Chapter 2
Digitalization of Education

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Abstract This paper discusses features and diversity of concepts and initiatives for digitalization in education. It also briefly discusses the advantages and challenges related to development of digitalized environments in education, as well as greater need for professional development of people working in digitalization. In addition, they encourage and promote innovation in many different spheres of life. The innovative capacity of technology is highly conditioned by the levels of digital skills of the population. It is not surprising that there is a very strong link between education and skills needed to utilize digital technologies in different spheres of life. An efficient, diverse, and strong higher education sector and research system will help the higher education sector to achieve this goal in the best possible way. Universities and faculties manage a significant portion of community resources and must use those resources effectively and for the benefit of society. Institutions will develop their positions according to their strengths and individuality and will contribute to higher quality and to other sectors of society. Furthermore, they will meet the needs of society in various fields and help each country to internationally affirm itself as an outstanding knowledge society. Digitalization is a tool for making fundamental changes in the processes, content, and various forms of work, which can put the education sector in a better position to achieve the goals of education and research, to increase quality and relevance in the approach to education for all. The time when experts talked about education technology in terms of audio, visual and experiential technology has passed. They also talked about hardware technology, software technology and a system based on technology. These are expressions from the past, as

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the old concepts in the field of educational technology or EdTech have been outdated during the last decade.

Keywords Digitalization · Digital skills · Higher education · Educational technology

2.1 Introduction

In everyday life, the Internet, mobile technologies, and online communities have significantly reshaped the way we educate ourselves, which is the key to the efficiency. Thus, for technologies such as robotics, connectivity, and machine learning to be sustained, organizations must be able to develop a digital culture that supports digital transformation. Many technologies are still at the beginning of their development and much more needs to be done to ensure that they are used in the most responsible and positive way for a healthy development of students. This development will continue to be monitored and an insight and recommendations on how best to incorporate digital (connected) tools into schools will be provided.

The aim of this paper is to distinguish between the research field of digitalization and the role of educational technology as an interdisciplinary field used for digitalization, and to provide an answer for the research questions what makes good educational software. This paper also analyses educational software, software programs that serve to support teachers and improve learning outcomes. The aim is to distinguish the field of research on digitalization and educational technology as an interdisciplinary field and to show some of the methods used for research questions arising from the concept of what makes good educational software.

2.2 Digitalization of Education

The modern scientific and technological revolution is radically changing all spheres of society. Informatization, as a civilizational process, is changing especially quickly and has affected all segments of people's lives and work, including education systems. Modern education, according to many scientists, is oriented towards the achievements of complete and overall digitalization. People will need to have the right digital education in the near future (already today) to be successful in their future workplace. They can get this type of education at school, university or at work.

The ongoing digital transformation[1] is making information technology education increasingly important on a daily basis. One important reason for this is that digital media provides new opportunities for digital learning. Digital education will allow everyone to continue participating in the real world in a certain way in the future.

[1] Many mistakenly confuse digital transformation with other applications of information technology in work and personal life.

Modern software will also enable the progress in terms of which educational content has been mastered and which areas still need further education. The advantage of new technologies and methods of work can be personalized, focusing on the development of the potential of each individual. Despite all the changes that occur after the digital transformation, the function of education remains unchanged: it should be possible for people to develop as individuals and allow them to participate responsibly in social, political, and economic life. Therefore education, that is developed on the basis of the latest technology is needed. In order for digital education to achieve the set tasks, the teaching staff at all levels must be educated and modernized. Digital education requires well-trained staff who are able to use digital media to convey relevant information to pupils, students, and trainees.

It is important that these efforts are practical, with an emphasis on the needs of reality. Many of the recent educational research has focused on teaching and learning within classroom conversations. This raises questions of the role of digitalization in supporting such conversations. The main hypothesis of this paper is that the nature of computers is dual– they are machines that can act as human beings (subjects), and this allows them to play a potentially recognizable and valuable role in educational conversations. In the world, the digitalization of education is closely linked to the changed way of life and work in the digital environment and the emergence of generations who were born and study in this particular environment. The authors plan to conduct scientific and professional research on digital education that will facilitate the education of the next generations, which would achieve an optimal potential and develop a culture of lifelong learning. This would prepare individuals to work to meet global challenges and achieve a more inclusive and contemporary society. It is expected that the planned research will, at the global level, enable effective approaches to digital education to support individual's educational ambitions. This will be achieved in the next period over the next three years through the implementation of the following activities contained in the planned development strategy:

- Investigate the impact of changes in the field of digitalization on national and international education policies in particular digital education;
- Plan recognised research methods focused on the higher education sectors as well as learning on a workplace;
- Apply a portfolio of recognizable interdisciplinary research, aligned with major university challenges, that reflects the underlying reality;
- Collaborate with leading domestic and international researchers on digital education;
- Increase the effectiveness and efficiency of digital education practices, taking into account the perspectives of all stakeholders;
- Develop outstanding graduates and scientists at the forefront of research and innovation in digital education.

The digitalization of education is a science-based trend towards reforming and modernising global education system. Digitalization means the transformation of

all types of information (texts, sounds, visual materials, video, and other data from various sources) into digital language.

Digital transformation is a long process of creating a "digital university organization" in which most processes are performed without any human participation. The specifics of the functioning of the university in the context of digital transformation are as follows:

- Creation of special units related to digital technologies within the management structure of the university.
- Conducting an online university survey with students on the use of distance education technology.
- Exploring the possibilities of using mobile digital devices to access electronic databases of university employees, students, and professors.
- Analysing the strategies and methodologies on the use of digital resources for the implementation, regulation, and control of educational processes.
- Observing the speed of interaction between teaching staff and students and other users of educational services using digital technology.
- Realization of new possibilities for organizational and social interactions between university staff and students of educational process.
- Identifying positive activities, aspects, and problems of the use of digital technology in university education.
- Examining the mastery of modern digital devices and software, as well as the ability to apply digital technologies in practice management, are mandatory competencies for all participants in the educational process [7].

Many universities have been using digital technologies for more than 10 years, such as electronic timetables, electronic library system, electronic educational resources (portals). On one hand, this facilitates the process of interaction between students and teachers [11]. Today's students, as digital users of educational services, see the following advantages of using digital technologies: the ability to listen to lectures by leading scientists and practitioners from other universities and countries, save time for education and training, learn in an easier and more understandable way, learn anywhere in the world, receive the most relevant knowledge all day long, anywhere in the world. They believe that continuous learning is much more interesting and enables the acquisition of competitive specialist skills.[2] However, the use of distance learning education technologies does not guarantee the participation of students in the learning process [12] and/or the achievement of high results [10], while changes do not occur only by establishing contact [5]. The factors that have an influence on forming the prestige and competitiveness of a university are dependent on the loyalty of students, which is reflected in their information about the provision of educational services and students' recommendations to their friends and acquaintances.

Digital innovations have opened up new opportunities for innovations in all spheres of life and work, especially as opportunities that enable entirely new forms

[2] Ibidem op. citatum.

of interaction. Digitalization differs from previous paths of technological innovations, with internal and external collaboration, and innovation platforms forming best practice management mechanisms. Digital transformation is penetrating the industry, many social organizations, and education is no exception. The goal for accomplishing this is to meet the expectations and new learning needs of today's students. They play a key role in the digital transformation of education service providers.

All over the world, digitalization in education is closely linked to the new way of life in the digital environment and to the emergence of new generations born and studying in a particular environment. To be successful in the workplace in the future, students will need to have the right digital education. Whether at school, university, or work—the ongoing digital transformation is making IT skills more and more important. The methodological transformation of the educational process itself, as an integral part of the digital transformation, should not be neglected. We are confident that the education system will be able to respond to the challenges of digitalization and seize the opportunities it provides, but a new comprehensive approach is needed. New possibilities for rapid data assessment enable the adaptation of learning content and methods to the individual needs of pupils and students. Intelligent software can guide their progress and identify which educational content is mastered and which areas still need traditional teaching. In this way, educational processes can be personalized, focusing on developing the potential of individual students. The condition for change is not only what is taught, but also methods of how to learn.

Whether digital platforms, virtual or augmented reality, online libraries or webinars are involved, the fact is that digital media enable many new and innovative forms of teaching and learning in schools, vocational institutions, and universities, as well as in corporate training and development programs for already employed. We believe that digital learning means more than the digitalization of existing educational materials. Digitalization in education will enable transformed forms and contents of communication, cooperation, and networking. As digital teaching is not tied either to time or place, it is more flexible, individualized and more mobile than previous forms and ways of learning. This means that in digitalization, learning content is created, shared with others, and developed together in the cloud or in the fog. With digital education, students accept greater personal responsibility at an early age, and at the same time improve communication and teamwork. Modern technology affects societies around the world and creates new opportunities and challenges, and its role in education is becoming increasingly important. Digitalization differs from previous technological innovation solutions, with internal and external collaboration and innovation platforms that form best practice management mechanisms. Digitalization in education in addition to the technological component has a crucial role in transforming the educational process. Digitalization in education is a great opportunity, but also a challenge in terms of proper use, which implies critical thinking, and by no means superficiality and mere consumerism.

The paper also deals with pedagogical possibilities and effects of education in the electronic environment. A variety of applications is found in digital media in education: from curricula and learning and training programs, databases and tools, through

learning games, experiments and simulations to complex communication and cooperation environments. Special attention is paid to the following topics: work with young people; vocational education; training; adult education (lifelong learning); pupils and students; teachers; school management; parents; use of the Internet and educational platforms; digital media in teaching; using digital media at home; computer use and professional successes; methodological problems.

Media characteristics, learning prerequisites, didactic design and learning culture.

Mastering the media is not relevant during the school period, but is especially important in the early childhood development phase. From the initial observation of the media as auditory and visual sources of challenges, through the development of media desires and preferences as well as the first forms of independent media management to active work with the media, different stages of children's media use can be monitored. The first contacts are in the parental home, and they largely depend on the level of parents' education. There, children should be trained to use the media as places of non-formal learning, as a means of mastering the world and as a subject of critical assessment, from which they will benefit in organizing their own lives. This requires, structurally, the improvement of media and pedagogical education of educators, as well as the close connection of family media education and professional improvement of media competence in pedagogical institutions. The amount of time children and teens spend on digital technology inside and outside of school has a significant impact on their learning in the classroom and on their physical and mental well-being. In youth, this leads to various forms of media use, which in turn is conditioned by the level of education. For teenagers, the media represent places of non-formal learning outside of institutionalized learning processes. They use media for orientation in the development of their personality, as a source of information and knowledge and for developing media competence. The disproportionate ability of young people to use information and knowledge or to be actively and creatively introduced into some youth cultures certainly contribute to the widening of the knowledge gap between educated and less educated young people. An important task of young people's extracurricular activities is therefore to prepare the conditions and opportunities for young people to gain experience related to the media and to try out different opportunities that media offer. The work in the media proved to be particularly successful. For professional education, a special task is set to analyse and think about the penetration of digitalization into the systems of work and the change of tasks that arise from it. This penetration is increasingly affecting the disappearance of the boundaries between work and learning. The focus is no longer on mastering a work system, but on developing the ability to solve problems in the work process with the help of digital technologies. Training processes are subject to special conditions, e.g. in the organization as part-time studies, as part-time learning, or leisure training. It is understandable that the possibilities of digital media are used here, especially the Internet and specialized platforms to provide support in such learning processes. In addition to training, there is a need in adult education to, for example in social, cultural, primary and language education, improve the involvement of digital media as a cultural technique and as a prerequisite for social engagement. In particular, those adults who are not involved in professional development must be given a

wide opportunity to acquire competencies that will enable them to actively participate in social life and have independent access to educational tools. Until now, these issues have not been sufficiently clarified, starting from the development of specific didactics suitable for encouraging and improving the development of competence in network-based learning processes, through the proportional preparation of standard training topics to the educational profiles of relevant trainees. An important although not a sufficient prerequisite for a successful work with digital media in education is a positive basic attitude towards new media. One such attitude can be understood by indicators of subjective opinion about the importance of working on a computer, interest in the computer, the social significance of the computer for everyday and professional life and possible positive or negative influences.

Many studies show that students in most countries have a very positive basic attitude towards digital media. This is true in international comparison, where there are certainly clear differences between boys and girls, in favour of boys. In addition to the growing social relevance of computers and the necessity to use them competently, for students the hope of improving teaching, i.e. learning and possible professional needs are important aspects, that affect both the importance of digital media and the open basic attitude towards them. If we look at students and their attitudes towards digitalization, then we notice that they assess the intermediary function of digital media as absolutely useful, this is especially true of learning programs, but they are more suspicious about improving motivation and individualization. However, their attitude, as in other groups, depends on their own experience. This partially restrained assessment of students may be an expression of the not yet fully proven use of digital media in teaching in colleges. To sum up, we can conclude that the actors participating in education in the world show a very positive basic attitude and basic mood regarding the social importance of digitalization and its application in teaching.

Parents on a broader level see digitalization as an opportunity and a benefit for the didactic area to support learning processes, but they are particularly critical and concerned about the Internet in terms of media education. However, parents generally, as can be read in various studies, give great importance to digital media for everyday life and profession, and believe that the school must also train children to work on a computer. In recent years, the number of parents who have set this task as an obligation has been growing.

Regarding the use of computers and the Internet in teaching, if everything is taken into account, it is not yet possible to talk about the evident integration of digital media in teaching, although the indicators of use in recent years are on the rise. In primary schools, the use of computers is more common, primarily in language and mathematics teaching, as well as in extracurricular activities, where teaching software and multimedia lexicons are used. In upper grades, digital media are more often used in the teaching of informatics, in extracurricular activities, in teaching of technical subjects, natural science subjects and economic subjects. As far as software is concerned, tools, presentation programs and programming languages are primarily used. In vocational schools, a special role in frequent use play the crafts, technical subjects, and informatics, and accordingly, the software specific to the appropriate

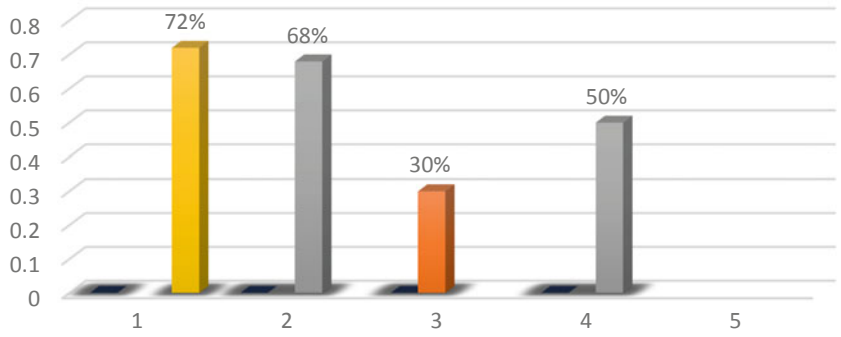

Fig. 2.1 Empirical data on the usage of the computer depending on the type of educational institution

profession is used. Compared to other types of schools, there are more available software packages. In 2018, half of the teaching staff often or occasionally use the computer in teaching, one third of the teachers frequently or occasionally use the Internet in general education schools.[3] The teachers, however, state that they want to use the media more in the future. Despite the fact that 72% of them want to use the Internet more often, and 68% want to work with a computer more often, still about 50% of them have not used digital media in teaching at all. The empirical data show that, depending on the type of educational institution, a group of 10 to 30% of teachers regularly use digital media in teaching. This group also represents the main user of online tolls for teachers. Over 90% of them use the computer due to the advantages it provides every day or several times a week for the preparation of classes and for after-school work, and more than half of them use a computer daily or several times a week in class. A graphical illustration to show the application of the computer is given in Fig. 2.1.

In contrast to the still relatively insufficient use of digital media in teaching, children and young people at home often use a computer. In 2018, it was found that 38% of children between the ages of 6 and 13 regularly use a computer (at least once a week) at school, and 86% of them use a computer regularly at home. Thus, 32% of young people use a computer every day or several times a week at school, and 76% used the computer at home with the same frequency.[4] Home use is not, however, limited to extracurricular activities, but also includes learning activities for school. The data from national research are also confirmed by international research in which the Republic of Croatia also takes part. If regular school usage (i.e. mostly every day or several times a week) is taken as a criterion, then Croatia, in the case of 15-year-old pupils, ranks last in comparison to the OECD member states.

Compared to other OECD member states, with above-average frequent home use, Croatia shows a great difference between school and home use of digital media. In

[3] The research was conducted by the authors in the area of Split, the Republic of Croatia.

[4] The study was carried out by the authors on a sample of primary school pupils in Split, the Republic of Croatia.

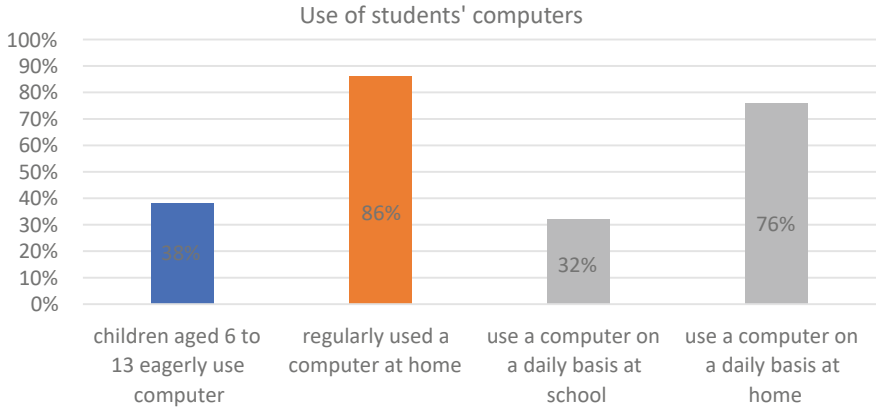

Fig. 2.2 Computer usage of primary school pupils in Split

addition to high expectations regarding the potential of digital media that enhance learning, the question of their effects also arises. At the same time, various levels can be noticed in which these influences are reflected: successes in the profession, professional competencies, changes in the teaching culture and aspects of school development. All data require a careful approach in two ways: on the one hand, correlations do not yet show anything about causal relationships, and, on the other hand, the research-methodological problem is that only bivariate relationships are often observed, which can be presented differently if influencing factors are considered to be control variables. Which models of analysis are finally appropriate is a question that needs to be clarified by research and methodology of research. Now, in any case, the cognitive hypotheses of research can be formulated on the basis of the mentioned connections (Fig. 2.2).

Much more detailed insight into the teaching processes of digital media is allowed by scientific studies of a typical individual case, in which not only the outcome but also the learning processes themselves are the subject of research. Such way of gaining information undermines the representativeness. Namely, such individual case studies show that digital media do not exacerbate the success of students in the profession, as it can be improved in some parts of certain areas. This can be applied to partial competencies in mathematics or to various aspects of success in system writing. Particularly high-quality studies indicate that the question of success in learning does not depend in large part on the extent of the characteristics of the used media, the prerequisites for student learning and the didactic design of teaching. The results of such studies, which tend to report negative impacts on learning success, show in the analysis of teaching activities that partial artifacts can arise, e.g. by shortening the explanation of professional content in favour of dealing with media-specific interests, and lead to misconceptions.

New media are demanding and accelerating the change of teaching. Many studies point in particular to a change in understanding of the role of the teacher. Instead

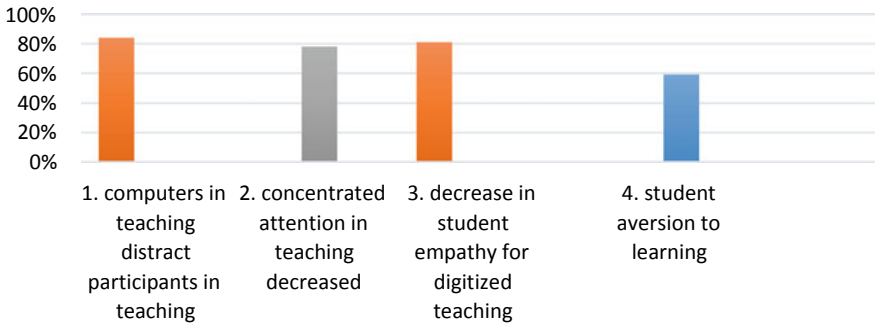

Fig. 2.3 Evaluation of computer application in teaching

of the role of transmitter of teaching messages, the teacher gets the function of an advisor and a moderator. In this regard, changes in teaching patterns are described. In a narrower sense, such models refer primarily to typical teaching activities with digital media, e.g. the application of training and checking software, the use of the Internet for search or cooperation, etc. But in a broader sense, these forms of work relate to how teachers in principle understand the design and delivery of teaching.[5] Thus, case studies of individual cases, such as those related to learning with a laptop (tablet), show that changes in the teaching culture are closely related to routine models of teaching procedures in practice. Those teachers who perform student-centred teaching using a laptop, notice fewer changes than those who hold fast to the teaching process in whose centre the teacher is. Efficient integration of new media succeeds mostly for teachers who contribute to the interaction of media content, learning predispositions and social forms with their teaching style. During the interviews, the respondents were asked to describe the key aspects needed to achieve the goal of digitalization in their school. At the school leadership level, the core of digitalization was linked to changes and transformations in teaching and learning. As shown in the following research (Fig. 2.3) and practice, digitalization processes are limited to the application of digital technologies without pedagogical and organisational changes. This paper provides an overview of the evidence of the authors from the research and evaluation studies related to digitalization, but also to broader higher education practices. It is argued that the use of ICT alone does not result in improved educational outcomes and ways of teaching:

1. computers in teaching distract participants in teaching 84%
2. concentrated attention in teaching decreased 78%
3. decrease in student empathy for digitalized teaching 81%
4. student aversion towards learning 59%

Little has been written and researched about specific teaching methods and/or challenges in teaching twenty-first century competencies. With the entry of digitalization into the field of education, it is not clear whether technology has helped

[5] The study was carried out by the authors on a sample of primary school pupils in Split, the Republic of Croatia.

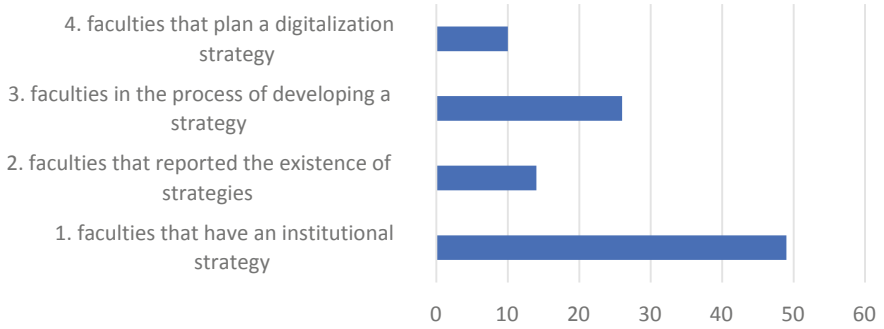

Fig. 2.4 An example of institutions having a digitalization strategy

to remove, or the removal of barriers has itself become another obstacle in integrating competencies. Gaining a teacher perspective is key to understanding barriers as well as solutions to mitigate barriers through innovative teaching methods applied worldwide through digital or non-digital platforms. The need for genuine teacher contributions exists in this area as an obstacle to the twenty-first century education and the role of digitalization. Digitalization is only successful when we have changed the way we teach (Fig. 2.4).

Gaining a teacher perspective is key to understanding barriers, as well as solutions to alleviate barriers through innovative teaching methods that emphasize the importance of the science-teaching process and the importance of placing students at the centre of all activities. The mission of the teacher changes from a mere transmitter of information to a conductor and organizer of a learning situation. To achieve this, several methods must be combined, which require a balance between theoretical and practical teaching. They can also be used to perform complementary activities. A pilot research on how digitalization is evolving, as a potential factor in colleges, reinforces the idea that digitization is directed towards technical development, often characterized by the first steps of change and development towards digitalization of education. Almost half of the institutions stated that they have an institutional strategy (49%), while only 14% reported the existence of strategies at the faculties. Just over a quarter (26%) said they were in the process developing a strategy. 10% of the faculties have a plan to develop digitalization strategy.

The digitalization of education includes various aspects of quality, from organizational issues, technological infrastructure to pedagogical approaches. Digital learning and education are just as important as formal education, although a much larger amount of information is available through digital learning. In addition, as digitalization moves forward as a key concept in higher education institutions, it also encompasses quality issues in many ways.

The essence of this part of the project is mapping and discussion on digitalization in teaching and learning in higher education institutions, which is understood as an external and internal process.

Digitalization initiatives have problems in achieving sustainability in schools, and the application and the use of technology largely supports previous practices and do not lead towards the change and development. The research based on evidence of digital transformation in teaching practices is often small-scale, and processes are often led and dependent on individual enthusiasts.

Education should not only be based on theory, as it is easier for educators when working with a larger number of students, but it must also be in line with the balance of practical knowledge and skills needed to start a profession. In the context of education and digitalization, transformations could be shaped as new knowledge and practices of teaching, learning, communicating, and organizing work in schools and at universities.

The concept of transformation in this paper is broken down into smaller analytical units. In short, the conceptualization of digitalization that emerges through smaller steps allows the analysis of gradual digitalization, although it may not result in a complete transformation in education. The analytical focus in this paper is how teachers, education leaders and educational technologists understand the object of digitalization, how educational institutions implement digital and educational changes, and how new practices and infrastructures emerge as a part of digital transformation in education. This, in turn, is expected to contribute to solutions at different levels of learning, and thus to transformation steps in school.

According to current research, changes should happen every 5 years because they are already permanent and rapid. They should then be applied in education, in line with future labour market needs, through communication with employers and companies that are a part of the labour market for future professionals. As discussed in the research, digitalization processes are often limited to the application of digital technologies, without interfering with teaching and learning practices or organizational infrastructures to support digitalization [4].

The need for research is in line with occupations that will disappear in the near future. Students will not be educated for occupations that will not be needed in the society in the future, according to the development of digitalization. Professors will not lose their jobs as they will shift to new subjects to teach or improve certain profiles in line with the development of digitalization. This fact has an influence of the application of digitalization of adult education. This means that those who have to retrain must master the process of digitalization of education, and later apply it to their jobs. Digitalization and the use of tools facilitate learning and presentation, speeding up the process of solving tasks that can be solved by more students at the same time. It also facilitates the process of examining tasks, and it is possible to show a video of many phenomena and processes. In doing so, projects and internships must be an integral part of 4, 5 or 6 years of education in cooperation with companies or institutions, depending on the profession for which the students are prepared. Upon completion of their education, students will undergo training, acquire the necessary skills and are ready for the labour market. Software in the field of education is an intellectual technology and is called educational software, it includes programming languages and accessories and the organization of teaching and learning, which is based on logic and pedagogy. Thus, the term educational software means both ready-made

computer programs, which can be used in teaching, and programs that help and guide the individual phase of learning. The educational software contains various curricula intended for users. The development of educational technology began when schools and colleges began transforming traditional classrooms into virtual classrooms by investing in educational software applications. The main goal of educational software today is to make learning exciting. Educational software provides adequate support to take advantage of developed and customized applications. The authors of the article formulated the hypothesis that, in general, universities are ready for long distance learning. There are also positive aspects and problems that are an encouragement to improve educational processes in the context of digitalization. The purpose of the study is to analyse the readiness of universities to develop digitalization at universities using educational software and computers.

Although, this certainly applies to all stages of the educational process; however, in higher education the development of new competencies has a certain need: higher education prepares students for a professional career in which they will move through challenges and decision-making based on (reflective) competencies that are especially developed during higher education. In this regard, higher education plays a crucial role in enabling students to become educated professionals, including competence in problem-solving, information and conflict resolution [3]. The respondents were asked about the subject of digitization in their faculty and their specific role/practice, how the subject (including digital, educational, and organizational needs) was discussed and developed now and over the years (individual and collective levels), how their faculties dealt with digital solutions and what support was available. The respondents were also asked to describe the problems and difficulties in trying to integrate digital technologies at different organizational levels, the examples of changes in colleges and their practice, and what was important to bring about such changes. Ongoing project, the first results of the analysis show that the form, quality, and dimensions of the students' thinking process differ significantly. This is partly based on external conditions such as motivation to study, building an identity before and during studies, study conditions, and so on, which then interact with the ways students use technology, interact with teachers and their educational software. The first findings allow a detailed assessment of individual solutions and styles when incorporating educational technologies for students. This can develop a discussion of why the use of technology is still ambiguous in higher education, both on the student side and on the teacher/leader [9] side and form the basis for recommendations for actively fitting individualized and iterative process facilitations into the pedagogical repertoire of higher education technology courses [9]. From the perspective of university teachers, digitalization has been specifically described as a tool for enhanced control of tasks, materials, and communication with students; for example, less work, administration, and better teaching and communication opportunities: "I saw the benefits of digital technologies pretty quickly; it was not an increased workload, but a relief in everyday life "and" to organize everything was the initial argument [2]."

The aim is to distinguish the field of educational technology research as an interdisciplinary field and to show some of the methods used to approach many research

questions that arise from asking what makes a good educational software. Educational solutions offer an alternative and innovative approach to conventional or traditional classroom learning methods. Therefore, it is needed to consistently develop educational software that transforms learning from conventional to innovative, focusing on powerful management systems, automated data synchronization, integration with customized mobile payments, and secure systems for communication and engagement of teachers and students. Qualitative findings show that learning occurs in the conversation of students working on the computer, and quantitative findings suggest that this approach can bring significant benefits in learning within the normal curriculum. Supporting the development of students' digital competence, according to teachers and educational technologists, is an opportunity for students to contribute to alternative ways of teaching, learning, communication and collaboration inside and outside the physical classroom. Accordingly, during the year, students were offered digital course modules (including security, integrity, seeking knowledge and information, developing critical thinking, and creating digital information) and digital support for educational assignments (for making digital presentations, movies, etc.).

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From a teacher's perspective, changes in teaching and learning practices are generally described as improved opportunities for individualized teaching, information distribution, and are more involved in student learning. "Students can just ask us and read, and they can do it directly on the computer. That way the classes become so lively, instead of handing in papers and waiting for comments for two weeks." There were also statements that "I now have my own reusable digital material" and "I should not take unnecessary time away from lectures due to lost work. However, as teachers put it, these aspects require digital systems and organizational support. In doing so, university teachers stated that digitization is seen as a tool to reduce administrative burden, which in turn allows teachers to develop digitally in the teaching process. Also one dean of a faculty said, "Most people are driven, curious and competent." For that, they need peace, quiet and protection from the administrative burden. In addition to the technological dimensions of digitalization, support is focused on the development of new teaching and learning designs, new ways of communication within the organization, new ways of planning and organizing schooling in rural areas and new ways of organizing administrative work. This also means that the digitalization budget must contain more than a technical infusion.

The modern scientific and technological revolution is radically changing all spheres of society. Informatization is changing especially fast as a civilizational

process that has affected all segments of people's lives and work, including education systems. Modern education, according to many scientists, focuses on the achievements and achievements of information and communication technologies (ICT). The development of modern science in the field of ICT in education requires the introduction of new approaches to the education system. Systematic thinking about the needs that lead to changes in established ways of teaching, and which are caused by the application of information technology in the process of learning and teaching, is one of the ways of thinking about modern tendencies in education. Today, education leaders face great challenges and opportunities, from ensuring that every student has support for successful graduation, to balancing budgets and encouraging transformation to develop their systems into the largest educational institutions of the twenty-first century. Lectures over the past year have been remote, hybrid or personal—it has introduced many challenges and opportunities for teachers and students. One of these opportunities is finding new ways to create systems in which students of all learning abilities can access learning from anywhere. The application of information and communication technologies (ICT) is changing education systems.

With the use of new technologies, education becomes available to a larger number of people regardless of spatial distance, time constraints, age, or special needs. With the help of new technologies, even less economically developed countries can become involved in the information society. Modern students, after all, have come to know the world through technology and accept all its forms. Not only that, but students quickly understand and make full use of it, so investing in educational software can have long-term and immediate benefits. Implementing new technology at a college or university requires more than just buying new computers and setting up a website. The successful use of technology for teaching and learning also requires major changes in teaching and organizational culture. In managing technological change, Tony Bates [1]—a world-renowned expert on the use of technology in university teaching—discovers how to create a new, technologically competitive academic organization. He conducted research from recent available papers and best practice cases—as well as from his thirty years of experience in using teaching technology—to provide practical change management strategies to ensure the successful use of technology.

The authors suggest how to win faculty support for teaching using technology and offer suggestions on appropriate decision-making structures and how to apply them. In doing so, they cover topics vital to all involved in technology or technology-based learning, as well as the topics that involve change of management in order to ensure the successful use of technology in higher education. Moving to the leading role of digitalization in higher education means taking on additional responsibility for strategic planning. Strategies to gain faculty support for technology teaching, appropriate reward systems, funding innovation, and regular technology-based teaching, workload and cost management, copyright issues, and helping the faculty develop a vision for teaching and learning with technology are all described, and advice is given on appropriate decision-making and reporting structures [1].

The digital transformation is causing major changes in higher education and research. These current changes impose the feeling that the combination of powerful

new communication technology, big data, profitable digital companies, new relationship of citizens with information and knowledge and the global state of the environment will bring either highly desirable or terribly harmful outcomes. The digital transformation has come into classroom because colleges want to use digital teaching materials. Digital versions of materials are much easier to modify and distribute, and can be incorporated with additional features that help students learn. These materials include assessments, which are based on student AI and can be assessed and analysed, while saving teachers valuable time.

The perception of permanent acceleration creates both extravagant and plausible images of the future. Within this confusing landscape, public higher education institutions and research institutions (referred to herein as "HER") need tools to anticipate change and develop appropriate strategies. Explaining how HER could evolve to meet digital transformation is complex and multi-layered. The rapid rate at which technology affects practices and organizations creates a high level of uncertainty. Digital implications that extend far into scientific disciplines, economic sectors, and civil society generate interdependence and nonlinear change. Educational software is a very complex product of intellectual, creative and teamwork, created for functions in educational processes. Students use educational software in several categories to cover and master curricular content and lesson plans, taking exams and learning. The efficiency of teaching and learning in modern conditions depends, among other things, on the quality of the applied educational software. The quality of educational software is determined by a whole set of relevant factors that are built into it, ranging from creation to adequate application in a specific educational situation. In the field of educational software, the terms "software review" and "software evaluation" are often used, and some authors do not differentiate between them when it comes to its evaluation or assessment. Of course, it is about the use of these terms in the English-speaking area, so it is necessary to interpret them in more detail.

The word "evaluation" is interpreted as the process of collecting, processing data, and using information to assess and decide on the value of educational software. The term "review" is used in the sense of a critical assessment of educational software, but without a thorough study and testing of that software product. This term is often used for superficial judgment or personal (subjective) impression. Educational software is a complex intellectual, IT, aesthetic, educational and technical product that must be evaluated as a complex whole. Evaluation of educational software is performed from different aspects, known as: formative evaluation, summary (complex) evaluation, technical evaluation and educational (educational) evaluation. **Formative** (preliminary) evaluation of educational software refers to the phase of its creation and development, and is based on the evaluation of the documentation of each part of the development process of educational software. **Summative** evaluation of educational software can be done through extensive testing by the method of parallel groups, observation, etc. The goal of summative evaluation of educational software is to determine whether the set goals and objectives are achieved and how. **Technical** evaluation of educational software is performed in order to check its technical characteristics in terms of: robustness (reliability on error), screen design, quality of equipment, etc. Information on the quality of educational software can

be obtained through assessment and evaluation. Based on the experience of specialized identification institutions. The methods, techniques, and instruments for quality evaluation in educational software (EPIE,[6] MicroSIFT,[7] Alberta Education[8]), for obtaining the basis for "measuring" the quality of educational software are used: description and catalogue records, careful reviews (assessments), systematic evaluation, data on non-recommended educational software in which basic shortcomings have been identified.

The paper gives in detail all important concepts around educational software, from its definition to the latest trends in educational software. Today, many universities and colleges have embraced the latest technologies to educate students for the future. From science and informatics courses to practice, cabinets are technology-based, using online educational software, which is now a reality. Educational software usually has different features based on its use, goals, and target users. However, the best educational software has some common features, listed below. Each student has a different pace of learning for different curricula. Therefore, it is crucial for a quality educational software solution to enable individualization in these areas. Students should be able to structure and manage their learning speed and save their work so that they can use it again later for joint courses. Students who may not like to sit in class and listen to a lecture or solve assignments may be thrilled with an educational game designed to teach math using sound and graphics. Educational software is applied in the following educational areas such as distance learning, networking, training, and more specific programs such as equipment training and support. Education and training software can be online (web-based) software, software that is downloaded and run on a local computer system, or software that is purchased and distributed through networked education systems for a large number of users. The basic function of most educational software programs, whether intended for college or for home use, is to improve the teaching process. Professors can use educational software in a variety of ways to achieve better success. Educational software allows students to monitor what they learn and to demonstrate their knowledge.

For example, free Microsoft Office software allows teachers to create concept maps, charts, and graphs, as well as enter test data. Teachers can also import data from e-books, websites, and blogs in an introduction to PowerPoint. This type of educational software provides teachers with excellent current details and interaction with students in an easy way [13].

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[6] The Department of Educational Programs and Institutional Effectiveness (EPIE) provides leadership and coordination of education and service initiatives across the United States, course and program approval, accreditation, strategic planning, class attendance, and institutional research.

[7] Students and teachers at eligible institutions can apply for Office 365 Education free of charge, including Word, Excel, PowerPoint, and now Microsoft Teams, plus additional tools in the classroom. Also cloud services to create a modern classroom. Microsoft Corporation is an American multinational technology company based in Redmond. The company's core business includes the development, production, licensing, support, and sale of computer software.

[8] The Education Capital Planning Division in Alberta is responsible for developing and implementing policies, plans and strategies to support infrastructure and capital planning and investment in the education system.

Another popular tool for cloud-based[9] colleges and professors is the online project management portal. Tools like Basecamp allow entire departments to be on the same page as they write a new test, develop new worksheets, or adopt a new textbook that is better in line with educational standards. These collaboration tools can be accessed anywhere with an Internet connection, which facilitates collaboration from home and uses school planning time more effectively to meet students' needs.

The types of educational software are classified in this paper according to the degree of user independence in managing the process of education, i.e. learning. Less independent work of the user is more defined by the educational software program, and more independent work is the one in which the software allows the user to manage and structure the process of his learning and work.

- Educational software that completely guides the user through the learning process and in which the user's independence is directed by the program is called management educational software. This type of software, in addition to the elements of educational content, also has instructions for use. The instruction gives the user a suggestion when to stop using the computer and to continue learning from the textbook or to make an experiment, i.e. to look for some data in other sources and/or to consult the teacher.
- Tutor educational software is intended for learning those educational contents that are learned in the form of programmed exercises and which the user must master in the same order (learning by mechanical memorization). It is software that has very rigid control algorithms built into it, which the software user can have little influence on.
- Diagnostic educational software is used to test the knowledge, abilities and skills of users for some educational content. This type of software provides the user with information of the feedback type, on the basis of which he can make management decisions about further learning or education flows.
- Educational training software is used exclusively to determine knowledge or build skills. The user manages his education and determines the difficulty of the task that the software contains and based on the achieved results, the user determines the tasks to be mastered.
- Educational software of the database type (knowledge) is designed in the form of a specialized encyclopaedia of knowledge. This means that the user can only get the information that is in some way of organization and content of the interpretation stored in the data bank. Based on his educational goals and tasks, the user structures the learning process using knowledge from the data bank.
- Educational software of the experimental type is used for experiments in laboratories and practical classes for measuring and controlling processes, apparatus and machines. There is also the use of additional hardware with the computer.

[9] Simply explained, cloud computing is the delivery of computing services — including servers, storage, databases, networking, software, analytics, and intelligence — over the Internet (the "cloud") to deliver faster innovation, flexible resources, and economies of scale. Usually, only the cloud services used are paid for, which helps reducing operating costs, run infrastructure more efficiently, and adapt to education needs.

With the help of a computer and specific software, the user manages the learning process with empirical methods.

- Educational simulation software allows some real systems to be represented using models on a computer and to simulate the processes of those systems on it. Also, with the help of simulation, it is possible to discover the functional and structural features of the system being studied. Depending on the previous knowledge, the user can program his own learning and education using simulation models given to him or construct them himself. In the application of simulation software, individual knowledge about the management of learning and education processes comes is demonstrated.
- Software tools are programs designed for users to design educational content that they master themselves. This primarily refers to tools for word processing, database formation, various calculations, graphics, etc. These software products provide great opportunities for complete self-management, knowledge acquisition, skill building and habit building.
- Graphic software has a great application for students and teachers. Thanks to this software, they can not only record and modify, but also create images present online or in the program. It also allows you to create elegant online presentations.
- Digital media—educational software. Educational software has turned a traditional classroom into a digital one. In the era of smart technologies, educational content has also become smart. Such software encompasses a variety of technologies, including artificial intelligence and machine learning, so that its digital content effortlessly adapts to different user needs and knowledge base. Moreover, smart content contains built-in grades so teachers can track and test students effortlessly.
- Intelligent tutoring systems are the highest level of quality educational software and are based on achievements in the field of artificial intelligence. Intelligent tutoring systems are dialogue-oriented systems, which, based on communication with the user, provide the necessary knowledge and advice that they explain in an adequate way. Such knowledge comes from experts and differs from textbooks. For now, the programs are still in research and development and are used in teaching and learning. Intelligent tutoring systems from the point of view of user management represent the highest level of independence [6].

The rapid development of technology has conditioned that education also becomes digital like many other industries. There are many educational software available on the market today [13].

- The authoring system allows teachers to create educational software. With this, they can easily design electronic cards or index cards on specific topics. They can also create tutorials, lessons for multimedia content. There is also an online authoring system that helps teachers in this regard.
- Desktop Publishing Leaflets, brochures and newsletters are created and designed using desktop publishing software. Using this, teachers inform students about faculty activities in an attractive way. It is a necessary skill for new graduates. Many colleges focus on desktop publishing packages, such as Microsoft Office

and Adobe Creative Suite. There are many paid courses and videos available on YouTube for learning.

- Graphic software, this type of educational software is especially used in making presentations. Using this software, students can capture, create and modify images available on the Internet. Adobe Photoshop, CorelDraw, Microsoft paint, Canva and Picasa are examples of graphics software.
- Reference software. The name shows its purpose. This software provides additional assistance when searching for research projects. Encyclopaedias, thesauri, atlases, and dictionaries are typical examples of reference software.
- Software evaluation. Such software is designed for student assessment. The test or exam ends on a networked computer. After that, this software scores each test of each student and provides the result as an output. This software can also help prepare students for exams. Many types of software are used to update, submit, assess and grade. Moodle, Google Classroom, Grading Master, and Blackboard Learn are the best examples of grading software.
- Tutorials software. This type of educational software offers students a platform on which they can learn on their own. Such software provides information on a particular topic, gives them time to practice, and ultimately examines their performance. Courser, Alison and Udemy are examples of software tutorials.
- Educational games. Some games are designed for educational purposes. Education and games in one place make the learning environment existing. Also, these games improve the motivation to learn. Charades, Hangman, Bingo, Pictionary and QuizAlize are the best examples of educational games.
- Demonstration software. This type of educational software is used for experimental purposes in the fields of biology, physics, chemistry. Sometimes the device is expensive to buy, or it is unsafe to work physically. Thus, this software assisted in the simulation and observation of the experiment. There is a lot of demonstration software such as Wolfram Demonstration Projects, MyPhysicsLab and PhET Interactive Simulation.
- Special needs software. Special needs educational software is designed for the needs of special students. Basically, this software, combined with the auxiliary software, provides an effective platform for learning for students with special needs. Computer text reading aloud, speech synthesizers, and multimedia software are examples of such software.
- Software for solving mathematical problems. This software helps teachers, especially mathematics, to develop student' problem-solving skills. Science teachers can also use this kind of software to conduct the results of experiments.
- Utility, educational software is a utility for teachers. It helps them to create tests and quizzes. It can be said that it functions as a grading book for teachers.

Through video conferencing, a student can acquire their education online. Students and teachers communicate and lead their discussions in virtual rooms. In this case, universities are also developing more programs, using distance learning models. They offer foreign students online courses without having to leave their country.

The paper argues that rapid digital disruption implies a method by which business technology is treated as an element of a strategy that would change. The advent of the Internet and the World Wide Web has changed and strengthened the role of technology in enabling new ways of doing business, and companies have begun to develop business and technology strategies in parallel. Now is the time of digitalization when technology has the potential to fundamentally change the nature of business and the way it does business. For this reason, it is necessary that all companies need to establish a technology-driven strategy. One that never stays intact, but is dynamic and capable will adapt quickly to change with the advent of new technologies. Successful companies will see technology as an opportunity for progress, not as something they just have to "deal with". Business success will be inextricably linked to the way modern digital technologies are used in all aspects. Future business success is likely to be characterized by companies that accept only digital disruptions.

The concepts of digital and digitalization of the company have existed for many years, however they still remain abstract. This lack of a common and concrete definition leads to a certain ambiguity already when it comes to the basic task of DMM: measuring the level of digitalization of a company. In this context, questions such as: What are the relevant variables for measuring digitization? How can they be quantified? How can a certain comparability between companies be ensured? How can one investigate whether a certain level of digitization affects a company's performance? In this regard, emphasis is placed on the need for further scientific research on digital maturity, in order to contribute to a deeper understanding of the current sociotechnical phenomenon of digital transformation. Recently, in the context of digitalization, researchers and practitioners have set out to assess the digital maturity of organizations. The proposed models based on the development and application of the maturity model still have a number of shortcomings. As for the maturity model measurement procedures, the existing academic literature does not yet offer specific quality criteria. As already pointed out, the target area of interest in terms of digitalization of companies is very wide and a significant research venture and consensus in its application and comparative analysis measurement of achievements is still ahead.

2.3 Conclusions

The paper argues that rapid digital disruption implies a method by which business technology is treated as an element of a strategy that would change. The advent of the Internet and the World Wide Web has changed and strengthened the role of technology in enabling new ways of doing business, and companies have begun to develop business and technology strategies in parallel. Now is the time of digitalization when technology has the potential to fundamentally change the nature of business and the way it does business. For this reason, it is necessary that all companies need to establish a technology-driven strategy. One that never stays intact, but is dynamic and capable will adapt quickly to change with the advent of new technologies. Successful companies will see technology as an opportunity for progress, not as something they

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