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How technology affects students' learning: an exploratory study on similarities and differences in school and home work between high school and university students

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ABSTRACT

This thesis aims to explain and show the different use of technology done by the students of the fifth grade of high school and of the university, in the field of learning. This difference is done both in the usage of technology at school or at university and in the use of it at home.

For this thesis, an ad hoc questionnaire has been made, administrated online. The sample of students who contributed to the research consists of 86 young adults. They answered 38 questions divided into the use they do of technology and technological tools at school/university and at home. This research is fundamentally focused on the attention, concentration, related to mental fatigue, and interest of young people in learning through technology. The results show differences between the students of the fifth grade and those of the university, in particular in the aspect of autonomy and freedom of use in formal contexts. Attention and concentration are stimulated especially at the university, also thanks to the ease of use and the speed of taking notes with technological devices. While for both groups of students, the prolonged use of technological means causes visual and mental fatigue. Most of the sample says that they are interested in technological innovation, even if they use it more in their free time.

INTRODUCTION

Technology has been part of our personal, educational and professional sphere for several years now, in every field we can see its influence, with always new innovations and cutting-edge technological tools. Certainly, the young people of today, those who belong to Z Generation, are the ones who were born with technology, with social networks and all of these tools are part of their daily life. In particular, the introduction of technology has led to several deep changes in formal contexts such as those of school and university, causing a change in students' learning both in class and at home; changes that have been mandatory and intensified since the advent of Covid-19 in 2020, which has led students and teachers of every order and degree to use technology every day to stay in touch and take lessons from home. This sudden change of doing lessons led to an awareness regarding the necessary continuous updating of teachers in the digital world, to be able to keep up and communicate with their students.

Because of that, this thesis aims to understand and know the students' learning change due to the use of technology in formal and informal contexts, so at school/university and at home, based on the comparison between students of the fifth grade of high school, called from now fifth graders, and university students, in order to discover the similarities and differences among the two groups of students in their use of technology, no one has ever made this comparison before. The main objectives are: discover the personal use of the digital tool done by sample students; the context in which they use the tool and the consequences in the use of digital. In doing so, the thesis is divided in six chapters, the first three are a general introduction to technology-related background in learning and leisure time, while the last three concern the study conducted with the exposure of the results obtained and their discussion. The first chapter, *Presentation of today's young people and their relationship with technology*, is a general presentation of Z Generation and its relationship with technology, which is daily present in young people's life; the second chapter, *The relationship with technology of fifth graders*, is focused on fifth graders and their relationship with technology both at school and at home, where it is expressed their preference in using traditional tools, such as notebooks and books, because they feel safer in learning the concepts to study, and there is also a reference to the need for training and updating of teachers in the field of technology, with the exposure of some reforms and initiatives to introduce technology in schools; the third chapter, *The relationship with technology of university students*, concerns the university students and their relationship with technological tools in university and at home for studying and taking notes, showing their

awareness over time of using technology and their ideas in combining the use of technological and analogical means to make the study more profitable; the fourth chapter, *The description of the survey*, is the description of the study with the aims and research questions formulated, the participants involved, the methods and instruments used in doing this; the fifth chapter, *The results obtained from the research*, concerns the results obtained from the questionnaire addressed to the students who participated to the research; and in the last chapter, the sixth, *The research's conclusions*, are shown the discussion on the results and the conclusion of the study.

This dissertation is based on the difference in reading through a screen or paper, exposed in Baron's book (2022), where the technological progress and development is updated and clear shown, and on the six categories of the User Engagement (UE) described by O'Brien: *focused attention, perceived usability, aesthetic appeal, endurability, novelty* and *felt involvement* (2016a) (O'Brien, Cairns & Hall, 2018), in order to understand the students' engagement concerning their use of technology. The sample of this research is composed by 86 students, 41 fifth graders and 45 university students; they are asked to answer an ad hoc questionnaire, built with Google Moduli, composed of 38 questions, 37 closed questions and one open, the last one, in order to know their ideas and perceptions about digital devices used in their own learning. In the results, all of these User Engagement's categories are summarized in three paragraphs concern the attention, the concentration related to mental and visual fatigue, and the ease of use of technological means. From this study have emerged different opinions about the digital world by sample students and it is interesting to know how they perceived the use of technology in their learning sphere, which is at the basis for their personal training. From these ideas it is important to remember that technology is part of our lives now and in the future, so it is fundamental to create a healthy and safe relationship with it, in order to keep up with times and know how to communicate with Z Generation.

CHAPTER I

Presentation of today's young people and their relationship with technology

1. Who are the young and why are they called Z Generation?

The young of today are all those people who have experienced a world characterized by technologies and digital environments, since their birth. They belong to a special generation, called Z Generation or Z Gen, which is composed of young people that today, in 2023, are among 11 and 26 years old, so they are born between 1997 and 2012. This generation belongs to the so-called *digital natives* because they have always been in contact with the digital world. Precisely, this term was invented in 2001 by the writer Marc Prensky, (Riva & Malighetti, 2020), to indicate the American generation of people born after 1985, the period of the mass diffusion of computers. In Italy, we talk about digital natives since the late nineties, only when computers and Internet started to be in most Italian homes. Howard Gardner (2014), (Bignardi, Marta & Alfieri, 2018), called them "*Generazione App*" (Davis-Gardner, 2014), because this group of people was born and developed with technology, computers and, subsequently, with social networks. All these new technologies are now an integral part of our lives.

Nowadays, the relationship between technology and young people is visible in the increasing use of Pcs and other technological tools, like smartphones and tablets, and, moreover, in the continuous development of new, increasingly innovative and attractive technological means, not only for young ones but also for their parents and older. Currently, we all own a phone, and thanks to this tool we can keep in touch with other people and always be updated on any event. Technology means speed, it is a sort of synonym, it is important to remember that Z Generation is the generation of "*tutto subito*" (Riva & Malighetti, 2020, p.47), this type of conception has developed, in young people, the need to get everything pretty much right away, all in one click of the keyboard, as if everything worked like Internet researches, which you get in seconds. In addition, the possibilities that technology offers to stay connected with friends, attract young people who feel a pleasant and reassuring feeling, which is defined "*beneficio della conessione*" (Bignardi, Marta & Alfieri, 2018, p.88).

Through the use of technology, Z Generation lives both a digital and a real life that enrich the process of the know how to be, the know how to do and the know how to become, everything to face the changing world (Bignardi, Marta & Alfieri, 2018). Each of these young people has a potential, that develops with technology which creates a suitable place to show

what they are capable of. This space is essential for them, because it reflects their needs and attracts them with numerous innovations, which are a fundamental part of their lives (Guazzone, 2021). An example of technology always developing are the social networks, which connected many knowledge networks on which these young people can rely in case of need, this is a practical function. The continuous creation of new apps attracts young who are naturally motivated to discover new things.

In the world of technology, one thing is for sure: the relationship between young people and virtual reality, the space shared with technology, is so close that they take it for granted and essential for their being and future development.

2. Z Generation develops with technology

As mentioned in the previous section, technology is particularly linked with Z Generation and this relationship not only concerns leisure, for example with the use of their personal social networks (es. Instagram, Facebook), but also the world of information and communication. Indeed, in the field of *ICT (Information and Communication Technologies)*, people have the opportunity to acquire a gradual competence in the use of tools and application software in order to find, interpret and exchange information, to organize and process it, to store them so that young people can develop their own ideas and present them accurately to themselves and others. Specifically, when we talk about technology, we refer to a discipline that "on the one hand, it studies and designs the devices, machines and apparatus that support the organization of social life, on the other it studies and designs new forms of control and management of information and communication"[1] (Sconocchini, 2010).

Technology has its origins, especially in the field of communication, with the computer invention, occurred in 1944 by the Ibm's engineers; the first computer was an automatic calculator called "Harvard Mark". Around the nineties, the introduction and development of technology has transformed this calculator first into an advanced typewriter and then into a communication tool. The developed countries had an economic boom throughout the 1990s, thanks in large part to the success of companies using digital technologies and the advances made by data transmission technologies (including computer, Internet and digital telecommunications networks). Already in 1999 almost all countries had an Internet

[1] Translation by the author

connection. At that time the digital revolution became global in all respects and during the 2000s the spread of digital technologies took place in developing countries[2].

Everything about technology, from the 90s until today is constantly evolving, meeting market needs, such as the creation of new software with certain functions or computers, which attract more and more young people to their use, despite the very high prices; these products are really lightweight and perfect to take to school, at university or at work. The demands of young people who use the technology on daily basis grows and manufacturers must be very careful to meet all their requirements. The introduction of technology brings continuous innovation and change, not only in the tools used but also in people's life, it changes the way people communicate with others and the way they work. A significant change occurred with Covid-19, during this period, technology was essential in every field, otherwise you would have been excluded from the world, in this sense, technology has had an important task and development.

Precisely because technology evolves with young people and vice versa, in the complicated period like that of Covid, computers, tablet and phones were essential to stay in touch with others and, in the school environment; different platforms have been used, such as Google meet, Zoom, Teams, to allow teachers to do lessons and students to communicate to each other. Taking into account two different researches, that of the *Sole 24 ore* newspaper and that of *SICuPP-Bicocca* (the collaboration of the Italian Society of Primary Paediatric Care and University of Milano-Bicocca), done between 2020 and 2021, it emerged that the time spent by young people of Z Generation in front of technological devices has increased by 67% during the first and the second lockdown, compared to normal pre-Covid situation. In addition, the adoption of a personal device, during the second lockdown, has grown to 58.4% against 23.5% detected during the first lockdown of 2020; these data show that technology, as well as being fundamental, has developed a lot in recent years and people, especially the young ones, have adapted and followed the change.

To understand the development of technology, you need to know its history, which is very wide but there are some key points: from the basis of the Internet's creation, in 1969, when the exchange of information, as it happens today, began by means of Defence Advanced Research Projects Agency (*Darpa*), of the United States Department of Defence, with the aim of making computer communicate within each other, regarding possible system malfunctions.

[2] https://courses.minnalearn.com/it/courses/digital-revolution/the-digital-revolution/

This network was called *Arpanet* (Advanced Research Projects Agency Network) (Riva, 2016, p. 43). From this date onwards, there have been continuous digital developments, like the invention of what became the *World Wide Web (WWW)*, by the British computer scientist Tim Berners-Lee, in 1989. The digital world spread rapidly and with it, Internet. Nowadays, more and more people use Internet to communicate, interact with others, so, we talk about *digitally literate people*, people who use technology in new ways and in an increasing number of areas of their lives. In 2020, more than a half of the world's population were active Internet users. This is the *age of information* and all people, especially young people, keep up with it and with all its updates.

3. Young people's interest in innovation

When we talk about Z Generation, we talk about innovation, so Z Generation is the innovation's synonym because it regards the connection between young generation of people and the continuous innovation in the digital world, that every year updates the programs and produces interesting news. Since its birth, "Generation Z has been profoundly shaped by advancement of technology" (Seemiller & Grace, 2017, p. 22); the people of this generation have always been in contact with technology and this is one reason why they are increasingly attracted to the innovation of this world. The attraction to digital is mainly related to the innovation of phone models, of new tablets and computers, with ever more advanced research systems and programs. The digital world arouses a strong interest in this generation also because it allows them to have access to an infinity variety of information and opportunities, for example in school, with access to digital books via computer and the use of the IWB, *Interactive Whiteboard*, and in the world of work, indeed, technological competence is increasingly required in different jobs and, through technology, it is possible to view many job offers, even in the world, not only in your country, because it connects the whole world on the net.

Furthermore, it is important to make a distinction about the different usage of digital tools: the digital ones used mainly in leisure time and the digital ones used for personal formation and learning, so involved in the learning process, as exposed below.

3.1 The innovation in leisure time

It is very likely that digital tools, especially phones, are preferred to use a lot in leisure time because of the usage of several apps, like WhatsApp, Instagram, Facebook, which are used not

only by young people, but also by adults (Riva & Malighetti, 2020). For example, thanks to WhatsApp, people can stay in contact with others, update and spend time chatting in relax. In addition, apps like Instagram and Facebook allow people to look other people's lives through the screen, watching photos and videos posted by them. While doing this, people lose track of time and, therefore, using these apps becomes a *leisure activity*, particularly appreciated by young people. Moreover, the use of updated technology and the tools related can help students in self-exploration of their values and passions, which is fundamental in the creation of themselves, electing positive and negative models, including through the use of social networks. Another app, which since 2020 keeps young people and not just them attached to the screen, is TikTok, which completely distracts people from what they are doing, watching funny videos that are viral. In all of these apps, there is a rapid response and continuous exchange between users, just through the screen of a phone and this is one reason because are viral between young generations.

Moreover, young people use a huge variety of applications, due to the usage of phones (Grenčíková & Vojtovič, 2017), and, in doing this, they achieve a "high degree of flexibility, responding to changes and adapting to new requirements and conditions in corporate strategies" (Grenčíková & Vojtovič, 2017, p.562). For example, in a platform like Instagram, any young person is in search of itself, identity building, social confrontation, self-esteem, body development and corporeity, which are all aspects that characterize young people's life, so, in this case, the app is conceived as a kind of opportunity to form themselves. In addition, they can have a social life comfortably at home, preferring it to the real social one, even if it is not healthy (Riva & Malighetti, 2020). In this way, it is important to remember that the idea of sociality has changed a lot over the years and the use of digital tools has brought personal and social changes in today's young people.

3.2 The innovation in the learning process

If digital tools can be perceived as means for leisure activities, mainly at home, at school and university things change, indeed, in the field of education, students use technology for their learning process. In this case, tablet and Pcs are used to take notes and study, it can be said that they are used in a more *formal way*; here, the innovation in systems used is fundamental, in order to allow students to be faster and faster in writing and in finding the necessary information to study. In addition, the communication via net is preferred by students because they can be

connected with lot of people at the same time and they can, for example, study together and they can mingle with each other, without meeting in person, so it supports and streamlines many day-to-day activities (Vaportzis, Clausen, & Gow, 2017). Students are also attracted by the novelty, curiosity and interest in the interactive tasks proposed by the digital world, but also by the visual appeal of the interface of the digital tools (O'Brien, Cairns & Hall, 2018).

Browsing the Internet and the use of technology allow students to have access to many sources, such as books in online libraries and thus, to optimize study time. All of this is possible through the use of digital tools, which strongly influences the world of education and personal training of young people. In particular, at university, students use both tablets and Pcs because, as opposed to notebooks and paper books, inside is contained everything necessary for lessons and study with little weight and write fast.

Moreover, the connection between people is useful not only to students, but also to teachers, who, with the use of digital means, have everything at hand and can stay in touch with students at any time of the day. The use of digital tools is engaging and motivating, it is a way to be closer to the reality of young people of today. Indeed, young people are able to express themselves very freely, mainly in the school and family context, where both parents and teachers try to help them form themselves and communicate with others. These educational figures have the task of promoting interest and active participation in the life of young, establishing strong and unique ties and supporting them. Positive and supportive relationships are essential for young people who always look for signs of approval in adults (Bignardi, Marta & Alfieri, 2018).

Returning to the starting point of this paragraph, the interest of young people in innovation grows more and more, basically because they are attracted by new models of phones, tablets and Pcs, their aesthetic appeal is one of the main features that attracts young people. Also, the ease and speed of use of these tools lead young people to prefer them, compared to classic notebooks (O'Brien, Cairns & Hall, 2018). In addition, digital tools are able to keep people in touch and this is one of the favourite things of young people, who seek for it, particularly, they want to connect themselves with family and friends in social circles, which allow the communication from great distances through the digital medium. When people are connected to each other, they create a *bridge,* which is a tie between them (Vidhate, 2020). As has been shown, technological innovation crosses many fields of people's lives, it is very important both in leisure, with the use of some specific apps and social networks, both in the

field of education and training, the so-called *formal*, with continuous updating of systems and tools for teaching that allow proximity to students.

4. The benefits brought by the use of technology

"The environment in which we live is strongly influenced by new technologies and techniques, as well as new applications implementation" (Grenčíková & Vojtovič, 2017, p.562), all the world is conditioned by the use of new means of communication and, therefore, the way in which people communicate is changing rapidly. As said in the section before, young people are naturally attracted by technological tools and these ones allow connectivity, centrality and time. In order: connectivity regards the connection between people all over the world; centrality means the first-person use of the digital tool and, finally, the time regards the possibility of being always in contact with others, without any time limits (Vidhate, 2020). The possible benefits that the use of technology brings with it concern both the field of learning and that of communication.

4.1 The benefits in learning

With regard to the learning of young people, one of the positive things related to the use of technology, both at school and at home, is the easy access to information through digital means and the ease in using them. The possibility of use a phone or a Pc could improve various skills and abilities, such as the ability to do multiple things at the same time, as writing and surfing the net in search of information, these tools permit a multifunction. In addition, the feeling of involvement and motivation in acquiring new information through the use of digital tools are related to technology. This can be a point in favour of using technology in class, so as to involve more students in the explanation made by the teacher and interest them in the topic treated.

Besides this, in the digital world, as already said, the use of social networks or other apps leads people to lose track of time because they are embedded in the virtual reality created by the technological medium, that could be a bad thing, but, at the same time, these social platforms can be used for learning. Indeed, here, people are engaged and interested in the use of them, looking at the screen. Most of the time, the deep involvement in the use of digital media entertains young people, that is a very positive feeling. The more they understand how to use and create familiarity with them, the more they will be advanced because technology is fundamental for the creation of their future. In fact, another place of extreme importance in

which technology develops, as already written in the previous sections, is the world of work. In the professional field there are several programs which provide training of employees to the use of technological means, two examples are: the *group communication support system* and the *group information support system* (Albeggiani et al. 2015; Scotti & Sica, 2007), with the aim of making employees cooperate in companies (Riva, 2016, p.111). In addition to work, the school has also adopted technological tools such as the IWB to be used by teachers to explain, in cooperation with students, or the online register, where parents can see the results of their children accessing to it with username and password unlike the now obsolete paper register. These are some of the examples of technological evolution which obliges both young and older people, as parents and teachers, to inquire about how technology works, because otherwise they would not be able to keep up with the continuous innovations and updates. Now it is a fact: no one can escape from technology and the use of it in school lays the foundation for the world of work.

Furthermore, it is true that it is difficult to be always up to date on the world of technology, but it is important to try because the future goes through technological advances. An example of the technological importance in our lives is the simple introduction of smart working, due to the pandemic situation started in 2020, led to a rethinking of working methods and the way to consider the technological education to be able to connect to the network. There is a need to be more familiar with the access to data processing and the management autonomy of the processing of information, everything related to the technological education of both young people and adults (Labriola, 2020). The advent of these new technologies in the workplace is a continuing challenge for adults, because they foresee a change of behaviour in organizing and managing the work, as in the case of teachers for online connection with students. Here, teachers had to rely in every way on technology, perhaps without having great skills in the use of this but to continue to work and communicate with students had to recognize in technology the only way.

4.2 The benefits in communication

Together with the field of learning, there is the field of communication. Through technology, a lot of communication happens online, called *Computer-Mediated Communication* (CMC) and it can be synchronous or asynchronous: the first one takes place in real time between the issuer and the recipient, such as a videoconference, thanks to the use of apps like Google Meet or

Zoom; while the second one allows people to choose when to participate in the interaction, an example of this is the email. There could be three reasons why young people choose to use technology and with this, the Internet network: need for information, need for connection and need for friendship; the first case is the need to be informed about what happens at that particular time; the second case is the need to be connected with the world; whereas the last case is the need to stay in touch with old friends or make new ones. Obviously, the technology has to be used with moderation and responsibility and, in this way, can be an extra way to communicate and update (Ozenda & Bissolotti, 2016).

Basically, the use of technology can satisfy different needs of people and offer a response to each of them, this is one of the explanations of the success of it among the young people of today. The possibility of making friends without the obligation of a face-to-face dialogue is a great opportunity, which brings people to use digital tools more and more. In the world of today, young people, but not only them even the oldest one, manage online friendships increasingly, because now you cannot live without technology, otherwise you are excluded from the world. An example of this statement can be WhatsApp: in this social network a group of friends who know each other can organize themselves to go play football, or can text in peace without encountering strangers, this applies to both young and old people and this is a very convenient way to chat. Through digital communication, students, for example, can contact their mates to discuss the homework to be done or to study together, using a computer display, stay comfortably at home.

On the contrary compared to young people, to understand the change, adults must abandon the previous behaviour and this process is called *unlearning*, "that leads to subtracting something from an organization's existing store of knowledge" as argued by Argyris and Schön (1996). For young generations, this process of learning new skills does not happen, because having been born with technology, they have always had the opportunity to learn and develop new skills so as to move easily in the world of technological innovation; indeed the technological world does not complicate things but facilitates and speeds them up (Piazza, 2019) and it is a great thing to take into account for today's generations that will be the adults of tomorrow. And, in particular, the thing that most attracts young people to the world of the net is that technology allows to communicate with people very distant from each other: people can communicate with family or friends regardless of the geographical distance and everything is totally free, it is really useful. (Bixter, Blocker, Mitzner, Prakash & Rogers, 2019). All of

these benefits brought by the technological world open the door to different possibilities, already understood by generations of young people, who today can only improve interest in the technological world that will increasingly be part of their lives and those of the whole world.

Eventually, the presence of technology and its innovations has brought many changes in the current world and will continue to bring them because it is constantly evolving. The more familiar you will be with technology and the more opportunities you will have for work and personal training in the near future.

5. The other side of the coin: the drop in attention

If on the one hand, technology brings with it innovation and interest on the part of the generations, especially the younger ones, on the other hand, the continuous use of digital tools leads to a decrease in attention and concentration both in the formal sphere, as at school or at home while studying, and in the informal one, as during the use of different apps, because people are immersed in their virtual world and do not realize that time passes. This other side of the coin is fundamental, because unfortunately too much technology does not always lead to positive consequences. It can certainly be a valuable resource in many situations but can become a source of problems. However, it must also be considered that "the attention of students in class has certainly not been put at risk by the advent of the smartphone: even before the problem was well known and defined as *wandering*, that is, distraction, daydreaming"[3] (Lloyd, 1968) (Wammes, 2019), (Petrucco, 2021, p.111); but while wandering is a phenomenon that is innate in the mental life of each person and does not require any cognitive activity of interaction, on the contrary, activities with the smartphone require a significant cognitive commitment due to the continuous management of feedback required, for example by social networks, and aggravate the problem. So, in general, the use of technological devices can be a distraction, especially during lessons at school. The main push to use these could be due to the need for validation and control of one's self in the social networks in which one is present up to get to real syndromes like that of *FOMO (Fear Of Missing Out)* or the fear of not being constantly updated and looking for forms of reassurance in the continuous search for feedback and new posts (Elhai, Yang, & Montag, 2020).

Technology gives people so much more material to work on, and it gives everyone an often more efficient and effective way to achieve the desired result. But there are cons that are

[3] Translation by the author

useful to keep in mind, indeed, often dealing with computers, tablets and interactive programs are a distraction for young people, this is also the opinion and perception of some teachers. Too many possibilities and too many stimuli often struggle to get the expected result in school. Moreover, the inequality of access to technological means outside the class is certainly still high, so that not all individuals are equally comfortable with the use of such tools, risking to have less chance of excelling than the mates who instead every day have to deal with devices of all kinds and types[4], it is very important to take into account the context in which students are. In this sense, the task of parents and teachers is to provide technological education to young people, thus increasing the pros and decreasing the cons in this field. As for the distraction caused by the use of technological tools, young people, who are used to using devices for much more fun things, such as chatting on social networks, play online games, write instant messages, not many would be able to focus on learning and this could slow down the lessons and therefore the teacher's explanation. But, in this way, it is also the task of the teacher to have the ability to capture the attention of the student: it seems that students turn their attention to the smartphone especially when they are bored by the lesson (Green, 2019) or when they treat concepts considered less important (Bolkan & Griffin, 2017). In addition, there is a risk that too much use or abuse of technology can lead people to be dependent on it and not be able to do without it during the day, and this is called *smartphone addiction* or *problematic smartphone use (PSU)* (Kuss et al., 2018); but with the right technological education, this can be avoided or at least contained.

Not only the school environment, but also leisure and entertainment are other fields that have been influenced by technology. Video games, digital streaming platforms with a multitude of series, movies and entertainment are an example, to date there are very few people who can live without using and watching them. However, based on research conducted by *Osservatorio scientifico della no-profit Movimento Etico Digitale*, published in *Sole 24 ore* newspaper, the growth in the use of technology by young people has increased since the pandemic period, in 2020, and continues to increase even today. According to the research numbers, 79% of young people between 11 and 18 years, so the youngest of Z Generation, spends more than 4 hours a day on social media, 28 hours per week, 120 hours a month. For example, it emerges that they unlock the phone at least 120 times a day, and they use it, in addition to being connected to their peers via social media, even to watch movies or listen to music late into the night. A special

[4] https://uniserblog.net/2018/01/04/i-pro-e-i-contro-delluso-della-tecnologia-nellambito-educativo/

attention is paid to the fact that for at least 2 hours a day they do not want to be disturbed, thus remaining in their *online world* and limiting contacts with the outside, creating an addiction to digital tools. Through the digital tool they isolate themselves from reality and, as consequence, young people have declines in attention and concentration, especially in formal fields like at school. These are consequences of a *Behavioral Addiction*, which leads to behavioural disorders and a psychological dependence on digital tools. As for the drop in attention, there is a particular disorder, called *attention deficit disorder* that results precisely from the excessive use of technology, even when it is not necessary, and it is a disorder from which subjects do not realize that they are affected.

Taking into consideration the research carried out by the University of Padua on 93 master's degree students on the problem of attention's deficit during online classes in the pandemic period, it emerges that more than 50% of young people say they are addicted to the use of mobile phone and use it during lessons to consult social networks or to surf the net. In particular, the age group most involved in this type of addiction is that from 16 to 25 years, so precisely the centre of Z Generation. It was found that on average 50% to 70% of students control their smartphone at least once during a lesson and few manage to resist the temptation (Atas & Çelik, 2019). Furthermore, students said that a sound or a vibration felt during the lesson or while they are performing a task that requires attention reduces the performance as much as active use of the instrument (Stothart et al., 2015) even the physical presence of the smartphone is a critical factor and significantly reduces the cognitive availability of our brain (Ward et al., 2017). There are several researches that have dealt with this phenomenon of the decrease in attention, that although it was present before the advent of the phones and technological devices, certainly over the years it has increased and especially in the last period since the spread of Covid-19 (Petrucco, 2021). But, as was mentioned at the beginning of this paragraph, field researches confirm that the attention drops naturally and has a variable duration even without the interference of technological means. Recent experimental evidence shows how attention increases rapidly during the first 10-20 minutes and then decreases slowly until at the end of a lesson (Bradbury, 2016). Obviously, as already demonstrated, the use of technological tools accelerates the drop in attention and concentration, because they are a source of distraction. But, in any case, even the teaching methods chosen by teachers for the presentation of the lesson are fundamental, because a boring and not very engaging lesson will encourage the student to get distracted with the phone or other technological means. So, this

problem of didactic strategies overlaps with the distracting effects of the digital means during lessons, everything is related.

To conclude, it is true that the drop in attention is not only due to the use of technological devices but is a natural thing of the brain after a certain period of time. However, with the right instructional strategies on the part of the teacher to engage students and motivate them to follow the lesson and the commitment in this by the young people, will ensure to increase the time of attention and concentration in the class, almost completely excluding distraction by technological means not aimed at learning.

CHAPTER II

The relationship with technology of fifth graders

1. Development of technology in schools

Humanity has been asking for millennia about the relationship between technologies and knowledge and how technological innovations can change the process of learning and sedimentation of knowledge itself (Gui, 2019). Today, the new media are the ultimate expression of the social phenomenon of globalization: contents travel on the net beyond national borders and contribute to change both our way of thinking and our place in the world (Primerano, 2022). With the advent of digital technology, young people have become well-adjusted to using digital tools, such as the Internet; according to a 2015 Pew Research Center report, 92% of teens going online daily (Wartella, Rideout, Montague, Beaudoin-Ryan & Lauricella, 2015). Precisely because technology is central in people's lives, since the late 1980s, it has also been introduced into the school world, with different periods of downtime and development. In recent times, technology has taken an even wider position thanks to the role of the school, which has integrated the technological tools for education and training within its environment, both for teachers and students. In this kind of new learning environment, there is the interactivity of the student and the mutual exchange of skills between the latter and the teacher. In the classroom, the enhancement of technological tools has found full and concrete satisfaction in a typical learning context. The introduction of digital in school has brought many changes and has laid the foundations for new awareness regarding the education of young people through digital means.

About the digital at school, it starts of been spoken in 1984 with the publication of the article "*Il computer a scuola. Un vero trionfo*", by *La Repubblica* newspaper, introducing the use of computers in the school context. As regards ministerial initiatives, in 1985, the first National Informatic Plan was inaugurated; years later, in 2015, the *Piano nazionale scuola digitale* (PNSD) was launched with the definitive transition to the *digital school*, with the aim of bringing digital innovation into the school sphere. Everything connected to digital is conceived as positive and bearer of novelties. In particular, the PNSD planned to use billions of euros to finance technology at school, but, unfortunately, to date after years of investments, almost all the objectives that had been set have not been achieved. This has happened because of many variables, such as political, social, economic and technological, and the picture

emerging from international studies is fairly homogeneous in pointing out the low importance of the introduction of ICT on learning levels (Candreva, 2021). The introduction of ICT in school serves mainly to adapt the teaching to the new digital natives and this is also producing a change in cognitive parameters and in the meaning of learning by those who learn. Indeed, comparing the typical frontal lesson with the innovative digital one, it results that the former is much more boring and less engaging for students, while the latter is more interesting but can lead to a much higher distraction.

Some data testify that from 2015 onwards, there was a strong acceleration towards digital teaching in the classes: the classrooms with a wi-fi budget went from 9,3% in the period from 2010 to 2011, to 52, 3% in 2013-2014, to 74% in 2017, taking into consideration that in the high schools this percentage is close to 85% (Candreva, 2021), a really important growth; with the consequent introduction of new systems, new orders and new production methods[1]. Obviously, the school has adapted to cultural change, characterized by immediacy, spontaneity and occasional. The main characters of technological innovation and the first to use the tools are the young people and the use of the latter is seen in a particularly positive light. Digital is seen as one of the main driving forces of the knowledge and school revolution (Gui, 2019). "The network is increasingly seen as an environment where knowledge is built together in a collaborative way"[2], as said by Moricca (2016) cited in M. Gui (2019). Digital technologies are conceived as improving the effectiveness of disciplinary teaching but also for the dissemination of new skills, necessary for the exploitation of these. Two main objectives are assigned to technologies: developing digital skills in young people and increasing the social inclusivity of the school, towards the most fragile students. Indeed, it is expected that technologies can make the school much more attractive and involving less motivated students or the ones who comes from disadvantaged backgrounds, in order to keep them within educational pathways until compulsory school completion. But to do this, the whole cannot be entrusted only to the technology, also the formation of the teachers is fundamental.

When technologies were introduced in teaching, they were a challenging endeavour and despite interest and investments, they are often not productively used in schools on a larger scale. Such limitations become especially important in today's reality where more distance and blended learning practices are promoted in schools. Therefore, the preparation of teachers to

[1] Vocabolario Treccani in *Il digitale a scuola. Rivoluzione o abbaglio?*, Gui, M. (2019)
[2] Translation by the author

combine technological, pedagogical and subject knowledge is becoming more crucial in teacher education (Ley, Tammets, Sarmiento-Márquez, Leoste, Hallik & Poom-Valickis, 2022). It is true that teachers welcomed technologies with open arms with the hope of lightening their work and involve students more. But unfortunately, the lack of their training has led to the non-use of technologies in the classroom, perhaps limited only to the use of the IWB for the projection of the textbook, or to their wrong use. If it is used correctly, "the IWB can become a real surface where to organize, break down and build knowledge, using not only the narrative and descriptive dimension of the book, but the plurality of new languages"[3] (Lazzari, 2017, p.58). According to data, in the decade from 2007 to 2017, there was a lease of founds in digital technologies and related training for the Italian school, with the new National Digital School Plan (MIUR 2015). In addition, with the *EU2020 strategy*, the European development strategy, outlined in 2010, has focused on technologies, innovation and improvement of living conditions; with the aim of developing these three fundamental factors for the formation of the individual, within ten years. So, the innovation with technology is the centre of people and students' lives and, as regard the teachers' relationship with technology, it has emerged that they prefer to use it at home, for example to prepare material for the lesson or to surf the net, they are very cautious in bringing technologies in class (Gui, 2019). The main problem of training teachers in the use of digital is that this, despite the various initiatives implemented since 2015 with the new PNSD, focuses on technological means and not on media education. For this reason, teachers are very insecure about how to approach students through technology. In general, teachers' use of digital tools is usually technically basic and supports traditional teaching models, but, as educators, they have a fundamental role not only in teaching but also to serve as role models for information- and communication-based teaching (ICT) (Amhag, Hellström & Stigmar, 2019). In support of this, a work developed by AGCOM (2019) with teachers of Italy, with MIUR's 2017 data, shows that they prefer to use digital for the consultation of digital sources and content (47,3%), for slides' presentation (29, 3%) and for the verification and evaluation of students (28,9%); instead, the activities of sharing digital material between teachers and students are less widespread. Specifically, to support innovation and technology transfer processes, in 2021, it has been presented "Italia Domani", the PNRR (Piano Nazionale di Ripresa e Resilienza)[4] education chapter; with a particular investment in

[3] Translation by the author
[4] https://italiadomani.gov.it/it/il-piano/missioni-pnrr/istruzione-e-ricerca.html

integrated digital teaching, training on the digital transition of school staff and new innovative skills in new classes and laboratories (Garavaglia & Petti, 2022).

In conclusion, it is essential to educate teachers in the use of digital in class in all its functions, in order to be closer to students and to involve them in the world of school. Without forgetting that teachers themselves can learn from their students, the digital natives.

1.1 Digital attraction: BYOD of the National Digital School Plan

BYOD is the acronym of *Bring Your Own Device* at school, it is an objective that was proposed by the PNSD in December 2015. Supported by MIUR, it is the 6th point of the action plan of the *Scuola Digitale*. This was conceived because the school's digital transition provides for a solid investment in the creation of digital environments in school spaces, while promoting a lightweight digital classroom vision, so that each class is ready to host teaching methodologies that make use of technology. The BYOD concerns the policy that the use of personal electronic devices during teaching activities is possible and effectively integrated. This must address the different themes, which include the coexistence on the same personal device of occasions both of teaching and for sociality, the security of interactions and the technical integration of personal devices with the provision of school spaces, inclusiveness and funding models for personal. As is already the case in other countries, the need to ensure the smooth use of learning environments by means of uniform devices, ensuring a controlled level of safety, with the possibility of opening up to flexible solutions, needs to be balanced; that allows students and teachers at the school to use a device, even their own. Initially, this issue was addressed very drastically, generally closing to any possibility of mixed use, without discriminating between the bundle of activities potentially carried out in school's environment. MIUR, to promote the Bring Your Own Device, has developed specific guidelines with clear standards and practices, identifying possible mixed uses of private device in the plurality of school activities, from the compilation of the electronic register to participation in project activities between students and teachers (Ministero dell'Istruzione e del Merito, 2015).

Because of the important economic investment that must be made to ensure the introduction of technology in school, the BYOD could be the key to give sustainability to the interventions of insertion of own touch devices in schools and, if it is accompanied by prudent support policies for unprivileged students, could really help to support these expenses (Lazzari, 2017). The trend to the BYOD approach was then confirmed by the 10-point decalogue for the

use of mobile devices at school, elaborated in 2018 by MIUR[5]. This decalogue lists some principles that push to leave freedom to teachers and on the use of digital mobile media within the classes. This assigns freedom to schools to regulate the use of phones and tablets through a policy of acceptable use and individual teachers to assess the concrete opportunity of their use. In the decalogue it is argued that: "Digital transforms learning environments. The possibilities of learning are expanded, both for the attendance of digital and shared environments, both for the access of information, and thanks to the continuous connection with the class"[6] [MIUR 208] (Gui, 2019, p.70). However, in the text are also made present the limits of the constant presence of phones in class, indeed, it is necessary to regulate the ways and times of use and not use of these tools to learn to recognize and keep separate the dimensions of the private and public. Unfortunately, in 2019 there was a stalemate in Italian policies in information technology and digitalization and this goal has not been carried out. This happens precisely when the daily life of students is increasingly pervaded by the use of technologies.

There are really different positions for and against the BYOD, but the main problem concerns the confidence in students' self-regulatory skills. There is a fear that the use of personal tools in class can distract students from teaching activities and lead to the use of social networks or videogames prohibited at school and, therefore, they are not used for the purpose for which they were brought. Thus, in this sense, it would seem advisable to protect students from a constant presence of these means during daily school life. But, at the same time, it is appropriate to allow teachers the freedom to use them at specific and limited times, both for teaching activities and for development activities of a conscious use of the same phones (Gui, 2019). Very often it happens, as shown by field research, that teachers are against adopting tools that they consider harmful to concentration and anti-educational for their students (Candreva, 2021). Today, the use of phones in formal learning contexts represents a potential distractor, but this behaviour would also depend on the teacher's ability to capture attention in students: it seems that students turn their attention to the phone especially when they are bored by the lesson or when they are treated concepts deemed less important. When BYOD is used as a tool during specific learning activities, leads the student to manage two simultaneous and challenging tasks from the cognitive point of view, namely follow what the teacher is saying and at the same time, operate with the device. According to recent researches, this multitasking

[5] https://www.latteseditori.it/images/blog/pdf-scaricabili/DECALOGO_DEVICE_-_BYOD.pdf
[6] Translation by the author

activity is frequent and inevitable and can have a negative impact not only on the attention but also on memory, on the understanding of contents treated and on the efficiency in competing a task. Thus, the risk to learning processes are high. There is a considerable research literature showing how students who do not use the phone in class are able to take notes more effectively, to remember a greater number of contents of the lessons and to perform better overall than those who use it (Petrucco, 2021).

The concept of BYOD is very positive in terms of minimizing school's costs in technology investment and especially with a view to technological innovation at school, but attention must be paid to the cognitive impact that the use of these devices can have in students. In addition, to achieve the goal, also teachers must have developed technical skills in managing these devices, in order to help and control students in using them. Eventually, the Italian government is trying to work in giving all Italian institutes adequate technical infrastructures to have good access to the network; indeed, unfortunately, in particular in inaccessible places, there are still many institutions that do not have them and this greatly limits the use of digital devices (Garavaglia & Petti, 2022).

To conclude, certainly it cannot be denied the importance of technological process, which is nothing more than the outcome of continuous social evolution. In the case of school, technological innovations have often given rise to exaggerated expectations of change, this has been overestimated. The expectation for the digital at school concerned a role of triggering the educational innovation. But we are still too early in this process to draw definitive conclusions; the change in the school environment due to technologies has not yet happened and therefore it cannot be said whether these are of positive or negative impact. An example is the e-learning that still a long and hard journey: the uncertainties in this area are still many and the school system has yet to define guidelines to allow the success. Digitalization has been a disruptive innovation for our societies and the school's task is to help all of us to critically analyze this huge change and prepare the next generations to be users of the tools through which culture is created and conveyed. It is wrong to think that digital technologies would change the fundamentals of teaching and the mechanisms of learning. From the didactic point of view, digitalization is not a revolutionary but incremental enrichment of the tools that it has at its disposal to educate its students (Gui, 2019). In this technological revolution, it is hoped that new generations of teachers can receive adequate stimuli to acquire those digital skills that will serve themselves to guide their students to develop the necessary abilities to consciously inhabit

the world of information and communication. Despite the introduction of technology, among the tasks of the school will still be promote in each student the critical skills of an aware use of the means and to develop its autonomous and creative use of them (Lazzari, 2017).

2. The change linked to the COVID-19

Today, fortunately, we are officially out of the pandemic emergency caused by Covid-19, a situation that will be told in history books. The restrictions that followed in this period have not only put public health in difficulty, but they have changed the way of live and the communication of the whole world. Here, technology has been fundamental in any field, such as in work, school and personal sphere; in the latter, it mainly mediated communication and allowed people to stay in contact despite the obligation to stay at home, communication has taken on an even more virtual dimension (Primerano, 2022). But, in addition to this, technology has allowed everyone to continue to work, although in smart working and, in particular at school, in spite of many difficulties, teachers and students have managed to move forward with the program. The health emergency has led the school community to accept and face a new social challenge regarding the teaching methodology that has inevitably impacted, from the psychological point of view, teachers, parents and students. At the beginning of the pandemic, in March 2020, the entire school system has been put to the test, leaning towards new social constructs and new ways of teaching and therefore, the transmission of knowledge. The main actors exposed to the pandemic effects in school are teachers who, in absence of unambiguous and one-way ministerial guidelines, faced an emergency situation of very wide and unprecedented proportions. As evidence of this, a 2020 survey, conducted by the Società Italiana di Ricerca Didattica, reported the testimonies of many teachers involved in the complex process of school readjustment, grappling with the *Distance Learning or E-Learning*[7]. Specifically: about 82% of the teaching staff were engaged in special training courses on distance learning and about 3,8% had to implement interventions in the use of strategies and teaching resources.

Taking into consideration teachers' point of view and to understand their perceptions about this situation, many researches have been done, one of them conducted by the research group of the chair of experimental pedagogy of Perugia University. This showed that 61,1% of teachers used the online teaching methodology from the beginning, while the remining 11%

[7] In Italian: *Didattica a Distanza* (DAD), translation by the author

was not able to use shared platforms with students or did not have the multimedia materials. Therefore, many teachers have used traditional lessons transposed online in the measure of 25,2% or sent the teaching material in the extent of 20,7% (Primerano, 2022). In addition, there were many other factors that made the distance teaching difficult, such as: the lack of human relationship and emotional and relational involvement, the intervention of parents from home, the ease of copying during class tests, the lack of participation by students, the Internet connection that in some cases was absent, the low concentration of pupils and the possibility of absence without teachers' supervision. Certainly, there were other factors depending on the age of the students and the context in which technology and innovation were used. Moreover, there were difficulties not only on the part of teachers, but also on the part of students, indeed, based on the above study, it has emerged that students had problems with limited Internet connection, decreased attention and concentration because of too many hours spent in front of the computer screen, increased class tests and homework and even poor understanding of requests from professors.

The pandemic has brought out the fragility of the school but at the same time, it had the merit of bringing it back to the centre of the public debate, agreeing that technological innovation was needed. With distance learning, the teaching methods have completely changed, but everything has taken place in a framework of legislative confusion and without adequate priori training. In most cases, teachers have simply replicated the practice of the lesson at a distance in the classroom, showing the desire to maintain a direct relationship with their students. But the more people went on with restrictions, the more they became familiar with this new way of working and learning. Indeed, as supported by the Ministry of Education, this experience of videoconferencing has facilitated the use of teaching methods more focused on the protagonism of students and their cooperative work. It is clear that with e-learning, the premises of the digitalization of the school are fulfilled and strengthened. It is not simply an emergency parenthesis, but a step towards a deeper transformation of the entire educational system, based on technological innovation (Candreva, 2021). The school apparatus in facing this sudden didactic experimentation deals with the opportunity to lay the foundations for an important efficiency of its educational, pedagogical and didactic mission (Di Palma & Belfiore, 2020). It is possible to say that from the beginning, teachers have shown good will and effort in the use of online teaching, engaging in the presentation and sharing of platforms, application and digital materials. Faced this situation, the school has proven to be able to exploit the

potential of both media and technology. The problem is to ensure that all this does not remain episodic and extemporaneous, so that it continues over time. For this reason, the commitment of teachers goes in the direction of not making technology something spontaneous and improvised, but something thought, designed and studied within the teaching and learning processes (De Vitis & Tempesta, 2022). Clearly, the path to e-learning is still long and tortuous: the uncertainties in the historical context as the one in which we are living are still many and the school system still has to refine and redefine the essential ways to involve and interest its students (Primerano, 2022).

3. The correct use of technology in class: suggestions to not strain students

In Italy, the focus on research and teaching has had a rather troubled history, unlike what happened in other countries such as the Anglo-Saxons. Still today, this delay weighs in the little importance that is attributed to the international didactic research in our country, in the innovation field. But, as demonstrated in the previous paragraph, with the pandemic caused by Covid-19 there has been an acceleration in the use of technologies and therefore a push towards innovation. In school, it emerges the growing need to provide all students with methods, tools and skills that enable them to relate effectively to an increasingly accelerated and complex society, in which digital technology mediates new needs and educational and pedagogical challenges. School must adapt to change and overcome the obstacles inherent in the educational system. It is evident that school institution and its educational service should innovate towards the characteristics if its students to perform the education and training process. In this sense, it is important to make a distinction between *technologies for teaching* and *teaching technologies*: the former refer to the use of technology in teaching considering the adoption of the most appropriate technological means to encourage and stimulate students' learning; while, the latter refer to the application of behavioural sciences to teaching, considering the design and evaluation of learning models through the use of knowledge derived from psychological, evolutionary and behavioural theories. The set of technologies for teaching consists of all those hardware or software tools adopted in order to facilitate the students' learning and improve the teaching process by teachers. Surely, digital and multimedia technologies have the ability to accompany in a natural gradual development and continuing cognitive training of students, without creating divisions between the school sphere and the personal one (Di Palma & Belfiore, 2020).

The use of technology in formal contexts such as school allows a meeting point with students, who are constantly in contact with the digital sphere. It is true that students and teachers cannot completely abandon the traditional teaching based on the consultation of schoolbooks and writing on notebooks; because both the traditional lesson and that delivered through technology have a fundamental function for students' learning. In particular, technology allows the sharing of information, documents or slides of the lessons between teacher and students, very easy and fast; in addition, as for the teachers, they have streamlined considerably the evaluation process compared to the old paper register and can share notes much faster with both colleagues and patents of teens. But, on the other hand, it is scientifically proven that spending too many hours in front of a computer screen or, in this case, the IWB screen is not beneficial to health and it risks losing focus and attention to students. In order to avoid these problems, the teacher must focus on effective communication and must pay attention to the gestures used, so as to allow visual involvement by students. Moreover, it is important to keep in mind that the fundamental characteristics of the IWB are: interactivity, flexibility, versatility, ease of managing and exchanging data and information, multimedia and visual content. So, it should be used not only for the projection of the book but also interactive slides, containing for example moving images or questions addressed to the pupils, which allow their interest in the topic treated.

3.1 Teaching with technology at school

In order to help teachers to enhance students' interest during lessons, they can use the Web 2.0 known as web tool that provides a various function in utilizing life, Internet become the main sector of this web 2.0 where people can read and write in the real time with no space and time boundaries. The term of Web 2.0 refers to the "next generation" of Internet technologies that facilitate interaction with the user. In other words, Web 2.0 tools can help teacher to develop new learning strategies that can, indeed, enhance student motivation, improve participation, facilitate learning and social skills, and increase self-directed learning. Moreover, the technology, especially learning tools are beneficial for improving students' critical thinking skill, as stated by Thomas, Morin, & Ly (2014), cited in Syahrizal & Rahayu (2020). In addition, when there is a drop in attention, the teacher can propose group works for the cooperation of students, with the following exposure via slides, or games through platforms such as: *Padlet* to do a brainstorming, *Mentimeter* to make surveys and votes, or *Quizziz* and *Kahoot* to play

competition and quizzes. But in order to do all this, it is necessary the competence in the use of these precious means and working methods by teachers, then a complete formation (Garavaglia & Petti, 2022). With the affirmation and spread of the Internet and technological innovation in schools, many initiatives for teachers have developed on the web. Over the period from 2001 to 2010, several models were introduced that allowed the teachers' training, one of these is the *blended e-learning* that concerns precisely the formation in school digitalization. Other ones are the first and second editions of *For Tic*, introduced in National Technological Training Plans. Another action plan launched by Europe was *Opening Up Education*, which focuses on three areas: creating innovation opportunities for teachers and students, the provision of resources to schools and the strengthening of network infrastructures and connectivity within the school context. Moreover, there is an educational portal called *Tecnologie Educative*, born from the international initiative of Intel® Teach, for the constant technological updating of teachers in schools of all levels; but it is also an excellent community of work and exchange of information, opinion and materials very useful for lessons. In addition to the platforms for training and updating teachers, there are others as *Education 2.0* or *Scuola digitale* which aim to bring students and teachers closer together and to bridge the gap between the two (Ozenda & Bissolotti, 2016).

Some strategies that teachers can implement after their training can be: the *edutainment*, which is the strategy of intertwining the education and entertainment of students through the usage of game platforms; exploiting the potential of Web 2.0, there are the *MindMeister* and *Mindomo*, for collaboration between teacher and students in class group works. Another one can be the *Webquest*, an inquiry-oriented activity where some or all of the information students interact with is available on the Internet, it is a path guided by the teacher that provides a list of websites related to a topic to be consulted and it can be done individually or in groups. There are many other strategies that can be used in class using technology, but first of all it is essential to know technology and technological means and how to use them. Therefore, a right education and openness to the world of innovation is necessary, not only for the use of it in class but also for approaching students, because they are the adults of tomorrow and training them from a personal and technological point of view is fundamental, in order to make them aware about all the possibility they have in the future.

4. Students' learning: by technological or traditional tools?

As already mentioned several times in this chapter, students of Z Generation are the ones in direct contact with technology so, for them it is normal to use it in the study sessions. But the need to use or not a digital tool for study and learning is very personal and, unless there is a great propensity on the part of the teacher in the class to entice to use technology for study, this will prefer the traditional means as a notebook and a pen to study and will privilege technology only for leisure. In this case, the traditional tool is preferred because since elementary school, students have been accustomed to using paper tools so they feel much more confident in learning and meeting the expectations of their teachers. As we have seen before, in the school there have been many initiatives related to the use of technology in class, but most of them have not come to fruition, because the objectives that were set have not been respected, due to several factors (Gui, 2019).

Compared to other European and non-European countries, Italy is far from the constant use of technology in the classroom for study, learning and explanation by teachers, this is precisely because the reforms were made but there was no interest in making them strictly apply. Probably, students perceive this resistance from adults in the use of technology, so they prefer to take notes and study with traditional tool, also because, in most cases, the teacher forbids to bring electronic devices into the class to take notes, for example, probably for the fear of not knowing how to handle them. Indeed, with the excuse of the continuous distraction and loss of attention by students, caused by the use of digital tools, teachers prohibit their use. It is true that at this age, young people prefer to use the digital means because they are attracted by the aesthetic, increasingly sought by manufacturers, by the continuous innovation that attracts the curiosity and the desire of students to keep up with the trends, but also by the speed and convenience of using these tools. When using these means, young people feel involved in a world, also called virtual reality, which sometimes makes them lose track of time, so on the one hand, teachers are right about the fact that they may lose concentration and attention during explanation and, in addition, the prolonged use of these tools can also lead to eye discomfort or headaches, as several research claim. Therefore, the main task of both students and teachers, who must be guide for the first, should be to really know the technology itself and make this a considered use, so as to avoid possible health problems and make the most of all its capabilities and opportunities. There is definitely a reason why technology has become so fundamental in our lives (Atasoy & Morewedge, 2017).

5. The use of technology at home: for study or leisure?

As said in the first chapter, Z Generation is the one of digital natives, of all young people who have always been in contact with technology. For them, the technological world is an indispensable sphere because it is connected to their reality. Nowadays, any young person is able to use technology and technological means better than adults and their teachers, without any kind of training. There is an implicit attraction to technology, to innovation that allows young to keep up with all the very fast changes of the world. The constant use of the net involves and implies new and complex dynamics that inevitably condition the modes of information, entertainment, learning and also the construction management of social ties. So, the network must be thought as a *social habitat* especially for young people. It is important to consider how communication tools exert a level of influence on the processes of attention, memorization and understanding, problem solving and thinking strategies, along with cognitive, emotional and behavioural activities. With regard to memory-understanding processes, studies show that new media, such as computers, facilitate the process of storing information, which partly depends on the mode of transmission used by these media. For example, bright and vivid colours and images used in advertising interludes capture the attention of the user. The storage process slows down while using the Internet, which it functions in the way one would hope it would (Wartella, Rideout, Montague, Beaudoin-Ryan & Lauricella, 2015), the memory capacities weaken for the simple reason that the computer, given its characteristics, replaces human nature. The media also exert influence on the ability of autonomous realization of critical thinking and social action: this influence can be seen with greater evidence in young people (Primerano, 2022). Their concept of technology usage varies at home; indeed, it can be used both for study and for leisure.

5.1 The use of technology for study

The use of technology for home study is widespread among young people today; this does not replace the traditional study characterized by the use of books and notebooks, but it goes to integrate with it. Since young people were born with technology, it is natural that it should also be used in study. They know how to move between digital environments, they know how to use and learn to use their features quickly. Among the main advantages of technology applied to study, there are: the ability to search for information quickly when you need, you can easily take notes and you can have all the files in one device always available. Technology is

synonymous with speed and this is very useful for students when they have to study at home to reduce their time in studying. However, while technologies are time-saving tools, it is also noted that they waste time because they distract, offer more attractive alternatives, involve in conversations that interrupt the study activity and disorient because of the amount of information that make it possible to examine. An example of this can be the research conducted by Mueller and Oppenheimer (2014), cited in Gui (2019), where it is shown that those who take notes with the computer, due to the higher speed of writing in the keyboard than the paper notes, tends to transcribe literally what they listen. While those who write on paper write less, but in a much more elaborated way and with own words, getting better performance in the understanding of content and memorization. This research shows how sometimes the speed and the ability to store a lot of information goes at the expense of depth, producing a cognitive overload.

Z Generation is a multitasking generation but it is detrimental to concentration and complex reasoning. However, students can take advantage of this multitasking combining the use of technological means with the need for learning, trying to stay focused. It is shown how students prefer digital reading over paper reading, but the evidence demonstrates that on screen reading is much faster and less careful. So, it is very important to pay attention on how information is received through digital, because in some cases, the technology-mediated study might be inconclusive. In addition to rapidity and ease of use of technological tools, students are also attracted to the aesthetic level. In fact, the use of the computer for example during the study creates a sense of contentment and satisfaction in students' mind, which can justify the constant use of digital in the study. These means act as cognitive, relational and social amplifiers, multiplying the vital opportunities, going beyond natural limits (Lazzari, 2017).

5.2 The use of technology for leisure

Obviously, in addition to the use of technology for study, young people also and mainly use it in their free time. Here, the field of learning, concentration and attention is abandoned and space is left for instant messaging, the use of videos and photos and active or passive participation in social networks, whose use has become so ubiquitous that it has impacted how, when and with whom people learn, as claimed by Greenhow et al. (2009) cited in Greenhow & Chapman (2020). In leisure time, digital is linked to social platforms that are constantly consulted and used by young people, who are immersed in the virtual reality. As said by the scholar Sherry

Turkle, cited in Primerano (2022), the presence of technology, in daily routine of young, has redesigned their social relationship. For them, technology and the use of social networks are fundamental in everyday life, because they allow them to keep in touch with their friends and exchange information. In this case, the use of technology allows students to relax and distract their mind, for example, after a long study session. The ability of new technologies to give access to wide worlds of information, contacts and relationships has been seen as a huge opportunity. But the main problem with using technology without a time limit is that it can cause a *digital overstimulation*, which is the overabundance of information at the cognitive level, that the brain is not able to handle. It is also for this reason that social platforms, like Instagram, have put the ability to set the time limit, precisely because they are platforms used mainly by young people.

As said in the previous paragraph, the use of digital, in addition to attracting, guarantees an immediate gratification that some content offer and therefore increases the possibility of a media overconsumption by people. Precisely because we live in a context of media overstimulation, face to face communication moments and ones of communicative actions in presence appear particularly important, especially for young people, not to lose human contact. In these moments, there is an opportunity to benefit from a slower pace and less fragmented communication. These different rhythms in listening are essential to make fruitful synthesis of all stimuli that the network offers us (Gui, 2019). So, social networks can be a fantastic reality, but it has seen, especially in the pandemic period, that the real socialization is fundamental because human beings cannot live on contacts mediated by digital. Social platforms are useful to stay informed about events happening around the world and to watch photos and videos in real time posted by people you follow. But it is important to make a distinction between true reality and virtual one, in order to not overload the mind. Especially in young people, it is fundamental to take breaks from the screen of the digital means used, to avoid health problems, such as the problem of posture, or not to strain mind. In fact, spending too many hours in front of a computer screen or phone, can really causes serious problems to the mind, because eyes receive continuous light signals that strain mind and make it really difficult to memorize and concentrate and, as said before, in some cases it can bring the difficulty of distinguishing the real world from the virtual one (Bucci, Schwannauer & Berry, 2019). Moreover, in order to avoid the phone or digital tool addiction, or hyper connection and detachment from the real

world, that can become serious problems, particularly if the young person is not followed by parents or by an educator as a teacher (Barbara & Coppola, 2021).

Thus, using digital means in young people is very useful for many reasons, but they must be used in the right way and in the right amount of time. In addition, the phenomenon of digitalization gives rise to a generational gap, where adults are closed in a dimension almost alien to the virtual one, within which instead young people communicate.

CHAPTER III

The relationship with technology of university students

1. Change of autonomy in study from the fifth grade of high school to the university

One of the biggest changes in a student's life and personal training is the transition from high school to university. Indeed, in this passage precisely changes the autonomy in study and in thought. When young people go to university, they change the way they study, take notes and organize their learning. They acquire greater freedom and autonomy than before, starting, as first thing, from the choice of the university faculty they want to attend. When students go to university, they should have a higher awareness of their abilities and be able to manage the new notions that will acquire. In most cases, it is not just a change from educational point of view and therefore learning, but it concerns a change in the personal life of the student, who acquires greater autonomy in managing him/herself, such as living alone away from home and parents. It is really a big leap in the own independence and freedom.

At university, students are treated as adults by professors, who demand a significant commitment in the frequency of lessons and organization in the preparatory study to the exams. During the lessons, students are free to organize taking notes as they wish, using traditional methods such as pen and paper, or using digital means such as computer and tablets, as there are no restrictions regarding the use of technology in class. Everything about the organization in the study is left in the hands of students, no teacher affects in this, they are totally free. It has to be said that the digitization of goods has created exciting improvements in the lives of people, especially the young one, who live in a world where all of a person's digital books, documents, music, photographs and videos can be stored in one pocket-sized device, providing the individual access to the library of content anywhere at any time (Atasoy & Morewedge, 2017, p.1). Own a digital device is more practical than a traditional one because everything is connected and just a click away. For example, when students take notes from different courses they follow, when they do it with the computer everything is at hand on the same device, while when they do it with traditional tools, they need more notebooks divided by different courses. So, it seems that the digital tool is preferred than the traditional one mainly for its practicality, but it is not always like this. Indeed, in a research conducted by Baron, Calixte and Havewala in 2016, it has emerged that not always studying and taking notes through digital means has its advantages. From 429 university students of different countries in the world, it has been

demonstrated how digital are chosen precisely for their practicality, low cost and possibility of integrating several books and notes in a single system; but, on the other hand, traditional tools are preferred as they allow a greater depth in study and understanding than digital ones. Some students affirmed that the study through digital is conceived as a *non-study*, because after several hours in front of the screen, they realize that they have fatigued their eyes and mind but have not fully understood the topics. So, one could say that digital tools can be very useful in class, during lessons to take notes thanks to their speed, while at home, for the study are preferred traditional means for greater understanding.

Definitely, the choice of taking notes and studying through a digital or traditional tool depends on the type of relationship that student has with technology. Most likely, a student who even during high school used technology both in class with the professor, both at home for study and found it an advantage, has a greater propensity to use it even at university independently. Of course, professors do not control students as they did in the high school and, in fact, they are left to organize their own study autonomously, but in doing this, especially if they chose to study through the use of a digital tool, they must be aware of the possible distractions that these means can bring.

Surely, technological means have a great attractiveness, but at the same distracting, not so much for their nature in itself but for the apps that have been installed inside and for easy access to different web portals. Therefore, there must be a great awareness in the use of these tools, especially if they are used in the educational field. Perhaps, it would be better to prefer traditional tools to study, if digital ones cause too much distraction. All this, if you have the right awareness and responsibility in studying should not happen, also because the university students are adults. Eventually, digital technologies and media seem to be the most suitable tools to re-enter the innovation scenario.

2. The change linked to the COVID-19

As explained in the previous paragraph, the emergency situation arising from the spread of Covid-19 has determined an extraordinary condition for all educational institutions. The experience of distance teaching in the university context, during lockdown, has led to a significant change of habits in the management of teaching/learning processes of teachers and students. “Thus, the lesson has taken on the connotation of an experience carried out not in school but ‘at home’ in a private place, that is, which allows us much more freedom and less

behavioural limitations of the traditional teaching context of the classroom"[1] (Petrucco, 2021, p.112). Developments in the field of technology are proving to be much faster than those in educational research and therefore, while technology offers wide possibilities to improve educational outcomes, attempts to exploit technology for learning could fail if they are not based on the science of learning. In general, a considerable number of institutions around the world had to think about how to guarantee the right of education and training despite the physical closure of schools and universities. Teaching has been moved online and, in doing so, the entire organizational structure of the school institution has been rethought. There has been a remarkable effort by all the actors and institutions involved. To allow the correct realization of this passage from physical spaces to virtual environments, it was necessary to implement a substantial review of contexts, languages, communication codes, methodologies, tools and human relationships. All those involved had to adapt and integrate in a reformulation and remodulation of their daily lives to deal with emergences, trying to respond to new social, cultural and organizational conditions (Dipace & Scarinci, 2021).

The effects of this radical and sudden transformation have been manifolded and have brought to light the large gaps of universities in various aspects, such as the lack and inadequacy of technological instruments and infrastructures, the lack of organizational flexibility, the need for teaching skills of teachers in the field of technologies, a shortage of digital skills of teachers and students. Unfortunately, all these shortcomings have realized a teaching defined *Emergency Remote Teaching*, which is in opposition to the *Effective Online Learning*. The latter is the result of the combination of different dimensions and pedagogical models, which require specific skills of educational design, also in the field of education technologies and learning environments. This did not happen in the emergency period. In this situation, methodological and digital skills are among the main features to cope with the emergency and the possibility to access training courses (Dipace & Scarinci, 2021). The teachers have found themselves managing stress and considerable workloads to reorganize the distance lessons, often without adequate methodological and technical support (Hodges et al., 2020).

In addition to online classes, the emergency caused by Covid-19 brought with it some health problems that manifested themselves in students; indeed, some of the consequences of this situation have led to fears, worries and anxiety among individuals. For example, in a research conducted on 606 Spanish university students, based on the brief 6-item version of the

[1] Translation by the author

original State Trait Anxiety Inventory (STAI)[2] (Spielberger et al., 1983), resulted that in the lockdown period, students experienced high levels of anxiety not only about the school situation, but also about the health situation related to themselves and loved ones, as they did not know how long this period would be and what it would lead to, there were too many uncertainties (Martínez-Lorca, Martínez-Lorca, Criado-Álvarez, Cabañas Armesilla & Latorre, 2020). Moreover, another research conducted by different researchers[3] in seven states in the USA, demonstrated that students' mental health was impacted by the lockdown, which also altered their lifestyle behaviours. Precisely for this reason, after this period, schools and even universities have equipped themselves with services that provided the figure of a psychologist to help young students, that is fundamental. From this research, "the most common changes in how students felt compared to before the pandemic were increased lack of motivation, anxiety, stress, and isolation"[4]; these feelings have led to big changes in the person.

Certainly, when we talk about Covid-19 we talk about a period that we spent three years ago and now it is only a bad memory. This period has not only brought with it consequences related to personal health, but also major changes in methodologies, tools and platforms that were used to support university students' learning in the post-Covid era which led to a *new normality* (Cahapay, 2020). During the Covid and in the period after it, e-learning platforms were used and the most known are: *Microsoft Teams, Cisco WebEx Meetings, Zoom* and *Google Meet,* that allow students and teachers to create virtual classes, individual or collaborative activities and real-time tests. For example, Teams has gradually evolved in the field of education, combining in a single environment many applications and tools useful for teaching and integrating with different learning management systems. Furthermore, other useful platforms for the exchange of lessons' documents were: *Docebo, BlackboardLearn, Coursera, Google Classroom* and *Moodle,* an advantage in a formal environment like that of university (Marafioti, Ciancarini, Ravotto & Gentile, 2022). Many of these e-platforms already existed before Covid, but during and after this period their use has been increased and they have been used in school environment precisely for their versatility and speed in being able to share teaching materials and to create a contact between students and teachers.

[2] It is a psychological inventory consisting of 40 self-report items on a 4-point Likert scale. It measures two types of anxiety: *state anxiety* and *trait anxiety*. By Knippenberg, Duivenvoorden, Bonke & Passchiner (1990).
[3] Browning, Larson, Sharaievska, Rigolon, McAnirlin, Mullenbach, Cloutier, Vu, Thomsen, Reigner, Metcalf, D'Antonio, Helbich, Bratman & Alvarez, 2021.
[4] Ibid

In conclusion, it can be said that technology has been fundamental during this period of the pandemic and thanks to it, everyone, in formal and non-formal contests, has realized that technology is part of our lives and that we cannot live without it. Indeed, in every field, people use digital means because of its speed and flexibility in share what they need and to communicate. Probably, if we look at it from this point of view, technology is preferred to traditional tools in daily life.

3. Increased awareness in the use of technology

Technology is able to make two good teaching practices possible on a large scale. It can spread, as in the case of *real-time feedback*, an effective teaching practice to a number of students that a teacher could not reach alone. It can also take on routine tasks, allowing teachers to focus on the more human *aspects of teaching*, especially those in which they excel. Technology alone is not the answer to all problems, but if it is well designed and developed it has the potential to provide support, improve and facilitate many aspects of teaching and learning, both for teachers and students. In particular, in order to achieve the best results for learners, digital experiences must be designed in such a way that technology enables teachers and students to put into practice as many actions as possible that, according to research, improve learning. Indeed, technology should be used to transform teaching practices so that they improve learning (Belenky, 2016). Currently, the pace of innovation for learning and teaching is accelerating dramatically to cope with a series of revolutionary and constructive forces that are creeping into higher education, challenging traditional teaching and communication models (Christensen & Horn, 2013; Miller et al., 2014).

The adoption of emerging technologies and the application of forms of educational innovation in the university, certainly offer a series of extraordinary opportunities that inevitably do to upset the balance and the structures that in some cases may seem resistant to change. This may lead to slower adoption of innovation practices resulting in a slowdown of processes. In order to increase the awareness about digital innovation, a proposal was made by Gilly Salmon in 2014. This is the *Framework for Innovation*, a transformation's model of practices aimed primarily at academic contexts and therefore higher education. This framework starts from the possible correspondence that the university can identify between its internal resources, structures and skills and the opportunities and risks that come from the external environment. In this way it is possible to enhance the capabilities and strengths of an institution,

this highlighting what excels and it can be understood which strategies to use to make it competitive, so what can do better and in a different way. So that changes can be implemented that have a positive impact on the organization, a series of economic and instrumental investments are necessary and above all it is necessary to provide for the appropriate timing of implementation that allow to establish and restore the right balance despite innovations. When this happened during the health emergency linked to Covid-19 imposed a sudden and radical change to educational institutions, without considering a whole series of preparatory activities that are instead provided in normal situations. The consequences have been manifolded and have brought to light the major shortcomings of the university in various aspects, such as the difficulty in communication between teachers and students, the inability to operate certain online platforms and, in some cases, the lack of real technological means (Dipace & Scarinci, 2021). For all these reasons, it is important to educate and make people aware of the use of technology.

3.1 The correct use of technology in class: educational intervention strategies to limit the distracting effects of digital tools

The use of technology in class has many positive aspects but unfortunately some are also negative and it is important to take action to try to reduce the excessive use of digital tools that can cause distraction. In fact, the teacher can help students in these ways: try to obtain an active interaction between teacher-student and student-student throughout the course of the lesson, for example, using apps like *Student Response Systems*[5] (Buil, Catalàn & Martínez, 2019) that allow students to use their phone or the digital device chosen as an interactive tool to answer questions about the content treated during the lesson; hold conferences with experts who clearly explain to students the negative effects of a continuous use of digital tools, inviting them to reflect on their behaviour during the online or in presence lesson, in this way students will develop the highest levels of mindfulness, or reflection (Lan et al., 2018). Surely, greater is the ability of the teacher to involve students, greater will be the interest of the latter towards the lesson and the topic treated. So, teaching and pedagogical preparation of teachers is also very important. In addition, the constant feedback from the professor is essential, because it give importance to students' work and if it is done through a digital platform, like Moodle, then

[5] These are applications that allow teachers to ask questions in the classroom and collect answers live, through the use of digital devices.

becomes an efficient use of technology. These strategies contribute to the conscious use of technology and to the decrease of its distracting effect, that affects especially the younger's mind because they live with it daily (Petrucco, 2021).

"The use of technology can only be successful with people who believe in its value and who are prepared to get the best. In order to facilitate this situation, it is necessary to overcome scepticism, to understand what knowledge and skills are needed to teach through it and to implement vocational training programmes on teaching through technology"[6] (Belenky, 2016, p.4). Users are more likely to use technology when they master the mechanisms and when they believe that using it helps them to achieve their goals.

3.2 Teaching with technology at university

Technologies can be a valid support both for educational innovation with the tools, and to facilitate access to continuing education and professional updating of teachers, in a scenario oriented to the *faculty development*, which is a wide range of activities aimed at developing teaching and assessment skills, leadership, research and scholarships, career development and organisational changes, specific to university teachers, as part of an increase in the quality of the university system. The challenge to which universities are called today is to be able to promote growth and improve the teaching experience, with the repercussions on learning outcomes. Training institutions are trying to respond to these needs by organising a series of activities within the framework of programmes and actions of faculty development, to actively involve teachers so that they can acquire the necessary skills and have effective tools for quality teaching. The university between innovation and change is a topic at the hearth of several international researches (Dipace & Scarinci, 2021).

In order to achieve good results, technology has to be used with care, according to best pedagogical practices and knowledge of disciplinary content (Belenky, 2016). Precisely for this reason, it is of fundamental importance the training of teachers and above all an update of university teaching and therefore, the specific skills of their teachers able to use strategies, methods and tools to encourage active, constructive and interactive learning. The need to respond to the challenge of meeting the needs of educational innovation is felt by a substantial part of formal education. In general, universities need to put in place a series of investments on several levels, ranging from the activation of research processes and teacher training, aimed at

[6] Translation by the author

the development of skills for a strategic use of educational technologies, the provision of structural and infrastructural resources, the digitalisation of university services and systems. Particularly, it was realized that after Covid-19, teaching online requires the use of different pedagogical approaches than the traditional lesson, it is important that teachers are adequately trained to be able to act in different environments ranging from the centrality of presence to the centrality of distance. In addition, technology alone cannot transform educational paradigms, teaching and learning. If, from a more general point of view, everything can change using technologies in teaching, from the pedagogical one nothing could change (Dipace & Scarinci, 2021). Vocational training must focus on all those aspects that are linked to the role of the teacher on teaching and learning through digital. While facilitating digital learning, the teacher performs four main functions: *pedagogical*, serving as a teaching guide on content, providing input, facilitating exploration by students, evaluating them and providing feedback; *social*, creating a friendly working environment where all students lie at ease when interacting with each other and with the teacher; *managerial*, setting and managing programs and course objectives, mediating discussions and interactions; *technical*, making students feel comfortable with the technical aspects of their learning experience, such as through digital platforms (Belenky, 2016).

3.3 Digital literacy of university teachers

The change brought by innovation has introduced the need to reflect on the importance of the most appropriate forms to promote the development of digital literacy of teaching staff. In the sense of enhancing skills related to problem solving, critical thinking, creativity, productivity and achieving a goal through the use of ICT. Over the years several initiatives have been created to allow the training of teachers, different thematic information meetings to facilitate the transition from the old to the new environment. An example of these meetings was organized by the Catholic University of Milan and by ILAB (Center for Innovation and Development of Educational and Technological Activities of the University)[7] in 2011-2012, with the *DidaTec* Corner, which was a series of meetings with a limited number and delivered at the faculties of Milan, dedicated to training, reflection on teaching technologies and their application within the different disciplines. This has made it possible to provide teachers with the basic tools and skills that can be applied independently or through the support of the learning designers of the

[7] In italian: Centro per l'Innovazione e lo Sviluppo delle Attività Didattiche e Tecnologiche di Ateneo

centre, to the lessons. In addition, in the following years, micro-learning materials were created for the individual study of teachers, called *DidaTip* (Rizzi & Bolognese, 2016).

With the use of new technologies, teachers faced a very important challenge that is divided mainly into five areas of transformation of the learning experience: *convergence*, between online and face-to-face learning, involving new forms of hybridization of learning spaces; *massive*, the extension of the classroom boundaries which allows access to a global audience to physical and virtual classrooms; *open*, costs reduction and access to higher education; *interactivity*, the ability to multiply opportunities for interaction between students, students and teachers; *diversification*, the experimentation of increasingly sophisticated means to improve teaching in an experimental and laboratorial key (Brown et al., 2021). To address these new factors that have emerged, teachers need to develop their digital literacy as much as possible and another example to keep up to date with new technologies is a research project funded by the Spanish Ministry of Education and Vocational Training, through the Salvador de Madariaga mobility programme, derived from the *I+D+i VOREMETUR*[8] research project, funded by the Spanish Ministerio de Economía y Competitividad, to propose a program of courses of academic innovation, that is subjects offered as credit supplements, free choice courses, cross training courses, where to verify the feasibility of this model, with the aim of being a transversal training experience and offered as a study support program by an *academic skill centre* service, for application in Spanish universities and at the University of Rome "*La Sapienza*" on the basis of fruitful collaboration between lecturers/researchers and librarians. While, in 2010, in the USA, the experiences of training courses designed for the universities of Berkeley and Stanford were published, with the assumption of this new literacy, later a practical guide to training in visual literacy was published (Marzal & Solimine, 2019). These are just some of the different initiatives proposed by universities around the world, to allow the development of digital literacy of university teachers, which is fundamental to keep up with the times and in the field of education, and also to be closed to students.

Digital teaching is therefore at the hearth of the overall transformation strategy of the new research university with two synergic fronts. The first is that of educational innovation with the aim of an overall transformation *student-focused* and *student-oriented*, while the second one concerns that of experimentation and technological collaborations. For universities, the digital transformation is a non-extendable challenge and an opportunity. In the light of the

[8] This is a tool for assessing multiliteracy in higher education, at university.

processes of massification and internationalisation of education, the most advanced universities have tended to focus on the order to renew their educational offer, with the aim of increasing the quality of study paths, through greater integration between research and teaching and a closer connection with the world of work, adapting formats and content to the needs of continuing training. It is important to remember that university is the transition to working life and the more students will be technologically prepared, the more jobs' skills they will have (Reda, 2022).

While, with regard to teachers, particularly important, also for reducing the workload and stress, is the in-depth knowledge of methodologies that allow them to rethink their teachings in an appropriate way in order to design and facilitate online and in presence learning experiences (Dipace & Scarinci, 2021). In a future prospective of universities increasingly immersed in the technological world, the training of teachers and students is essential, in order to promote the awareness that the choice of the technological tool is functional to the setting of the reference teaching (Laurillard, 2014). Today more than ever, teaching must go hand in hand with technology.

4. Students' learning: the need to use digital devices to take notes

At the time of enrolment in university, students usually have a writing practice that is mainly related to the topics, little notes and some reports made during the high school, period in which writing is not practiced overall (Lavinio, 1991). The activity in which university students usually spend most of the time during traditional lectures is taking notes (Moin, Magiera & Zigmond, 2009). Taking notes is a skill that begins to develop from high school and to university becomes fundamental. The skill is purely personal, as it is the students to decide how and when to take notes, to select the important things that are explained by the professor during the lesson, which will be functional to his/her study at home. According to some studies, this activity involves cognitive processing and offers a higher probability for later recovery of content than when students only pay attention to the lecture's information without taking notes (Dunlosky, Rawson, Marsh, Nathan & Willingham, 2013). The main difference from high school to university is that, during the first, students are joined by the professor who explains them the most important notions, while in the second case they are alone and take notes independently. Especially at university, the accuracy and attention in taking notes allows the student to have higher results in studying. Placing notes at home, after attending the lecture, is

a fundamental part of the student's university career. Indeed, one of the best techniques preferred by students is to record the lessons in class with the mobile phone or with any other digital device, so that they can relisten to it at home and not miss even a piece of the explanation done. Notetaking is a multidimensional process because students must pay attention to the explanation, select the relevant information and then translate it into specific phrases (Steimle, Brdiczka & Mühlhäuser, 2009). At university, students have the opportunity to use digital means without having the consent of the teacher, provided that it is done only for personal study; without injury to the dignity of the teacher, for profit, without tampering and the creation of false dubbing and without dissemination on social networks, unless there is the consent of the person concerned. Otherwise, a violation of the rules could be criminal, so it is important to be very careful[9].

Upon the arrival at university, students must decide whether to take notes using pen and paper or use digital tools, a very personal choice. In fact, they must not only take into account the speed and practicality, but the fact that one or the other modality involves in a different way the perceptual and cognitive system of the student, leading to a different understanding of what is written and read and this affects the way of thinking, of understanding the world around him/her. This choice contains in itself a tangle of considerations, weightings and meditations, embracing a range of issues ranging from economic values, aesthetic appreciation, technological charm, due to the need to keep up with novelties and the continuous innovation present in the technological market. Surely, today's digitation, as already stated earlier, allows students to have in the palm of their hand any necessary information and access multiple files at the same time quickly, which with traditional methods is done much more slowly. So, digital tools are able to perform the same functions as traditional one, but saving a lot of time for those who use them. An example of digitalization can be that of traditional tools, such as books, based on the *Gutenberg Project* which is the first revolutionary project of creating a digital library accessible to all, conceived by Michael Hart. In order to give relevance to the books' content and put in the background their physical form considered only ancillary to publisher for commercial purposes. Students' learning is influenced constantly by technology indeed, current and emerging technology and software are now offering reflowable text and features to support academic use of, for example, electronic textbooks or *e-books* (Rockinson-Szapkiw, Courduff, Carter & Bennett, 2012). But, on the other hand, when students use these digital tools feel

[9] https://www.liveuniversity.it/2020/02/10/universita-registrare-lezione-legalita/#:~:text=

particularly involved in this reality, which however is not real, causing the possible loss of time cognition and therefore, also the possible loss of concentration and attention in class. Moreover, the prolonged use of technology during study sessions can cause eye and mind problems, which require a break. Eventually, in favour of digital tools there is the ability to perform several tasks simultaneously, to draw fast connections between various concepts and modes of communication that are all skills that those who live in a multicultural and constantly changing world must be able to dominate, in order to make the most of the resources at their disposal without being overwhelmed by them. It has not to be forgotten that Z Generation is the generation of multitasking (Meglioli, 2021).

4.1 Some differences in technological thinking

Considering the expansion of new technologies, the number of students who takes notes with a computer or tablet is significantly increasing and the old-fashioned *pen-and-paper* method is decreasing. Some studies encourage the use of electronic devices as aids for learning strategies, whereas other researches argue exactly the opposite, claiming that these resources hider and diminish students' academic performance (Ragan, Jennings, Massey & Doolittle, 2014). Precisely because of these conflicting positions, several researches have been made over the years. One in particular, conducted by Bui et al. in 2013, has shown that students who used computers to take notes, obtained better results in short-term memory task, and the conclusion was that they wrote more content and recalled more information in free short-term recall tasks. In another research has been taken into consideration the cognitive field as for taking notes with digital means or by hand. It emerged that "using the computer as a tool for notetaking involves an initial advantage by increasing the amount of information recorded, but this efficiency is lower when the task demands a deeper coding level: this is more efficiently achieved using handwriting" (Aragón-Mendizabál, Delgado-Casas, Navarro-Guzmán, Menacho-Jiménez & Romero-Oliva, 2016, p.103). The differences that exist between handwriting and computer writing registering procedures should be analysed for tasks that require deeper levels of processing than simple transcriptions.

So, around the world, from school classrooms to university, many have stressed the benefits that technology can bring in improving, supporting and facilitating teaching and learning (Belenky, 2016). As for taking notes, this use of technology, which in some cases can

lead to the drop of attention and concentration in young people, is important to do it thoughtfully.

5. The use of technology at home: for leisure or for study?

Obviously, as introduced in the previous paragraphs, technology is not only used in formal contexts, but also university students use it as a means for leisure. As we have seen, there is a greater awareness on the part of young people regarding the use of technology, but this not exclude them from the fact that they can be distracted by this attraction to digital. Definitely, the use that students make of technology at school and at home is different, because in the latter they have a greater freedom and less control by teachers. Moreover, when they are at home, they have less interest in being careful in the study, while in class they need a lot of concentration to understand the topics. For this, two distinctions are made, regarding the use of technology for leisure or for study.

5.1 The use of technology for leisure

If class distraction is possible through technological devices, at home, outside the formal context, students are even more at risk of distraction by using them, because they have much more freedom and do not need to use them only to study. As it was said in the previous chapter, today's students are those belonging to the Z Generation and all, except for someone, have been enrolled for several years in the main social networks. Indeed, WhatsApp, Instagram and Facebook are part of their daily lives, to browse the lives of others through the images and videos they post and to stay updated on everything that happens in the world in real time, a real guarantee. For example, they were the first to experience Instagram, in fact this platform was created in 2010, when they were teenagers and particularly attracted to this new world. Precisely for this, for them to spend a minimum of hours during the day in social networks is essential and without, most likely, they would feel without a part of their person. Most likely, even if during the study they use a technological means, when they take a break from it, they still switch to the phone screen to consult social media, because it is an automatic thing they cannot do without. This is conceived as a relaxing phase after a study session or during a break, as they lose time watching the lives of others from the comfort of home.

It is true that the dimension of social networks is a continuous distraction for young people, especially when they are in class or during study and, as already said in the first

paragraph, maybe, if the temptation is really too high, perhaps it is better to study with a traditional tool and hide the phone or the digital tool that involves distraction; this would be a responsible choice that a university student should make when he/she realizes that the time on social media is greater than that devoted to studying. But, on the other hand, social media are useful also for personal formation, indeed, they are invaded by several pages that deal with current and past issues ranging from history, economy, to the situation on our planet, so they can be of leisure, but at the same time allow the user to inquire and learn new things, that maybe at school or university they are not explained (Seemiller & Grace, 2017).

5.2 The use of technology for study

As technology is used in class to take notes, surely it is also widely used at home to arrange them and to study. But, precisely because at home students are without the teacher's control, they tend to get more distracted. Perhaps, as already introduced in the first paragraph, combining the use of digital means in the class thanks to their speed and convenience to the use of traditional ones at home, can be a useful strategy to allow a major comprehension of what it is studied and do not strain the mind too much. This can permit a greater preparation for exams. The distracting effects brought by technological tools were seen in particular in the period of Covid-19 when schools and universities were invaded by technology and forced to use it to allow contact between students and teachers. Because everyone was confined at home to take lessons and there was not teachers' control, students were very tempted to distraction through the use of digital devices such as their phone. These distractions are not only caused by the use of the phone, but also by the use of different apps, as just said in the previous paragraph, like social networks or games, which may have been installed in tablets or computers that were used as a screen with teachers. In fact, by a survey conducted by the Italian professor at the University of Padua, Petrucco (2021), on 128 master's degree, regarding the use of social media during the lessons in presence and at a distance, it has emerged that most students have used the phone with various intensities both before, during classes in presence, and during online classes, in the months of lockdown. In addition, the digital tool was used to browse the web in search of topics not related to those of the lessons. So, if there is distraction and high drop of attention during classes both online and in presence, it is inevitable that there is also in individual study. They must devote the right time to study and also to breaks from this, which are fundamental in order not to strain the mind. In this way, the use of technological tools only for consulting

social networks and other types of apps should be done only in leisure time (Dhar, Ayittey & Sarkar, 2020).

Several researches agree that the use of technology in most cases is only distracting, and that students prefer to use digital tools mainly because they are attracted by their aesthetic appearance and the desire for innovation, therefore not for study in itself. But, at the same time, it is important to remember that university students are almost adults and the choice of digital cannot be pushed only by the aesthetic factor, but certainly for the convenience and speed of which the technological devices are equipped (Petrucco, 2021).

CHAPTER IV

The description of the survey

1. Objectives

As stated in the previous chapters, technology is part of our lives and it occupies the personal and formative sphere of every individual in the world. For the great development that technology has had over the years, different researches have been done in order to explore its influence in the different fields of human life. More and more working places have started to use technological devices to work and, in addition, with the advent of Covid-19, technology has been essential in formal environments such as school and university, to allow teachers and students to communicate with each other and move forward with the program. Certainly, Z Generation, that is in daily contact with technology, has developed a great sense of curiosity, necessity but also dependence on this, because they cannot do without it. Differently from the past, today's students use technology for both leisure and study, because for them everything is connected and just a click away. Considering these aspects, the objectives of this survey have been divided in three macro-categories, making the distinction between fifth graders and university students:

1. *Personal use of the tool*: the first objective aims to understand the students' preference to use the digital means or the traditional ones, so their interest and perceptions in using technology and its innovations. In addition, the function of the digital tool in learning is investigated, as it is used to take notes, to study, to do both or neither. Also, the change of learning through technology is explored.
2. *The context of use*: the second objective wants to know the place in which students use technological or traditional tools, as in formal contexts, like school and university, or non-formal ones, like at home. Moreover, it wants to understand if there are some restrictions or limitation in the use of digital devices at school, principally in high school, where, probably, students are more under the control of teachers.
3. *Consequences in the use of digital*: the third and last objective examines the possible consequences due to the use of technological tools, such as the mental fatigue or the eye discomfort, linked to the distraction and the drop of attention in class that can be caused by apps, like social networks, installed in these means, therefore, here students express their opinions.

Surely, the technology's field with its innovations is very wide. The impact and all the consequences that these can have in the learning of each student is very diverse, but this distinction between different degrees of education and formal and non-formal areas, allows you to have a fairly specific overview of the topic.

2. Problem to investigate: technology-based learning

In the previous paragraph has been illustrated that technology has invaded our lives for several years, and, although Z Generation is composed by young people who have always been in contact with the digital world, there could be differences between those who attend the fifth graders and those who instead go to university, especially on the use of technological means for study and take notes. Therefore, this survey wants to explore the boundaries of the technology-based learning, if it is conceived as positive or negative by young people and if they think that, in the future, all the school system will be based on the use of technology. Obviously, technology, as every topic that is observed, has its pros and cons, but here they will be exposed by the students who use it every day, at school and at home. Indeed, the difference investigated is not only that between the conception of the usefulness of technological means conceived by students, but also that of the different use made at home. Certainly, technological tools, like phones, are always used by young people, because they are the means of communication to keep in touch with their friends and with the whole world, through the use of the social platforms. So, the problem to investigate is to know if the technology, in addition to being used as just exposed, is also used in the field of learning.

The concept of technology changes according to age, in fact, most likely, university students who are older, just feel the need to use technological means in the study and for taking notes to save time, because, for example writing to the computer, it allows to be much faster both during the lessons and during the study. Furthermore, students at university have more freedom in bringing with them their technological device, while, high school students tend to use more traditional tools, as the digital ones are very often not allowed in class, but this also depends on the teachers. Indeed, there are teachers who believe in the technological development and progress and encourage their students to use technology both in class and at home. Probably, in high school, if the teacher sets the example and uses technology in class, giving some training to students, explaining how to make the most of it, then even young people will try to use it at home to study and not just limit its use to that of social apps or games. All

this talk would also include the training of teachers, so a really broad topic. Therefore, the survey's problem is only focused on the usage of technology done by students of different ages, with the aim of comprehend if they prefer the digital or the analogical for their learning and if they have some kind of limitation in using technological means, for example in formal environments, as that of the school.

3. Questions and assumptions formulated

The field of technology related to learning is very wide and involves several variables on which to investigate. Indeed, before proceeding with this survey, which is a *semi-experimental research project*, three research questions and assumptions have been formulated, so as to give order and create expectations, that once obtained results will be answered. Certainly, as already said, the influence and concept of technology change according to the person and context in which they are used, in addition, technological means can be used for both study and leisure, while traditional means have a limited use of the formal scope of the study both in class and at home. Here are exposed the previous questions and assumptions related to this survey conducted in the field, where there are different aspects to take into consideration.

3.1 Research questions

This is an exploratory survey that requires open questions to provide possible answers. The research questions formulated are descriptive and are emerged directly from the objectives of this work. In order to examine the relationship between technology and learning, at school and at home, the following research questions have been formulated:

1. *What are the habits of students about using digital and analogical devices for study?*
   This research question wants to investigate if students prefer to use digital or analogical devices for study, in particular, it aims to know the frequency of use of the tools and if, the Z Generation which is digital, is attracted by the use of technology also in personal learning. Precisely with the distinction of use at school/university and at home.
2. *Do the rules/habits of the school context meet or hinder students' attitudes?*
   The second research question aims at investigating is there are some types of restrictions in educational institutions, maybe in class by teachers. If, the school/university context is open to the use of technological means or still prefer only the traditional ones; or if it

is making a path to train both students and professors to the conscious and correct use of technology. This question is addressed more to the formal context.

3. *Are there differences in the use of digital and analogical devices compared to age and environment?*

   The last research question wants to comprehend if there is some kind of relationship between the preference in the use of digital or traditional tools and the age and environment variables. If students are encouraged from high school to use technological tools or this happens mainly with the arrival at university, where students are older and therefore there should be a greater awareness in the use of technology, both at school and at home.

These research questions will be answered in the results presented in the next chapter, in a perspective of comparison of fifth graders and university students, in formal contexts and informal ones. The wide field of technology is synthetized in this comparison investigated with the direct answers provided by young people.

3.2 Assumptions

The assumptions of this research that will be tested are related to the use of technology for students' learning and the preference linked to this field about traditional or technological devices, taking into consideration that the young people of today are always in contact with technology. The difference between the use of these tools in formal and non-formal environments, with the aim of understanding if there are some limitations in the use of technology in class or if students are free to bring their own technological device for taking notes. Also, the use of technology for studying is conceived as positive or negative by students of different grades of education, in order to know if it is used only for leisure or it is also useful for learning.

4. Research participants

The participants of the study are eighty-six students, divided into fifth grade of high school and university. They are all young adults aged 18-24 from different schools and universities in Italy. In particular there are 41 fifth graders (47,7%) and 45 university students (52,3%). Principally, there are the 37,2% of boys and the 62,8% of girls, so the research sample is more feminine. In the tables below there is information about the age and the schools/universities addresses

attended by the sample. Grouping of schools/universities addresses attended was done in three main categories, for school: scientific, technical, linguistic; while for university: scientific, economic, language.

Table 1 - *Information on the age of participants*

Age	Number of students
18	31
19	15
20	5
21	12
22	7
23	12
24	4

Table 2 - *Schools attended by students*

High School	Number of students
Scientific	9
Technical	10
Linguistic	22

Table 3 - *University addresses attended by students*

University	Number of students
Scientific	21
Economic	11
Language	13

5. Instrument employed

After the identification of the objectives and the research literature, the first step was the preparation of the instrument. The survey has been carried out basing on students' responses to an ad hoc questionnaire, which was the instrument used for collecting the data. This

questionnaire was built with Google Moduli and it largely consisted of 37 closed-ended items, such as multiple choices, yes/no questions and Likert scales, in order to make the questionnaire easy and quick to fill out. There was also an open-ended question, which is the last one, that allow students to add their point of view about the pros and cons of the technology in the learning field. The total questions are 38 and take inspiration from the article written by Baron, Calixte & Havewala in 2016.

The questionnaire has been organized in four sections. The first section concerns the students' personal data, indeed, here are asked the consensus to completing the questionnaire anonymously, age, gender and school/university address attended. The second section relates the *students' relationship with technologies*, it concerns the general use done by students of digital technologies for study and their interest in innovation. This section has been specifically designed to have a general overview on the use of technology by students, without making the distinction between formal and non-formal context. The last two sections have been made basing on the User Engagement (UE), which is a quality of user experience characterized by the depth of a student's investment when interacting with a digital system (O'Brien, 2016a) (O'Brien, Cairns & Hall, 2018). In order to measure this engagement, the User Engagement Scale (UES) was used, which is a 31-item experimental questionnaire based on six factors or dimensions: *focused attention, perceived usability, aesthetic appeal, endurability, novelty* and *felt involvement*. All of these categories have been used to conduct the survey and to build the questionnaire, they have permitted to understand the technology's usage done by students and their perceptions about the new technological developments and innovation; their interest in the field of innovation but also in the use of a screen instead of a book for studying.

The third section, entitled "*Learning in school"*, aimed at exploring the use of technology done by students in schools/universities in order to understand their involvement, interest and also the use or not of technological devices done by teachers in class. In addition, this section wants to know if there are some restrictions/limitations in the use of digital tools imposed by school or teachers during the lessons.

The fourth and last section of the questionnaire is entitled "*Learning at home*", it aimed at understanding if students, for their study at home, prefer to use technological or analogical means and, if they use the technological ones, how much they consider they are useful for concentration and memorization, although they are constantly tempted to use online apps, such as social networks.

After this section, there is the open question, which serves as the general closure of the questionnaire, indeed, in the dedicated space, students can write arguing or making a bulleted list of the pros and cons of using technology at home and at school/university, always concerning their learning. This question was created taking inspiration from the article written by Taipale in 2015.

The questionnaire has been drawn up in italian, in order to allow everyone to respond easily, avoiding misunderstandings in understanding questions. This instrument has been chosen because of its easy access to make modifications, its versatility and because it allows the gathering of a large amount of information in a short time, even at distance. Moreover, as already said, it is very easy and quick to fill out for the respondents since "a long questionnaire is discarded"[1] (Balboni, 2003). The questionnaire will be found in the Appendix.

6. Methodology

This dissertation can be defined as exploratory research on the relationship between technology and learning in formal and non-formal context, with the direct response from students of fifth grade of high school and university. As stated in previous chapters, there is literature and several researches that examine this relationship, but there are no studies that compare the use of technology of fifth graders and university students. Therefore, this research can be conceived as a novelty in the field of learning with technology. This study clarifies the preferences of students about the use of digital or traditional devices in personal learning, and the perception of technology that could change with the age and context. All of this is gathered through the questionnaire built on Google Moduli and then, the link was shared to students via email and WhatsApp. The investigation was conducted in January of the academic year 2022/2023. The questionnaire was filled out spontaneously by students and all the answers obtained are anonymous, in order to respect people's privacy. This procedure reached a consistent number of responses in a short time; indeed, all the answers were obtained in less than a month. In addition, the online format has facilitated the analysis of the data.

The respondents had to answer a set of questions concerning their relationship or not with technology, at school/university and at home; they had to show their opinions and perceptions in the context they use digital devices. Moreover, the final part of the questionnaire in addition to express the pros and cons perceived by students in the use of technological means,

[1] Translation by the author

also allow them to express their future ideas about learning with technology, thus, giving a general overview of the topic. The data collected have been arranged in tables and charts for a better understanding. For the analysis of the last part of the questionnaire, composed of an open question, the open-ended responses have been read to find repeated patterns or features and grouped, so as to make a clear presentation of the students' opinions.

CHAPTER V

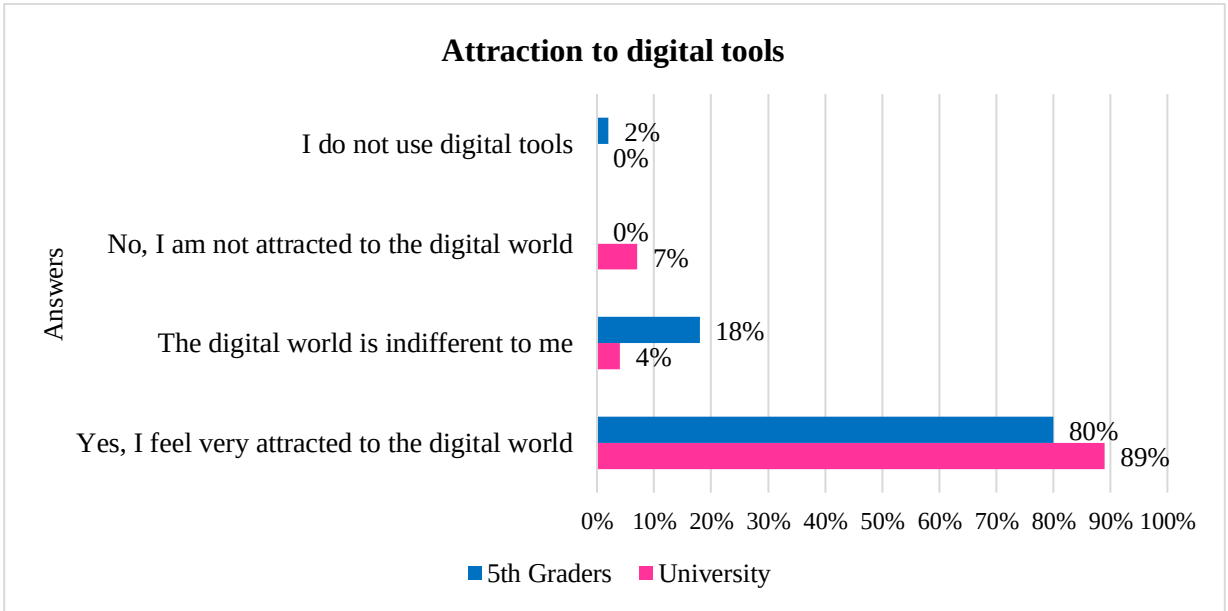
The results obtained from the research

1. The sample's relationship with technology

In this chapter the results of the questionnaire at the center of the present investigation will be explained, based mainly on the comparison between fifth graders and university students. The first section of the questionnaire corresponds to the personal data of the sample (age, gender and school/university attended) that were exposed in the previous chapter. Therefore, here the results presented will be those of the second, third and fourth sections.

First of all, the second section of the questionnaire can be conceived as a general section regarding the wide use and interest of students about technology. It begins with the students' relationship with technologies, so the first question of this section is about the attraction to the digital tools, which is expressed with a mean of 2,92, based on a Likert scale of values from 1 to 4. In the graph in figure 1 below it is possible to see the difference in attraction towards digital tools among students, in the form of percentages. There is a high attraction to digital means by both categories of students (80% for fifth graders and 89% for university); instead, there is a greater indifference to the digital world experienced by fifth graders (18%), as opposed to those at the university (4%); some of university students (7%) said that they are not attracted by digital world, while the 2% of the fifth graders do not use digital tools in general.

Figure 1 - *Students' comparison about digital tools' attraction*



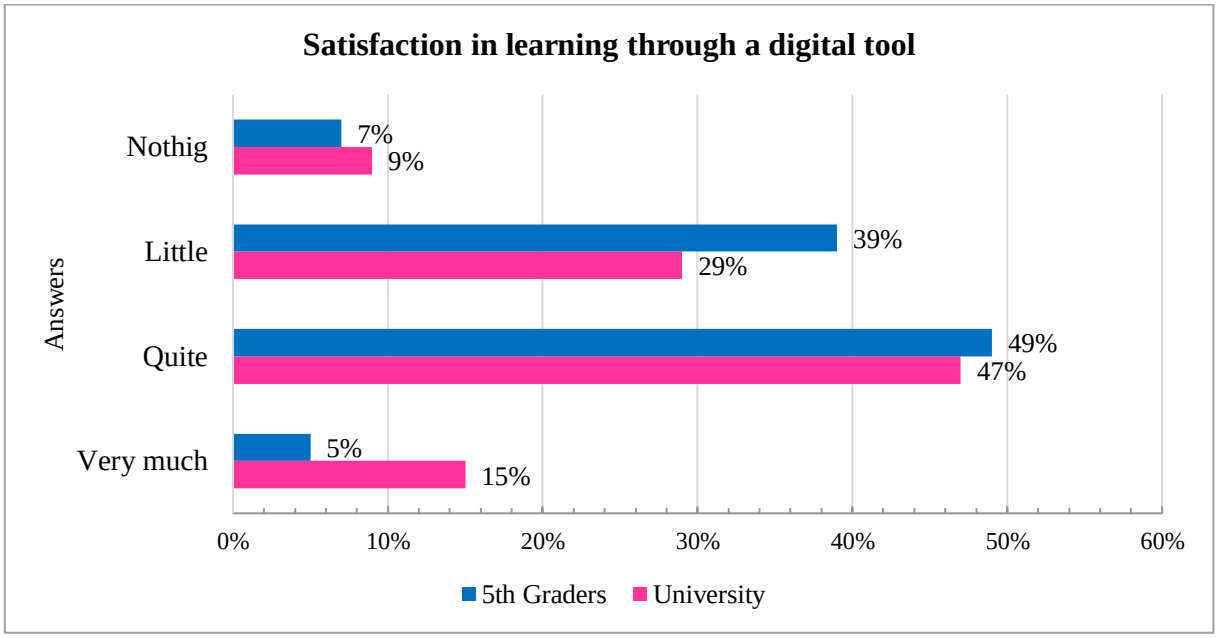
In addition, students were asked with which digital tool they take notes or study and the results are exposed in the table 1 below, in percentages format. As regards the fifth graders, we have similar percentages for the use of the Pc combined with the phone, but the highest percentage, which is 39%, concerns who responded to not use any digital tool to study or takes notes, whereas, under this heading, there is only the 7% of university students; the lowest percentages of this part of the sample belong to items "Pc + tablet" (5%) and "tablet" (2%). Unlike the fifth graders, the majority of university students, so the 62% of them, uses a Pc to take notes and study and the 13% always uses a Pc but combined with a tablet, for this part of students there are the items "tablet" and "Pc + phone" that have the same percentage (9%).

Table 1 - *Digital tool used to take notes/study*

Answers	5th Graders	University
Pc	22%	62%
Tablet	2%	9%
Pc+ Phone	32%	9%
Pc+ Tablet	5%	13%
Any tool	39%	7%

Related to the use of digital tools, students were asked whether or not they own a personal tool, excluding the personal mobile phone, and it emerged that the 100% of university students have one, while as regards the fifth graders, the 97% said that they own one whereas, the 3% no, however, the results are very similar. Moreover, students were asked if they find satisfaction in learning through a digital means, in a Likert scale formed by four values ranging from "nothing" to "very much". It has emerged that both categories of students find learning through a digital tool *quite satisfactory*, with a total mean of 2,60 and there is not a large percentage difference for this item (49% for fifth graders and 47% for university). This question has a mean of 2,51 for fifth graders and of 2,69 for university students; there is an interesting difference in the item "very much" where only the 5% of the fifth graders answered it, compared to the 15% of the university students. All the percentages linked to this question are showed in the graph below (Figure 2). As you can see, the satisfaction of learning through a digital means is expressed by both sides of students.

Figure 2 - *Students' satisfaction in learning through a digital tool*



The last two questions of this second section regard the interest in the continuous innovations created by the digital world and also the context in which these innovations arouse the students' engagement. As regard the general interest about innovations, the sample's mean corresponds to 2,79 and there are differences in this field, indeed, among university students more than 50% find interest in digital innovation; while among fifth graders, the 39% say that find interest in innovation, whereas the 44% has little interest in it. Instead, for the context of use, four main items have been created, taking into account the possible students' context of use: *leisure time, school/university, leisure time and school/university, I do not care*. The results are showed in the table 2 below.

Table 2 - *The innovations' context of use by students*

Context of use	5th Graders	University
Leisure time	34%	4%
School/University	10%	12%
Leisure time and school/university	54%	82%
I do not care	2%	2%

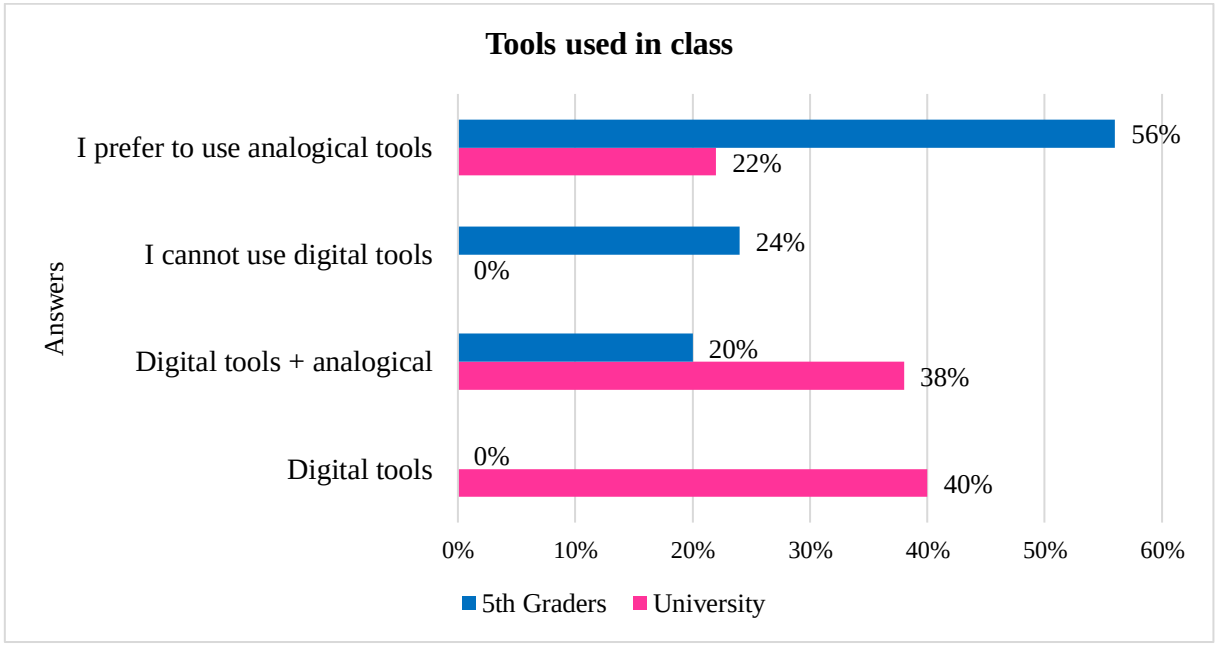
With the questions about innovations in digital world, the second section of the questionnaire concludes and this was only a general view about students' relationship with technological tools. The next two sections (third and fourth ones) are more specific.

1.1 Main differences at school and at home

In this paragraph is exposed the first difference about school/university and home, considering the use or not of the digital tools in these two different contexts, mainly for studying and taking notes, shown in the graphs below (Figure 3 and Figure 4). This is a sort of introduction to the next paragraphs where all the results of the questionnaire are shown.

Here, in particular, as regard the use of digital tools in class, it has emerged that the 40% of the university students uses only digital means, while the 38% uses both digital and analogical ones. Whereas as concerns the fifth graders, no one of them uses only digital tools in class and the 56% prefers to use traditional tools. Interesting is the data concerning the impossibility of using digital tools, indeed the 24% cannot use technology in class, non-existent data for the university.

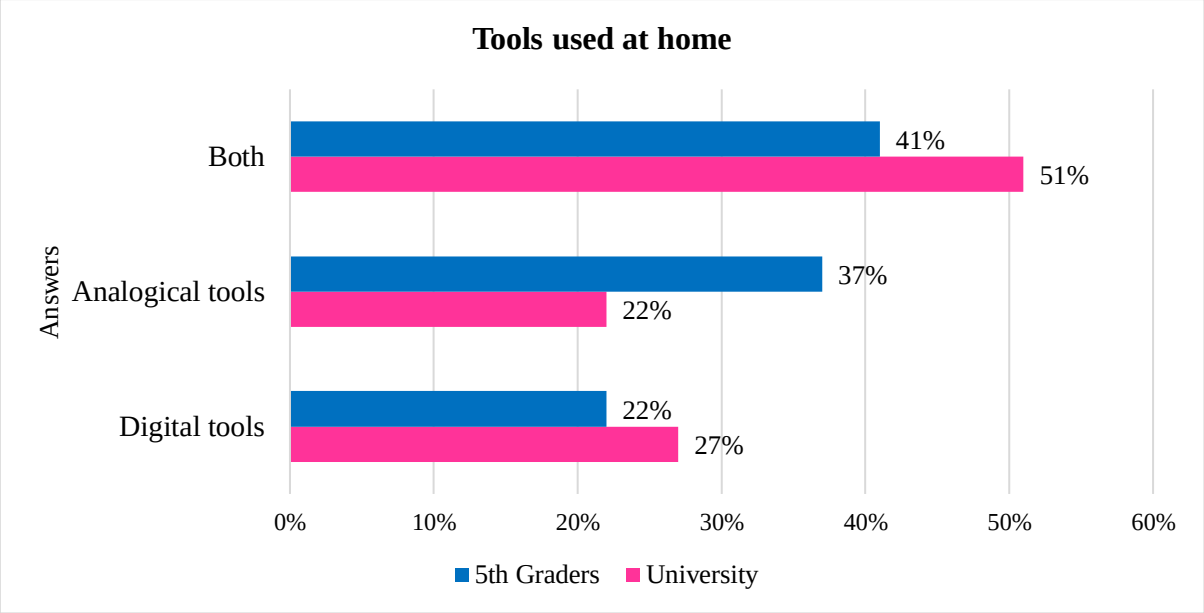
Figure 3 - *The use of digital tools in class (school/university)*



As regard the use of digital tools at home for studying, it has emerged that the 51% of university students uses both digital and analogical means, but the 22% prefer to use only

traditional ones; while, considering the 5th graders, the 41% of them uses both tools and the 37% said that prefers to use analogical ones.

Figure 4 - *The use of digital tools at home*



In the next paragraphs will be exposed the results concerning the questions about the use of technology at school/university and at home, always based on the distinction between fifth graders and university students. Considering the age of participants and the context of use of technologies there are some interesting differences that have emerged, which can confirm or refute the reference literatures on the topic. In other to make the results and the comparison clearer, three main sets of responses were created: *the attention through technology, the drop in concentration* and *the ease of use of technological tools.* These three categories are some of the ones used for the creation of the questionnaire, from the ones of the User Engagement (UE), exposed in the previous chapter (O'Brien, 2016a) (O'Brien, Cairns & Hall, 2018). There is also a last paragraph dedicated to the last question of the questionnaire which is the open one. This section collects all the students' impressions and opinions about the technological tools.

2. The attention through technology

From this paragraph onwards, the questionnaire's questions and answers concerning the six categories of User Engagement already mentioned will be analysed; these answers belong to

the third and fourth section of the questionnaire. The analysis of the data will be divided, for each paragraph, in two parts based on the difference of responses about the use of technology in class and at home, in order to get all the data clearer and easier to read.

In this section all the questions regarding the growth or decrease of attention through the use of digital tools will be exposed, taking into consideration the students' feelings about the use of digital means.

2.1 The attention through technology in class

Here, the attention through technology in class is analysed and the results of first question linked to this category are expressed in the table 3 below, where are showed all the students' feelings when they take notes in class, in order to understand if they think that the digital tool can increase their attention during teacher's explanation. As for the fifth graders, the values that are most significant are those that concern *involvement* (37%) and *little interest* (37%), which are the opposite of each other; while as for university students, the value that stands out more than the others is that of the "*involved*" (52%) item, followed by the "*motivated*" one (29%) even if with a lower percentage. You can see that for both categories, the other items present in the table have rather low percentages and some are 0%. However, the main percentage difference that you can see is the one regarding the item "involved".

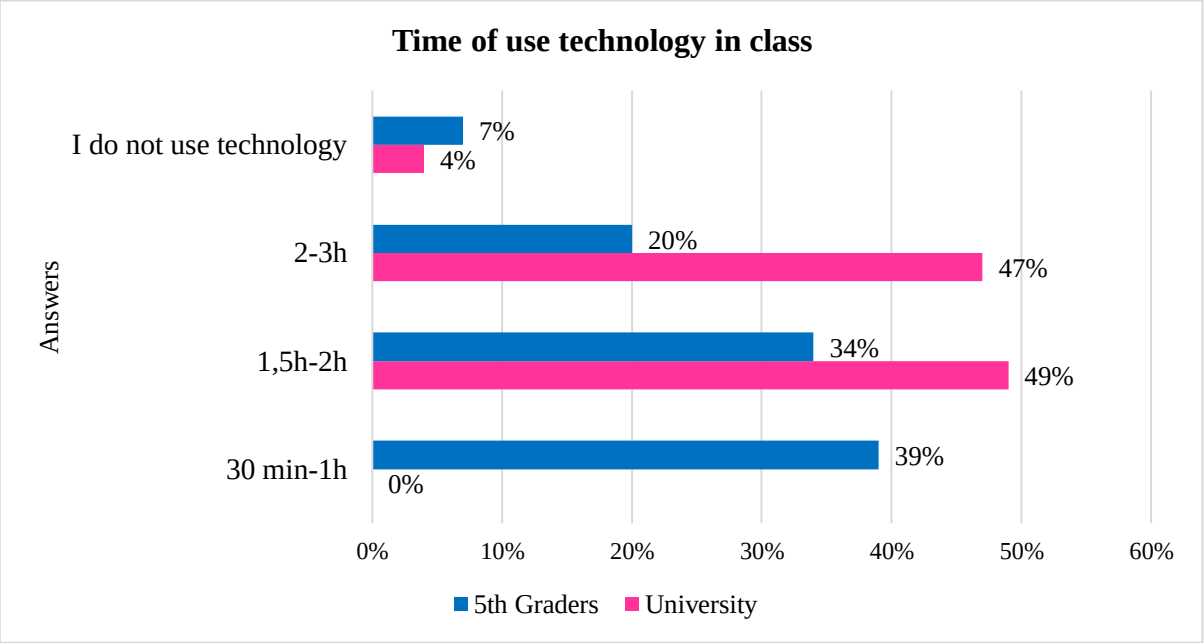
Table 3 - *Students' feelings about use of technology in class*

Feelings	5th Graders	University
Motivated	16%	29%
Involved	37%	52%
Little interested	37%	9%
Bored	5%	2%
Facilitated	0%	2%
Convenient	0%	4%
Confused	0%	2%
I do not use digital tools	5%	0%

In addition, students were asked whether the possibility of using a digital tool in class, such as Pc or tablet, can allow a greater attention to the topic explained by the teacher than

traditional tools and it has emerged a total mean of 2,17, with the respective difference of 1,90 for the fifth graders and 2,44 for university students. In relation to attention, there is the interest stimulated by the use of a digital tool during the lesson, indeed, students have answered with a mean of 2,63, with a value of 2,56 for fifth graders and of 2,71 for university students. The last question linked to the attention category concerns the use of technology done in class, expressed in time, in order to know how long students can stay focused through the use of a digital tool; in particular, for both parts, the time of use goes from hour and a half/two hours up to two/three hours. This relationship with time is expressed in the graph below (Figure 5).

Figure 5 - *The time of use of technology in class*

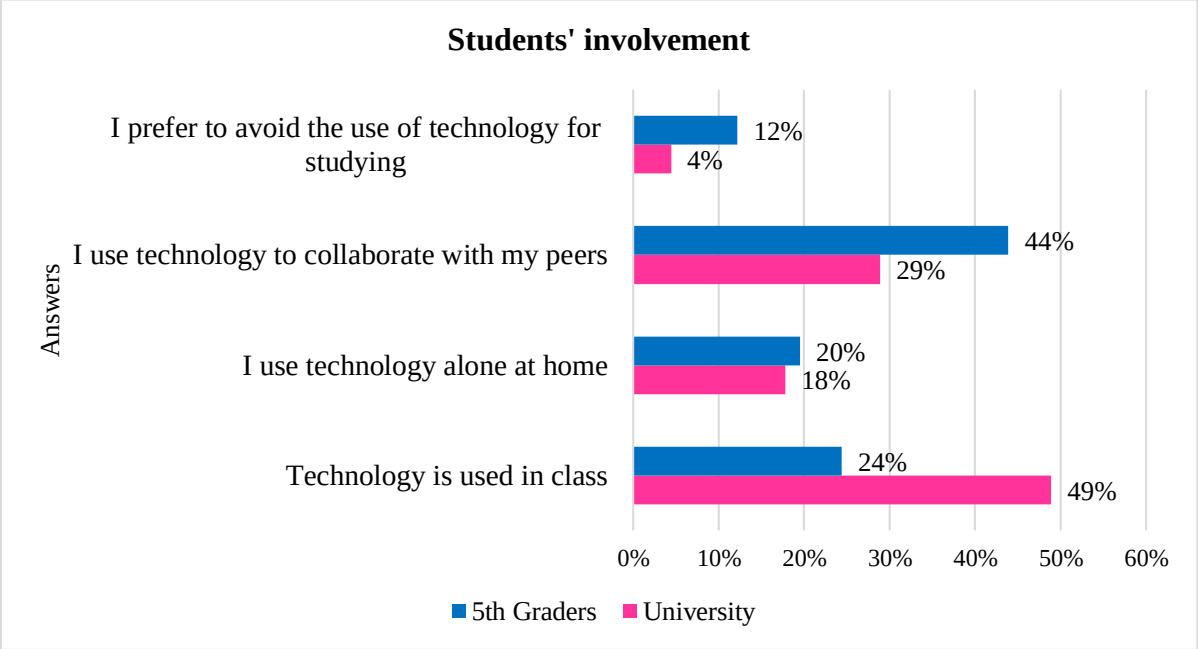


2.2 The attention through technology at home

This subparagraph shows the increase or the decrease of the attention through the use of technology at home. It opens with students' feelings about the use of technology at home, focused in particular on *involvement*, indeed, students were asked in which field of learning they feel most involved in using technology. The answers are showed in the graph below (Figure 6), where the fifth graders answer that they feel more involved when they use technology to cooperate with peers in class (44%) and the minority of them prefer to avoid the use of technological means in the study (12%); only the 20% uses technology alone at home. As regards university students, they feel more involved when using technology in class (49%) and

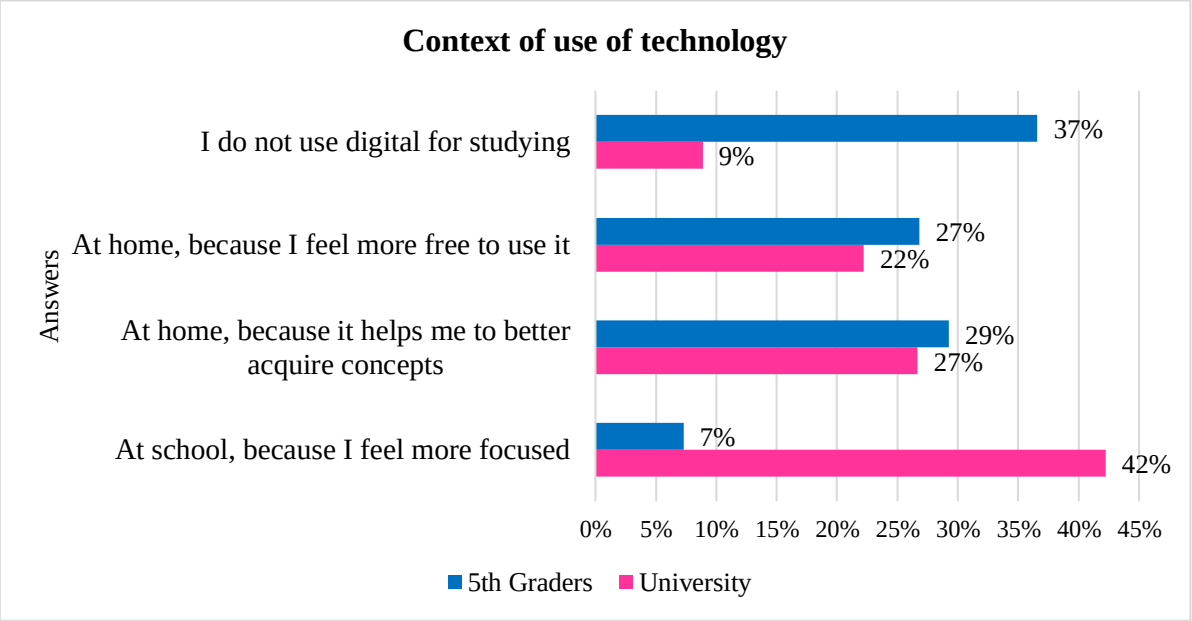
only the 4% prefers to avoid the use of technology to study. Here the main difference between sample students can be notice in items with the highest percentages, which concerns the cooperation with peers among fifth graders and the personal use of technology in class among the university students, so two different conceptions in the use of digital tools.

Figure 6 - *Students' involvement at home*



In order to understand if students' attention at home increase or decrease, they were asked where prefer to use digital to study and the data are exposed in the graph below (Figure 7). Here, the 37% of fifth graders, the highest percentage for this part of the sample, answered that does not use the technology to study, while only the 7% prefers the school because it feels more focused, for the other two items we have similar percentages: 27% for the freedom to use them at home and 29% because they help them to better understand the concepts; among university students, the 42%, the highest percentage of the graph, prefers to use digital tools at school and only the 9% does not use technology to study. You can see the extremes of the answers, to which belong the most significant percentages for the two parts of the sample, that are the opposite. It is interesting to be noticed that the middle voices, which relate to the use of technology at home, are very similar for both parts, indeed, the percentages differ very little.

Figure 7 - *Students' use of technology in different contexts*



Also here, students were asked if the possibility of using a digital tool at home can allow a greater attention to the topic studied than traditional tools and it has emerged a total mean of 2,33, with the difference of 2,21 for the fifth graders and 2,44 for university students; the majority of the sample (45,3%) agrees that the use of technology at home does not particularly increase the attention in the study and the reason why will be shown in the last paragraph of this chapter. Even at home was asked, related to attention, whether using a digital tool in individual study, the interest of students increases towards the topic to be studied and a total average of 2,24 has emerged, with the difference of 2,15 for fifth graders and of 2,33 for university students, here, few students, only nine of the entire sample, said that their interest in the topic is *very much* through the use of a digital tool. Also in this question, the majority of students (39,5%) agrees that the use of technology at home does not particularly increase their interest and therefore their attention.

3. The drop in concentration

In this paragraph the questions related to concentration through technology will be analysed. The title contains the word "drop", because as you will see in the exposure of the results, the concentration through the use of a technological means decreases according to students' perceptions. The detailed analysis of this category will be done in the net chapter, which is the

one of final discussions. Here, the data are showed mainly in the form of averages because the questions belonging to this category were made with the Likert scale, therefore, it is much clearer to find the midpoint of the answers with the addition of some significant data.

3.1 The concentration through technology in class

As for the alteration or not of concentration through technology in class, both students and teachers are involved and, in order to make the data exposure clearer, at the end of this paragraph there is a Table 4 containing the mean and mode of the questions analysed with the relative questions administrated. In the first question about this category, students were asked whether the teacher's explanation through the use of, for example, the digital book or the university handouts can help them memorize the topics explained; it has emerged a total mean of 2,72, with 2,54 for the fifth graders and 2,89 for university students. In this question, both sides replied that the digital in class can help "quite" their memorization and the score of fifth graders tends to be oriented down the scale, while the one of university students upwards. Related to memorization, there is concentration, in fact, the next question concerns the students' concentration through the use of technology with a total mean of 2,41, different for fifth graders with 2,15 and for university students with 2,67. Here, students' responses range from "little" to "quite" in the Likert scale, but anyway, the fifth graders' scores are oriented down. The next question is really interesting because there is a big difference between the two parts of students, here, the need to use a digital tool in class for learning is investigated: the total mean is 2,28, with 1,88 for fifth graders and with 2,67 for university students. As you can notice, the highest value concerns university, indeed, students better conceive digital as necessary in their learning, while for most of fifth graders there is no such need, with an orientation of answers ranging from "little" to "nothing". The last question about the concentration in class concerns students' visual and mental fatigue that may have been experienced after a prolonged use of a digital device, with reference to a maximum use of three consecutive hours. The total mean is 2,87, 2,66 for the fifth graders and 3,07 for university students; here, interesting are the data concerning the university, indeed, the majority of students (21) answered with the maximum score of the scale, which correspond to "very much", so, this fatigue is perceived much more by university students.

Table 4 - *Mean and mode of students' concentration answers in class*

	5th Graders		University	
Questions	**Mean**	**Mode**	**Mean**	**Mode**
Does the teacher's explanation by using the digital book/university handout help you in memorizing the topics?	2,54	3	2,89	3
Does the lesson through the digital book/university handouts promotes your concentration in class?	2,15	2	2,67	3
The use of a digital tool at school, is it necessary for your learning?	1,88	2	2,67	3
After using your device for a prolonged period of time in class (max 3h), do you experience visual/mental fatigue?	2,66	3	3,07	4

3.2 The concentration through technology at home

In this subparagraph the results concerning the concentration through a technological device at home will be showed. The first question regards the memorization, favoured or not through a screen, the total average obtained was of 2,09, with 2,10 for fifth graders and with 2,07 for university students, the values are very similar, indeed, the whole sample has been oriented on answers ranged from "nothing" to "little"; the answers were not really positive, therefore, maybe the memorisation does not depend on the use of a digital tool. The next two questions are related and concern the concentration increased or not by the use of a digital tool; the first one is formulated via Likert scale based on four values and has obtained a total average of 1,97, one of the lowest values seen so far, with 1,85 for fifth graders and 2,09 for university students, also here oriented to negative values. The following related question asked students who had expressed a positive opinion (in reference to the answers ranging from "quite" to "very much" of the scale) to the previous question, usually how long they could stay focused while studying or taking notes at home, so here, only positive feedback, by those who believe that the digital tool increases their concentration, and not the whole sample are taken into account, precisely, 23 positive answers among fifth graders and 27 for university students. The table 5 below allow you to better understand the answers to this question and the data are expressed in the number of students who answered the question in order to make clearer the comparison between answers' number.

Table 5 - *Positive feedback from part of the sample*

Answers	5th Graders	University
30 minutes/1 hour	8	6
1,5-2 hours	10	17
2-3 hours	4	2
More than 3 hours	1	2

As you can see, the item that has obtained the majority of answers is that of 1,5-2 hours, although with a difference between the two parts. It is important to take into account that, according to statistical data confirmed by the reference literature (Paus, 2005), the average concentration of a person varies from 30 to 40 minutes, so, for the answer to this question, it must be considered that within this period of time, the concentration is not continuous and probably, students take short breaks.

For the last question of this category, as has been done in the previous subparagraph, students were asked if after studying with a digital device for a prolonged period of time (maximum 3 hours), they experience visual or mental fatigue and the general mean obtained is 2,91, with 2,78 for fifth graders and 3,04 for university students. As it is possible to notice, the data of the section *in class* and in the section *at home* are quite similar, with higher values for university and slightly lower ones for the fifth graders. With these results, the category "concentration" ends.

4. The ease of use of technological tools

As stated by the reference literature (Baron, Calixte & Havewala, 2016), technological tools are recognized for their speed of writing and their ease of use. Therefore, this paragraph is dedicated to these two characteristics, which are the main hallmark of technological means from the traditional ones. The answers related to this category will be expressed by graphs and means, in order to make the comparison between the two parts of students' sample clearer and easy to understand.

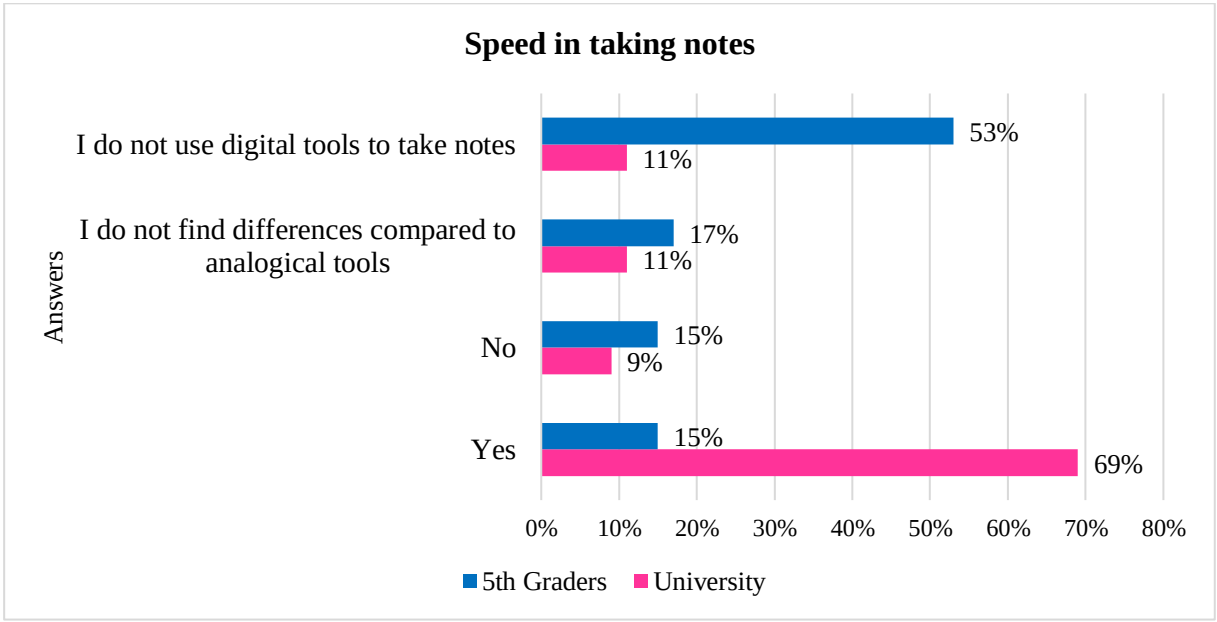
4.1 The ease of use of technological tools in class

As just said in the introduction of this paragraph, the ease of use of technological means is one of their main characteristics and that for which, very often, young people prefer digital to the

analogic tools, combined with their speed in writing such as taking notes. Here, the perception of ease of use and speed of digital tools by students in class is investigated and its results are explained in the form of graphs and averages.

The first question concerns the speed, students were asked whether using a digital tool allows them to take notes faster in class during the lesson and there are two particularly obvious answers compared to the others: the 53% of fifth graders said that they do not used technology in class, as stated so far by the data expressed in the previous paragraphs; while the 69% of university students said that the use of a digital tool really allows them to take notes faster during the lesson and thus save time in tidying up notes and studying at home. Instead, the other percentages of the items are quite similar for both parts, as you can see, the biggest differences are between the items "Yes" and "I do not use digital tools to take notes". These data are showed in the graph below (Figure 8).

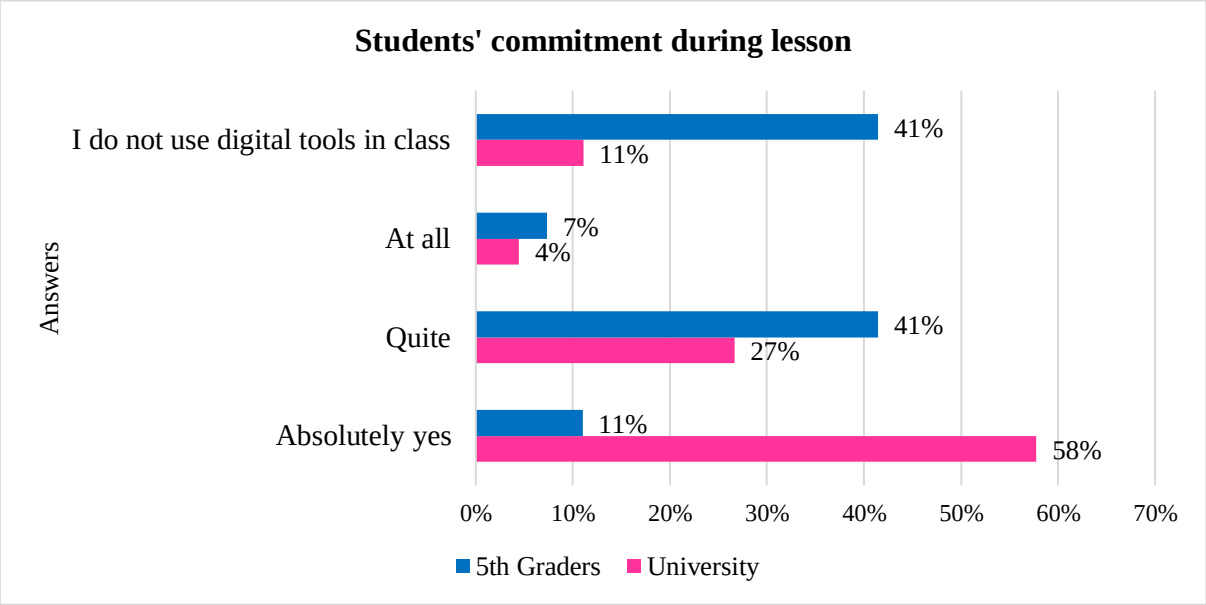
Figure 8 - *Students' perception in the speed of taking notes through a digital tool*



The next question asks students if the ease of use of digital tools most conducive their engagement during the lesson and here the answers are differentiated. As regards the fifth graders, there are percentages equal to 41% for two items: "Quite" and "I do not use digital tools in class", it would seem that for them the commitment during the lesson is not encouraged by the use of a digital tool; instead, it is the opposite for university students, indeed, the 58% of

them said that their commitment through a technological means is absolutely promoted and the 27% answered "Quite", for this item, the highest percentage belongs to fifth graders. Interesting in this question is the 11% of both parts of students which is expressed in the opposite items: "Absolutely yes" for university students and "I do not use digital tools in class" for fifth graders. Another information that can be noticed by comparing this question to the previous one is that in both graphs, the 11% of university students do not use digital tools to take notes in class, therefore, they were consistent in responding to the questionnaire. The results are showed in the graph below (Figure 9).

Figure 9 - *Students' commitment through the digital tool during lesson*

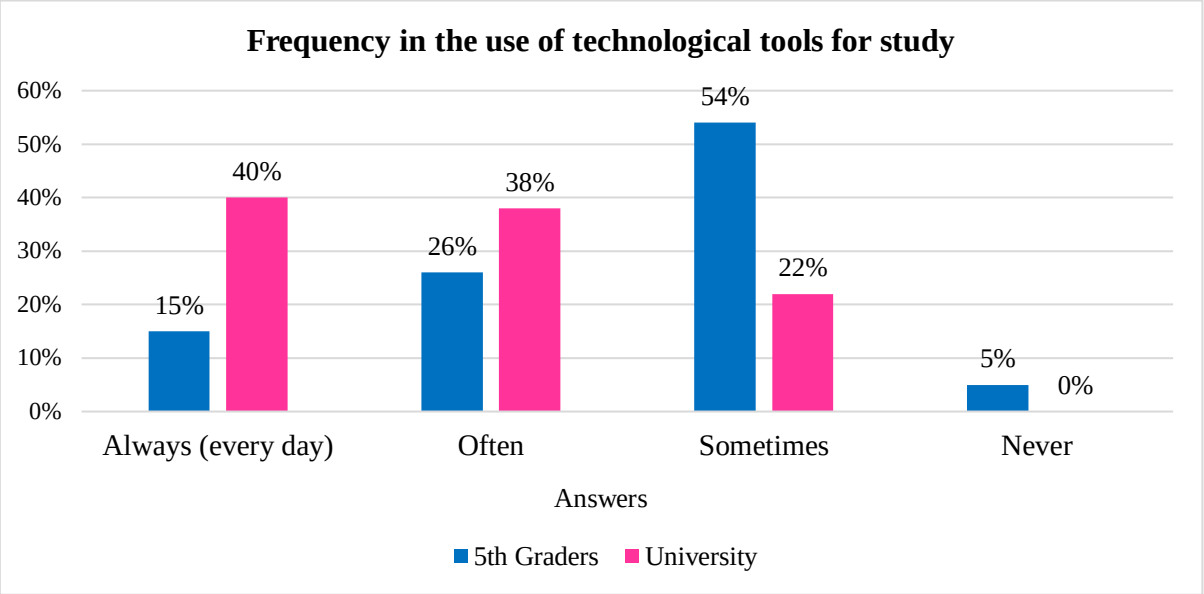


The last question about the use of technological tools at school concerns whether students consider fundamental or not the use of technology in class to facilitate teaching by the teacher, for example through the usage of slides, videos, pdf and others; the results are expressed by averages because of the use of Likert scale. The total mean of this question is 2,97, with 2,78 for fifth graders and 3,16 for university students, a great difference, here the most frequent answer has been 3, corresponding to "quite" from both sides, who are oriented towards the positive values of the scale.

4.2 The ease of use of technological tools at home

In this section are showed the results concern the ease of use of the technological means at home, in the form of graphs and averages. As in the previous subparagraph, the first question regards the speed in writing of a digital tool and students were asked whether through the use of it, they find that reordering notes and the subsequent study of these is faster and more practical than traditional tools. The results of this question are expressed by mean and the total one is 2,92, with 2,66 for the fifth graders and 3,18 for university students. Also here, there is a great difference between the two parts, in particular, the fifth graders are oriented to the negative values of the scale, while the university students to the positive one; probably, this result depends on the use or not of the digital tool that is made in class by both students and teachers. In the next question of this section, students were asked how ease of use of digital tools helps them in studying at home and the answers are expressed by mean. The total mean is 2,70 with 2,59 for fifth graders and with 2,80 for university students; by both parts, the major answers were given for the third and fourth item, corresponding, in order, to "little" and "quite", therefore, for the whole sample the ease of use of digital means is not essential in personal help at home study. The last question of this category concerns the frequency of using the digital tool to study at home, in order to know if the tool is used at home and, if the answer is positive, how many times the sample uses it. Indeed, students were asked how many times they use the Pc, tablet or both for individual study at home and it was found that most of the fifth graders uses digital means "sometimes" (54%), while, the 26% uses it or them "often" and only the 5% never uses a digital tool in their own learning, here, the use of the personal phone is not considered, assuming that every student in the sample has one. Whereas as regards the university students, the majority of their answers go from item "often" (38%) to "always" (40%), therefore, most of the university students employs every day the digital means in their own study, both in reorder notes taken in class and to study; in addition, it can be seen how none of university students answered that they never use digital to study, probably because they consider the technology a fundamental part for their learning, in line with universities' data seen so far. All the results of this question are expressed in the graph below (Figure 10); this graph is a histogram, different from those presented already because the frequency shown in this way is much more understandable and clearer.

Figure 10 - *Students' frequency in the use of technological tools for study*



5. *Students' impressions and opinions about technological tools*

This is the last paragraph of this chapter and it is built on the last question of the questionnaire, in which students had the opportunity to write, in a few lines or a bulleted list, their opinions, impressions and ideas about the technological tools, based on their use and experience with them. This last part is particularly interesting because it gave the opportunity to understand what students think of the digital means and of technology in general, without relying on pre-structured questions as was the case for the previous sections of the questionnaire, they could express themselves freely. Even for this question was made the comparison between the perceptions and ideas of fifth graders and university, exposing the main pros and cons that have resulted in the answers.

5.1 The pros of technology according to sample students

In this section, the pros of technology resulted from the answers of sample students to the last question of the questionnaire will be shown. In particular, all the data are divided into two tables, consisting of three categories: *attention, concentration* and *ease of use*, which are the same in which the data so far exposed were divided, concerning the division of fifth graders and university students, in order to make the comparison detailed and clear to those who read, despite different responses being similar for both parts of the sample. As you will see, these answers will confirm some statements of the reference literature previously exposed.

5.1.1 The technology's pros expressed by fifth graders

Taking into account the categories in which the data are divided, the one that appears more dense with answers is the "ease of use", in which the speed and ease of writing notes and finding information was reaffirmed; the utility of having many files on a single device, as opposed to several notebooks and books (the traditional ones) divided into different subjects, so the space-saving and the possibility of having less weight in the rucksack; the opportunity of seeing each other from a distance and ease in typing error correction. As regards the attention category, here students talk about the stimulation of visual memory; the increased interest towards the subject or topic treated/studied; the possibility of doing schemes through the use of slides or other apps. While, in the last category, the one of concentration, students report the greater written and mental order thanks to the digital tools; the greater quick learning curve and the increased memorization with the study concentration. The answers are shown in the table 6 below.

Table 6 - *Technology's pros of fifth graders*

	Answers
Attention	• Stimulate and help visual memory • Increased interest in the subject treated/studied • Greater understanding of schemes • Schematization through slides and apps
Concentration	• Greater written and mental order • You study better • Quick learning curve • Greater memorization of topics and study concentration
Ese of use	• Speed and convenience in writing notes and speed in finding the necessary information, search speed • Ease of having many files at your fingertips in one device; great versatility; very light, small and practical, less weight in rucksack • Interactive; easy to see peers/friends from a distance • Help in writing research and texts • Easy correction of typing errors

5.1.2 The technology's pros expressed by university students

In the table 7 below, all the answers about the technology's pros according to university students are shown. Here, many answers are similar to the above table concerning the fifth graders responses, additionally, in the attention category there is the increase of it thanks to the use of technology in class by the professors; while as regards the concentration, it is encouraged by the use of pdfs or other documents uploaded by teachers. As for the ease of use, the interest in innovation and the little waste of paper have been added, in comparison with fifth graders. But here, interesting are the answers given by students who attend scientific courses, indeed, the majority of them replied that the technological tools allow the insertion of images, like the precise geometric figures, and formulas necessary for the understanding of the subject and the use of specific apps and means, non-existent on paper, for the performance of certain exercises, for example mathematical. For them, there is also the possibility of use applications that allow you to deepen some concepts, such as the 3D viewers; in addition, through digital tools there is the possibility to correct the frequent miscalculation quickly and easily that with traditional tools would be much longer and complicated to do.

Table 7 - *Technology's pros of university students*

	Answers
Attention	• Visual learning and less passive study • Focus on the study with few distractions • More attention thanks to the use of technology in class by the professors
Concentration	• Better study through the use of Pdfs/slides and documents uploaded by professors • Help concentration during lesson in class and study at home • Greater understanding of topics
Ease of use	• Fast writing and retrievability of information • Very useful to deepen the topics treated • More order in notes writing and ease of reading • Ease and speed in taking notes in class • Interest in innovation

	• All at hand in one device with less paper waste • Possibility to insert the images in the clipboard and to take advantage of the applications for the deepening of concepts • Easy correction of typing errors • Possibility to download the eBooks • Easy file sharing and exportation • Easy integration of the material provided by teachers • Work with peers at a distance

5.2 The cons of technology according to sample students

In this subparagraph, the cons of technology resulted from the answers of sample students will be shown. Even here the data are divided in two table formed by the three categories mentioned above, concerning the division of fifth graders and university students. There are similar answers by both parts of the sample and they will confirm the reference literature as done by the previous data.

5.2.1 The technology's cons expressed by fifth graders

In the table 8 below, it is possible to notice that the category in which are expressed more cons of technology is that of the concentration, indeed, here fifth graders have answered that the use of digital tools leads them to an increase in visual and mental fatigue and greater distraction due to the continuous notifications, from for example the social networks, that arrive in the devices, in fact some students said that they prefer to use the traditional tool in order to avoid the distraction caused by the digital one; in addition they have exposed that technology can also lead to health problems, such as neck and back pain due to the continuous poor posture assumed during the study. While, for the attention category, students responded that they find their thoughts limited during study and greater loss of time cognition, compared to analogic tools. Instead, as regards the last category, the ease of use, there is only one voice which concerns the battery, principally of the Pc, indeed students complained that when they use the digital tools, they must always have at hand the charger to prevent the computer or any other tool from draining during lesson or study at home. Moreover, a response that has been given by some students, which has not been included in the table 8 because it does not fall into the three categories exposed, is that they do not use digital tools in class due to the impossibility of use,

that is, its use by the school or teachers is prohibited. This goes to confirm much of the reference literature presented in chapter two.

Table 8 - *Technology's cons of fifth graders*

	Answers
Attention	• Thought during study limited • Loss of knowledge of time
Concentration	• Increased visual and mental fatigue • Little concentration and greater distraction also because of the notifications that arrive in Pc/tablet • Preference in using traditional tools to avoid distractions due to Internet • Neck and back pain and cause of other health problems due to poor posture
Ease of use	• Need to always keep the computer charged and risk that it will drain during lesson or study session

5.2.2 The technology's cons expressed by university students

In this last subparagraph, all the answers about the technology's cons according to university students are shown. As in the previous sections, most of the responses are similar between fifth graders and university because they have similar perception about the use of digital means. For the attention category, students have answered that with technology they have less memorization and they prefer to use print notes in order to better sets the concepts, for example before of an exam, they also feel more isolation from reality. In concentration, they experienced visual and mental fatigue and motor fatigue and stiffness due to incorrect posture, distraction from the apps installed and feel more mental confusion compared with analogical tools. In the last category, they have answered that they need to know how to use the digital means and they have a difficulty in the communication with those who do not have the same tools or skills in using them; even here they said that it is fundamental to have always with them a charger in order to prevent the tool from draining.

Table 9 - *Technology's cons of university students*

	Answers
Attention	• Do not facilitate memorization • Isolation from reality • The paper sets the concepts more firmly
Concentration	• Tiring with visual and mental fatigue • Many distractions caused by installed apps • Preference in printing documents because the screen causes headaches • With paper there is greater concentration • More mental confusion • Motor fatigue and stiffness due to incorrect posture
Ease of use	• The familiarity in using it is necessary • Important to carry the charger and have a socket to charge the device, remember to charge it the day before the lesson • Screen too small • Difficulty communicating with those who do not have the same tools or skills in using them

Overall, students seem to have showed a positive attitude towards the use of technology and the digital tools both at school/university and at home, despite the possible distractions that these can bring and the health problems that can be a consequence if they are use too often. In conclusion of this chapter, some of the students who took part in the questionnaire gave their opinion on the questions asked and said that it was a well-structured questionnaire and that the questions were clearly expressed without creating doubts. All the findings emerged by this study will be discussed in detail in the next chapter.

CHAPTER VI

The research's conclusions

1. The final discussion of the main results obtained

In this last chapter of the thesis will be discussed the main results obtained and the conclusions of the study will be exposed. In particular, in this paragraph the discussion about the results will be divided mainly in the three research questions linked to the three research objectives shown in the fourth chapter, in order to make all the discourse clearer and more ordered for the reader; a final subparagraph is dedicated to the last question of the questionnaire, the open one.

1.1 Discussion on objective one: the personal use of the tool

This first research object is linked to the research question "*What are the habits of students about using digital and analogical devices for study?"* and regards the second section of the questionnaire given to students, the one in which the relationship with technology of the sample students is investigated. Indeed, here students have answered questions about their personal use of technological means, first of all it was asked how much they were attracted to the latter and the high percentages (80% for fifth graders and 89% for university students) coming from both parts of the students, as in figure 1, confirm that there is a great attraction to the digital world, as demonstrated earlier in Baron, Calixte and Havewala's article (2016). In addition, as regards what kind of digital tool is used by students to take notes or study, we saw that the highest percentages for fifth graders concern Pc + phone (32%) and the use of any digital tool (39%); while, on the contrary, among university students, the highest percentage regards the use of Pc (62%), followed by other much lower percentages for the other means; therefore here it is possible to see a deep difference about the digital tool preferred by the sample students, as it can be seen in table 1 in the fifth chapter. Besides attraction to digital tools, students were asked about their satisfaction in learning through the use of the digital and the answers, for both parts of students, are oriented from little (39% for fifth graders and 29% for university students) to quite (49% for fifth graders and 47% for university students), as we can see, the percentages of these two items are similar for the whole sample, thing that we cannot say for the item "very much" which sees the 15% of university students respond, compared to the 5% of the fifth graders, it is clear that university students have a more satisfaction in study or learning through

digital tools, maybe because they have the opportunity to use them much more even in class than the fifth graders, who can have more restrictions by school or teachers, see the figure 2.

In this section of the questionnaire is also investigated if the continuous innovations created by the digital world arouse or not the students' engagement and, as regard the general interest about innovations, the sample's mean corresponds to 2,79 and it is interesting the fact that more than 50% of university students finds interest in innovation, while, among the fifth graders only the 39% finds interest in it and the 44% has little interest towards it, which is a high percentages for the sample, perhaps because they are not encouraged to implement innovations at school. Related to innovation there is also the preferred context of use of this and both for fifth graders (54%) and for university students (82%), the leisure time and school/university is the context/time preferred for using the digital means, so the innovations, as stated by Seemiller & Grace in their article, in 2017. Therefore, for some questions there are deep differences among the sample, but for others they share the same ideas and perceptions, as it can be seen in table 2.

1.2 Discussion on objective two: the context of use

The second research objective is related to the research question "*Do the rules/habits of the school context meet or hinder students' attitudes?"*, mainly focused on the context of use of the digital means preferred by sample students, but, in this section also the results obtained in the third and fourth sections of the questionnaire and after divided into the three categories exposed in the fifth chapter, *attention, concentration* and *ease of use*, are exposed. As already seen with the results, the main comparison of the research is based on fifth graders and university students, who, by answering the questions, will make us understand if the three categories just mentioned are in favour or are a source of obstacle in their learning, both in class and at home. Starting from this, for the second objective, as first thing is considered the use that students make of digital tools first in class and then at home. As for the use in class, we can refer to the figure 3, where the 56% of the fifth graders respond that they prefer to use analogical tools, probably because they are not very familiar with the digital and are much confident in using traditional tools, such as notebooks and books, because they are more used also by teachers for the explanation of topics in class, this can also be confirmed by the 24% of them, who have answered that they cannot use digital tools at school; on the contrary, among university students, we can see that the majority of percentages goes for the use of digital tools and analogical ones

(38%) and for only digital tools (40%), nobody said that cannot use them in class, because they have much more freedom in usage compared with fifth graders and less restrictions and control by teachers, confirming Petrucco's claims (2021) mentioned in chapter III. Instead, as regards the use of digital at home, we can refer to figure 4, in chapter V, where we can see that the highest percentages concern the item of use of both tools, digital and analogical, 41% for fifth graders and 51% for university students, but, we can see that there is still an important difference between the use of the preferred analogical tools from the fifth graders (37%) and those technological preferred by university students (27%). Therefore, from the comparison in the use of digital and traditional tools in these two contexts is visible as, although there is a great influence of digital, in particular among university students, the analogical means are still a key part in learning of both parts of students.

From now on in this and in the next paragraph, the six categories of the User Engagement (UE) described by O'Brien in 2016 (O'Brien, Cairns & Hall, 2018) will be analyzed in detail, the ones summarized in the three main shown above. For the second objective, the students' interest in digital tools is combined with the teacher's use in class, so there is a mix of the answers from the third and fourth sections of the questionnaire. Starting with attention category, students were asked if the teacher's explanation through digital means stimulates more their interest about the topic treated in class, the total mean is 2,63, and the one of university students is 2,71 and for the fifth graders is 2,56, so, the interest is stimulated more in university students and less in fifth graders, probably because the majority of teachers do not use technology in class for the explanation, as stated by Rizzi & Bolognese (2016), cited in chapter III; while, at home, they answered that the digital tool is not fundamental to increase their interest on the topic studied, indeed the total mean is 2,24, which is lower than the previous one, so they do not consider a great importance of technology in individual study, taking into consideration the rise in interest. In another question, students were asked to respond about the time they use technology in class and, as you can see in figure 5 of fifth chapter, we have the highest percentages of university students for items 2/3 hours (47%) and 1,5/2 hours (49%), while, among fifth graders, the highest percentages regards items of 1,5/2 hours (34%) and 30 minutes/1 hour (39%); therefore, it is clear that university students use much more technology than fifth graders, who have certainly more restrictions by teachers. Moreover, students were asked in which context they prefer to use technology and, as it possible to see in figure 7, there are the extremes of the answers, to which belong the most significant percentages for the two

parts of the sample, that are the opposite: the 37% of fifth graders do not use technology, while the 42% of university students prefer to use it in class because they feel more focused, here, the highest percentages for both groups of students are concentrated in the middle items related to the use at home, this is interesting because affirms that the preference of sample students is mainly in the use of digital tools at home, so they have a similar perception. In addition, when students were asked if using a digital tool at home can allow a greater attention to the topic studied than traditional tools, has emerged a total mean of 2,33 and the majority of the sample (45,3%) agrees that the use of technology at home does not particularly increase the attention, because in using digital tools there is also a lot of distraction due to notifications from installed apps; whereas, at school, students were asked if the possibility of using a digital tool in class can allow a greater attention to the topic explained by the teacher than traditional tools and it has emerged a total mean of 2,17, with the most fifth graders' answers oriented down the scale and the ones of university students in the middle of the scale; therefore, a greater attention is perceived by the university students and not by the others.

The second category is the one of concentration and the paragraph is entitled "*The drop in concentration*" because, from the results obtained, when students used technology in studying, they perceive a drop in concentration, especially after several hours of usage, they feel less focused and feel the decrease in concentration. But, when they are asked about if the teacher's explanation through a digital tool can help them in memorization of contents, they answered that it can help *quite* their memory (2,72), so the scale's answers are oriented towards the positive values; while as regards if the use of technology by teachers can help students in concentration during lesson, their answers are oriented downwards (2,41); so, technological tools help memorization probably also thanks to the activation of visual memory, while, concentration is not favoured due to possible visual and mental fatigue in front of the screen.

The third category is that of the ease of use of the technological means and students were asked about if the use of technological tools at school is considered fundamental or not to facilitate teaching by the teacher and the total mean is 2,97, the highest of all results, indeed, both fifth graders and university students consider fundamental the use of technology in class by the teacher in order to better understand the topic and feel facilitated in learning. In addition, it was asked how ease of use of digital tools helps them in studying at home, the total mean is 2,70, with singular means quite similar for both parts of students, indeed, most of the responses were concentrated in the central values of the Likert scale, confirming the fact that the ease of

use of digital tools tends to make them prefer to traditional ones to study, as stated by Taipale in 2015. The last question linked to this second research objective concerns how often they use technology to study at home, so the frequency in using technology, and as concern the university students, the highest percentages we have in items ranging from *often* to *always (every day)*, as you can see in the figure 10; whereas, among fifth graders, the highest percentage is in the item *sometimes* (54%), also here it is evident that technology is considered a fundamental part of the individual study by university students but it is not indispensable for fifth graders, who tend to prefer traditional means, as already demonstrated by other data exposed.

1.3 Discussion on objective three: the consequences in the use of digital

The third research objective is related to the research question "*Are there differences in the use of digital and analogical devices compared to age and environment?*" focused on students' feelings and perceptions about the use of technology in class and at home and on the consequences derived from the continuous and prolonged use of technological means. First of all, as regard the attention category, students were asked how they feel while using a digital tool to take notes and, as it is possible to see in table 3, the two items most relevant for the fifth graders were *involved* and *little interest*, which are contradictory as they are two opposites feelings, with the same percentage (37%); while among university students, the two most relevant items were *involved* (52%) and *motivated* (29%), here you can notice that university students have a greater awareness of the use of technology than the fifth graders**.** Remaining within the realm of feelings, students responded when they feel more involved and as it is possible to see in figure 6, the 44% of fifth graders uses the technology to collaborate with peers and the 49% of university students uses the technology in class, so the use done by the latter is more individual than the one done by the first, who tend to cooperate more with friends.

In the concentration category, students were asked about the necessity of use the technology for their learning in class and here, there is a deep difference among the two parts of the sample, indeed, university students feel the necessity of the technology in class, with a total mean of 2,28, while, fifth graders do not feel this necessity, their mean is about 1,88, one of the lowest overall results, probably because they are not encouraged to use it by teachers. Linked to the necessity of technology's use in class, students were asked if their memorization is favoured or not through a screen and the total average obtained was of 2,09, with the singular

means from both parts of students similar, oriented down the scale, so storage is not too favoured by the use of digital. Related to memorization, there is also a question concerning the increase in concentration through a digital tool and the total average is 1,97, a very negative result, in fact most of sample students stated that their concentration does not increase if technology is used rather than a traditional tool, particularly among fifth graders, who got the lowest average of all (1,85). Associated to this question, the following one collected the positive feedback regarding the increase in concentration and asked these students how much they manage to stay focused while studying or taking notes and, as it is possible to see in table 5, for both parts of students prevails the item that concerns the hour and a half to two hours, surely with some breaks in the middle, confirming what is written in the article of Atasoy & Morewedge (2017). In the concentration category, there is exposed one of the biggest consequences due to the continuous use of digital means: the mental and visual fatigue, both in class and at home. Students were asked whether after using the digital tool for a prolonged period of time (maximum 3 hours), they experience this mental and visual fatigue and, in class, the total mean is of 2,87, while at home it is of 2,91, two very similar results, testifying to the fact that the majority of the sample perceives this fatigue and probably, when they prefer traditional tools is just to avoid it or to "relax" a little the mind, as stated by Rockinson-Szapkiw, Courduff, Carter & Bennett in 2012. In conclusion of the class concentration section, the questions in the questionnaire are summarized in table 4, where all the means and modes are exposed and it is very useful to understand that the higher values are obtained with the answers of the university students, while, for the fifth graders, the values are more oriented to the low of the scale; mainly, university students consider technology fundamental for their learning.

As concern the third category, the ease of use, students were asked if the speed in writing of the digital means allows them to take notes faster and, as it is possible to see in the figure 8, the 69% of the university students answered that the speed in writing allows them to take notes faster in class, while the 53% of the fifth graders answered that they do not use digital means to take notes; so it is clear that technology in class is more used by university students in class, probably, because they are much more familiar. They were also asked if through the use of digital tools their reordering of notes and the resulting study is much more practical and faster, compared to traditional ones and the total mean is 2,92, here, both parts of the sample agree that the speed is a very useful property in favour of digital, as already said by Meglioli in 2021. In conclusion, students were asked whether or not the ease of use of digital tools favours their

use during lesson and, as it is possible to see in figure 9, among fifth graders, we have the same percentage (41%) for two items, *I do not use digital tools in class* and *quite*, so their opinions are divided in half; while, among university students, the 58% uses digital thanks to its ease of use, here, obviously, who uses technology most are the university students, confirming all the other data obtained.

2. Pros and cons in the use of technology

This section is dedicated to the last question of the questionnaire, the open one, which concerns the pros and cons of the use of technology and its digital devices in class and at home, in addition, there are the perceptions and ideas of sample students, expressed freely.

2.1 The pros in the use of technology

In this subparagraph we will talk about the results concerning the pros of the use of technology expressed by the two parts of the sample students, referring to the tables 6 and 7 of the chapter V. As it is possible to see, at a glance, university students have said far more pros than the others, mainly in the category of the ease of use. But we start from the attention category, here, both parts of students agree on the fact that technology help visual memory and learning; fifth graders feel more interested and have a greater understanding towards the topic explained and prefer the schematization through slides and apps; while university students feel more focused on the study and have more attention in class if the professor uses the technology to explain. As concerns the concentration category, both sample students agree on the greater memorization in class and study concentration at home; fifth graders said that they have also a greater mental and written order, and a quick learning curve; while university students added that they study and understand better a topic when teacher uses and provides them Pdfs and slides. Regarding the ease of use, whole students agree in the fast writing and retrievability of information and speed in writing notes, the ease of having many files at their fingertips in one device, the great versatility, digital devices are very light, small and practical with less weight in the bag, the work with peers at a distance and the easy correction of the typing errors; moreover, university students added that digital tools are very useful to deepen topics treated, they have more order in notes taking and ease of reading, they have more interest in innovation, they also have the possibility to insert images in the files, download eBooks, share documents and integrate them in their own notes. There is also a reference to those who attend scientific

courses, who said that, thanks to the use of technological means, they can insert geometric figures and write the formulas at the basis if the subjects studied, the resolution of some mathematical exercises is much faster and practical, compared to traditional tools, in addition, they can also use some apps which allow to deepen some concepts and they can correct easily the miscalculation errors, which with analogical means would be much longer.

It has to be said that the whole sample agrees in most pros of technology, the list done by university students is longer than that of the fifth graders, probably because they have much more familiarity than the latter in using the advantages offered by the technological world. As already mentioned on the third chapter, the leap from the fifth grade of high school to university is fundamental, especially with regard to the tools used for study and certainly, the fifth graders, once arrived at university, will be able to integrate their list of pros related to technology; because the more you use the technological tools, the more you have the opportunity to discover all its advantages and exploit their qualities.

2.2 The cons in the use of technology

In this section, all the results concern the cons in the use of technology exposed by the sample students will be commented, referring to the tables 8 and 9 in the fifth chapter. Here, from both parts of students, the concentration category is the one that has the densest counter-list, because it is related to the consequences of the prolonged use of technological means, such as mental and visual fatigue exposed in the previous paragraphs. Starting from attention category, the whole sample agrees that through the use of digital tools, you lose track of time and then you isolate yourself from reality; moreover, fifth graders perceived their thinking during study limited, while university students said that technology does not facilitate the memorization and the paper can sets better the concepts in mind. For concentration category, both parts of students stated that the technology increases visual and mental fatigue after a continuous study session, there is a great distraction caused by the notification from the apps installed, they prefer the printed notes in order to avoid distractions and headaches, in addition, they feel neck and back pain and other motor problems due to poor posture; in this category, university students added that digital devices caused a more mental confusion. For the last category, the ease of use, the only common point for both parts of students is that it is important to take the charger with you to prevent the digital tool from draining in the middle of a lesson; university students also added that in using digital devices is fundamental to have familiarity with them, otherwise, there will

be difficulty in communicating with those who do not have the same tools or skills in using them, also the screen too small is a cons perceived by them.

Eventually, it can be said that the main cons are found in the concentration category, as it is linked to the possible negative consequences of the continuous and prolonged use of digital means, students perceive as principal cons the mental, visual and physical fatigue, maybe because this does not happen with traditional tools as, there is not the brightness of a screen and the eyes do not tire, moreover, using traditional tools, there is certainly less distractions related to the apps and social media installed in the digital means used to study, as stated by Vidhate in 2020. As seen, there are many pros than cons in using technology for learning and the mainly cons are related to health problems, so, it is important to not strain and overload our mind with too many hours in front of digital tools, breaks during study session or work are fundamental.

3. Conclusions of the survey

With the advent of technology and its continuous innovations, our way of thinking and communicating with other people has changed. This change does not only affect the generations of young people, like the Z Generation, but all the people in the world because technology is now present in every field: personal, educational and professional. Surely, technology has had a strong impact on learning change in young people and educational institutions, because they had to adapt to the continuous updating in the use of new technological means, both for study and for teaching. Inspired by this great change, this work investigates the technological relationship and differences between the students of the fifth grade of high school and of the university. Thus, this study aimed at a better understanding of the similarities and differences in the usage of technology done by the two parts of students, mainly in two different contexts, at school or university and at home. In particular, chapter I, II and III investigates the theoretical background of the Z Generation's learning with the influence of technological means and, also, the development of technology over the years in school and university, related to the preparation and formation of teachers in using it during lessons. The following chapters, IV, V and VI focus on the study done with the questionnaire, and the results obtained. The questionnaire is built and explored the six categories of the User Engagement (UE) described by O'Brien in 2016 (O'Brien, Cairns & Hall, 2018). The results obtained, divided in three main categories, show that technology is much more used by university students both in class and at home, than the fifth graders, who do not have enough familiarity in using it, especially at school. University

students have more autonomy and freedom in using technological tools in formal contexts, compared to fifth graders, who have restrictions from school or teachers. As regards the attention and concentration, they are stimulated especially at university, also thanks to the ease of use and the speed in taking notes during lesson, fundamental qualities of technological tools, and memorization of topics is favoured when teacher uses and share the files to be studied, students feel that through technology, the teacher's explanation is facilitated. But, both parts of sample students agree on the fact that the prolonged use of technology and, therefore the sitting in front of the screen, causes mental and visual fatigue, in some cases even physical, due to the wrong posture. In addition, students said that using digital tools is also a source of attention and concentration's decrease, caused by the notifications coming from installed apps.

The deep difference that has emerged from both sides of the students is that university ones consider the technology fundamental for their study, also because they have a great awareness in the use of it, while fifth graders conceive technology as an opportunity to cooperate with their peers and it is not indispensable in their individual study, surely because they are less familiar. This is demonstrated when they were asked whether or not they are interested in innovation, where most of the university students answered yes although they use it in leisure time, while a nice portion of fifth graders said that they do not use technology, also because they are not encouraged to do so, mainly in learning field.

Eventually, the results of this work indicate that university students tend to use technology and its tools more, both in formal and informal contexts, than fifth graders. The interest in the digital world is present in both groups of students, although in different percentages, but, as it has been seen, the main influence comes from the context in which technologies are or are not used. One thing is for sure, it is important to keep up with technology because it is part of our present and essential in our future.

4. Strengths and weaknesses of the study

The strengths of this study lie in its nature and purpose: the exploration of the technological relationship between fifth graders and university students, done mainly in the use of digital devices at school/university and at home. So far, several studies have been done about the influence of technology, and therefore of the digital world, in the learning of young students, but no one has explored the difference in the use of technology between fifth graders of high school and university students; so, this study can serve as an introduction to future studies,

perhaps with a larger sample of students. Even if the sample obtained for this study is large enough (86 students), at least to understand different perceptions and ideas exposed by students in the field of technology and also analogical, without being limited to a small number of participants. Although the results obtained are satisfactory for this research and show that there is much to investigate in order to understand the technological relationship of young people in their learning, a larger sample, perhaps aimed at all high school students, and not only the fifth graders, could give a broader and more complete view of the topic, so this is a limit of the study. In addition, with a larger sample, there would be the possibility of having a clearer division between males and females and also the possibility of investigating this technological relationship within many more school/university courses than the study performed, by making multiple comparisons between the different categories of students, no limited to the comparison performed in the study just done; in which, further comparisons, beyond to that between fifth graders and university students, could not be made because of the lack of a sufficient number of students to be divided into the various categories, as the comparison would not have been valid. Another interesting comparison is the one made between the italian and other foreign schools, which has already been done by other researchers in less recent years, then an update with the latest data must be done. The opportunity to investigate through a wider sample allows to deepen much more this comparison and to know many more ideas and preferences related to the habits of using digital tools of today's students, those who were born and raised with technology.

5. Implications and suggestions for further research

First of all, the implications for further research include an increased awareness about the relationship with technology of young people of Z Generation, in order to know their perceptions in the digital field related to the one of learning, which is at the basis for their personal training. When we talk about technology in the field of learning, it is underlying that much of the use that is made of technology in schools goes through the teacher, an adult not always in contact with the digital world, who must constantly be up to date and maybe even get inspiration and advice from his/her students, that most of the time are better equipped in this area. Taking into account this, being up to date with technology and its innovations is fundamental not only in the learning field, but also in the personal area, both of students and teachers, in order to keep up with times and, in particular for young people, to have great

opportunities in the world of work, where always more companies required a computer training to be able to communicate with the outside world. So, the usage of digital tools during study sessions is very important nowadays and young people have to use them more and more in order to acquire knowledge and familiarity, especially for people who attend the fifth grade of high school. As can be seen from the results shown in chapter V, the latter are those who are least exposed to the use of technology, especially in class, because of school or teachers' restrictions; to encourage the use of technology in class, teachers should know how to use it and permit students to use it autonomously, explaining how to use digital tools, giving rules for cooperative use with peers. The introduction and subsequent gradual use of these means is crucial, so as to avoid letting students use them for personal use only. In this direction, it is essential that teachers evaluate all the pros and cons of using digital tools and explain them to their students, so as to make them aware of how prolonged use can cause health problems, such as mental and visual fatigue and postural problems, as already highlighted in the previous chapter. The task of teachers should be to educate to the correct use of these devices, combining the personal sphere with that of learning, encouraging young people to use technology in individual study and to take notes. Therefore, an important advice for teachers could be, always up to date with new technologies, that the more they use technology in class, the more they will be in close contact with their students, because the latter are the ones who were born with technology and this is part of their daily lives. This is fundamental because of the great need for media education in schools, because there is a risk that students, mainly those in high school, use technology only for personal interest, as in leisure time with the consultation of social networks or other app, not aimed at learning. A gradual education to the safe and correct use of technology should be mandatory in high schools, an even in middle schools, which is already only proposed and never implemented by the government, so as to allow students to acquire knowledge and not find themselves at the end of schools, ready for university, without proper training. Indeed, as we have seen from the data obtained with the questionnaire, the university tends to use digital devices daily in the field of learning, because of their practicability and ease of use, also because technology is much more used by professors through slides and documents that then easily share with students. Keeping up with technology is also an opportunity for teachers to stay up to date on the evolution of the world and on the needs of young people.

This research was restricted to the comparison between fifth graders and university students, as already said, thus, in addition to taking into account the limits of this research

exposed in the previous paragraph, a suggestion for further research could be to extend the study to the opinions and perceptions of teacher about the technological field, in order to know how they feel when they use the digital devices, what they think about their personal preparation and training and the opportunities provided to them by the Italian State to update.

What emerged from this study was that university students have more familiarity in using technological means compared to fifth graders and both groups of students tend to use technology more in their free time, certainly linked to the use of the phone to consult social networks; however, the negative sides of technology that has emerged is the drop in concentration related to mental and visual fatigue due to the continuous usage of too bright screens which strain the mind. Therefore, the aim of this research was to investigate the change in learning after the introduction of technology with its tools in formal and informal contexts and the results obtained through the questionnaire helped in meeting the objectives that were shown in chapter IV. They have opened plenty of possibilities to properly deepen and study the issue.

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Appendix: the questionnaire

Hereafter the questionnaire used for this research will be reported. Students was administered in Italian, and here are the italian and English versions.

ITALIAN VERSION

Quanto la tecnologia influisce sull'apprendimento. Differenze e analogie dell'apprendimento a scuola e a casa.

Nell'ambito del Corso di Laurea Magistrale in Scienze del Linguaggio dell'Università Ca' Foscari di Venezia è in corso un progetto sperimentale di ricerca in ambito formativo e didattico sul tema "Quanto la tecnologia influisce sull'apprendimento. Differenze e analogie dell'apprendimento a scuola e a casa.", condotto dalla dott.ssa Silvia Bozzatto con la supervisione delle proff. Monica Banzato e Francesca Coin.

Il progetto prevede un'indagine esplorativa da svolgersi attraverso la somministrazione e compilazione del seguente questionario sottoposto agli studenti dell'ultimo anno di scuola superiore e quelli dell'università, iscritti ad indirizzi diversi. La ricerca ha lo scopo di indagare quanto la tecnologia influisca sull'apprendimento, in particolare, individuare eventuali differenze e analogie dell'apprendimento in due differenti ambienti: a scuola e a casa.

Le attività proposte saranno somministrate in forma anonima e non prevedono la raccolta di dati sensibili. Il questionario durerà circa 10 minuti.

Grazie per la vostra partecipazione!

Le prove hanno un valore puramente descrittivo e non possiedono alcuno scopo diagnostico. I dati verranno raccolti in forma anonima, non verranno divulgati a terzi e saranno trattati nel pieno rispetto della privacy, come previsto dal D.lgs. 163/2017, Ex art. 13 D.L. 196/2003 ed ex art. 13 Regolamento Europeo 2016/679, esclusivamente per scopi di ricerca e didattici.

*Clicca su "acconsento" nella parte sottostante per partecipare allo studio. Se non desideri partecipare, esci semplicemente da questo link.

- Acconsento

Prima sezione: dati anagrafici degli studenti

1. Qual è la tua età?
2. Sesso:
    - M
    - F
    - Preferisco non specificare
    - Altro
3. Frequenti
    - Scuola superiore (ultimo anno)
    - Università
4. Indirizzo di scuola o università frequentato

Seconda sezione: il tuo rapporto con le tecnologie. Questa sezione riguarda il tuo utilizzo generale delle tecnologie digitali per lo studio.

5. Gli strumenti digitali ti attirano al loro utilizzo?
    - Si, mi sento molto attratto dal mondo digitale
    - No, non mi sento attratto dal mondo digitale
    - Il mondo digitale mi è indifferente
    - Non utilizzo strumenti digitali
6. Quanto ti senti attratto dagli strumenti digitali?
    - Per niente – Poco – Abbastanza – Moltissimo
7. Strumento digitale con cui prendi appunti/studi:
    - Nessuno
    - Pc
    - Tablet
    - Telefono
    - Altro

8. Hai uno strumento digitale personale?
    - Si
    - No
9. Se la risposta alla domanda precedente è SI, specifica qual è il tuo strumento digitale personale
10. Trovi l'impiego della tecnologia inutile?
    - Mai – Qualche volta – Spesso – Sempre (tutti i giorni)
11. Trovi soddisfazione nell'apprendere attraverso uno strumento digitale?
    - Per niente – Poco – Abbastanza – Moltissimo
12. Le continue innovazioni nel mondo del digitale attirano il tuo interesse?
    - Per niente – Poco – Abbastanza – Moltissimo
13. Le innovazioni degli strumenti digitali ti interessano principalmente per:
    - il tempo libero
    - scuola/università
    - tempo libero e scuola/università
    - non mi interessano

Terza sezione: apprendimento a scuola. Concentrati ora sull'utilizzo che fai IN CLASSE dei dispositivi digitali per lo studio.

14. In classe, tendi ad utilizzare gli strumenti digitali rispetto a quelli tradizionali (es. quaderni, libri etc...) per prendere appunti?
    - Si, uso solo strumenti digitali
    - Abbastanza, ma utilizzo anche quaderni e libri
    - No, perché in classe non posso usare strumenti digitali
    - No, perché preferisco utilizzare quaderni e libri
15. Utilizzando uno strumento digitale per prendere appunti, ti senti:
    - Motivato
    - Coinvolto
    - Poco interessato
    - Annoiato
    - Altro

16. L'utilizzo di uno strumento digitale ti permette di prendere più velocemente gli appunti durante la lezione?
    - Si
    - No
    - Non trovo differenze rispetto agli strumenti tradizionali
    - Non uso strumenti digitali per prendere appunti
17. La spiegazione da parte dell'insegnante tramite l'utilizzo del libro digitale/dispense universitarie, ti aiuta nella memorizzazione degli argomenti?
    - Per niente – Poco – Abbastanza – Moltissimo
18. La lezione attraverso il libro digitale/dispense universitarie favorisce la tua concentrazione in classe?
    - Per niente – Poco – Abbastanza – Moltissimo
19. La facilità d'uso degli strumenti digitali favorisce il loro impiego da parte tua durante la lezione?
    - Assolutamente si
    - Abbastanza
    - Per niente
    - Non uso strumenti digitali in classe
20. La possibilità di usare uno strumento digitale, come Pc o tablet, a scuola, ti consente una maggiore attenzione, rispetto agli strumenti tradizionali?
    - Per niente – Poco – Abbastanza – Moltissimo
21. Utilizzare uno strumento digitale a scuola, è necessario per il tuo apprendimento?
    - Per niente – Poco – Abbastanza – Moltissimo
22. Consideri fondamentale l'utilizzo della tecnologia a scuola per facilitare l'insegnamento da parte del docente (es. uso di pdf, ppt, video, etc...)?
    - Per niente – Poco – Abbastanza – Moltissimo
23. Uno strumento digitale stimola maggiormente il tuo interesse durante la lezione!
    - Per niente – Poco – Abbastanza – Moltissimo
24. Durante le lezioni in classe, per quanto tempo viene utilizzata la tecnologia?
    - 30 minuti - 1 ora
    - 1,5 - 2 ore
    - 2 - 3 ore

- Non usiamo la tecnologia in classe

25. Dopo aver utilizzato il tuo dispositivo per un periodo prolungato di tempo (max 3h) in classe, accusi affaticamento a livello visivo/mentale?
    - Per niente – Poco – Abbastanza – Moltissimo

Quarta sezione: apprendimento a casa. Concentrati ora sull'utilizzo che fai A CASA dei dispositivi digitali per lo studio.

26. Per studiare a casa, ti senti più attratto dagli strumenti digitali oppure da quelli tradizionali?
    - Strumenti digitali
    - Strumenti tradizionali
    - Entrambi
    - Altro
27. Tramite l'uso di uno strumento digitale, trovi che il riordino di appunti e lo studio di questi sia più veloce e pratico, rispetto agli strumenti tradizionali?
    - Per niente – Poco – Abbastanza – Moltissimo
28. Ritieni che lo studio a casa attraverso uno schermo favorisca la memorizzazione?
    - Per niente – Poco – Abbastanza – Moltissimo
29. L'utilizzo di uno strumento digitale a casa aumenta la tua concentrazione?
    - Per niente – Poco – Abbastanza – Moltissimo
30. Se la risposta alla domanda precedente è positiva, di media quanto tempo riesci a stare concentrato mentre studi/prendi appunti?
    - 30 minuti - 1 ora
    - 1,5 - 2 ore
    - 2 - 3 ore
    - Più di 3 ore
31. Quante volte utilizzi il pc/tablet per studiare a casa?
    - Mai – Qualche volta – Spesso – Sempre (tutti i giorni)
32. Senti che la possibilità di utilizzare il digitale nello studio a casa sia più utile rispetto agli strumenti tradizionali?
    - Per niente – Poco – Abbastanza – Moltissimo

33. Utilizzando uno strumento digitale nello studio individuale aumenta il tuo interesse verso l'argomento da studiare?
    - Per niente – Poco – Abbastanza – Moltissimo
34. Senti di più la necessità di utilizzare il digitale per studiare:
    - a scuola, perché mi sento più concentrato
    - a casa, perché mi aiuta ad acquisire meglio i concetti
    - a casa, perché mi sento più libero/a di utilizzarlo
    - non utilizzo il digitale per studiare
    - altro
35. Ti senti più coinvolto quando:
    - la tecnologia è usata in classe
    - utilizzi la tecnologia da solo a casa
    - utilizzi la tecnologia per collaborare con i compagni in classe
    - preferisci evitare l'uso della tecnologia nello studio
36. Quanto la facilità d'uso degli strumenti digitali ti aiuta nello studio a casa?
    - Per niente – Poco – Abbastanza – Moltissimo
37. Dopo aver studiato con pc/tablet per un periodo prolungato di tempo (max 3h), accusi affaticamento a livello visivo/mentale?
    - Per niente – Poco – Abbastanza – Moltissimo
38. Pensa alla tua esperienza con l'utilizzo di strumenti digitali per l'apprendimento, a scuola e a casa, descrivi i pro e i contro (puoi anche fare un elenco puntato, max 4 righe).

ENGLISH VERSION

How technology affects learning. Differences and analogies of learning at school and at home.

As part of the Master's Degree Programme in Language Sciences at Ca' Foscari University of Venice, an experimental research project is underway in the educational and educational field on the theme "How much technology affects learning. Differences and analogies of learning at school and at home.", conducted by Silvia Bozzatto with the supervision of the Professors Monica Banzato and Francesca Coin.

The project involves an exploratory survey to be carried out through the administration and completion of the following questionnaire submitted to students of the last year of high school and those of the university, enrolled in different addresses. The research aims to investigate how technology affects learning, in particular, identify any differences and analogies of learning in two different environments: at school and at home.

The proposed activities will be administered anonymously and do not involve the collection of sensitive data. The questionnaire will last about 10 minutes.

Thank you for your participation!

The tests have a purely descriptive value and have no diagnostic purpose. The data will be collected anonymously, will not be disclosed to third parties and will be treated in full respect of privacy, as provided for by Legislative Decree 163/2017, Ex art. 13 D.L. 196/2003 and ex art. 13 European Regulation 2016/679, exclusively for research and teaching purposes.

*Click on "I agree" below to participate in the study. If you do not wish to participate, simply exit this link.

- I agree

First section: students' personal data

1. How old are you?
2. Gender
    - Male
    - Female
    - I prefer not to specify
    - Other
3. You attend
    - High school (5^{th} grade)
    - University
4. Address of school or university attended

Second section: your relationship with technology. This section is about your general use of digital technologies for study.

5. Do digital tools attract you to their use?
    - Yes, I feel very attracted to the digital world
    - No, I'm not attracted to the digital world
    - The digital world is indifferent to me
    - Do not use digital tools
6. How attracted are you to digital instruments?
    - Not at all – Little – Enough - Very much
7. Digital tool for taking notes/studies:
    - Any tool
    - Pc
    - Tablet
    - Phone
    - Other
8. Do you have a personal digital tool?
    - Yes
    - No
9. If the answer to the previous question is YES, please specify your personal digital tool
10. Do you find the use of technology useless?
    - Never – Sometimes – Often - Always (everyday)
11. Do you find satisfaction in learning through a digital tool?
    - Not at all – Little – Enough - Very much
12. Do continuous innovations in the digital world attract your interest?
    - Not at all – Little – Enough - Very much
13. The innovations of digital tools interest you mainly for:
    - Leisure time
    - School/university
    - Leisure time and school/university
    - I don't care

Third section: learning at school. Now focus on your use of digital devices done IN CLASS for study.

14. In class, do you tend to use digital instruments compared to traditional ones (e.g., notebooks, books etc...) to take notes?
    - Yes, I only use digital tools
    - Quite, but I also use notebooks and books
    - No, because I can't use digital instruments in class
    - No, because I prefer to use notebooks and books
15. Using a digital tool to take notes, you feel:
    - Motivated
    - Involved
    - Uninterested
    - Bored
    - Other
16. Using a digital tool allows you to take notes faster during class?
    - Yes
    - No
    - I find no difference compared to traditional instruments
    - I don't use digital tools to take notes
    - Other
17. Does the teacher's explanation through the use of the digital book/university handouts help you in memorizing the topics?
    - Not at all – Little – Enough - Very much
18. Does the lesson through the digital book/lecture notes encourage your concentration in the classroom?
    - Not at all – Little – Enough - Very much
19. Does the ease of use of digital tools make it easier for you to use them during class?
    - Absolutely yes
    - Quite
    - By no means
    - I don't use digital instruments in class

20. The possibility of using a digital tool, such as a Pc or tablet, at school, allows you to pay more attention than traditional tools?
    - Not at all – Little – Enough - Very much
21. Using a digital tool at school, is it necessary for your learning?
    - Not at all – Little – Enough - Very much
22. Do you consider fundamental the use of technology in school to facilitate teaching by the teacher (e.g., use of pdf, ppt, video, etc...)?
    - Not at all – Little – Enough - Very much
23. A digital tool stimulates your interest during the lesson!
    - Not at all – Little – Enough - Very much
24. During class, how long is the technology used?
    - 30 minutes- 1 hour
    - 1 hour and a half- 2 hours
    - 2-3 hours
    - We do not use technology in class
25. After using your device for an extended period of time (max 3h) in class, do you experience visual/mental fatigue?
    - Not at all – Little – Enough - Very much

Fourth section: learning at home. Now focus on your use of digital devices done AT HOME for study.

26. To study at home, do you feel more attracted by digital or traditional tools?
    - Digital tools
    - Analogical tools
    - Both
    - Other
27. Through the use of a digital tool, do you find that the reordering of notes and the study of these is faster and more practical, compared to traditional tools?
    - Not at all – Little – Enough - Very much
28. Do you think that studying at home through a screen promotes storage?
    - Not at all – Little – Enough - Very much

29. Does using a digital tool at home increase your concentration?
    - Not at all – Little – Enough - Very much
30. If the answer to the previous question is positive, how long can you stay focused while studying/taking notes?
    - 30 minutes- 1 hour
    - 1 hour and a half- 2 hours
    - 2-3 hours
    - More than 3 hours
31. How often do you use your pc/tablet to study at home?
    - Never – Sometimes – Often - Always (everyday)
32. Do you feel that the possibility of using digital in your home studio is more useful than traditional tools?
    - Not at all – Little – Enough - Very much
33. Using a digital tool in individual study increases your interest in the topic to be studied?
    - Not at all – Little – Enough - Very much
34. You feel more the need to use digital to study:
    - at school, because I feel more focused
    - at home, because it helps me to better acquire the concepts
    - at home, because I feel more free/a to use it
    - I don't use digital to study
    - Other
35. You feel more involved when:
    - technology is used in class
    - use technology alone at home
    - use technology to collaborate with classmates
    - prefer to avoid the use of technology in the study
36. How much the ease of use of digital tools helps you in the home studio?
    - Not at all – Little – Enough - Very much
37. After studying with a pc/tablet for a prolonged period of time (max 3h), do you experience visual/mental fatigue?
    - Not at all – Little – Enough - Very much

38. Think about your experience using digital learning tools, at school and at home, describe the pros and cons (you can also make a bulleted list, max 4 lines).