 8 - *Attend the lesson modified in the virtual classroom by group 4 (experimental group 2)*

Group 4 attends the lesson in the virtual classroom (a virtual classroom different from that of group 3).

- The mode is that of a fake live streaming but equal to the "real live streaming";
- the lessons were on 24 and 26 October. There are 17 students on 24 and 17 on the 26;
- the lesson of 24 is identical to that followed by group 3;
- the lesson of 26 is identical to that followed by group 3, plus 26 minutes of teacher/student relationship;
- in the relational phase the students asked questions of content clarification (in 2 cases), of concrete application of digital technologies in the educational field (in 9 cases). The relational session lasted 26 minutes;

- the students only used the live, they were not given access to the material recorded in on demand mode.

Phase 9 - *Assessment tests: Test_01 and Test_02 (group 3 and group 4)*

Assessment tests group 3:

- on October 25th, the first assessment test was given (Test_01), at 18.30. The test is related to lesson 1 modified through the use of the Independent variable 1 (intervention on visuals);
- on October 27th, the second assessment test was given (Test_02), at 18.30. The test is related to lesson 2 modified through the use of the Independent variable 2 (chat).

The two tests were carried out in the late afternoon of the day following the lessons.

1. *Multiple choise question tests* (see annex 7) tested the knowledge acquired as a result of the first lesson (test_01).
2. The *Open-ended question tests* (see annex 8) tested the skill/ability to apply the knowledge acquired, through 3 open-answer questions (test_02).

In the Table no.14.VI is possible to see the learning outcomes of the group 3:

- the average result for the test_01 is 25,2;
- the average result for the test_02 is 25,8.

Table no.14.VI. *Didactic path Group 3 (experimental group)*

ID	Test_0	Lesson 1 24th October	Test_01	Lesson 2 26th October	Test_02
Id4	12	Si	27	No	X
Id11	10	Si	25	Si	28
Id19	12	Si	24	Si	23
Id23	10	Si	25	Si	24
Id25	4	Si	28	Si	26
Id40	15	Si	26	Si	27
Id52	4	Si	22	Si	24
Id56	4	Si	23	Si	25
Id61	6	Si	25	Si	28
Id65	6	Si	14	Si	21
Id72	10	No	X	No	X
Id79	14	Si	28	Si	30
Id92	14	Si	26	Si	29
Id97	15	Si	24	Si	26
Id103	10	Si	25	Si	25
Id11	8	Si	20	Si	21
Id115	12	Si	15	Si	13
Id120	12	si	30	Si	30
AVERAGE	9,88		25,2		25,8

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Assessment tests group 4:

- on October 25th, the first assessment test was given (Test_01), at 18.30. The test is related to lesson 1 modified through the use of the Independent variable 1 (intervention on visuals).
- on October 27th, the second assessment test was given (Test_02), at 18.30. The test is related to lesson 2 modified through the use of the Independent variable 1 (intervention on visuals) and the Independent variable 2 (relational part).

The two tests were carried out in the late afternoon of the day following the lessons.

1. *Multiple choise question tests* (see annex 7) tested the knowledge acquired as a result of the first lesson (test_01).
2. The *Open-ended question tests* (see annex 8) tested the skill/ability to apply the knowledge acquired, through 3 open-answer questions (test_02).

In the Table no.15.VI is possible to see the learning outcomes of the group 4:

- the average result for the test_01 is 25,47;
- the average result for the test_02 is 27,82.

Table no.15.VI. *Didactics path Group 4 (experimental group)*

ID	Test_0	Lesson 1 24th October	Test_01	Lesson 2 26th October	Test_02
Id8	8	Si	26	Si	28
Id21	5	No	X	No	X
Id31	8	Si	26	Si	28
Id35	13	Si	23	Si	26
Id36	6	Si	25	Si	29
Id39	10	Si	28	Si	30
Id47	8	Si	26	Si	29
Id58	13	Si	27	Si	30
Id63	7	No	X	No	X
Id71	16	Si	24	Si	27
Id75	12	Si	26	Si	28
Id76	10	Si	25	Si	28
Id83	10	Si	24	Si	27
Id86	11	Si	25	Si	24
Id93	9	Si	26	Si	30
Id99	14	Si	27	Si	30
Id116	11	Si	25	Si	26
Id124	18	Si	25	Si	27
Id127	10	Si	25	Si	28
AVERAGE	10,47		25,47		27.82

VI.9.3. THE POST-EXPERIMENTAL STAGE

Data analysis

The verification and assessment of the project are based on the criterion of consistency between its various phases as well as on the congruence between the instrumental system and the methodological rigor. The assessment method has been described in the paragraph VI.8.2.1. *Measurement of learning outcomes (dependent variable).*

Table no.16.VI highlights the general picture.

Table no.16.VI. *General framework of comparison between the groups with reference to the three tests*

Group 2 (control group)				Group 3 (experimental group)				Group 4 (experimental group)			
Name	*T_0*	*T_01*	*T_02*	*Name*	*T_0*	*T_01*	*T_02*	*Name*	*T_0*	*T_0 1*	*T_02*
Id2	10	22	26	Id4	12	27	X	Id8	8	26	28
Id6	9	22	21	Id11	10	25	28	Id21	5	X	X
Id10	9	X	X	Id19	12	24	23	Id31	8	26	28
Id14	14	27	25	Id23	10	25	24	Id35	13	23	26
Id17	8	14	20	Id25	4	28	26	Id36	6	25	29
Id28	14	25	24	Id40	15	26	27	Id39	10	28	30
Id44	14	30	28	Id52	4	22	24	Id47	8	26	29
Id54	13	X	X	Id56	4	23	25	Id58	13	27	30
Id57	10	24	23	Id61	6	25	28	Id63	7	X	X
Id60	10	22	13	Id65	6	14	21	Id71	16	24	27
Id77	7	23	23	Id72	10	X	X	Id75	12	26	28
Id88	13	24	25	Id79	14	28	30	Id76	10	25	28
Id89	8	23	20	Id92	14	26	29	Id83	10	24	27
Id101	14	26	24	Id97	15	24	26	Id86	11	25	24
Id105	14	22	21	Id103	10	25	25	Id93	9	26	30
Id107	9	22	23	Id11	8	20	21	Id99	14	27	30
Id109	14	25	23	Id115	12	15	13	Id116	11	25	26
Id122	14	22	24	Id120	12	30	30	Id124	18	25	27
								Id127	10	25	28
Average	**11,3**	**23,3**	**22,7**		**9,75**	**23,8**	**25**		**11**	**25,5**	**27,9**
Average		**23**				**24,4**				**26,7**	

We studied the results of the three groups that participated in the experiment using the web conference tool in different ways:

1. the control group 2 used the web conference in its normal mode (like professor Gramigna usually use it);
2. the experimental group 3 used the modified web conference (indipendent variable 1) in both lessons 1 and 2;

3. the experimental group 4 used the modified web conference (indipendent variable 1 plus indipendent variable 2): independent variable 1 in lesson 1; independent variables 2 in lesson 2.

If we look at the average scores of the two tests (t_01 and t_02), the picture appears as follows (Bar chart no.3.VI):

a) average score of control group 2 is 23
b) average score of experimental group 3 is 24,4
c) average score of experimental group 4 is 26,7

Bar chart no.3.VI. *Average score of learning outcomes test 1 and 2. Groups 2,3,4*
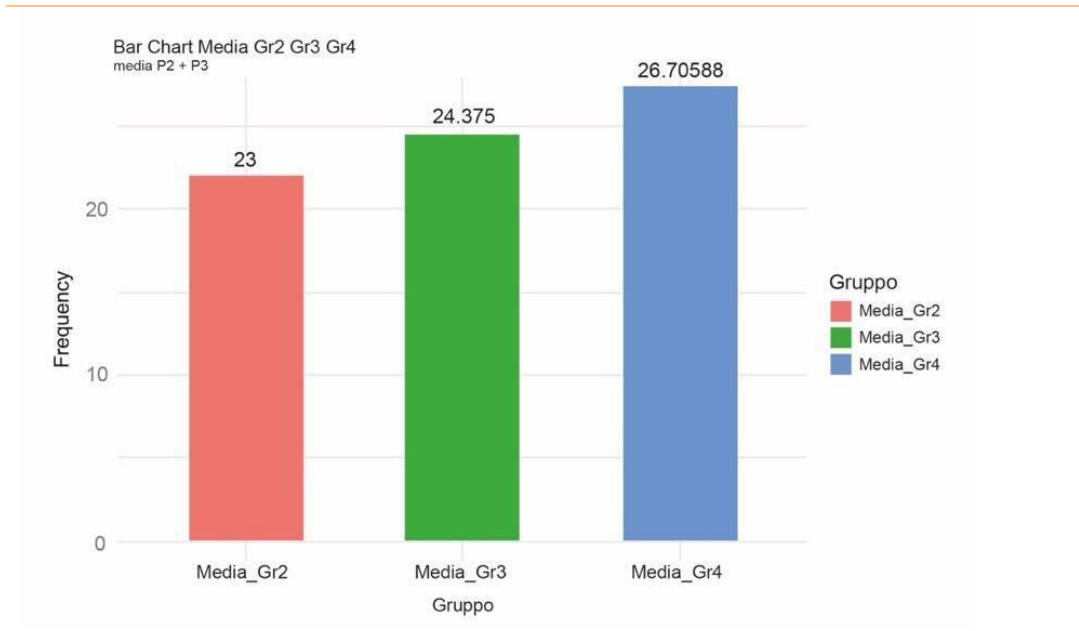
The two experimentals groups obtained a higher score, respectively 24,4 (experimental group 3) and 26,7 (experimental group 4), compared to the control group 2 (23); the comparison between the control group 2 and the experimental group 3 always shows a small difference (equal to 1,4); the comparison between the control group 2 and the experimental group 4 shows a significant difference of 3,7 points; the comparison between the two experimental groups is in favor of group 4: 2,3 points more than group 3.

These data immediately show how the independent variables had a positive effects, but this analysis is too general. As mentioned in the previuos paragraphs *Research variables* and *Measurement of learning outcomes (dependent variable)* we needed a more in-depth analysis.

We have already seen the results of the entry exam, Test_0 (Bar chart no.1.VI and no.2.VI) about pre-knowledge of the three groups.

In this part, as mentioned previously, we will try to analyse:

1. how worked the Independent variable 1 (learning outcomes test_01). The comparison of the learning outcomes of the two experimental groups (both exposed to independent variable 1 in the test_01) with those of the control group, will tell us if the independent variable 1 has worked;
2. how worked the Independent variable 1 with different contents (learning outcomes test_02). The comparison of the results of the control group with those of the experimental group 3 (still exposed to independent variable 1) will tell us if the independent variable 1 has continued to work. It is a verification test of the functionality of the independent variable 1, with the same sample (control group and experimental group 3) but with different contents (validity indicator);
3. how worked Independent variable 2 (learning outcomes test_02 experimental group 4). Comparing the results of the experimental group 4 (exposed to independent variable 2) with those of the control group, we will understand if the independent variable 2 has worked;
4. the comparison between test_01 and test_02, of experimental group 4 and control group, will tell us if the independent variable 2 has had an impact on learning outcomes: in test_01 the experimental group 4 is exposed to independent variable 1, in test_02 experimental group 4 is exposed to an independent variable 2. The difference in increment can be significant. If the increase of the experimental group 4, in test_02 with respect to the control group is higher than that obtained in test_01, then the independent variable 2 has certainly worked. This is an indicator of how chat plays an important role.
5. the comparison between the differences of increase of the two experimental groups (test_0/test_01; test_0/test_02; test_01/test_02) will give us some other information on the weight of the two independent variables. So on the rule of the chat.

Test_01 and Independent variable 1 (visuals)

The test_01, as said previously, was structured as multiple choice questions, consisting of 15 questions; each question had 4 possible answers. The answers could be right, inaccurate or partially correct, wrong. For the evaluation of the questions the following indicators were used: *Correct*: 2; *Partially correct:* 1; *No answer:* 0; *Wrong answer:* -1.

The results are shown below (Bar chart no.4.VI):

1. the control group 2 reported an average score of 23.3;
2. the experimental group 3 reported a slightly higher average score (23.8);
3. the experimental group 4 is the one that reported the highest average score (25.5).
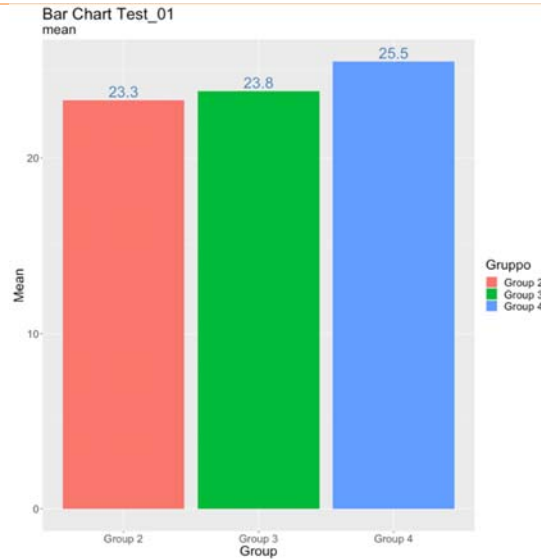
The final results are rather homogeneous, especially between the control group 2 (23.3) and the experimental group 3 (23.8). The experimental group 4 (25,5) seems to have responded better to the Independent variable 1.

The analysis of the score classes (Bar chart no.5.VI) shows the distribution of group 4 towards the area of the best scores (BNA and OTT); groups 2 and 3 both show a wider distribution (from LNS to OTT), even if group 3 is positioned definitely better than group 2.

Bar Chart no.5.VI. *Score classes test_01 - Groups 2,3,4*
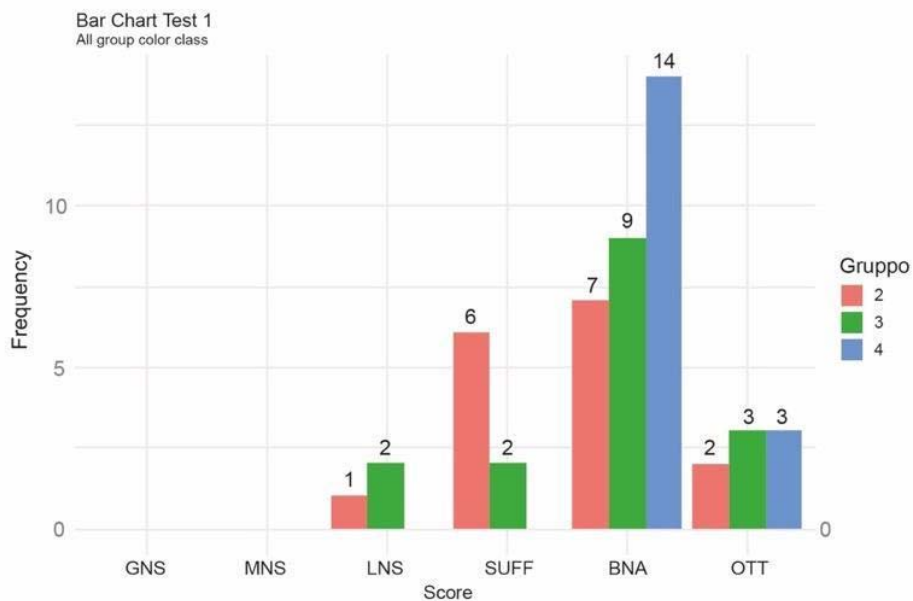
Differences of increase between the entry exam (test_0) and the test_01.

It is important for an objective evaluation read the differences of increase between the entry exam (test_0) and the test_01.

The results of test_0 are shown below:

1. the control group 2 reported an average score of 11,3;
2. the experimental group 3 reported an average score of 9,75;
3. the experimental group 4 reported an average score of 11.

The results of test_01 are shown below:

1. the control group 2 reported an average score of 23.3;
2. the experimental group 3 reported an average score of 23.8;
3. the experimental group 4 reported an average score of 25.5.

The increase between test_0 and test_01 was (Bar chart no.6.VI):

1. in group 2 equal to 12;
2. in group 3 equal to 14;
3. in group 4 to 14.4.

Bar chart no.6.VI. *Improvement between test_0 and test_01 - Groups 2,3,4*
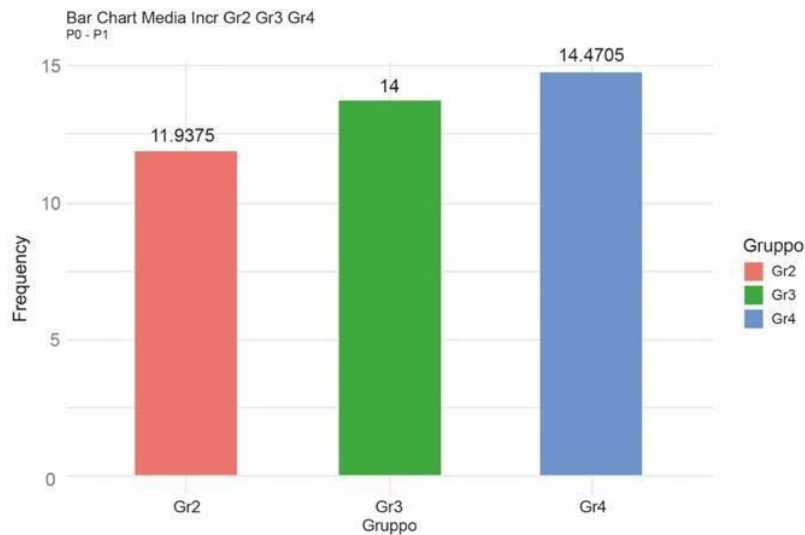
The independent variable 1 seems to have promoted good results for both experimental groups:

• the difference between the experimental groups and the control group is evident (2,1 between group 3 and group 2; 2,5 between group 4 and group 2);

- the difference between the two experimental groups (3 and 4) is instead very small, equal to 0.4.

This result prove even more the positive effect that the independent variable 1 has had on learning outcomes. The work done by the researchers, on the multimedia presentation, modified on the basis of international guidelines, has helped the students of the two experimental groups to learn better.

If we compare students' increments according to the score classes, between the test_0 and the test_1 (Bar chart no.7.VI), we clearly see how the two experimental groups tend to move towards the part related to the highest scores.

The experimental group 4 is compact within the OTT classes (3 students) and especially BNA (14 students). Experimental group 3 moves decisively towards the higher classes, but in a less compact way: 12 students are in the highest classes (3 in the OTT, 9 in the BNA), 4 in the classes around the sufficiency (2 students in the SUFF , 2 in the LNS).

The control group 2 seems to have responded less well. It is dispersed in 4 different scoring classes (1 student in the LNS, 6 students in the SUFF, 7 students in the BNA, 2 in the OTT): in the same way as the experimental group 3, but with a lower average score. And especially the control group 2 is the one that was much more homogeneous than the two experimental groups: in the Test_0 the 16 students of the control group were all between the MMS class (8 students) and LNS (8 students).

Bar chart no.7.VI. *Graphical representation of Dependent variable (score classes) through the comparation of Test_0 e Test_01*

| Test_0 | Test_01 |
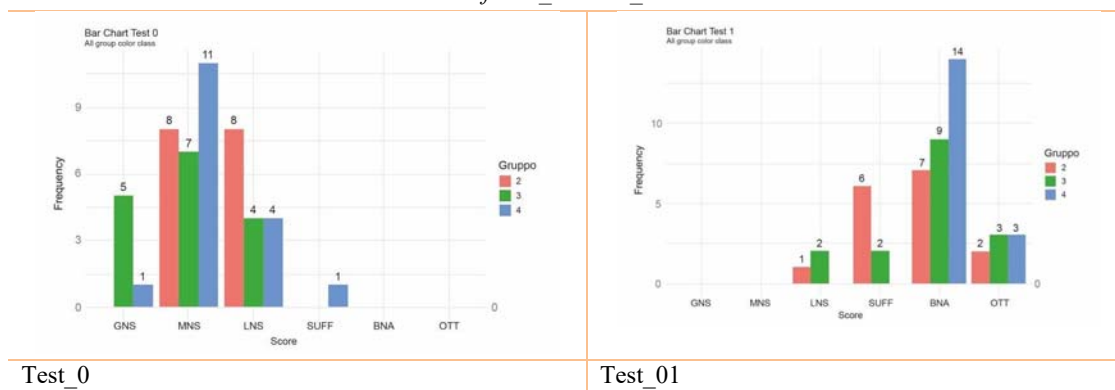
Result one. We can get the following impressions. The independent variable 1, the use of visuals according to the identified international guidelines, has had a positive impact on dipendent variable (learning outcomes). The two experimental groups seem to have responded well to the manipulation of the independent variable 1, obtaining higher learning outcomes than the control group.

Test_02 and Independent variables 1 (visuals) and 2 (visuals and chat)

The test_02, as said before, was composed of 3 open-ended questions to test especially skills and ability of the students. These are the questions for the two experimental groups:

1. *You are an elementary school teacher. Would you use e-books to your pupils? If so how?*

2. *Book or digital book at school? Motivate your choice with concrete example.*
3. *Write a definition of education (in the new digital envoinroment)*

For the evaluation the teacher has adopted the following parameters. For each open-ended question 3 indicators have been identified: topic adherence, content knowledge, ability (transfer).

Each of these indicators has been assigned the following score scale (Table no.4.V): *Topic adherence*: invalid (0); incomplete (0,5); partial (1); coherent (1,5); *Content knowledge:* invalid (0,4); serious insufficient (0,8); insufficient (1); sufficient (1,2); Decent (1,4); Good (1,6); Top marks (2); *Ability/transfer:* invalid (1,3); serious insufficient (2,6); insufficient (3,3); sufficient (3,9); decent (4,6); good (5,2); top marks (6,5).

We remember that this test is related to the second lesson in which: the experimental group 3 was submitted to the Independent variable 1 (modify visuals); the experimental group 4 to the Independent variable 2 (modify visuals and relational activity).

The results of the test_02 are shown below (Bar Chart no.8.V):

1. 22.7 is the average score of the control group 2;
2. 25 is the average score of the experimental group 3;
3. 27.9 the average score of the experimental group 4.

Bar chart no.8.VI. *Learning otcomes Test_02 – Groups 1,2,3*
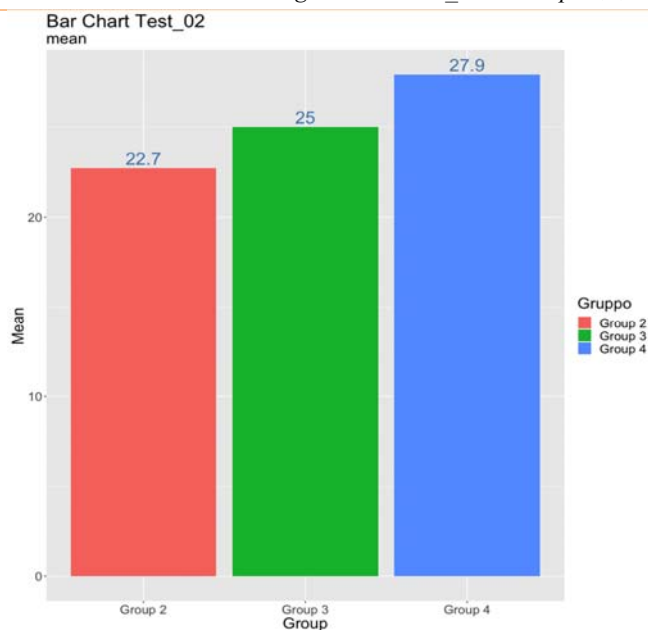
The two experimental groups get a higher score than the control group:

- the experimental group 3 obtained a score higher than 2,3 in comparison to control group;

- the experimental group 4 obtained a score higher than 5,2 in comparison to control group.

If we analyze the results of the test_02 by score classes (Bar chart no.9.VI), we see how experimental group 4 moves decisively towards the highest scores (14 students are in OTT class and 3 students in BNA class); the experimental group 3 also moves towards higher scores, although less clearly than group 4 and especially still in a non-homogeneous way (6 students are in the OTT class, 7 in the BNA class, 2 in the SUFF class and 1 in the LNS class); group 2 also moves towards the highest scores, although less importantly than the two experimental groups, how we saw, and, as for group 3, in a non-homogeneous way (only one student reaches the OTT class, 10 are in the BNA class, 4 in the SUFF and 1 in the LNS class).

Bar chart no.9.VI. *Score class, test_02 - Groups 2,3,4*
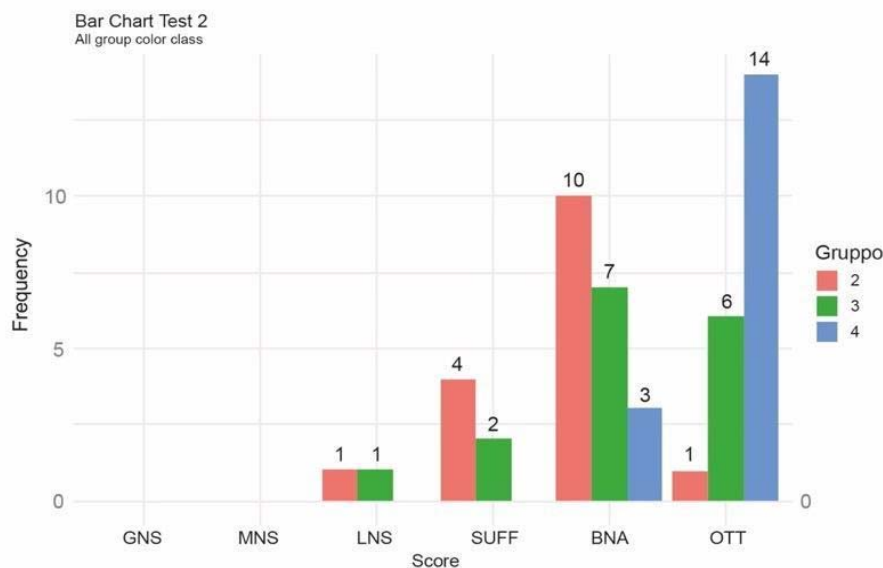
This time the difference between the experimentals groups and the control group seems even more significant than the previous test. We can therefore obtain the following results:

1. the experimental group 3 exposed to independent variable 1 obtained better learning results than the control group 2 (2.3 points more). This result improved the performance of the experimental group 3 on the control group compared to the first test_01 (the difference was 0.5). An increase of 1.8 points can be noted. The data is even better if we take into consideration how the difference in increase between the two groups has been done considering the input test on the pre-knowledge (the experimental group 3 grows almost 4 points more than the control group) (see below, *Differences of increase between the entry exam (test_0) and the test_02.*). Therefore, from the comparison between the experimental group 3 and the control group it is evident how the independent variable 1 has had a positive impact on the learning outcomes. This confirms and supports the previous result on the functionality of the independent variable 1.

2. The experimental group 4 subjected to independent variables 2 grew compared to the control group: it had a score of 5.2 points higher. 5.7 if we consider the difference in increase between the two groups considering the entry test on the pre-knowledge (see below, *Differences of increase between the entry exam (test_0) and the test_02.*). This means that the independent variable 2 showed a positive effect. Furthermore in test_02, the experimental group 4: a) in addition to having increased its learning outcomes with respect to the control group; b) grew more than the experimental group 3, almost 3 points more. This means that the independent variable 2 also had a positive impact, higher than the variable independent 1. A more precise comparison between the difference in growth of the two experimental groups may give some more precise data on the relationship between the two independent variables (see next paragraph).

Differences of increase between the entry exam (test_0) and the test_02. It is important for an objective evaluation to also read, as we made for test_01, the differences of increase between the entry exam (test_0) and the test_02:

The result of test_0 are shown below:

1. the control group 2 reported an average score of 11,3;
2. the experimental group 3 reported an average score of 9,75;
3. the experimental group 4 reported an average score of 11.

The result of test_02 are shown below:

1. the control group 2 reported an average score of 22,7;
2. the experimental group 3 reported an average score of 25;
3. the experimental group 4 reported an average score of 27,9.

The increase between test_0 and test_02 was:

1. in group 2 equal to 11.4;
2. in group 3 equal to 15,25;
3. in group 4 to 16,9.

These data confirm what we had already said above on the increments of the experimental groups 3 and 4 in comparison to the control group. Their growth compared to the control group was higher than the growth they had in test_01: this confirm one more time the efficacy of both idependent variables, 1 and 2.

In the bar chart no.10.VI is possible to see the same results.

Bar chart no.10.VI. *Graphic representation of learning outcomes (dipendent variable) trough the comparison between Test_0 e Test_02 – Groups 1,2,3*
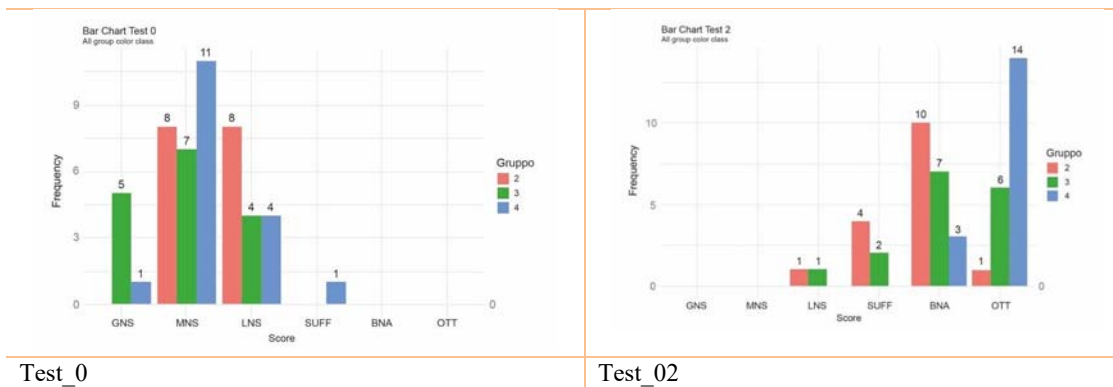
| Test_0 | Test_02 |

If we compare students' increments according to the score classes, between the test_0 and the test_2, we clearly see how the two experimental groups (experimental group 3 is green, experimental group 4 is blue) tend to move towards the part related to the highest scores.

The experimental group 4 is compact within the OTT classes (14 students) and BNA (3 students). Experimental group 3 moves decisively towards the higher classes, but in a less compact way: 13 students are in the highest classes (6 in the OTT, 7 in the BNA), 3 in the classes around the sufficiency (2 students in the SUFF, 1 in the LNS).

The control group 2 seems to have responded less well. It is dispersed in 4 different scoring classes (1 student in the LNS, 4 students in the SUFF, 10 students in the BNA, 1 in the OTT): in the same way as the experimental group 3, but with a lower average score.

Differences of increase between the test_01 and the test_02. To understand better, however, we can also to compare the results obtained by the two experimental groups in the test_01 and test_02 in comparison to control group.

The test_01 we remember has involved an intervention by the researcher with the independent variable 1 (intervention on Visuals): this involved both experimental groups. The test_02 instead concerned an intervention by the researcher on the independent variable 1 (intervention on the visuals) that involved the experimental group 3; and an intervention by researcher on independent variable 2 (intervention on visulas and intervention on the relational activity) that involved the experimental group 4.

The comparison between the growth of the experimental groups and the control group can give us some other information in relation to the independent variables.

In the analysis of score classes to compare the test_01 and the test_02, the shift of group 4 to the highest scores is evident (Bar chart no.11.VI).

In the group 4 the relationship between the 14 students in the BNA class and the 3 students in the OTT class has reversed to the benefit of higher learning outcomes. Group 3, as previously mentioned, instead has a lower average score and a non-homogeneous sample composition within the scoring classes (6 students are in the OTT class, 7 in the BNA class, 2 in the SUFF class and 1 in the LNS class).

Bar chart no.11.VI. *Moving groups 2, 3 and 4 respect to the scoring classes (Test_01/Test_02)*

| Test_01 | Test_02 |
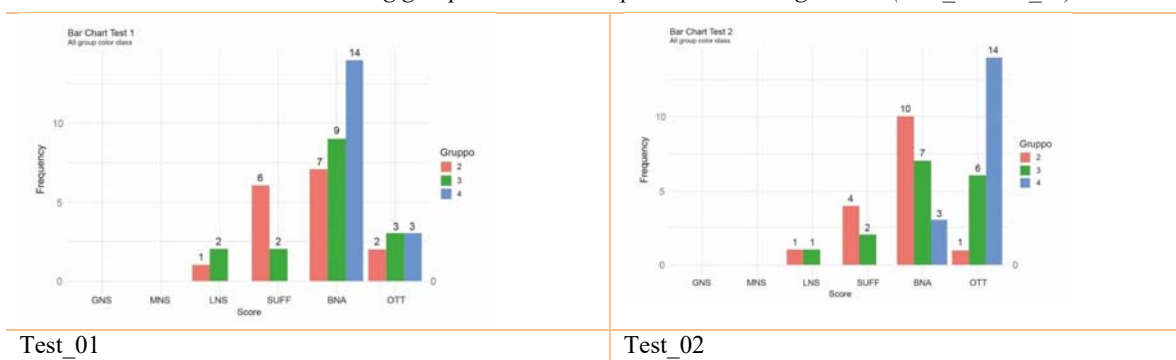
It is clear from Bar chart no.11.VI that something in group 4 has had an important result: both in terms of absolute score and in terms of the score of individual students. None of them is in the low scoring classes.

Result two. In the Test_02 the experimental group 3 improves its learning outcomes compared to the control group. Therefore the single use of the independent variable 1 continues to have a positive impact on the dependent variable.

The experimental group 4 obtains the best results, both compared with control group and experimental group 3, therefore the independent variables 2 has had a positive impact on the dependent variable, higher than independent variable 1: both experimental groups have grown compared to the control group, but the experimental group 4, also exposed to the chat, has grown more.

Independent variable 1 and Independent variable 2 compared: differences in increase of two experimental groups (test_0/test_01, test_0/test_02, test_01/test_02)

We have seen in the previous paragraph the difference in increase between the two experimental groups and the control group comparing the test_01 and the test_02. And as the experimental group 4 exposed in test_02 to independent variables 2 has had a higher increase than that obtained by the experimental group 3. This led us to think how the chat has had an important impact: both experimental groups grew compared to the control group, but the experimental group also exposed to chat grew more.

Now to have additional confirmations, with respect to the greater effectiveness of one of the two components of the independent variables 2 (visuals and chat), we can verify the differences in increase between the two experimental groups.Table no.17.VI shows the comparation of learning outcomes of the two sperimentals groups:

1. the comparation between test_0 and test_01
2. the comparation between test_0 and test_02
3. the comparation between test_01 and test_02

These comparisons are useful for verifying the difference in impact of the two Independent variables.

Improvement difference of the two sperimentals groups (with indication of the indipendend variables involved)

	Increment Group 3	Increment Group 4	Differences
t_0/t_01	14 (VI 1)	14,5 (VI 1)	+ 0,5 group 4
t_0/t_02	15,25 (VI 1)	16,9 (VI 2)	+ 1,65 group 4
t_01/t_02	1,25 (VI 1)	2,5 (VI 2)	+ 1,25 group 4

The increase between test_0 and test_01 was (Bar chart no.12.VI):

a) 14 in group 3;

b) 14,5 in group 4.

Bar chart no.12.VI. *Learning outcomes test_0 and test_01 group 3 and 4*

Test_0. Groups 3 and 4	Test_01. Groups 3 and 4.
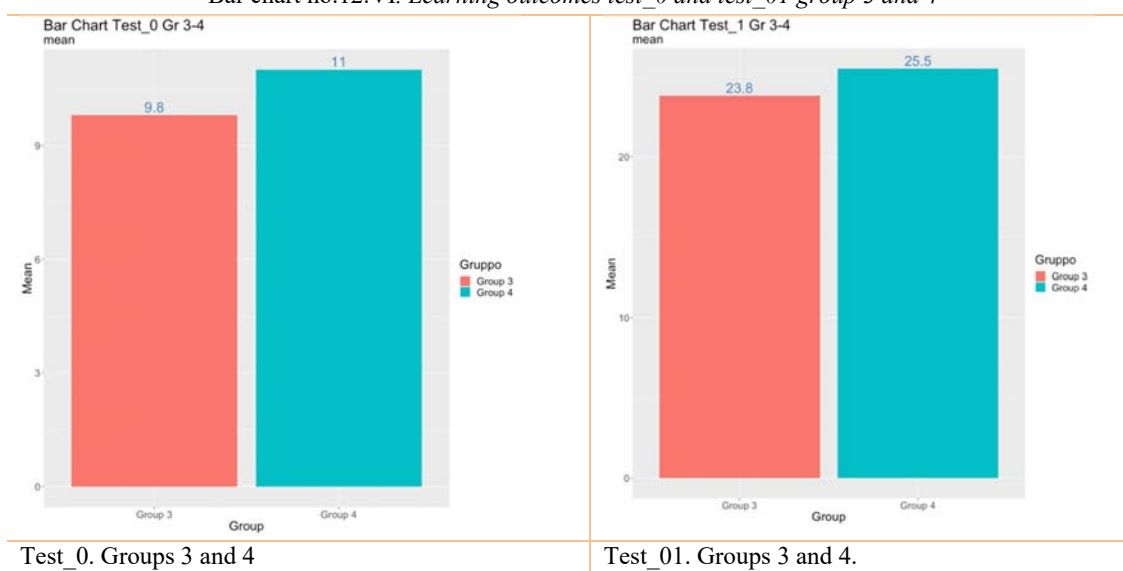
The Independent variable 1, as seen previously, seems to have brought good results to both experimental groups, which have grown homogeneously: there is a small difference in favor of group 4, equal to 0,5.

This small difference could be the result of coincidence.

The increase between test_0 and test_02 was (Bar chart no.13.VI):

a) in group 3 equal to 15,25;

b) in group 4 equal to 16,9.

Bar chart no.13.VI. *Learning outcomes test_0 and test_02 group 3 and 4*

| Test_0. Groups 3 and 4 | Test_2. Groups 3 and 4 |
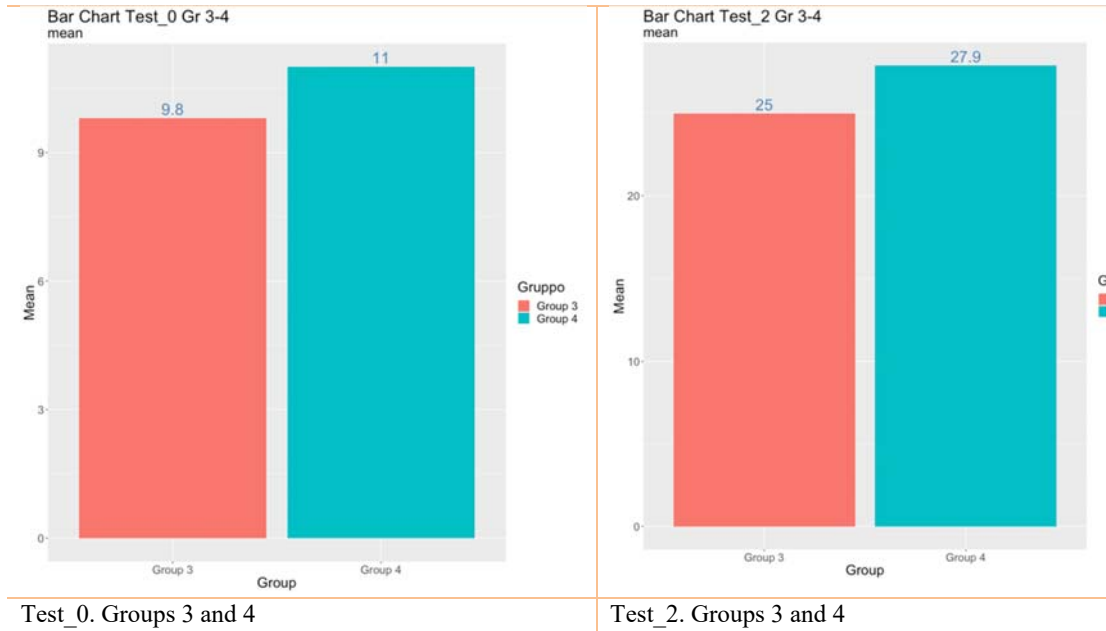
The results improved for both experimental groups compared to the control group (as see before), but this time the difference of increase of the experimental group 4 (16,9) compared to the experimental group 3 (15,25), appears greater (+ 1,65), compared to + 0.5 of the difference between Test_0 and Test_01.

Independent variable 2 seems to have made a more important contribution to the learning processes.

This is evident even if we compare the difference in scores between Test_01 and Test_02. The increase was (Bar chart no.14.VI):

a) in experimental group 3 of 1,25
b) in experimental group 4 of 2,5

Bar chart no.14.VI. *Learning outcomes test_1 and test_02 group 3 and 4*

| Test_1. Groups 3 and 4 | Test_2. Groups 3 and 4 |

174
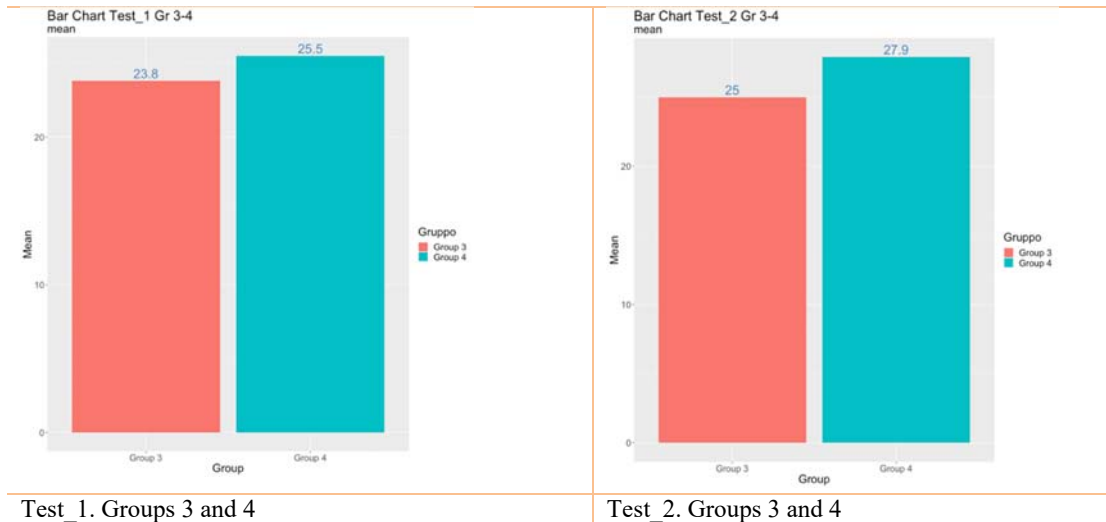
The difference between experimental group 4 and experimental group 3 was of 1,25 always to favour of group 4.

This seems to confirm what has already been said.

When the experimental groups were exposed to both independent variable 1 (in test_01) their difference in increase compared to the input test_0 was very slight, only 0.5. This means that both groups have grown in the same way.

When the experimental groups were exposed differently to the variables 1 and 2 (in test_02): the difference of increase between the test_0 and the test_02 was equal to 1.65 in favor of the experimental group 4; the difference in increase between test_01 and test_02 shows an increase in increment always in favor of the experimental group 4 equal to 1.25. In both cases, therefore, the growth of the experimental group 4 compared to the experimental group 3 was higher than the 0.5 of the previous increase (test_0 / test_01).

This means that the independent variable 2 resulted in a higher increase than the independent variable 1.

Last considerations

In the visual representation of dependent variable, it is possible to see the same result (Bar chart no.15.VI). The displacement of the experimental group 4, from the first to the last test, appears evident and constant. What is equally evident is the homogeneity of the group: the 17 students are all in the highest part of the score classes (14 in the OTT class, 3 in the BNA class).

Bar chart no.15.VI. *Visual representation of dependent variables (learning outcomes)*

Rosso: gruppo 2
Verde: gruppo 3
Blu: gruppo 4

| Test_0 | Test_01 | Test_02 |
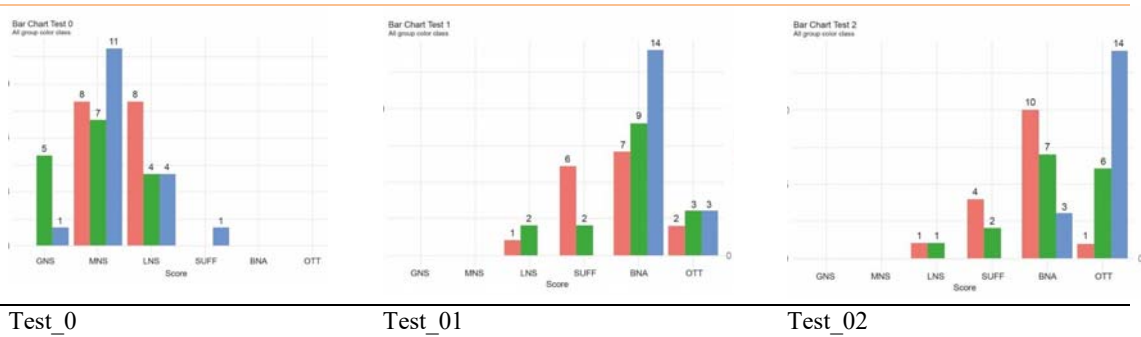
The experimental group 3 subjected to independent variable 1, but not to independent variable 2, has moved towards the top of the scoring classes. But with results much lower than the experimental group 4, and especially not in a constant way.

The control group 2 is the one that has obtained the worst results, even if it appears evident from the graphical representation as not very different from the experimental group 3. It started with very homogeneous skills, but then the sample was distributed on all the classes of score.

The last chart on average scores and dispersion bars (Bar chart no.16.VI) seems to confirm the functionality of the independent variables 2 on learning processes, but in particular the relational aspects. In the graph we can see the comparison of the averages in the 3 groups, to which we have added a dispersion bar. The dispersion bar shows the minimum and maximum scores obtained by the students, represented by the extremity of the bars. In this way we can observe a position index (mean) and a dispersion index (min-max).

We have already said a lot about the media.

In this graph it is interesting to note that for the experimental group 4 the dispersion index in tests 01 and 02 is very low compared to the other two groups: 23-28 in test_01; 24-30 in test_02. It had been 6-18 in the entry test_0.

The other two groups are equivalent, with a greater performance of the experimental group 3 if we compare the dispersion with the input test_0.

This means that students subjected to independent variable 2 have been very compact in learning processes. The relational part, we think, between teacher and students played an important role with respect to the motivational processes of the students of the experimental group 4.

Bar chart no.16.VI. *Average scores and dispersion bar, groups 2, 3, 4*
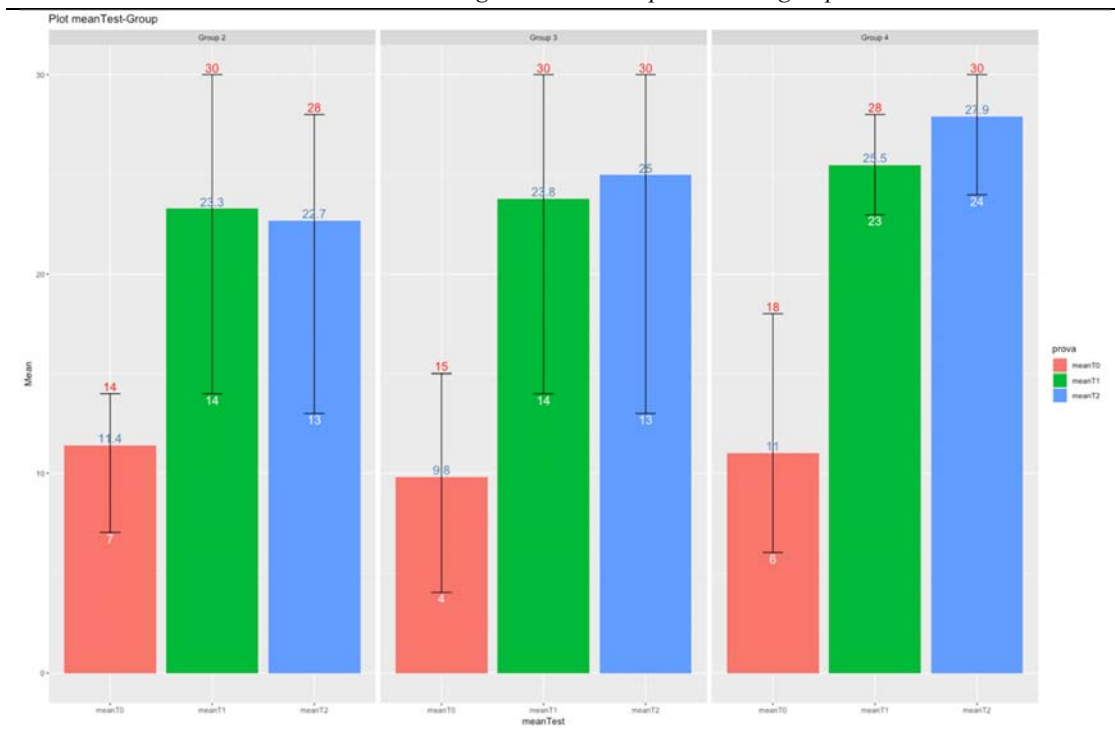
The teacher-student relationship obtained with the 25 minutes of the chat during the web conference put in contact the teaching and learning process of all the students in group 4.

This is also evident from the tipology of questions during the chat session. Almost all the questions that the students made to the teacher concerned the application of concrete cases. And this allowed:

1. to the teacher, to better contextualize those that have been the objectives of the course (ie the transformation of theoretical knowledge into concrete skills/competences); objectives that had been clearly presented by the teacher at the beginning of the course and which were repeated before the learning tests were carried out;
2. to the students to reduce the possibility of misunderstanding as much as possible.

As said before, the relational aspect, central in the training in attendance, becomes even more important in the training mediated by technologies, so it is important to avoid the reduction of contact and increase the interaction between teacher and learners and between learners. When it comes to the web conference lesson, the dynamics of synchronous and interactive communication, if well exploited, allow students at home to virtually enter the classroom and fully experience the teaching process.

VI.10. THE CONCLUSIONS OF THE RESEARCH

From the analysis carried out the research framework is clear. We summarize the results we have identified during the analysis.

Result one. The Independent variable 1, the use of visuals according to the identified guidelines, had a positive impact on learning outcomes. The two experimentals groups seem to have responded well to the manipulation of the independent variable 1, obtaining higher learning outcomes than the control group.

Result two. The Independent variable 2, the use of visuals combined with chat, had a positive impact on learning outcomes. The experimental group 4, exposed to the independent variable 2, had significantly better results than the control group.

Result 3. The independent variables 2 is the one that has most influenced the dependent variable. The difference of increase between the experimental group 4 (exposed to the independent variable 2, visuals and chat) and the experimental group 3 (exposed to the independent variable 1, only visuals) can attribute to the chat an important role in the improvement of the learning processes.
Below are the most important point of the analysis.

A - *Positive results of the research: the learning outcomes of experimental groups confirmed the hypothesis.*

The hypothesis was the following:

The valorization of the didactic content presented by the professor of higher education using web conference in according with multimedia learning principles, regarding visuals and visuals combined with chat activities, increase the learning outcomes in the FAD model experimentation.

Our research activity, we believe, has returned a clear picture: in a mediated environment, how the one of *FaD model*, the correct methodological use of the principles of multimedia learning has a positive effect on learning processes. In this sense, the use of the web conference can not be considered a "communicative fashion" accessory, but must be carefully prepared and planned.

Our independent variables applied to the web conference environment - the manipulation of visuals through the application of multimedia learning principles, and the use of online relationship tools allowed by web conferences tools - had a positive impact on the dependent variable (learning outcomes). We have seen how both visuals (independent variable 1) and visuals combined with chat (independent variable 2) have positively influenced learning outcomes. We have not measured scientifically how much chat has influenced learning processes; but we have seen that it plays an important role. What emerges clearly is how the correct use of functional teaching paradigms in a web conference environment improves students' learning.

The results of the two experimental groups were higher than those obtained from the control group. As underlined by Prof. Gramigna: "The results showed a more meaningful learning (specific disciplinary knowledge), accompanied by the development of metacompetences (logic, criticism, arguments, personal processing skills) by the students of group 4. We could observe an activity of careful information processing: not only notions and contents, but processes of self-reflexivity on the didactic experience ".

We like to remember once again how the use of images, static or dynamic, realistic or reconstructed, with an educational purpose, must be guided by principles that are a result of research activities on multimedia learning. If one wants to promote learning processes, visual representations, in every shape or form, they must be functional to the cognitive processes that one intends to activate. The image must therefore be considered, as Calvani said (2011, p. 29), "as an integrated component in a more complex learning ecology, and its usefulness must be evaluated in relation to the role it can play in this system". Learning by students through multimedia presentations does not depend on the presentation of the necessary information, but on the presentation of the necessary information according to the functioning mechanisms of the students' mental and cognitive processes.

Finally is important to remember how it is unanimously believed by the international scientific community that the transmission of information, without feedback, control, discussion of problems, exercise, application of the inductive method, does not produce meaningful learning.

The applications of the theoretical aspects related to the principles of visual and multimedia communication, discussed in Chapter III *Multimedia learning and cognitive processes: for design in higher education* (studies related to cognitive psychology and the principles of Instructional design), have seen how they are fundamental if we want to encourage critical and reflective learning processes. The knowledge of this disciplinary field is fundamental both for designing and creating didactic artifacts in a conscious way (from multimedia presentation in power point to more complex products), and to use appropriately the many open educational resources, made available online by qualified universities and international organizations. As we have also seen in our experience, there are frequent cases in which teachers concentrate on the exclusively decorative use of multimedia materials to support their teachings, without considering the result, in terms of meaningful learning, that such materials may have on the acquisition of knowledge by students. They often use a multimedia presentation in the classroom or in a web conference environment only because all the educational settings, real or virtual, are designed to create lessons using power points (or other

presentation software). As in the *FaD model* of the University of Ferrara. From a learning point of view it is much better to use a didactic communication based on the teachers' oratorial capacity, rather than on a multimedia presentation that does not satisfy the functioning mechanisms of the human mind.

Equally is important the knowledge of the teaching paradigms functional to the use of technologies, discussed in the Fourth chapter, *Educational paradigms, cognitive artifacts and multimedia design.* It has been said that the introduction of technology into teaching and learning processes does not automatically lead to educational innovation. There are frequent situations of 2.0 learning environments in which old models of transmission teaching are used. A lot of professors use video lessons, teaching units in pdf, other materials, without exploiting the true potential of new technologies in the direction of participatory, collaborative and relational paradigms. In a teaching, as we have seen, it is important to transmit information, but it is also important to make students work and to involve them through more constructivist methods. Our idea is that in order to maximize a "technological" didactic setting we need to know the role of technologies as cognitive artifacts, and especially, the main learning theories. Especially those that have shown the way for a conscious use of the technologies of education and learning. Investigated theoretical models that have made us understand how the constructivist-social paradigm is the one that lends itself most in educational environments based on information and communication technologies.

B - *Comparison between the two Independent variables: the Independent variable 2 seems to have given better results.*

As mentioned several times, we intervened on two independent variables related to the principles of using the web conference:

1. The *Independent variable 1* provided for an intervention on visuals (multimedia presentation in power point). Based on the guidelines and the multimedia learning principles identified, we have intervened to improve teaching communication. Below are the problems found in the multimedia presentation, within the web conference environment: complementarity between words and images, decorative image function, adaptation of texts, redundancy, lack of graphic organizers to explain relationships and organize knowledge.
2. And the *Independent variable 2*, which provided an intervention on visuals combined with the use of chat for about 26 minutes. The chat, as mentioned, allows you to recreate a normal educational situation, based not only on the transmission of information, but on interactive exchanges. Exchanges useful both to the teacher and to the students.

The difference of increase between the experimental group 4 (exposed to the independent variable 2, visuals and chat) and the experimental group 3 (exposed to the independent variable 1, only visuals) can attribute to the chat an important role in the improvement of the learning processes.

In practice, the continuous relationship and feed-back activity envisaged by the Independent variable 2 is essential: a) to the success of the teaching processes (the teacher can intervene based of user response); b) the success of learning processes (students can improve performance if they are aware of their critical issues).

In particular, when the measurement of learning refers not only to knowledge, but also to skills the teacher-student exchange helps to better contextualize the theoretical concepts (from knowledge to know how).

The relational aspect, central in the formation in presence, assumes even more importance in the e-learning. For this reason it is important to increase the interaction between teacher and learners and between learners. In the case of the web conference, the dynamics of synchronous and interactive communication, if well exploited, allow students at home to obtain the keys to enter the classroom and fully experience the teaching experience.

Also the Independent variable 1 has had, as mentioned, an important weight, even if lower, on the learnings of the students. This underlines and confirms what we have said in the previous point. In the *FaD model* educational environment the transmission didactic part is important (naturally improved with the application of multimedia learning principles), but must be integrated by the interactive and relational part.

All the experiences analyzed in the theoretical part on the teaching and learning relationship according to a transmission logic - chapter I *The role of visuals in the construction of the knowlwdge: a historycal path between cinema and television* and part of chapter II, *Video pedagogy and visual articact: for multimedia design in higher education* - showed the limits of this approach. Cinema and television first, but also the video afterwards, despite their important teaching potentials - the visual language shows better than the verbal language and written a series of scientific phenomena and not, the visual languages allow a look at the world interesting for the processes educational, etc. - have never had an important impact on the world of school and university. In our opinion, the biggest problems were: the technological difficulty of their employment, the training of teachers, but especially the lack of relational and interactive possibilities in these audiovisual tools.

In order to obtain meaningful learning outcomes, such as the ability to evaluate, re-elaborate and apply competences in a competent manner, it is necessary to give students work tools capable of promoting analysis and reflection. The didactic stimuli offered by the audiovisual representation to be transformed into real knowledge must be subjected to the comparison with the class, real or virtual. Discussion, constructive confrontation, problem solving, verbalization and argumentation are activities that transform vision (and the web conference is a visual representation!) into meaningful learning. Therefore the interaction and the constructive relationship have a significant didactic impact.

C – Need for additional studies

As it always mentioned during the text, the use of technological tools, such as the web conference, provided us with an apparent simple use confidently. The results of this experience tell us that even if the teacher's purpose is to facilitate the understanding, the risk of provoking learning difficulties and cognitive overload is often exist.

In the analyst case, the text presentation (through the teacher's speech) and the visual message were not complementary. The visual message is often consists of other written text which seems to be too extensive to elaborate easily during the listening (redundancy effect). The conversational part (chat) was not used, which might have even been used in order to create a better contextualisation and clarification through an immediate feedback. As it might happen in a classroom lesson.

This mode of presentation did not favor the students of group 2, but at the same time did not even confused them too much. The control group 2 responded well even if with lower results. For the moment we can elaborate a critical consideration. We can assume that the Independent variable 1 (the intervention on visuals) has not had a very strong impact for the following reason: the members of group 2 did not process the information according to a double processing (teacher's message and visual message) but focused their attention exclusively on the spoken message of the professor; this allowed them to avoid/eschew more damaging effects related to the increasing number of the cognitive load. It has been said in the theoretical part, the multimedia presentation how demonstrates advantages over the presentation of a single source. But due to the presence of two interfering sources of information, the possibility of overloading in elaboration exists, as be seen in our case. The negative effect of poor multimedia presentation can be diminished through a self-regulation principle, that is to say the selection of only one of the sources. In our case, students may have decided to pay attention only to the sound source (the speech by prof. Gramigna), thus simplifying the task of processing information. This most likely happened because of the teacher's oratorical capacity who succeeded to direct the attention of the student in the virtual classroom to his sound message despite of an ineffective power point construction. These indications could open a new search path.

This indication urges/persuade us to recommend an immediate intervention on this aspect, namely on the correct use of the chat, within the FaD model at the University of Ferrara. The teacher could do this alone, or with the help of an online tutor, tutors prepared to manage network interactions in such a way as to distinguish learning as a social rather than an individual process. In parallel, a longer-term intervention on visuals could be envisaged (through teacher training and the involvement of a multimedia laboratory or an Instructional design to support the teacher). It is good to compare the final conclusions based on this aspect.

We like to conclude by remembering the most important aspect of this research: in order to have a significant impact on learning processes, each cognitive artifact must be designed and used following precise theoretical paradigms binding its use. Unfortunately, as our research has shown, this does not happen in the analyzed experience. For this reason, in the general conclusions, we propose a series of indications for the University of Ferrara. This is for two reasons. The first: to give at the research a concrete role. The second, linked to the first: try to improve the FaD model that, as we have seen from the data, is involving a very large number of university students.

GENERAL CONCLUSIONS

> *Too see is not to perceive.*
> *To perceive is not to understand.*
> *To show is not to explain.*
> (Tverski *et al.*, 2008).

We would like to conclude this path with a quote from Tversky to underline one last time, how the use of visuals with an educational function must be guided by principles that must be the product of the research activities on multimedia learning. If we want to facilitate the learning processes, visual representations, in all their forms, it needs to be functional to the cognitive processes that we intend to activate. The image must therefore be considered, as Calvani says (2011, p. 29), "as an integrated component in a very complex learning ecology, and that is in accordance with the role which can play in this system its usefulness must be evaluated".

The objective of this research was to analyze the epistemological paradigms that guide university teachers through the use of audiovisual cognitive artifacts (web conferences). More precisely, we wondered if in terms of learning the effects of a lesson which are made by the multimedia tools are different depending on the way in which the teaching communication is structured in order to support the verbal comment of the teacher. A secondary objective is to identify guidelines on multimedia learning processes and in general on mediatised teaching activities. These guidelines are the result of scientific evidence that can be used by teachers as well as by Instructional designers in order to mediatise the teaching communication more effectively in terms of significant learning.

Our hypothesis has been confirmed, that is the valorisation of ~~the~~ a didactic content presented by the teacher through a multimedia teaching by the aids of the web conferences (images and relational activity) can faciliate the teaching processes in terms of improvement of the learning process.

The study highlighted like distance learning practices are being metabolized in conventional teaching methods (in the presence). This, alongside the obvious positive aspects (disappearance of the concept of non-attending, aid to disabled people and economically disadvantaged people, facilitation of educational activities for those who need ongoing training), is leading to the implementation of inefficient e-learning procedures, as a move of the frontal lesson and use of educational transmission paradigms. Hence the need to accompany the standardization process with a new didactic model, with a strong epistemological impact, that would optimize the learning potential and minimizing the critical elements detected.

The University of Ferrara in the field of distance learning and digitalisation of teaching has played an important role in Italy, as it is clear from the research activities, very large number of students and student workers who, starting in the mid-1990s, they took advantage of offered courses in a different way from the conventional one (e-learning, blended learning, presence support). At the same time we need to be aware that this enormous work has not had an important impact on the cultural level within the University and the telematic education, despite being widely used; it now seems to fragment and relegate in order to a support and assistance a role. The teaching structures (especially in situations of presence support), even though they are aware of its usefulness, is

employed when they cannot do without it, but off course without applying a real didactic-procedural-organizational strategy.

We believe at this point we are set fair for overcoming cultural diffidence on technology and starting a structured and systemic path. A meditated use of teaching technologies would allow teachers to acquire those digital skills that are functional to an unstoppable "transition to the future", and to improve the didactics. It would allow the students to be "digital citizens" (an attempt already started for several years in high schools) as they underlined the main orientations of the European Union and some advanced studies. Moreover, for the development of a strategic action, the University of Ferrara has human resources in the field of educational technologies (researchers, tutors, technical staff), a wealth of expertise are not easily attainable in other Italian universities. There are different aspects to intervene, we conduct to it through a concrete operational proposal.

Operational proposal

From what has been said in the University of Ferrara twofold perspectives should be made: one technological, and the other cultural.

1. The first concerns the preparation of the technical infrastructures which is necessary for the normal development of the mediatised teaching activities and also for the identification of human resources with their management ambitions.
2. The second, as a longer-term prospect, concerns a cultural challenge. It is able to determine over time the significant impacts: on the academic teaching practices, on the transmission of knowledge, on new knowledge constructions, on the management of relations with students, on the functional strategies to the active participation of students, on the new self-assessment and finally on evaluation tools, etc. This second perspective appears to be a very complex challenge but it can bring great benefits to the University of Ferrara in terms of more flexible training proposals and improvement of learning processes. Without a natural thinking about the replacement of the real environments along the virtual ones, rather than by assisting the two complementary systems.

This second aspect can only be pursued by the university policy that can influence technological, methodological, organizational and didactic aspects. We will try to identify a series of indications divided by the area of intervention.

A - Technological infrastructure

Naturally the technical part plays its role in mediatised teaching processes, that is, the teaching processes which takes place in virtual web environments, whether using multimedia materials and artifacts, requires good network infrastructures, large and secure storage systems. But it must be cleared how technology should be subordinated to the methodological aspects and not create any cultural and technological obstacle to the leading actors during the training process (teachers, students, tutors). Technology results must be so refined and not invasive, almost invisible, appeared natural and remained in the background. In order to overcome a resistance to technological

innovation, we need to create an educational set to be experienced naturally and not as a foreign body which is in panic (technophobia). The teacher-students' attention should be addressed to a didactic task, but not the tools, as it happens with pen, book and a slate blackboard. The process of standardization of a technology is quite long and depends both on the degree of complexity of allowed functions and ~~on~~ the cultural aspects which is related to the acting way within the university institution. It is therefore necessary an investment in the following areas:

1. the functional technologies for data streaming (web conference for the classroom lesson) towards a quantitatively variable audience (as summarized in the introductory section at the University of Ferrara there are about 7,000 students who have access to a virtual classroom environment);
2. data storage and security technologies;
3. the availability of virtual classrooms (for the web conference sessions of the classroom lessons) according to the number of lessons that will be used and the number of students who will follow from a distance. The same software can be used for remote meetings;
4. hardware/software to be installed in university classrooms (for the lesson course in the web conference): computers, webcams, microphones, etc.;
5. a classroom equipped with a sufficient number of computers to carry out automated verification tests through the use of digital systems (Moodle environment) by a large number of users;
6. technologies for the educational materials productions usable in asynchronous mode and with different levels of interactivity (video lessons, instructional videos, interactive videos, multimedia products, e-books, digital teaching units, etc.).

In my opinion, an investment in this area must be considered as a long-term rethinking opportunity on investment choices.

B - *Constitution of a teaching center: the new role of the research center on technologies for communication, innovation and distance learning*

Digital in the Knowledge Society is now a process that invests all the activities of human action, such as the economic, cultural, social, communication ones etc. In universities, the digital technology touches the administrative processes, those of communication and teaching. The latter, on the contrary to what is happening in second grade schools or in the major international universities, has been very little and often only influenced in a technical and instrumental way in the Italian universities. As Roberto Maragliano remarks about the use of technologies in universities: "(...) wishing to provide an overall evaluation of the processes at a national level, that of teaching is configured as the most marginally involved area, since ~~as~~ it is linked to the material and ideological conditioning that ~~is~~ would be difficult and, according to some even improper, subject to discussion. But if one does not want to stand by impotent in the university institution process of marginalization, within the framework of the mechanisms of production and reproduction of the highest levels of knowledge; it is necessary to bravely face to such a commitment ~~to~~ of rethinking and revising the most current teaching practices and of research" (2016, pp. 149-155).

To promote this process in our University, we propose the formulation of a series of strategies, general and specific objectives for the Research Center on communication technologies, innovation and distance learning. Objectives more focused on the methodological and didactic aspects in compared to those actually foreseen by the center.

Strategic objectives

The Center of Technologies with the aims of Communication, Innovation and Distance Learning, is configured as a strategic resource of the University. On the one hand, it aims to improve the quality of teaching and learning, and on the other, to increase the number of students (through a boost to the educational offer and the number of enrolled students in degree courses that do not require a maximum number).

All this is due to the correct use of digital technologies that permit teaching as activities with a high degree of accessibility, a route to e-learning, blended learning, or a functional lifelong learning, in line with the Europe and Horizon 2020 programs and with the Italian digital Agenda. But also, in compliance with the ministerial guidelines for the planning of the academic years 2016-18 (Ministerial Decree 8 August 2016, No. 635).

General objectives

1. Improving the quality of teaching and learning through the integration of technologies in the traditional lessons;
2. to propose the departments to a co-design with innovative and experimental forms of non-conventional teaching. (e-learning, blended learning, dual presence-distance mode, MOOC);
3. to intervene in delay university career (reducing the out-of-course students) and contribute to reducing the phenomenon of university abandonment;
4. to facilitate the conditions of study for non-attending students and working students;
5. to broaden the educational offer from the University of Ferrara to new groups of users (adults, workers) increasingly in terms of lifelong learning, lifelong/continuous learning, professional development.

Specific objectives

- To carry out a research on the digital education linked to the design of new educational settings by the use of telematics (technological infrastructures, virtual Moodle platforms, virtual classrooms) and by creation the multimedia resources, the possibility of having a significant impact on learning processes would be fulfilled. Finally, managing an online interaction and relative teaching activities;
- to intervene in the digital teaching design project in collaboration with the departments or individual teachers;
- to manage online teaching environments (Moodle), virtual classrooms and the relative technologies;

- to promote the use and diffusion of the technologies within the University, through a system of continuous relationship between the different system subjects/operators;
- to realize the digital materials necessary for educational activities (video lessons, instructional videos, e-books and digital teaching units, etc.);
- to promote the courses with a technological updating: a) for teachers with the issues relating to the digital education; b) for the technical personnel, multimedia designers, and the network tutors;
- to monitor and evaluate digital education activities in collaboration with the teaching delegates and with the scientific sectors of the University that deal with the research in the areas of teaching and assessment;
- to design the technological didactic settings, the network infrastructure and data storage systems, in collaboration with the other University centers.

The activity of the Technology Center must mainly include the ones that are addressed to the teachers, but not only, and the emphasis must be on design methods that make the students learning more effective (Gianecchini & Gubitta, 2017).

C - Training of the university teacher

In universities it is important to work on digital education from a cultural point of view. In Italy, since the eighties a number of projects have been carried out in the secondary schools (1st and 2nd grade) to introduce what is now called 2.0 teaching, and substantial resources have been invested in teacher training and to set up suitable learning environments. Little or nothing has been done in the university field even though the didactic preparation of university professors is considered as one of the most effective strategies in the international field in order to improve ~~ing~~ the quality of university education. Based on Felisatti and Serbati indications (2017), numerous European and international documents recommend to States are invested in the training of university teachers. The problem is gradually emerging even in Italy where in the presence of poor teaching value by comparison to research, some interesting experiences are emerging.

It is proposed, as other Italian universities are doing, a training intervention to support the professors of the University of Ferrara with a focus on educational technologies. The professor of the University of Ferrara as it happens in traditional teaching cannot be centralised in the entire production chain of his teaching in FaD mode. Rather, it must work within an educational team (Ardizzone & Rivoltella, 2003), in a team, specially set up to manage social, communicative, technological, and naturally didactic aspects (Ghislandi, 2002). It is proposed to assist the teacher, on the one hand, with the document production workshop in order to improve the didactic and communicative impact of tools used for multimedia, and on the other hand, through the support of an online tutor. By far, the consolidated results, such as the quality of e-learning experiences, on one hand, depends on the role of the teacher as "learning facilitator" rather than as "transmitter of knowledge", on the other hand, is based on the work of tutors who is prepared for managing the network interactions (Galliani, 2005). In particular, the work of the tutor must play an important role if one wants to distinguish learning as a social process rather than as an individual one. This would

allow to enhance the formative cooperation and the principles of social constructivism within the remote FaD model.

D - University Policy

The Net has now become the infrastructure of the so-called Knowledge Society and on which all human actions of an economic, social, cultural, political, communicative and interpersonal nature take place. In universities, digital conversion involves three macro-sectors: administration, communication, and teaching. Italian university teaching is the area most marginally involved in this process, due to a series of material and ideological constraints. Even if the advantages of distance or mixed training are now obvious, naturally equal learning outcomes. It is a teaching modality that due to its spatio-temporal/space-time flexibility can achieve a user otherwise being excluded from learning possibilities for different reasons: young people living in geographic areas far from university centers, working students, adults who want to retrain, all the subjects who need processes of lifelong learning (a process considered as a "third mission" of the University and whose aim is to change or replace a learning that is no longer appropriate in respect to the recent social or work needs, and in the professional field or staff).

Another important fact is how, today, the use of digital technologies in educational communication in formal learning contexts become one of the main factors for the qualification of teaching activities. The quality of university teaching was meant, being enriched. For example, among the causes of the students' learning difficulties, even in attendance at compulsory classes, the following hinders appear in the indications obtained from the pedagogical research: mismatch between the training proposal and the characteristics of the students, continuous lack of self-evaluation and evaluation forms external of the learning process, lack of active participation with all its outcome (discussions, thematic analysis, clarifications, etc.). In practice, the activity of continuous relationship and feed-back is essential for the teaching and learning processes success (the teacher can intervene based on user response, students can improve their performance if they are aware of the own criticalities). Naturally, a very low relationship as in the best universities between teachers and students (1 to 16 is that of the universities placed at the top of international rankings) is certainly a guarantee of higher educational quality.

The path of those universities that cannot afford this relationship and that simultaneously want to fulfil the need to increase the number of graduates (in Italy the average compared to other European countries is very low) must be different, of course without penalizing the quality of learning. We agree with what Domenici said (2016, p.12): "On equal terms, there can also be another way to increase the quality of the processes and results of university education. That which passes through the systematic and integrated use of modern information and communication technologies, and of the most accredited the technologies of education".

It is clear how such interventions (training of teachers, technological / methodological support for teaching activities, innovation of teaching models, role of the center of technologies, etc.) can only take place with the definition of an explicit and shared University policy, which sees the technologies as a strategic element for the University of Ferrara.

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GRID FOR MAPPING THE TOOLS USED IN THE FAD MODEL
(by researcher)

Course : _____

Didactics period   Second semester academic year 2016-2017

Didactics tool	Amount	Typology	Note
Video lessons			
Educational video			
Synchronous e-seminar			
Forum			
Chat			
Wiki			
Blog			
Glossary			
Feedback			
Assessment text			
Auto assessment text			
Other			

Università degli Studi di Ferrara

Dipartimento Studi Umanistici

<u>Annex 2</u>

ENTRY EXAM TEST (TEST_0)

Course   *Children's literature*
Module   *Children's literature and new digital technologies*

Prof. Anita Gramigna

26th September 2017

Name (without family name): _____

University registration number: _____

ID number (by researcher): _____

An effective e-book is:
1. a digital book equivalent to paper
2. a book that allows reading everywhere and whenever you want
3. a book "augmented" by multimedia tools
4. a lighter book

Digital natives are:
1. computer experts
2. young people who live well on the web
3. Internet enthusiasts
4. videogames fans

The learning process of digital natives:
1. it improves if multimedia educational technologies are used
2. depends on the design of the teaching intervention
3. it improves if social and 2.0 technologies are used
4. I do not know

The Web must be considered by the user / student for its value:
1. technological
2. instrumental
3. cultural and communicative
4. economic

The Netiquette is:
1. a way to protect intellectual property
2. a set of rules and good online education
3. an anti-spam technique
4. a technique to protect against viruses

Which definition is less exact? Platforms like Facebook, Twitter, Google+, YouTube:
1. refer to the scope of social-networking
2. they are archives of information
3. allow users an authorial role
4. offer contents of type User Generated Content

Does the participatory culture allowed by current technologies have educational value?
1. Yes
2. No
3. Yes, but only for young people
4. I do not know

Communication and information technologies:
1. have educational value
2. may have educational value
3. have educational value for adolescents
4. I do not know

Which of the following transactions is permitted by law:
1. use what is on the web without mentioning the origin
2. use written or ideas from social networks
3. quote all the materials written by others
4. refer to works by others without mentioning their provenance

The so-called 2.0 technologies:
1. they are very expensive
2. need programming skills
3. they need IT skills
4. none of the previous answers

Which of the following is not considered as a social network:
1. Facebook
2. Linkedin
3. Google Chrome
4. Twitter

Which of the following is not indicated as a negative effect of the web?
1. cognitive overwork
2. collective stupidity
3. addiction (from browsing or playing in virtual worlds)
4. I do not know

The concept of cultural industry in the era of the digital revolution:
1. it is strengthened
2. has entered a crisis
3. has been exceeded
4. remained unchanged

Which of the following tools is functional to educational processes in high schools?
1. Viral communication
2. Web 2.0
3. Web programming
4. LIM (multimedia interactive whiteboard)

Collective intelligence is:

1. An economic theory
2. An artificial intelligence software
3. A socio-informational theory
4. A technical-cultural theory

ORIGINAL SPEECH TEXT AND ORIGINAL VISUALS
OF MULTIMEDIA PRESENTATION

Course   *Children's literature*
Module   *Children's literature and new digital technologies*

Prof. Anita Gramigna

Lessons
3 17th October
4 19th October

Slide 1

Hello everyone, let's start today with the module on the relationship between technologies and children's literature. You remember we talked about it during the first meeting. We have said how important it is to tackle the theme of multimedia learning in school age in this teaching. I will not dwell on this aspect.

Why do we talk about children's literature in relation to technology? Because now you can not consider, for example, the relationship between children's literature, children, and digital devices, devices that you know very well and better than me, devices like smartphones and tablets that are used, not only for reading, but also for the social reading activities allowed by these tools, even for very young users.

Slide 2

Here it is. The main objective of this module, as already mentioned during the introduction of the course is to see how some aspects of communication technologies can find concrete application in teaching experiences based on the use of media, technologies and the web. Of course we can not make a 360-degree reasoning on educational technologies, so the aspects on which we will focus attention are related to participatory, authorial, social practices. Not technologies as tools, but as cognitive artifacts. Naturally ... a more specific objective is to see how these cultural practices can be applied effectively in the subject matter

of this teaching. In primary and especially secondary schools, technologies such as LIM have been used for several years, and more and more often we hear about didactic 2.0, pedagogy 2.0 etc. Behind this way of working, there must be a methodological awareness on the part of the teachers.	
Slide 3 It is clear to everyone how in recent years the diffusion of digital technologies has profoundly changed people's lives, in the way of communicating and interacting with others, so much so that they talk about the digital revolution. This revolution inevitably also affects the educational and training scenarios, forcing parents, educators and teachers to question their own role in relation to this phenomenon. Smartphones, tablets, notebooks, in fact, are now a widespread presence not only in the lives of adults and young people but also in that of children.	
Slide 4 For the last ten years we have been referring to new generations of students, digital natives, in relation to their high media consumption: Net Generation, Millennials, Instant-Message Generation, Generation Y, and Gamer Generation Screen Generation. Many researches and international studies have dealt with the learning styles of the New Millennium Learners, the first generation whose life is marked by ubiquitous communication prostheses. But be careful. After a widespread enthusiasm about the positive role of technology in educational situations ... it is now clear that the digital skills of young people do not involve automatisms in learning processes: there are no scientific data to support the existence of a generational fracture. And the contrast between native and non-digital natives risks passing the idea of better learning through the use of digital media and web 2.0. That said, it is evident that the new generations of students grow in technological environments and live the Internet galaxy naturally, unlike adults. So, it is important to see what literature says or	

scientific research related to learning processes in the presence of multimedia technologies. It is enough for us to stress once again how there are no automatisms between the use of multimedia and the improvement of learning processes. And this must be the attitude towards the use of digital media in children's literature.	
Slide 5 That said, let's go into the specifics of the relationship between book and digital technologies. In the meantime, there is a first positive data: it is a fact that thanks to the digital revolution, the production of texts for children and young people is greatly increased in quantitative terms; just as we know that this important increase lies outside the traditional production of books (paper publishing). Today, production for children can count on audio formats, audiobooks, multimedia products usable on the net or on CDs, on computer and tablet formats. This new situation of production and use suggests, as can be seen from a series of studies that we will be assisting, in a more or less long time, a profound change in reading and writing practices. It is not the case for the short time we dedicate to these questions to try to make judgments. Let's take what's happening as a matter of fact.	
Slide 6 In fact, it is clear from how researchers who analyze the trends in the world of childhood have now moved their attention: their attention has shifted from television to the new media sector, trying to define the relationship between children and digital technologies. Among these, e-reading seems to be fertile ground for the debate: whether attention is focused on the new potential of the medium or that the usual (and probably sterile) question is asked whether it is "better" the paper or ebook. Also because I believe that these are different elements and proposals, not so much when we talk about the simple transposition of the text from paper to the digital instrument (first we	

read a paper book now we read a pdf on tablet or computer) but rather 'approach to enhanced ebooks, or those electronic books that integrate text with multimedia elements. They are certainly two different things.

Slide 7

A survey conducted in the United States in 2016 on reading by children and parents has shown that the use of digital books reaches very high figures: more than ninety percent of children up to thirteen at least once a week use electronic devices to read. While, when it comes to reading for their children, sixty percent of parents still prefer paper books.

On the side of educational perception, parents believe that printed ebooks and books are equally useful for learning activities and, moreover, consider a plus the presence of advanced interactive options within e-books, so as to push 35% of they say that these characteristics are an important element in the choice of a security to purchase, a clear increase compared to 27% of the previous year. So the ebook can be good for educational activities and offers something more than the paper book.

These data lead us to see how, in a trend publishing market such as the US, the adoption of digital reading tools is now commonly used when talking about children's books. What is probably still difficult to metabolize is the difference between the elements, yielding to the temptation to compare instruments that are not very comparable. We do not speak, we repeat, of the digital transposition of a simple text, where the medium changes but the substance is, in principle, the same; we refer rather to the aforementioned enhanced book, where the inclusion of multimedia content of a different nature takes the experience on a different level, without judgments that define it better or worse, simply different. When this data appears in its evidence, the dogma that divides supporters of the paper and electronic will probably assume less importance.

Slide 8 The questions naturally to ask are many. What are the risks of premature use by children of new digital technologies? And what are the opportunities? As mentioned in the introductory day of the course it is not the intention of this part of the teaching to question these issues, interesting but which would lead us astray with respect to the objective of this module. I would like after this premise to work on what I think are the important characteristics of digital media, in relation to the educational sciences. Working on the inspiring principles of digital media. Because? Because as I said, according to personal procedures, you can identify the correct use, from an educational and didactic point of view, of these tools in relation to reading practices and possibly writing in the field of children's literature.	
Slide 9 The theme linked to what are called 2.0 technologies is part of the ongoing debate on the relationship between technologies and related media languages and learning teaching processes. A theme that in my perspective must be crossed by the principle according to which educational technologies must be governed by didactic paradigms far from instrumental visions. Rather, we need to think of skills related to the development of critical thinking, the conscious access to information, education for participation and citizenship. We must consider the media as cultural environments within which young people live, build and exchange meanings. This is important in my opinion: the school must not constitute a parallel universe in contrasting its tradition (in this case the culture of the printed book) with the possibilities offered by the Net. It must evolve in the direction of approaching that reality by redefining its own identity.	

Slide 10

But be careful! We must, of course, always be aware of how there is no scientific evidence, remembers Antonio Calvani (if you are interested in the bibliography of deepening there is a text on these aspects), when we talk about the effectiveness of multimedia and the web, in knowledge building by the students.

I was reading a study published by the European Commission and the New Media Consortium (a non-profit organization that brings together education technology experts in the United States) that highlights two urgent issues facing European education: on the one hand, scarce knowledge and digital skills of students, for study purposes; on the other, teacher training, the need to integrate the effective use of information and communication technologies in the teacher training path. At the Italian level, however, we should not hide how the training of teachers in particular still appears to be a complex problem for the resolution of which we need a renewed political and economic strategy: that is, we need to allocate significant investments to teacher training and improvement of the technological infrastructure. It is therefore important to underline the necessity, on the one hand, of the strategic choices to which we have referred, on the other, of the use of technologies in respect of clear methodological lines, the result of research projects, and distant from so-called technocentric visions. Only in this way can the use of technologies allow significant learning, as understood by Ausubel, which you will surely have faced in other teachings. I recommend going to see you again what Ausubel says.

Slide 11

The communicative and social potential of digital media is attracting the attention of scholars who deal with media pedagogy. In particular we tend to attribute an important educational value to the various forms of participatory culture.

In the indications of Henry Jenkins the affiliation, that is to be users, in a formal and

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informal way of online communities, the production of creative materials, the collaborative problem solving activities functional to the development of new knowledge, as happens with Wikipedia or with the activities of spoiling, they contribute to the construction of those digital skills that are fundamental to the scholastic and working success of the citizens. More generally, now the role of technologies in social relations and access to information, etc. raises important questions in the educational field.

Maybe not in the universities but certainly in high schools. Many didactic experiences, I repeat especially in high schools, are already characterized: from the use of problem-solving and social media, from paths focused on the relationship between the formal and non-formal dimensions, on participatory and collaborative activities, on the partner paradigms -costruttivisti.

Slide 12 Naturally, there is also the perception, shared by many, that the activities allowed by the network and by all communication devices can also lead to cultural, social and human impoverishment. Just think of what Pierre Lévy said that you know for sure. Levy has identified cyberspace as an environment conducive to the development of collective intelligence that is one of the cornerstones of much web 2.0, but the scholar has also questioned the ambivalent effects of digital systems. The network according to him can determine: isolation and cognitive overwork, for example communication stress and excess of permanence to the screen; dependence on navigation or play in virtual worlds; effects of prevarication and control, just think of the almost monopolistic dominance of economic giants on important network functions, etc .; exploitation as in some cases of controlled telecommuting or transfer of productive activities in the Third World; collective stupidity, noise, conformism of the network and virtual communities, accumulation of data without information content.	
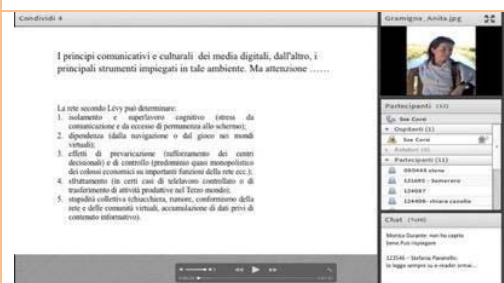
Slide 13

We immediately say that what interests us in this technology called Web 2.0, born in 2004, is related to the new philosophy that allows users to take a priority role in the media communication processes. I quote verbatim: Participatory architecture is the reason for the success of many software designed to encourage participation and organized in such a way as to allow users, while acting to pursue their own interests, to collaborate in building a collective value.

Open culture and participation architecture allow to incorporate the social component to the technological one, that is to enable a person-centered use of the Net. The centrality of people is the most evident feature of Web 2.0.

Slide 14

I also found this significant example: Nick Jaffe ended up tonight! He puts on the headset and relaxes on the armchair after finishing his night broadcast live worldwide. Nick is not a famous DJ, he is a simple podcaster and is only 13 years old. His study is in the bedroom.

Nick appears as the symbol of the new media ecosystem, where information and communication are produced by the masses rather than by the masses. He is a teenager who produces and consumes communication unthinkable only a few years ago. His media diet consists of a virtuous circle of production, publication, creative and personalized consumption, exchange. Nick is representative of that generation which, alongside the use of mainstream stories, intends to "write its own story". A post on a blog, a video on Youtube or even a sequence of messages on your Facebook wall, to then advertise it and try to make it the protagonist of the media space. Writing see is an important concept in this teaching, of course here we talk about it in general and without considering qualitative aspects etc. Think how many Nick there are today, even in this classroom ...

Slide 15 So, in practice, the most evident results of this new communication paradigm are the enormous production of User Generated Content content, ie content generated by the bottom without the mediation of the classic publishing groups: Blogs, Citizen journalism, Wikipedia, Google, activities on social networks and on video aggregation portals like YouTube etc. The work of millions of new authors, called prosumer, (synthesis between production and fruition) young and non-students and workers, who write, play, take photographs, discuss topics close to them, create software and applications, have determined a form of collective narration and significant changes in the relationship between cultural industry and consumption.	
So who is it that participates among you according to these modalities? ... .audio unclear ... when the boys speak	rumore
19 October 2017	
Slide 16 Let's start again from the analysis of the phenomenon "widespread author". It has been said that this is upsetting the media world and above all the editorial aspects. In short, what can we get then. Also think of the same production systems as they are changing, the editorial processes become less industrial and turn to niches of consumers, representative of the different instances, traditions, beliefs, ways of life. It is interesting, I quote Ricciardi, to observe how technology, assuming familiar forms and entering into all aspects of everyday life, now constitutes the habitat of human beings, "leaves the restricted domain of techniques to become a character actor of an entire civilization" . Of the same opinion, Time Magazine which, to underline this profound cultural revolution based on the logic of sharing and widespread democracy, has assigned, already the cover of	

10 years ago, of 2007, to the user-author, called "You".

"Who are these people? (...) The answer is: you! And to take hold of the global media, to found and define the new digital democracy, to work in exchange for nothing and beat the professionals on their own ground? Always you. You are the person of the year 2006 of Time ". Of course it is a mistake to mitigate these novelties more than necessary, then we must go deeper: Web 2.0 is seen from what is read on the web, conveys on itself the stupidity of the masses no less than their intelligence. Some of the comments that you read on YouTube and on Facebook make you trepid for the future of humanity even for their spelling, not to mention the obscenity and hatred that you come across. But the important thing is the desire to participate, so this is precisely what this mixture is that makes Web 2.0 so interesting .... it is a social experiment on a mass scale and, like any experiment worth trying, it could also fail.

Slide 17

In short, here is a series of issues to work on.

Certainly the definition, elaborated in 1947 by Theodor Adorno and Horkheimer, of cultural industry, that is, of that process of industrialization of aesthetic forms that transforms culture into commodity, has entered into crisis. The disintegration of the mainstream is creating a market of different cultural fragments and millions of niches, all equally worthy of being treated.

The new right to cultural participation makes consumers more powerful and forces those producers who do not want to lose consensus and sales to find a new agreement with the public.
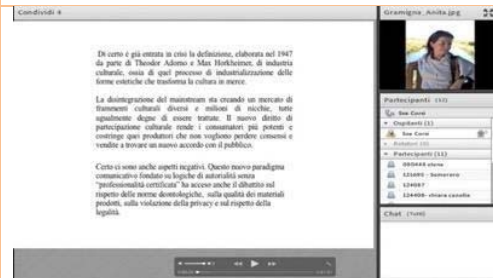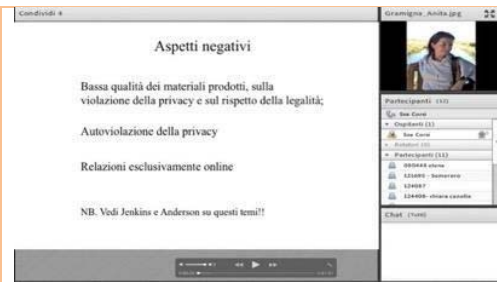
Slide 18

Of course there are also negative aspects. This new communication paradigm based on the logic of being an author without "certified professionalism" has also ignited the debate on the respect of ethical standards, on the quality of the materials produced, on the violation of privacy and respect for legality.

Two the most obvious concerns. The first, relating to the dissemination of personal data, the self-regulation of privacy can put at risk, through contacts with people who hide behind false profiles, the safety of adolescents.

The second, concerning the replacement of real contacts with virtual ones, brings many young people to communicate and relate through the exclusive use of devices. With obvious negative repercussions on face to face relationships with family and friends or on the care of one's physical appearance: online relationships do not require sophisticated clothing and a well-groomed appearance.

Jenkins's opinion is interesting about quality. Henry Jenkins also underlines the social, educational and cultural importance of the creative and participatory process, intervening in one of his posts in defense of rubbish: "We must not reduce the value of participatory culture to its products, we must instead think about its process. Think for a moment about all the courses of art and creative writing that are held in schools all over the world. Think, for example, of how many children learn to make clay pots. We do not teach it because we think that many of them as adults will become professional ceramists. In fact, many of them will only produce shapeless blocks of clay that only a mother can appreciate. We do it because we see a value in the process of creating something, in learning to manipulate the clay or what is available. In other words, there is a value in creation, completely independent of the value we attribute to the fruit of the creative act. In this perspective, the enlargement of the number of those who can create and share with others what they have created is important even if none of us produces anything better than the literary equivalent of a lump of clay that will be

appreciated by those to whom it is intended ... the mother or the fan community ... and by no one else ".

Finally, one can not agree with the problem of quality with Chris Anderson: "Maybe you are looking for funny videos on cats, while my favorite videos, the tutorial on welding, do not interest you. In the meantime, I want to see funny stunts from a video game, and your video about cooking does not interest me. The videos of our delicious relatives are obviously very interesting for us and very boring for everyone else. The trash is in the eye of the beholder. What really matters is relevance. We will always choose a low quality video on a topic that really matters to us, instead of a high quality video of something that we do not care about ".

What do you think about it? Do you have your idea about it?

Slide 19

Now let's see what are the technologies that allow collaborative activities on the network. Technologies that favor the processes mentioned.

We can include these technologies under the macro category of social media, which includes tools such as wikis, blogs, microblogging, forums, aggregators and social bookmarking, video sharing portals like YouTube, social networks such as, MySpace, LinkedIn, Facebook, Flickr, Twitter, Google Plus, and many others.
It is not easy to give a precise definition of these environments, based on technological platforms that allow more or less advanced social practices. Practices certainly not new.

The studies of social networks fall under the discipline of Social Network Analysis whose methodological approach of sociological matrix dates back to the thirties of the last century. Naturally, with the advent of the Web, social networks find extraordinary applications.
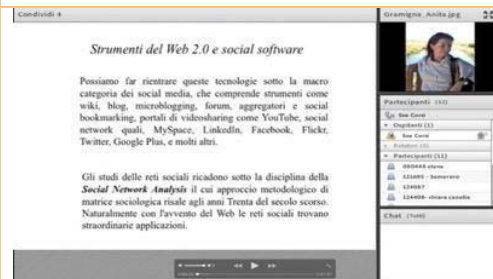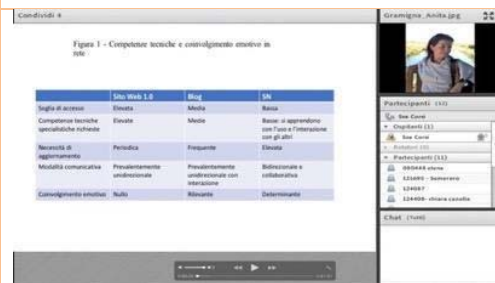
Slide 20 The best known example is Facebook, but there are many environments visited by users and made alive by participants, active members of communities, inhabitants, who can have a virtual home: "we are no longer guests at Google's home or customers in the Amazon store, but with our social network page we are the owners of our home page: the richness of the page, the setting of texts, the documents and multimedia objects that are included, the multiplicity of references, the indexing of contents so as to make them more accessible they depend exclusively on us "	
Slide 21 In all these environments, the specialized technical skills essential for the management of Web sites 1.0, appear secondary to the centrality of other factors, cultural, emotional, intellectual, relational, social, promotional. In the slide it is clear how, from the point of view of the use of social networks, these relationships have been reversed. What do you think about it? Interesting discussion but technically problematic	
Slide 22 In the awareness of the importance of a scientific definition of our objects of study, here it seems more appropriate to describe the functioning mechanisms of one of the most important social networks, Facebook. "Facebook helps you connect and stay in touch with people in your life." In the sentence inserted in the home page of the site, founded in 2004 at Harvard by Mark Zuckerberg, the mission in terms of social network service of Facebook is clear. Born as a book of Harward University students, the "face book" was subsequently opened to high schools, companies and anyone over thirteen years of age, to offer a virtual meeting place and maintain relationships with friends, classmates study, relatives, employees, potential clients.	

About ten years after his birth, Facebook is not only a place for virtual meetings with friends, offers both entertainment and communication functions, it lends itself to different uses: as well as being a means to build one's identity on the web, it is an instrument of web and social marketing, viral communication, acts as an archive of digital documents such as photos, videos, articles, works like an immense virtual game room; at the same time it absorbs the functions of e-mail and instant messaging etc.

Slide 22

On Facebook, the relational component and the socialization component are central: it is possible, for example, to found or join groups, to share personal interests, study, professional, civil commitment, or participate in games and tests of intelligence.

Facebook embodies the characteristics of a virtual community within which social spaces are simulated for the production and exchange of knowledge and knowledge: millions of individuals share their skills, experiences, stories, stories and interests every day.

Participating in this immense virtual society represents, on the one hand, an alternative way to the excessive rituality of social face-to-face practices that can cause annoying preclusions for aesthetic, social, cultural reasons, on the other, it allows to increase its social capital through access to resources related to the possession of a durable network of relationships that can bring benefits and emotional support.

Moreover, the aggregation of individuals in digital environments is encouraged by the re-presentation in social networks of a series of characteristics of real life: the instinct to socialization, the need to build relationships, are decisive stimuli to the logic of digital participation.

As well as another important element concerns the use of Facebook as a stage for the construction of the self. Just think of the

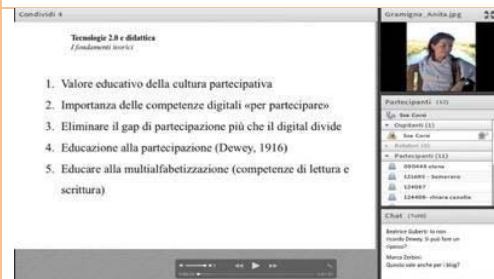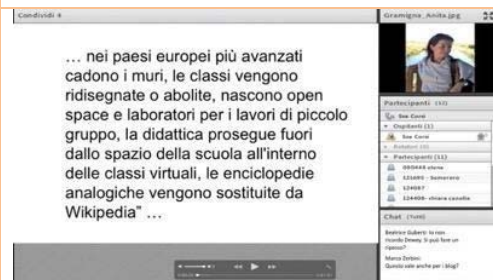|	
extreme care taken in drafting the personal profile, from the type of information included ... photos, texts, videos .... to the frequented friendships, from the applications used up to the language used. With a philosophy of use based on the centrality of individuals it was not difficult to imagine Facebook as a place for personal presentation and promotion, in which to tread the digital stage, aware that the chosen image will hit the sensory sphere of the audience on this side of the screen. Facebook therefore allows its members to experiment with a new public dimension, to create a reputation, a reputation, a personal brand. In the logic of digital storytelling ... transmediale or crossmediale ... .. to help, sometimes unconsciously or unexpectedly, other times in a studied and prepared way, the search for personal success contributes to the logic of the Net, with its many functions dedicated to dynamics of publication, circulation, distribution, the more traditional media contribute, giving an enormous visibility to the phenomena of the Net, and companies that see in those who have success online partners to affiliate and with whom they relate.	
Slide 23 Vediamo allora adesso di concentrarci sul rapporto tra tecnologie di rete e didattica. Argomento centrale nel nostro insegnamento. In light of the new possibilities, communicative, cultural, social, allowed by the digital media, described, we tend to attribute an important educational value to the various forms of participatory activities. There is an awareness of the need for the acquisition of the skills necessary to live in the knowledge society: the ability to use technologies with a critical and critical spirit for training, work, leisure time and communication. . As a result, the role of the educational institution is also discussed. It is evident that this has no longer the exclusive rights of a time in the construction of functional skills for the working, social and cultural future	

of citizens. Above all, if the teaching interventions must be aimed at avoiding the gap in participation in contemporary culture and in enabling new citizens to exercise their citizenship rights, in line with the New London Group's definition of the concept of education: "If it were It is possible to define in a broad sense the objective of education, one could say that its primary purpose is to ensure that all students benefit from learning in order to participate fully in public, community ... creative ... and economic life ".

The theme of participation education, already dear to John Dewey in his reflections on the relationship between education and democracy, is finding ever more attention. In the most technologically advanced societies, the problem of the digital divide, understood until a few years ago as access to computers or the broadband network, includes today the idea of an obstacle to participation.

The focus of teaching interventions is therefore moving from a technological problem to a question of multi-literacy, attentive to both reading and writing skills, in order to favor the ability to find, understand, create, information and communications in different contexts

Slide 24

Concretely, participatory culture and the concept connected to it, of connective intelligence, are the basis of the birth of many educational initiatives based on the logic of pedagogy 2.0. These initiatives include the construction of educational sets that bring the informal dimension closer to the formal one: in the more advanced European countries, the walls fall, the classes are redesigned or abolished, open spaces and laboratories for small group work are born, the teaching continues outside the school space inside virtual classrooms, analog encyclopedias are replaced by Wikipedia

... nei paesi europei più avanzati cadono i muri, le classi vengono ridisegnate o abolite, nascono open space e laboratori per i lavori di piccolo gruppo, la didattica prosegue fuori dallo spazio della scuola all'interno delle classi virtuali, le enciclopedie analogiche vengono sostituite da Wikipedia" ...

Slide 25

The use of technologies must be directly connected, finally, to the physical spaces of the classroom, which in the application of a constructivist didactics, must assume a different configuration from the current one: the classes must be equipped with mobile benches, with variable geometry, according to the teaching paradigm employed, transmissive and asymmetric, or based on learning by doing.

In addition, the use of the LIM, interactive multimedia boards and other devices ... tablets, totems, electronic instruments for the recording of presences etc. used in a didactics enhanced by technologies and digital contents, to complement the school manual, must provide for integration between the real and virtual classroom.

For example, the functional teaching set for cooperative problem solving activities should be inspired by the overturned class ... flipped classroom ... a model used in the countries of Northern Europe and in the Anglo-Saxon language.

Slide 26

In fact, there are those who argue that in the coming years the most significant changes in the teaching processes will be due not only to the greater weight that the technologies will assume, but also to the integration, within the teaching practices, of a series of elements from professional and social activities. So from a formal / non-formal relationship a new educational scenario is foreseen, characterized by the following elements: permanent formation as a normal practice; learning processes integrated by network models; teacher as a mediator / organizer of the student-knowledge-technology circuit; loss of the value of certification / qualification, to the advantage of the real skills possessed by individuals.
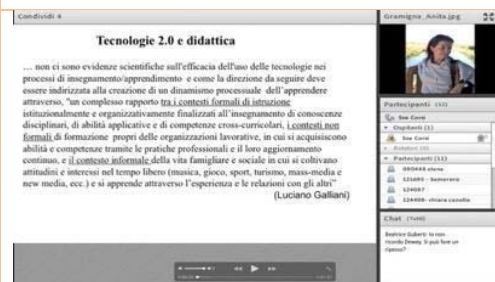
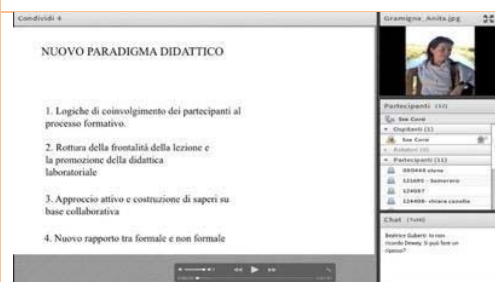|	
Slide 27 Finally, an approach of this nature is useful to avoid making young people believe that extra-curricular educational opportunities are better than those offered by the educational institution: if the two environments are compared, it is evident that the practice of the transmission lesson is based on the centrality of the teacher, can be extraneous and not involving those who daily use 2.0 technologies.	
Slide 28 Certain of a change, guided by a methodological awareness, are important indications of Luciano Galliani, who remembers that there is still no scientific evidence on the effectiveness of the use of technologies in teaching / learning processes. According to him, the direction to follow must be directed to the creation of a procedural dynamism of learning through: a relationship between formal contexts of instruction for the purpose of teaching disciplinary knowledge, cross-curricular competences; non-formal training contexts (those of work organizations) in which skills and competences are acquired through professional practices; the informal context of family and social life in which interests are cultivated in leisure time ... music, games, sports, tourism, mass media and new media, etc. ... and we learn through experience and relationships with others ".	
Slide 29 The integration of formal, informal and non-formal activities can support teaching models based on the logic of involving the participants in the training process. Through the breaking of the frontality of the lesson and the promotion of laboratory teaching, the student not only participates in the processes of knowledge construction, but can become the main actor in the educational process. In line with active teaching methods, employed, for example, in the past by John Dewey ;, Freinet, Freire, valued by the principles of constructivism.	

These learning models, based on an active approach, can determine the construction of knowledge on a collaborative basis, starting from reflective practices necessary to solve problems. In this context, the recognition of the interests and skills possessed by the new generations is gaining importance in order to accompany their growth, through a functional use of their skills, technology, communication, creativity and collaboration.

A final reflection must concern the disciplinary contents, which, if faced with a 2.0 perspective, must exit the walls of the school, to get in touch and confront professional and social contexts: the school in practice must open itself to the ways of learning life real and pay attention to languages, tools, codes of social and work derivation.

Slide 30

In the sociological and educational field there are those who are questioning the ability of the expression generated by the user (User Generated Content ... and self-regulated) to contribute to the public cultural sphere through the overall growth of information and knowledge. All this certainly favors democratic processes: the greater the number of people able to create cultural meanings within a new form of digital citizenship, the more solid this participated democracy will be.

All this is insensitive to the skills and competences that are the fruit of greater digital literacy. It is then evident that the phenomenon of widespread authoritarianism must invest the educational problem. If the student, as previously mentioned, must be the main actor of educational practice and if he wants to favor his active role, it becomes important to use teaching / learning models able to take into account this wave of "young authors" and the identification of educational strategies that consider students not containers to fill, but talents to encourage growth and potential.
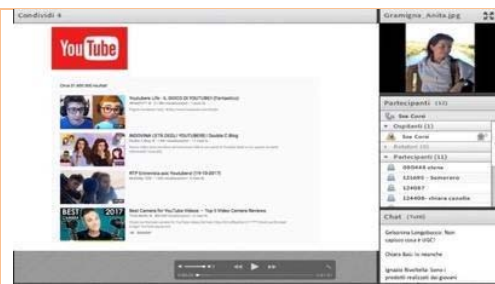
Slide 31

Think of another social like YouTube. I do not know him well but reading the suopi numbers can no longer be overlooked. Disciplinary areas dealing with media ... media literacy, media education, media literacy .... they must enable students not only to engage in critical reading but also to become aware producers.

Certainly the activity of production and collaboration meets both the favor of the students who in this way can represent their own interests using forms of expression close to them, as well as that of many educators by virtue of the social dimension that results. Doing involves the division of tasks into a collective work and directed towards the achievement of precise objectives. Communication skills, time management, accountability, ability to choose and make decisions on the part of the individual members of the group are important elements for educational activities. From the conceptual point of view, in the past, it was widely believed that the productions of the students could generate, through the repetition of the genres seen on television, a sort of ideological slavery through the naturalization of the dominant practices. In the last twenty years this approach has fortunately been overcome.

Slide 32

We have seen how production and participation are dominant practices on the web and can not be overlooked by current discussions on the use of media in educational practice. This offers, therefore, new opportunities for research on media education, presents epistemological and methodological challenges for the social sciences as well as for the humanistic and pedagogical ones.

We have already said the importance of the contents generated by users in the knowledge society, in which consumption is exceeded and only reading activity in the direction of different activities, reading / writing / sharing / circulation. We have also said how all this must have a reflection in educational and educational practices. We have talked a lot about young

| authors and the need to identify teaching strategies to foster their growth and potential. I fully agree on this need ... it is important to maximize the cultural, participatory principles allowed by the web and new technologies. The ebooks certainly allow the application of these principles ... and in this direction you must consider this part of the course.

Good evening | |

ORIGINAL SPEECH TEXT AND MODIFIED VISUALS (BY RESEARCHER) OF MULTIMEDIA PRESENTATION

Course   *Children's literature*
Module   *Children's literature and new digital technologies*

Prof. Anita Gramigna

Lessons
3   24th October
4   26th October

Data lezione: 24 Ottobre 2017	
Slide 1	
Slide 2 Hello everyone, let's start today with the module on the relationship between technologies and children's literature. You remember we talked about it during the first meeting. We have said how important it is to tackle the theme of multimedia learning in school age in this teaching. I will not dwell on this aspect.	
Slide 3 Why do we talk about children's literature in relation to technology? Because now you can not consider, for example, the relationship between children's literature, children, and digital devices, devices that you know very well and better than me, devices like smartphones and tablets that are used, not only for reading, but also for the social reading activities allowed by these tools, even for very young users.	
Slide 4 (timed slide) 4a Here it is. The main objective of this module, as already mentioned during the introduction of the course is to see how some aspects of communication technologies can find concrete application in teaching experiences based on the use of media, technologies and the web.	

4b Of course we can not make a 360-degree reasoning on educational technologies, so the aspects on which we will focus attention are related to participatory, authorial, social practices. Not technologies as tools, but as cognitive artifacts.	
4c Naturally ... a more specific objective is to see how these cultural practices can be applied effectively in the subject matter of this teaching. In primary and especially secondary schools, technologies such as LIM have been used for several years, and more and more often we hear about didactic 2.0, pedagogy 2.0 etc.. 4d Behind this way of working, there must be a methodological awareness on the part of the teachers.	
Slide 5 It is clear to everyone how in recent years the diffusion of digital technologies has profoundly changed people's lives, in the way of communicating and interacting with others, so much so that they talk about the digital revolution. This revolution inevitably also affects the educational and training scenarios, forcing parents, educators and teachers to question their own role in relation to this phenomenon. Smartphones, tablets, notebooks, in fact, are now a widespread presence not only in the lives of adults and young people but also in that of children.	Rivoluzione digitale e scenari educativi

Slide 6-7 (timed slide) For the last ten years we have been referring to new generations of students, digital natives, in relation to their high media consumption: Net Generation, Millennials, Instant-Message Generation, Generation Y, and Gamer Generation Screen Generation. 7 (animazione) Many researches and international studies have dealt with the learning styles of the New Millennium Learners, the first generation whose life is marked by ubiquitous communication prostheses.	NATIVI DIGITALI E NUOVI ABITUDINI MEDIALI **Net Generation** Millennials **Instant-Message Generation** **Generation Y** **Gamer Generation** **Screen Generation**
Slide 8 (timed slide) But be careful. After a widespread enthusiasm about the positive role of technology in educational situations ... 8 a it is now clear that the digital skills of young people do not involve automatisms in learning processes: there are no scientific data to support the existence of a generational fracture. And the contrast between native and non-digital natives risks passing the idea of better learning through the use of digital media and web 2.0.	Paolo Ferri Nativi digitali sagg_Bruno Mondadori **Attenzione!** E' ormai evidente come le competenze digitali dei giovani non comportano automatismi nei processi di apprendimento.
Slide 9 That said, it is evident that the new generations of students grow in technological environments and live the Internet galaxy naturally, unlike adults. So, it is important to see what literature says or scientific research related to learning processes in the presence of multimedia technologies.	Importanza della ricerca IND IRE ISTITUTO NAZIONALE DOCUMENTAZIONE INNOVAZIONE RICERCA EDUCATIVA

Slide 10 It is enough for us to stress once again how there are no automatisms between the use of multimedia and the improvement of learning processes. And this must be the attitude towards the use of digital media in children's literature.	 Importanza della ricerca NON CI SONO AUTOMATISMI TRA USO DELLA MULTIMEDIALITÀ E MIGLIORAMENTO DEI PROCESSI DI APPRENDIMENTO!
Slide 11 (timed slide) That said, let's go into the specifics of the relationship between book and digital technologies. 11 a In the meantime, there is a first positive data: it is a fact that thanks to the digital revolution, the production of texts for children and young people is greatly increased in quantitative terms; just as we know that this important increase lies outside the traditional production of books (paper publishing). 11 b Today, production for children can count on audio formats, audiobooks, multimedia products usable on the net or on CDs, on computer and tablet formats. 11 c This new situation of production and use suggests, as can be seen from a series of studies that we will be assisting, in a more or less long time, a profound change in reading and writing practices. It is not the case for the short time we dedicate to these questions to try to make judgments. Let's take what's happening as a matter of fact.	 Rapporto libro e tecnologie digitali 1. Aumento della produzione di testi per bambini e ragazzi grazie all'editoria digitale; 2. Differenziazione multimediale: audiolibri, file audio, formati per il web, per computer, per tablet; 3. Si prefigura un cambiamento nelle pratiche di lettura e scrittura.
Slide 12 In fact, it is clear from how researchers who analyze the trends in the world of childhood have now moved their attention: their attention has shifted from television to the new media sector, trying to define the relationship between children and digital technologies.	 Trasloco del testo

Among these, e-reading seems to be fertile ground for the debate: whether attention is focused on the new potential of the medium or that the usual (and probably sterile) question is asked whether it is "better" the paper or ebook.	
Slide 13 Also because I believe that these are different elements and proposals, not so much when we talk about the simple transposition of the text from paper to the digital instrument (first we read a paper book now we read a pdf on tablet or computer) but rather 'approach to enhanced ebooks, or those electronic books that integrate text with multimedia elements. They are certainly two different things.	
Slide 14 (timed slide) A survey conducted in the United States in 2016 on reading by children and parents has shown that the use of digital books reaches very high figures: more than ninety percent of children up to thirteen at least once a week use electronic devices to read. While, when it comes to reading for their children, sixty percent of parents still prefer paper books.	
Slide 15 On the side of educational perception, parents believe that printed ebooks and books are equally useful for learning activities and, moreover, consider a plus the presence of advanced interactive options within e-books, so as to push 35% of they say that these characteristics are an important element in the choice of a security to purchase, a clear increase compared to 27% of the previous year. So the ebook can be good for educational activities and offers something more than the paper book.	

Slide 16	
These data lead us to see how, in a trend publishing market such as the US, the adoption of digital reading tools is now commonly used when talking about children's books. What is probably still difficult to metabolize is the difference between the elements, yielding to the temptation to compare instruments that are not very comparable. We do not speak, we repeat, of the digital transposition of a simple text, where the medium changes but the substance is, in principle, the same; we refer rather to the aforementioned enhanced book, where the inclusion of multimedia content of a different nature takes the experience on a different level, without judgments that define it better or worse, simply different. When this data appears in its evidence, the dogma that divides supporters of the paper and electronic will probably assume less importance.	

Slide 17	
The questions naturally to ask are many. What are the risks of premature use by children of new digital technologies? And what are the opportunities? As mentioned in the introductory day of the course it is not the intention of this part of the teaching to question these issues, interesting but which would lead us astray with respect to the objective of this module. I would like after this premise to work on what I think are the important characteristics of digital media, in relation to the educational sciences. Working on the inspiring principles of digital media. Because? Because as I said, according to personal procedures, you can identify the correct use, from an educational and didactic point of view, of these tools in relation to reading practices and possibly writing in the field of children's literature.	

Slide 18 The theme linked to what are called 2.0 technologies is part of the ongoing debate on the relationship between technologies and related media languages and learning teaching processes. A theme that in my perspective must be crossed by the principle according to which educational technologies must be governed by didactic paradigms far from instrumental visions. Rather, we need to think of skills related to the development of critical thinking, the conscious access to information, education for participation and citizenship. We must consider the media as cultural environments within which young people live, build and exchange meanings.	
Slide 19 This is important in my opinion: the school must not constitute a parallel universe in contrasting its tradition (in this case the culture of the printed book) with the possibilities offered by the Net. It must evolve in the direction of approaching that reality by redefining its own identity.	
Slide 20 But be careful! We must, of course, always be aware of how there is no scientific evidence, remembers Antonio Calvani (if you are interested in the bibliography of deepening there is a text on these aspects), when we talk about the effectiveness of multimedia and the web, in knowledge building by the students.	

Slide 21 (temporizzata) I was reading a study published by the European Commission and the New Media Consortium (a non-profit organization that brings together education technology experts in the United States) that highlights two urgent issues facing European education: on the one hand, scarce knowledge and digital skills of students, for study purposes; on the other, teacher training, the need to integrate the effective use of information and communication technologies in the teacher training path. At the Italian level, however, we should not hide how the training of teachers in particular still appears to be a complex problem for the resolution of which we need a renewed political and economic strategy: that is, we need to allocate significant investments to teacher training and improvement of the technological infrastructure.	 1. Scarse conoscenze e competenze digitali degli studenti, a fini di studio. 2. Formazione degli insegnanti.
Slide 22 It is therefore important to underline the necessity, on the one hand, of the strategic choices to which we have referred, on the other, of the use of technologies in respect of clear methodological lines, the result of research projects, and distant from so-called technocentric visions. Only in this way can the use of technologies allow significant learning, as understood by Ausubel, which you will surely have faced in other teachings. I recommend going to see you again what Ausubel says.	 Centralità della *metodologia* per ottenere apprendimenti significativi come indicato da *Ausubel*.
Slide 23 The communicative and social potential of digital media is attracting the attention of scholars who deal with media pedagogy. In particular we tend to attribute an important educational value to the various forms of participatory culture.	CULTURA PARTECIPATIVA

Slide 24 In the indications of Henry Jenkins the affiliation, that is to be users, in a formal and informal way of online communities, the production of creative materials, the collaborative problem solving activities functional to the development of new knowledge, as happens with Wikipedia or with the activities of spoiling, they contribute to the construction of those digital skills that are fundamental to the scholastic and working success of the citizens. More generally, now the role of technologies in social relations and access to information, etc. raises important questions in the educational field.	 Cultura partecipativa Affiliazione Produzione materiali creativi Attività di problem solving Contribuiscono alla costruzione di quelle competenze digitali fondamentali al successo scolastico e lavorativo dei cittadini.
Slide 25 Maybe not in the universities but certainly in high schools. Many didactic experiences, I repeat especially in high schools, are already characterized: from the use of problem-solving and social media, from paths focused on the relationship between the formal and non-formal dimensions, on participatory and collaborative activities, on the partner paradigms -costruttivisti.	 CULTURA PARTECIPATIVA E DIDATTICA
Slide 26 (temporizzata) Naturally, there is also the perception, shared by many, that the activities allowed by the network and by all communication devices can also lead to cultural, social and human impoverishment. Just think of what Pierre Lévy said that you know for sure. Levy has identified cyberspace as an environment conducive to the development of collective intelligence that is one of the cornerstones of much web 2.0, but the scholar has also questioned the ambivalent effects of digital systems. The network according to him can determine: isolation and cognitive overwork, for example communication stress and excess of permanence to the screen; dependence on navigation or play in virtual worlds; effects of prevarication and control, just think of the almost monopolistic dominance of economic giants on important network	 **Aspetti negativi del Web** 1. isolamento e superlavoro cognitivo 2. dipendenza 3. effetti di prevaricazione e di controllo 4. sfruttamento 5. stupidità collettiva

functions, etc .; exploitation as in some cases of controlled telecommuting or transfer of productive activities in the Third World; collective stupidity, noise, conformism of the network and virtual communities, accumulation of data without information content.	
Slide 27 (temporizzata) We immediately say that what interests us in this technology called Web 2.0, born in 2004, is related to the new philosophy that allows users to take a priority role in the media communication processes. I quote verbatim: Participatory architecture is the reason for the success of many software designed to encourage participation and organized in such a way as to allow users, while acting to pursue their own interests, to collaborate in building a collective value. 27 a Open culture and participation architecture allow to incorporate the social component to the technological one, that is to enable a person-centered use of the Net. The centrality of people is the most evident feature of Web 2.0.	 Web 2.0 e paradigmi comunicativi: partecipazione Open culture e **architettura della partecipazione** consentono di inglobare la componente sociale a quella tecnologica ossia di abilitare un utilizzo della Rete incentrato sulla persona. La **centralità delle persone** è la caratteristica più evidente del Web 2.0.
Slide 28 I also found this significant example: Nick Jaffe ended up tonight! He puts on the headset and relaxes on the armchair after finishing his night broadcast live worldwide. Nick is not a famous DJ, he is a simple podcaster and is only 13 years old. His study is in the bedroom.	 Centralità della persona
Slide 29 Nick appears as the symbol of the new media ecosystem, where information and communication are produced by the masses rather than by the masses. He is a teenager who produces and consumes communication unthinkable only a few years ago. His media diet consists of a	 Centralità della persona

virtuous circle of production, publication, creative and personalized consumption, exchange. Nick is representative of that generation which, alongside the use of mainstream stories, intends to "write its own story". A post on a blog, a video on Youtube or even a sequence of messages on your Facebook wall, to then advertise it and try to make it the protagonist of the media space. Writing see is an important concept in this teaching, of course here we talk about it in general and without considering qualitative aspects etc. Think how many Nick there are today, even in this classroom ...

Slide 30 So, in practice, the most evident results of this new communication paradigm are the enormous production of User Generated Content content, ie content generated by the bottom without the mediation of the classic publishing groups: Blogs, Citizen journalism, Wikipedia, Google, activities on social networks and on video aggregation portals like YouTube etc. The work of millions of new authors, called prosumer, (synthesis between production and fruition) young and non-students and workers, who write, play, take photographs, discuss topics close to them, create software and applications, have determined a form of collective narration and significant changes in the relationship between cultural industry and consumption.	
Slide 31 So who is it that participates among you according to these modalities? ... .audio unclear ... when the boys speak	
26 October 2017	

Slide 32	
Let's start again from the analysis of the phenomenon "widespread author". It has been said that this is upsetting the media world and above all the editorial aspects. In short, what can we get then. Also think of the same production systems as they are changing, the editorial processes become less industrial and turn to niches of consumers, representative of the different instances, traditions, beliefs, ways of life. It is interesting, I quote Ricciardi, to observe how technology, assuming familiar forms and entering into all aspects of everyday life, now constitutes the habitat of human beings, "leaves the restricted domain of techniques to become a character actor of an entire civilization" .	«la tecnologia, assumendo forme familiari ed entrando in tutti gli aspetti della quotidianità, costituisca ormai l'habitat degli esseri umani, esce dal dominio ristretto delle tecniche per diventare attore caratterizzante di un'intera civiltà». Ricciardi
Slide 33 (temporizzato) Of the same opinion, Time Magazine which, to underline this profound cultural revolution based on the logic of sharing and widespread democracy, has assigned, already the cover of 10 years ago, of 2007, to the user-author, called "You". 33 b "Who are these people? (...) The answer is: you! And to take hold of the global media, to found and define the new digital democracy, to work in exchange for nothing and beat the professionals on their own ground? Always you. You are the person of the year 2006 of Time". Of course it is a mistake to mitigate these novelties more than necessary, then we must go deeper: Web 2.0 is seen from what is read on the web, conveys on itself the stupidity of the masses no less than their intelligence. Some of the comments that you read on YouTube and on Facebook make you trepid for the future of humanity even for their spelling, not to mention the obscenity and hatred that you come across. But the important thing is the desire to participate, so this is precisely what this mixture is that makes Web 2.0 so interesting .... it is a social experiment on a	Chi sono queste persone? (...) La risposta è: voi! E per prendere in mano i media globali, per fondare e definire la nuova democrazia digitale, per lavorare in cambio di niente e battere i professionisti sul loro stesso terreno? Sempre voi. Voi siete la persona dell'anno 2006 di Time". TIME You.

mass scale and, like any experiment worth trying, it could also fail.	
Slide 34 (temporizzata) In short, here is a series of issues to work on. a Certainly the definition, elaborated in 1947 by Theodor Adorno and Horkheimer, of cultural industry, that is, of that process of industrialization of aesthetic forms that transforms culture into commodity, has entered into crisis. The disintegration of the mainstream is creating a market of different cultural fragments and millions of niches, all equally worthy of being treated b The new right to cultural participation makes consumers more powerful and forces those producers who do not want to lose consensus and sales to find a new agreement with the public. c Of course there are also negative aspects. This new communication paradigm based on the logic of being an author without "certified professionalism" has also ignited the debate on the respect of ethical standards, on the quality of the materials produced, on the violation of privacy and respect for legality. d Two the most obvious concerns. The first, relating to the dissemination of personal data, the self-regulation of privacy can put at risk, through contacts with people who hide behind false profiles, the safety of adolescents. e The second, concerning the replacement of real contacts with virtual ones, brings many young people to communicate and relate through the exclusive use of devices. With obvious negative repercussions on face to face relationships with family and friends or on the care of one's physical appearance: online relationships do not require sophisticated clothing and a well-groomed	**Una serie di questioni …** ➢ Crisi del concetto di Industria Culturale ➢ Nuovo rapporto tra consumatori e produttori ➢ Autorialità diffusa e professionalità non cerificata ➢ Autoviolazione della Privacy ➢ Vita reale e vita online ➢ La qualità dei materiali (Jenkins) ➢ La qualità dei materiali (Anderson)

appearance.

f

Jenkins's opinion is interesting about quality. Henry Jenkins also underlines the social, educational and cultural importance of the creative and participatory process, intervening in one of his posts in defense of rubbish: "We must not reduce the value of participatory culture to its products, we must instead think about its process. Think for a moment about all the courses of art and creative writing that are held in schools all over the world. Think, for example, of how many children learn to make clay pots. We do not teach it because we think that many of them as adults will become professional ceramists. In fact, many of them will only produce shapeless blocks of clay that only a mother can appreciate. We do it because we see a value in the process of creating something, in learning to manipulate the clay or what is available. In other words, there is a value in creation, completely independent of the value we attribute to the fruit of the creative act. In this perspective, the enlargement of the number of those who can create and share with others what they have created is important even if none of us produces anything better than the literary equivalent of a lump of clay that will be appreciated by those to whom it is intended ... the mother or the fan community ... and by no one else ".

g

Finally, one can not agree with the problem of quality with Chris Anderson: "Maybe you are looking for funny videos on cats, while my favorite videos, the tutorial on welding, do not interest you. In the meantime, I want to see funny stunts from a video game, and your video about cooking does not interest me. The videos of our delicious relatives are obviously very interesting for us and very boring for everyone else. The trash is in the eye of the beholder. What really matters is relevance. We will always choose a low quality video on a topic that really matters to us, instead of a high quality video of something that we do not care about ".

What do you think about it? Do you have your idea about it?	
Slide 35 (temporizzata) Now let's see what are the technologies that allow collaborative activities on the network. Technologies that favor the processes mentioned. a We can include these technologies under the macro category of social media, which includes tools such as wikis, blogs, microblogging, forums, aggregators and social bookmarking, video sharing portals like YouTube, social networks such as, MySpace, LinkedIn, Facebook, Flickr, Twitter, Google Plus, and many others. It is not easy to give a precise definition of these environments, based on technological platforms that allow more or less advanced social practices. Practices certainly not new. b The studies of social networks fall under the discipline of Social Network Analysis whose methodological approach of sociological matrix dates back to the thirties of the last century. Naturally, with the advent of the Web, social networks find extraordinary applications. c The best known example is Facebook, but there are many environments visited by users and made alive by participants, active members of communities, inhabitants, who can have a virtual home: "we are no longer guests at Google's home or customers in the Amazon store, but with our social network page we are the owners of our home page: the richness of the page, the setting of texts, the documents and multimedia objects that are included, the multiplicity of references, the indexing of contents so as to make them more accessible they depend exclusively on us "	**TECNOLOGIE** **Strumenti del web 2.0 e social software** Social media — Wiki, Blog, Microblogging, YouTube, MySpace, LinkedIn, **Facebook**, Flickr, Twitter, Google Plus e molti altri.... Teoria di riferimento **Social Network Analysis**

Slide 36	
In all these environments, the specialized technical skills essential for the management of Web sites 1.0, appear secondary to the centrality of other factors, cultural, emotional, intellectual, relational, social, promotional. In the slide it is clear how, from the point of view of the use of social networks, these relationships have been reversed.	
Slide 36	
What do you think about it? Interesting discussion but technically problematic	
Slide 37	
In the awareness of the importance of a scientific definition of our objects of study, here it seems more appropriate to describe the functioning mechanisms of one of the most important social networks, Facebook. "Facebook helps you connect and stay in touch with people in your life." In the sentence inserted in the home page of the site, founded in 2004 at Harvard by Mark Zuckerberg, the mission in terms of social network service of Facebook is clear. Born as a book of Harward University students, the "face book" was subsequently opened to high schools, companies and anyone over thirteen years of age, to offer a virtual meeting place and maintain relationships with friends, classmates study, relatives, employees, potential clients. About ten years after his birth, Facebook is not only a place for virtual meetings with friends, offers both entertainment and communication functions, it lends itself to different uses: as well as being a means to build one's identity on the web, it is an instrument of web and social marketing, viral communication, acts as an archive of digital documents such as photos, videos, articles, works like an immense virtual game room; at the same time it absorbs the	

functions of e-mail and instant messaging etc.	
Slide 38 (temporizzata) a On Facebook, the relational component and the socialization component are central: it is possible, for example, to found or join groups, to share personal interests, study, professional, civil commitment, or participate in games and tests of intelligence. b Facebook embodies the characteristics of a virtual community within which social spaces are simulated for the production and exchange of knowledge and knowledge: millions of individuals share their skills, experiences c Participating in this immense virtual society represents, on the one hand, an alternative way to the excessive rituality of social face-to-face practices that can cause annoying preclusions for aesthetic, social, cultural reasons, on the other, it allows to increase its social capital through access to resources related to the possession of a durable network of relationships that can bring benefits and emotional support. d Moreover, the aggregation of individuals in digital environments is encouraged by the re-presentation in social networks of a series of characteristics of real life: the instinct to socialization, the need to build relationships, are decisive stimuli to the logic of digital participation. e As well as another important element concerns the use of Facebook as a stage for the construction of the self. Just think of the extreme care taken in drafting the personal	**Facebook** ➢ Socializzazione ➢ Produzione e scambio di saperi ➢ Aumento del capitale sociale ➢ Caratteristiche di «vita reale» ➢ Consente costruzione del sé e palcoscenico digitale ➢ Strumento di marketing e narrazione digitale

profile, from the type of information included ... photos, texts, videos .... to the frequented friendships, from the applications used up to the language used. With a philosophy of use based on the centrality of individuals it was not difficult to imagine Facebook as a place for personal presentation and promotion, in which to tread the digital stage, aware that the chosen image will hit the sensory sphere of the audience on this side of the screen.

f

Facebook therefore allows its members to experiment with a new public dimension, to create a reputation, a reputation, a personal brand. In the logic of digital storytelling ... transmediale or crossmediale ... .. to help, sometimes unconsciously or unexpectedly, other times in a studied and prepared way, the search for personal success contributes to the logic of the Net, with its many functions dedicated to dynamics of publication, circulation, distribution, the more traditional media contribute, giving an enormous visibility to the phenomena of the Net, and companies that see in those who have success online partners to affiliate and with whom they relate.

Slide 39

Vediamo allora adesso di concentrarci sul rapporto tra tecnologie di rete e didattica. Argomento centrale nel nostro insegnamento.

a

In light of the new possibilities, communicative, cultural, social, allowed by the digital media, described, we tend to attribute an important educational value to the various forms of participatory activities.

b

There is an awareness of the need for the acquisition of the skills necessary to live in the knowledge society: the ability to use technologies with a critical and critical spirit for training, work, leisure time and communication. . As a result, the role of the educational institution is also discussed.

Tecnologie 2.0 e didattica

Dibattito sul ruolo della scuola

➤ Valore educativo della cultura partecipativa
➤ Importanza delle competenze digitali «per partecipare»
➤ Eliminare il gap di partecipazione più che il digital divide
➤ Educazione alla partecipazione (Dewey, 1916)
➤ Educare alla multialfabetizzazione (competenze di lettura e scrittura)

c

It is evident that this has no longer the exclusive rights of a time in the construction of functional skills for the working, social and cultural future of citizens. Above all, if the teaching interventions must be aimed at avoiding the gap in participation in contemporary culture and in enabling new citizens to exercise their citizenship rights, in line with the New London Group's definition of the concept of education: "If it were It is possible to define in a broad sense the objective of education, one could say that its primary purpose is to ensure that all students benefit from learning in order to participate fully in public, community ... creative ... and economic life ".

d

The theme of participation education, already dear to John Dewey in his reflections on the relationship between education and democracy, is finding ever more attention. In the most technologically advanced societies, the problem of the digital divide, understood until a few years ago as access to computers or the broadband network, includes today the idea of an obstacle to participation.

e

The focus of teaching interventions is therefore moving from a technological problem to a question of multi-literacy, attentive to both reading and writing skills, in order to favor the ability to find, understand, create, information and communications in different contexts

Slide 40 (sincronizzazione testo)

Concretely, participatory culture and the concept connected to it, of connective intelligence, are the basis of the birth of many educational initiatives based on the logic of pedagogy 2.0. These initiatives include the construction of educational sets that bring the informal dimension closer to the formal one: in the more advanced European countries, the walls fall, the classes are redesigned or abolished, open

Tecnologie 2.0 e didattica

In concreto

... nei paesi europei più avanzati cadono i muri, le classi vengono ridisegnate o abolite, nascono open space e laboratori per i lavori di piccolo gruppo, la didattica prosegue fuori dallo spazio della scuola all'interno delle classi virtuali, le enciclopedie analogiche vengono sostituite da Wikipedia" ...

spaces and laboratories for small group work are born, the teaching continues outside the school space inside virtual classrooms, analog encyclopedias are replaced by Wikipedia	
Slide 25

The use of technologies must be directly connected, finally, to the physical spaces of the classroom, which in the application of a constructivist didactics, must assume a different configuration from the current one: the classes must be equipped with mobile benches, with variable geometry, according to the teaching paradigm employed, transmissive and asymmetric, or based on learning by doing. |

DIDATTICA COSTRUTTIVISTA E AULE
Le classi devono essere attrezzate con banchi mobili e ricombinabili, a geometria variabile, a seconda del paradigma didattico impiegato, trasmissivo e asimmetrico, oppure improntato sul learning by doing |
| Slide 42

In addition, the use of the LIM, interactive multimedia boards and other devices ... tablets, totems, electronic instruments for the recording of presences etc. used in a didactics enhanced by technologies and digital contents, to complement the school manual, must provide for integration between the real and virtual classroom. |

USO DELLE LIM
LIM e altri devices devono prevedere l'integrazione tra l'aula reale e quella virtuale. |
| Slide 43

For example, the functional teaching set for cooperative problem solving activities should be inspired by the overturned class ... flipped classroom ... a model used in the countries of Northern Europe and in the Anglo-Saxon language. |

FLIPPED CLASSROOM
Il set didattico funzionale ad attività di problem solving cooperativo dovrebbe ad esempio ispirarsi alla classe ribaltata, flipped classroom, modello impiegato nei Paesi del Nord Europa e di lingua anglosassone. |
| Slide 44

In fact, there are those who argue that in the coming years the most significant changes in the teaching processes will be due not only to the greater weight that the technologies will assume, but also to the integration, within the teaching practices, of a series of elements from professional and social activities.
So from a formal / non-formal relationship |

Tecnologie 2.0 e didattica |

a new educational scenario is foreseen, characterized by the following elements: permanent formation as a normal practice; learning processes integrated by network models; teacher as a mediator / organizer of the student-knowledge-technology circuit; loss of the value of certification / qualification, to the advantage of the real skills possessed by individuals.	
Slide 45 Finally, an approach of this nature is useful to avoid making young people believe that extra-curricular educational opportunities are better than those offered by the educational institution: if the two environments are compared, it is evident that the practice of the transmission lesson is based on the centrality of the teacher, can be extraneous and not involving those who daily use 2.0 technologies.	**Tecnologie 2.0 e didattica**
Slide 46 (testo sincronizzato) Certain of a change, guided by a methodological awareness, are important indications of Luciano Galliani, who remembers that there is still no scientific evidence on the effectiveness of the use of technologies in teaching / learning processes. According to him, the direction to follow must be directed to the creation of a procedural dynamism of learning through: a relationship between formal contexts of instruction for the purpose of teaching disciplinary knowledge, cross-curricular competences; non-formal training contexts (those of work organizations) in which skills and competences are acquired through professional practices; the informal context of family and social life in which interests are cultivated in leisure time ... music, games, sports, tourism, mass media and new media, etc. ... and we learn through experience and relationships with others ".	**Tecnologie 2.0 e didattica** ... *non ci sono evidenze scientifiche* sull'efficacia dell'uso delle tecnologie nei processi di insegnamento/apprendimento e come la direzione da seguire deve essere indirizzata alla *creazione di un dinamismo processuale dell'apprendere* attraverso, "un complesso rapporto tra i contesti formali di istruzione istituzionalmente e organizzativamente finalizzati all'insegnamento di conoscenze disciplinari, di abilità applicative e di competenze cross-curricolari, i contesti non formali di formazione propri delle organizzazioni lavorative, in cui si acquisiscono abilità e competenze tramite le pratiche professionali e il loro aggiornamento continuo, e il contesto informale della vita famigliare e sociale in cui si coltivano attitudini e interessi nel tempo libero (musica, gioco, sport, turismo, mass-media e new media, ecc.) e si apprende attraverso l'esperienza e le relazioni con gli altri" (Luciano Galliani)

Slide 47	
a	
The integration of formal, informal and non-formal activities can support teaching models based on the logic of involving the participants in the training process.	
b	
Through the breaking of the frontality of the lesson and the promotion of laboratory teaching, the student not only participates in the processes of knowledge construction, but can become the main actor in the educational process. In line with active teaching methods, employed, for example, in the past by John Dewey ;, Freinet, Freire, valued by the principles of constructivism.	
c	
These learning models, based on an active approach, can determine the construction of knowledge on a collaborative basis, starting from reflective practices necessary to solve problems. In this context, the recognition of the interests and skills possessed by the new generations is gaining importance in order to accompany their growth, through a functional use of their skills, technology, communication, creativity and collaboration.	
d	
A final reflection must concern the disciplinary contents, which, if faced with a 2.0 perspective, must exit the walls of the school, to get in touch and confront professional and social contexts: the school in practice must open itself to the ways of learning life real and pay attention to languages, tools, codes of social and work derivation.	
Slde 48	
In the sociological and educational field there are those who are questioning the ability of the expression generated by the user (User Generated Content ... and self-regulated) to contribute to the public cultural sphere through the overall growth of information and knowledge. All this	

certainly favors democratic processes: the greater the number of people able to create cultural meanings within a new form of digital citizenship, the more solid this participated democracy will be.	
Slide 49 All this is insensitive to the skills and competences that are the fruit of greater digital literacy. It is then evident that the phenomenon of widespread authoritarianism must invest the educational problem. If the student, as previously mentioned, must be the main actor of educational practice and if he wants to favor his active role, it becomes important to use teaching / learning models able to take into account this wave of "young authors" and the identification of educational strategies that consider students not containers to fill, but talents to encourage growth and potential.	 L'autorialità investe il problema educativo
Slide 50 Think of another social like YouTube. I do not know him well but reading the suopi numbers can no longer be overlooked. Disciplinary areas dealing with media ... media literacy, media education, media literacy .... they must enable students not only to engage in critical reading but also to become aware producers. Certainly the activity of production and collaboration meets both the favor of the students who in this way can represent their own interests using forms of expression close to them, as well as that of many educators by virtue of the social dimension that results. Doing involves the division of tasks into a collective work and directed towards the achievement of precise objectives. Communication skills, time management, accountability, ability to choose and make decisions on the part of the individual members of the group are important elements for educational activities. From the conceptual point of view, in the past, it was widely believed that	

the productions of the students could generate, through the repetition of the genres seen on television, a sort of ideological slavery through the naturalization of the dominant practices. In the last twenty years this approach has fortunately been overcome.	
Slide 51 We have seen how production and participation are dominant practices on the web and can not be overlooked by current discussions on the use of media in educational practice. This offers, therefore, new opportunities for research on media education, presents epistemological and methodological challenges for the social sciences as well as for the humanistic and pedagogical ones.	Produzione e partecipazione come pratiche dominanti del web che non possono essere trascurate dai dibattiti in corso sull'uso dei media nelle prassi didattiche. Ciò offre, pertanto, nuove **opportunità alla ricerca** sulla media education, presenta **sfide epistemologiche e metodologiche** per le scienze sociali come per quelle umanistiche e pedagogiche.
Slide 52 We have already said the importance of the contents generated by users in the knowledge society, in which consumption is exceeded and only reading activity in the direction of different activities, reading / writing / sharing / circulation. We have also said how all this must have a reflection in educational and educational practices. We have talked a lot about young authors and the need to identify teaching strategies to foster their growth and potential. I fully agree on this need ... it is important to maximize the cultural, participatory principles allowed by the web and new technologies. The ebooks certainly allow the application of these principles ... and in this direction you must consider this part of the course. Good evening	Conclusioni Giovani autori e e-book

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Dipartimento Studi Umanistici

Annex 5

TEXT_01 (GROUP 2)

Course   *Children's literature (academic year 2017-18)*
Module   *Children's literature and new digital technologies*

Prof. Anita Gramigna

18th October 2017

Name (without family name)_____

Registration university number: _____

ID number (by researcher): _____

The production of texts for children in the digital Era:
1. has remained stable
2. it has diminished
3. it has increased
4. it has only increased in the United States

From an educational point of view an e-book is considered useful:
1. for its lightness
2. for its portability
3. for the interactive potentials
4. for its versatility

The learning process of digital natives:
1. improves with the use of multimedia educational technologies
2. depends on the design of the teaching intervention
3. it improves if social and 2.0 technologies are used
4. improve if you use computer labs

The use of technologies in educational situations must be governed by:
1. aesthetic and communicative aspects
2. a psycho-pedagogical reflection
3. links with the students' media habits
4. use of digital and multimedia languages

What tools can play a role in teaching processes? (There can be more correct answers)
1. YouTube
2. Blog
3. Facebook
4. Wiki

Does participatory culture have educational value?
1. Yes
2. No
3. Yes, but only for young people
4. Yes, but only for adults

Web 2.0 can play an important role in educational processes:
1. because it is used by everyone
2. because it is used by young people

3. for its social and participatory characteristics
4. for its important technical qualities

Which of the following, according to Pierre Lévy, is not a negative effect of the web?
1. isolation and cognitive overwork
2. collective stupidity
3. search for educational information
4. addiction (from browsing or playing in virtual worlds)

The collective intelligence of Pierre Lévy refers to:
1. to school activities
2. to activities favored by the web
3. to university activities
4. to activities of educational policies

The authorial activities allowed by social tools have educational value?
1. Yes
2. No
3. Only those of writing
4. Only those carried out in formal environments

The school towards technologies:
1. he must fight them
2. he must protect himself
3. must approach
4. he must govern them

The so-called 2.0 technologies that allow authorial logics:
1. they are very complex
2. they have taken familiar forms
3. need programming skills
4. they need IT skills

The concept of the cultural industry of Adorno and Horkheimer in the light of the digital revolution:
1. it has strengthened
2. has entered a crisis
3. it has been exceeded
4. it remained unchanged

The theoretical paradigms on social networks:

1. born in the thirties
2. born in the 60s
3. born with the advent of digital
4. born with the advent of Facebook

Which of the following is not considered a social network:
1. Facebook
2. Linkedin
3. Google Chrome
4. Twitter

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Dipartimento Studi Umanistici

<u>Annex 6</u>

TEXT_02 (GROUP 2)

Course   *Children's literature*
Module   *Children's literature and new digital technologies*

Prof. Anita Gramigna

20th October 2017

Name (without family name)_____

University registration number:_____

ID number (by researcher): _____

a. You have to design a digital book for children. In the process of adapting from a paper book what will be the characteristics of the digital book?

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

b. Book or digital book at school? Motivate your choice.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

c. Give a definition of education

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

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<u>Annex 7</u>

TEXT_01 (GROUPS 3 AND 4)

Course   *Children's literature*
Module   *Children's literature and new digital technologies*

Prof. Anita Gramigna

24th October 2017

Name (without family name):_____

University registration number:_____

ID number (by researcher): _____

A digital book for children is effective:
1. if it remains identical to the paper equivalent
2. if it allows reading everywhere and whenever you want
3. if it is "increased" by the potential of digital
4. if it allows printing of pages

New millennium learners or digital natives:
1. they have superior multimedia learning skills
2. they live naturally in multimedia environments
3. they have superior cognitive abilities
4. they learn to program on their own

Cognitive technologies in teaching processes are tools:
1. that must enhance man's capabilities
2. that must lighten man's abilities
3. that must favor technocentric attitudes
4. that must favor multimedia attitudes

Is the participatory culture, daughter of the Network, functional according to Henry Jenkins to the teaching processes?
1. *Yes*
2. *No*
3. *Yes, but they are in non-formal educational activities*
4. *Yes, but only in university teaching activities*

The media in the perspective investigated must be considered for their value:
1. technological
2. instrumental
3. cultural
4. communicative

Communication and information technologies:
1. they have educational value
2. they can have educational value
3. they have educational value for adolescents
4. they have educational value for the more mature students

Can the concept of widespread authoritarianism have an educational value?
1. *Yes*
2. *No*

3. *Yes, but only for young people*
4. *Yes, but only for adults*

Which of the following in the indications of Pierre Lévy is not indicated as a negative effect of the web?
1. isolation and cognitive overwork
2. collective stupidity
3. search for educational information
4. addiction (from browsing or playing in virtual worlds)

The collective intelligence of Pierre Lévy refers to:
1. *to school activities*
2. *to activities favored by the web*
3. *to university activities*
4. *to activities of educational policies*

The authorial activities allowed by social tools have educational value?
a) Yes
b) No
c) Only those of writing
d) Only those carried out in formal environments

The school towards technologies:
a) he must fight them
b) he must protect himself
c) must approach
d) he must govern them

The so-called 2.0 technologies that allow authorial logics:
a) they are very complex
b) they have taken familiar forms
c) need programming skills
d) they need IT skills

The concept of the cultural industry of Adorno and Horkheimer in the light of the digital revolution:
a) it has strengthened
b) has entered a crisis
c) it has been exceeded
d) it remained unchanged

The theoretical paradigms on social networks:
1 born in the thirties

2 born in the 60s
3 born with the advent of digital
4 born with the advent of Facebook

Which of the following is not considered a social network:
1   Facebook
2   Linkedin
3   Wikipedia
4   Google+

Università degli Studi di Ferrara

Dipartimento Studi Umanistici

<u>Annex 8</u>

TEXT_02 (GROUPS 3 AND 4)

Course   *Children's literature*
Module   *Children's literature and new digital technologies*

Prof. Anita Gramigna

26th October 2017

Name (without family name): _____

University registration number:_____

ID number (by researcher): _____

1. You are an elementary school teacher. Would you use e-books to your pupils? If so how?

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

2. Book or digital book at school? Motivate your choice with concrete example.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

3. Write a definition of education (in the new digital envoinroment)

_____
_____
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Diploma supplement
CHILDREN'S LITERATURE

Academic year: 2017/2018
Teacher: Anita Gramigna
Credits: 6
SSD: M-PED/02

TRAINING OBJECTIVES

Transversal skills
It is a study that regards the creative and reflexive space of each person, which seeks the objective of building a highly specialized expertise in relational and emotional capabilities that the narrative, applied with pedagogical sensitivity, can and must activate. For this purpose, we will not forget to provide lexical coordinates and the discipline's epistemological framework, for critically orientating in a theoretical-practical sense inside the horizon of the themes faced.
Educational intervention involving new digital technologies (e-books mainly).

Knowledge
The theories are based on the principles of Pedagogy Narrative. To this end, we will propose the analysis and the application of a specific series of principles, strategies, techniques, and educational intervention's praxis:
3. narrative pedagogy in comparison with children's literature;
4. children's imaginary and narrative logic.
The course aims to build - along with the students - a highly specialized expertise, about the capability of educational intervention:

Skills
Starting from the application of the most innovative methods in the field of children's narrative. They will offer experiences of text analysis and creative writing: classic or through the principles of digital media.

PREREQUISITES

Knowledge of the basic conceptual and linguistic instruments.

COURSE PROGRAMME

Organization and specialized formative planning in the following significant situations:

10. The pedagogical analysis of examples of meaningful narrations on the formative point of view;
11. Elaboration of materials and worksheets;
12. The children's novel and the metaphor as a cognitive instrument;
13. The role of emotions in learning processes;
14. The valorisation of human resources between equals;
15. The aesthetic dimension of education;
16. Characteristics and paradigms of digital media;
17. Author concept and User Generated Content;
18. Technologies for digital books.

In the first meetings – of introductory character – we will discuss the general coordinates of the discipline, its role in the world of childhood, the new frontiers of educational research.

DIDACTIC METHODS

After the first meetings, of introductory character, all the lessons will have a mainly laboratorial character: case analysis.
Streaming of the lessons for Students who works or who cannot attend them, available through Se@ services.

LEARNING ASSESSMENT PROCEDURES

In each module there will be a multiple choice test.
The test consists in the writing of an elaborate on one of the program's topics.
Evaluation parameters: we will evaluate the capabilities of critical, propositional and planning orientation, between the themes faced during the course.
The *Children's literature and new digital technologies* module will provide for different assessment procedures.

REFERENCE TEXTS

Anita Gramigna, *Lo straordinario e il meraviglioso*, Roma, Aracne, 2015.
Luis Sepulveda, *Storia di una gabbianella e del gatto che le insegnò a volare* (qualsiasi edizione).