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NEW DIGITAL COMPETENCE FOR SCIENCE TECHNOLOGY AND ENGINEERING EDUCATION

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Abstract. *In the years 2019-2021 a significant step was made in terms of distance learning, which would have otherwise, in normal circumstances, taken several years. While the solutions applied were the best in the given situation, the question arises of what these solutions imply in terms of long-term, systematic changes. The presented research touches upon three key areas that characterize today's schools: motivation, atmosphere, and competences of teachers and teacher-training students. The starting point of this research is the premise that the pre-crisis digital competences are simply not good enough for today's situation, or for the near future. Research results show that such fast-tracked changes and the transition to distance education have led to a significant decrease in the motivation of both, teachers and students, that the general atmosphere has worsened, and that there is a significant decrease in competences to be perceived, especially with regard to social and communication competences. The research shows also that neither teachers nor students are sufficiently qualified to work in the society of the future, in society 5.0. What is needed are actual, real changes in the field of digital literacy and digital competences, also indicated in this research.*

Keywords: *digital literacy, digital competences 1.0, digital competences 2.0, science/technology/engineering literacy, society 5.0*

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Introduction

The Chinese room experiment (Searle, 1980) could serve as a metaphor not only for the world of physics but also for the human condition. Imagine yourself as sitting alone within a cell of your subjective awareness. Now and then, everyone receives cryptic messages from the outside world. While only dimly comprehending what you are doing, you compose responses, which you slip under the door. In this way, you manage to survive, even though you never really know what the hell is happening. This is the kind of situation in which people find themselves today, more than ever before.

The eruptive social change of the past few years has brought today's society to a crossroads. On the one hand, people are clinging on to a way of life that they know and that is close to them. But even if they don't admit it, this way of life is mostly a matter of the past and not the future. Education is also a part of this way of life (Aberšek, 2018). The education system is also at a crossroads: it is presumed that education is the foundation of society and therefore it must be conservative and must not follow the current requirements of today's society, but on the other hand education needs to be future-oriented; to create jobs, to create a workforce that will be able to start working in the world immediately after completing school, with the technology that will be relevant at the time. However, all these demands create a loop, some sort of illogical thinking, as the educational process lasts a minimum of 12 years (9 years of primary and lower secondary school and 3 years of upper secondary school or vocational school), but up to 18 years and more (tertiary education). Developmental psychology assumes that children acquire specific competences in specific developmental periods, and if this period is missed, it is extremely difficult to compensate for that (Dumont, et al., 2013). The educational process is supposed to be planned at least 12-20 years in advance, it is supposed to provide children with the knowledge that will be needed in the 'distant future', about which nothing is known, but according to today's criteria and the speed of social and technological change (OECD, 2019, Sepulveda, 2020). Therefore, in terms of digital learning, it seems that the digital literacy and/or digital competence of today is not in line with the requirements of tomorrow!

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Research Problem

The society of the future requires entirely new kinds of knowledge, skills and competences which is a serious problem for Society 5.0. Those competences, which are known today as (digital) literacy/digital competences (let us refer to them as digital competence 1.0 (DC 1.0)), need new concepts, because some knowledge, skills and competences are more important than they are in today's world – the first among them is undoubtedly functional, digital, technological and engineering literacies (Kordigel Aberšek & Aberšek, 2020, NAEP, 2014). Therefore, to solve this serious problem a new kind of digital competence is needed, to which we shall refer to as digital competence 2.0 (DC 2.0).

In short, people not only have to be digitally literate according to today's standards (DC 1.0), but also according to an entirely new standard of digital competence, a kind of functional, digital, technological and engineering literacy, or DC 2.0, which must be developed (Dumont, et al., 2013, Flogie & Aberšek, 2019, Kordigel Aberšek & Aberšek, 2020, 2013, NAEP, 2014). In presented research the first step to solve this problem was done.

Research Focus

In recent research, the term digital literacy is used in the plural form. Digital literacies are now an umbrella term for "information literacy"," digital literacy" and "new literacies". In this context *information literacy* is understood as the ability to handle information in general, *digital literacy* is understood as the ability to handle technological devices (hardware and software), and the term *new literacies* covers a series of new and innovative skills associated with ways of working with online content and social technologies (Machin-Mastromatteo, 2012).

The term competence first appeared in an article written by White (1959) in 1959 as a concept for performance motivation. Later, in 1970, Lundberg and Wolek (1970) defined the concept in Planning the Executive Development Program. Generally, a competence is defined as the capability or ability of an individual to do a job properly.

In facing the dilemma between the terms digital literacy and digital competence, EU policy makers chose the term digital competence; they speak about the development and strategic planning of digital competence initiatives in Europe and EU member states. According to this decision, a Digital Competence Framework for Citizens, known as DigComp, was designed. According to DigComp, digital competence is structured: it consists of five structural elements, which are referred to as *competence areas*. These include:

- competence in searching, evaluating and managing digital content,
- competence in communicating and collaborating through digital technologies,
- competence in creating digital content,
- competence in ensuring safety in digital environments, and
- competence in solving problems in digital environments (Carretero, et al., 2017).

Similarly, DigCompEdu (Punie & Redecker, 2017), the EU document dealing with the digital competence of educators, describing the competence needed to guide the educational process in the digital society. The DigCompEdu framework reflects and synthesizes the structural elements of digital competence into a coherent model, which allows educators at all levels of education to comprehensively assess and develop their pedagogical digital competence.

Both, DigComp and DigCompEdu offer a predictable list of structural elements as part of digital competence. However, considering the changes in the society over the past year, as well as the very nature of Society 5.0, it seems necessary to re-think the content covered by the term digital competence, and admit that the concept is not wide enough to encompass all the requirements of Society 5.0. Therefore, it seems necessary to introduce a new term: digital competence 2.0 (DC 2.0). Digital competence 2.0 covers the majority of competences listed in DigComp and DigCompEdu and is extended to include competences of functional technological and engineering literacy (Kordigel Aberšek & Aberšek, 2020; NAEP, 2014). This broadens the idea of DigComp's' competence in solving problems in digital environments, to include competence in identifying needs and technological responses, ethical use of new technologies, and creativity in using digital technologies. Referring to functional, digital, technological and engineering literacy does not refer to specific competences for specific parts of society (for the professional mobility of certain professions, e.g., engineering professions), but mainly to general competence, which all members

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of this society require for their life mobility. In general, this type of competence can be defined in terms of three aspects (Kordigel Aberšek & Aberšek, 2020):

1. *Understanding technology and its role in society,* which includes the effects of technology on society (e.g., social networks) connected with ethical and moral dilemmas and consequences (e.g., self-driving car).
2. *Understanding the process* of designing and operating technology systems, i.e., the nature of technology, the engineering process of creating tools to develop technologies (for specific professions) and the basic principles of dealing with everyday technologies, including maintenance and troubleshooting, which is a required skill for everyone.
3. *Information and communication technology management*. This includes computers and learning tools using various software, network systems (e.g., mobile networks, 5G) and protocols or operating systems (e.g., Windows, iOS, Android) (Flogie & Aberšek, 2019, 2015).

This research attempts to provide answers to some fundamental questions related to the society of the future – Society 5.0: to what extent does thinking about teacher training for the digital age lead to a necessary reflection on changing current education paradigms? What are the learning (and professional development) needs of teachers for the digital age? An additional question, arising from the above two: how does one teach digital citizenship? What gaps occur, and what are the risks of standardizing teacher education?

In generalizing the problem of standardizing digital competence DC 1.0, short-term and long-term anomalies in digital learning can be detected:

- *Short-term anomalies* are related to the fact that untrained or insufficiently trained staff (educators) are unable to take on new challenges. In addition, practitioners/teacher mostly do not have the necessary/relevant knowledge, skills, abilities and competences for working in different situations in the society of today and the future. This can be solved by means of non-formal education, which, of course, must be based on reliable and accurate research and curriculum. However, it should be pointed out that such functional trainings, in order to reach all interested parties as quickly as possible, should be designed in at least two stages: first, the training of practitioners (teachers' multipliers); and second, these multipliers implementing in-service trainings directly in their work environments.
- *Long-term anomalies* on a systemic level are mainly reflected as a lack of appropriate curricula at teacher training institutions.

Though people live in the here-and-now, they have the capacity to think about future events, remote places, distant others, and alternative realities. This ability to think about events that extend beyond the immediate context is one that many might take for granted. There is some research (Brügger, 2020, Trope, et al., 2007) that suggests, however, that this may be a uniquely human skill. Construal level theory (CLT) attempts to explain how people accomplish this remarkable feat (Trope, et al., 2007). Central to the understanding of CLT is the idea of psychological distance, which refers to the removal of an object or event from direct experience – what is happening to me in the immediate here-and-now. The qualifier 'psychological' in the term 'psychological distance' refers to the idea that the mind treats these different dimensions of distance in a mentally similar manner.

A challenge in thinking about psychologically distant events is that one often lacks information about detailed specifics. Psychological distance affects the extent to which one thinks about an event, person, or idea, and this will influence how concrete or abstract those thoughts are:

- High-level construal is when people think abstractly. For example, considering the role of education and digital competence 2.0 in Society 5.0;
- Low-level construal is when people think more concretely and is associated with psychological proximity. For example, considering the role of digital competence 1.0 in today's education.

Thus, according to this theory, in times of non-crisis, people thought about the crisis in which they now find themselves on an abstract level (high-level construal), whereas now they are placed in an actual situation and think about psychological distance at a concrete level (low-level construal). Two fundamental problems can therefore be analysed in relation to teachers' digital competences:

- The low-level construal problem is related to the today's information society. The computer is seen as a tool in the hands of humans. This problem raises the fundamental question of digital competence, i.e., what digital competence means in terms of DC 1.0.
- The problem of digital competence of tomorrow is a high-level construal problem. It is related to the needs of Industry 4.0/Society 5.0, which places entirely new demands before the educational system in the field of digital learning. The existing DC 1.0 will not be enough for tomorrow's Society 5.0/Industry

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4.0. The education system of the future will require educators not only to be digitally literate according to DC 1.0, but also according to DC 2.0. A key part of DC 2.0 are the so-called functional, engineering and technological digital literacies, where the computer is no longer considered just as a tool in the hands of humans. Rather, one may assume that computers will be managed by AI, they will become autonomous and will be able to independently perform a huge number of activities without human help. In Society 5.0, it will be necessary to develop an understanding of modern technologies and cyber security work. It will be necessary to ethically assess the decisions made by AI systems. Human-human and human-computer communication will not be enough; rather, an understanding of communication between humans and computers, between the internet of people and the internet of things, and between humans and artificial intelligence, will need to be developed.

Research Aims and Research Questions

The year 2020/2021 provided the world with an unexpected insight into the future. Everyone was forced to enter a highly specific set of circumstances. It seemed as though the earth was spinning faster than normal: because of the "social experiment" caused by the pandemic, people now live in a society that would only be achieved through natural development sometime around 2024-2025. Based on these circumstances, a survey was conducted to compare digital competence and attitudes related to digital competence 1.0, and digital competence 2.0. With sufficient reliability according to similarity theory (Byrne, 1971), this research attempts to simulate the transition from the existing DC 1.0 to a new, necessary DC 2.0, primarily from the point of view of human attitude to these changes. These requirements are manifested today in the form of distance learning, changes in the pedagogical paradigm, the changing role and importance of technology in the educational process, and the overall transformation of labour market requirements (working from home, changing the role of humans in modern-day marketing activities, introduction of intelligent technological solutions (e.g., Amazon's warehouse robots, home delivery, etc.), increasing use of manufacturing robots.

Three research questions were formed, namely:

- To what extent does thinking about teacher training for the digital age lead to a necessary reflection on changing current education paradigms (DP 1.0 to DP 2.0)?
- What are the learning (and professional development) needs of teachers for the digital age (competence DP 2.0)?
- How to teach digital citizenship? What gaps occur, and what are the risks of standardizing teacher education (ethical, moral and technological problems related to DP 2.0)?

Research Methodology

General Background

Pilot research was conducted to present digital competence (DC 1.0), based on research work done mainly in 2019. In addition, based on research work done between 2020 and 2021, a "simulation", or "prediction" of the requirements and necessary digital competences (DC 2.0) which will be needed in the society of the future (2024-2025), was performed. The results of the research were analysed in light of the Construal Level Theory (CLT).

Between March 2020 and March 2021, a longitudinal survey was conducted among different level students of teacher-training programs. The survey was carried out four times during the period from the beginning of the transition to distance learning up to the return to school, i.e., in March, June and October 2020, and in March 2021. The survey included three sets of questions in order to try and provide answers.

Finally, the teachers and students' attitude to their own digital competence (personal data protection, cyber security and ethical dilemmas, communication skills, and mastery of technologies that support distance learning), was analysed. How does one teach digital citizenship? What gaps occur, and what are the risks of standardizing teacher education (ethical, moral and technological problems related to DP 2.0, interest/motivation and atmosphere)? The research design is schematically shown in Figure 1.

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Figure 1
Research Design

Problem *Transformation of existing digital competences (DC1) in digital competences for "tomorrow" (DC2)*	
DC1	**DC2**
Research questions	
To what extent does thinking about teacher training for the digital age lead to a necessary reflection on changing current education paradigms (DP 1.0) (especially social, communication and work competences)	To what extent does thinking about teacher training for the digital age lead to a necessary reflection on changing current education paradigms (DP 1.0 to DP 2.0 What are the learning (and professional development) needs of teachers for the digital age (competence DP 2.0)? How to teach digital citizenship? What gaps occur, and what are the risks of standardizing teacher education (ethical, moral and technological problems related to DP 2.0)?
Research	
Approach 1	**Approach 2**
Instrument Survey with two sets of questionnaires.	Instrument Longitudinal survey with a questionnaire with three sets of questions.
Goals	
Monitoring users' motivation and atmosphere while using modern technologies and required skills, focusing on the attitude towards digital competences (DC 1.0 or 2.0) and on the development/use of digital technologies in the future.	Track changes in the transition from a low-level construal to a hypothetical high-level construal, whereby we monitored changes in the attitude of students towards live/distance learning, and students' opinion about their own competence in using contemporary learning technologies.

Sample

The research was carried out with teacher and students of teacher-training programs at University of Maribor. The direct results were used to present finding, pseudonyms were assigned for each one of the participants, so their identity is not relevant.

Research *approach no.1* involved 85 students of teacher-training programs, of which 12 students in science and technology programs and 73 students in the primary teacher's program, and 45 teachers at the Faculty of Education and Faculty of Natural Science and Mathematics, University of Maribor.

Research *approach no. 2* was conducted only among students of 3 and 4-year classes of teacher training programs. 54 students participated, 12 of them students on science and technology programs of Faculty of Natural Science and Mathematics and 42 students on the primary teacher program at the Faculty of Education.

Instrument and Procedures

From the perspective of CLT, high-level construal means that people adopt an abstract mode of thinking. In terms of educational needs of Society 5.0, this refers to long-term, abstract visions, to the role of education in Society 5.0. During the initial period of the Covid-19 pandemic in Slovenia (roughly from March 2020 to April 2021), high-level construal actually turned to low-level construal, representing the problem of introducing modern technologies (in this case, the introduction of technologies that support distance learning, which has become a close and concrete issue). All of a sudden, distance learning needed to be introduced immediately, at a very concrete level, and there was no time for a systemic, long-term strategic approach which was being developed before. Two research approaches were developed for tracking and evaluating conditions prior to, during, and after the pandemic, with an emphasis on low-level construal:

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Research approach no.1 included monitoring users' motivation and atmosphere while using modern technologies and required skills, by means of two sets of questionnaires, focusing on the attitude towards digital competences (DC 1.0 or 2.0) and on the development/use of digital technologies in the future. The social, communication and work competences (mastering ICT as part of DC 1.0) were tested. With regard to DC 2.0, social and communication competences with an emphasis on the attitude towards personal data protection, cyber security, ethical dilemmas, the necessary (new) communication skills, and mastery of technologies supporting distance learning, were also analysed.

Research approach no. 2 included a longitudinal survey which was used to track changes in the transition from a low-level construal to a hypothetical high-level construal, whereby changes in the attitude of students towards live/distance learning, and students' opinion about their own competence in using contemporary learning technologies, were monitored. A questionnaire with three sets of questions was used to conduct a quantitative survey using a 5-point Likert scale, and focused on distance learning, which was performed throughout the pandemic with the help of a variety of computer tools, including e-mails, Moodle learning management system, MS Teams, and Zoom tools.

The research presented is primarily theoretical, pointing mainly to the lack of education today and shows the guidelines for the development of the field of education in future (Kordigel Aberšek & Aberšek, 2020). The empirical part of the pilot survey was conducted before the restriction on movement (starting on 16 May 2020 in Slovenia), between 9 and 11 March 2020. Afterwards, it was repeated in June 2020, and October 2020, and in March 2021. From a position of validity and reliability, research gives only the direction of development, while only time will show the correctness of these set development guidelines, because there is nothing we can say for sure about the future. This will require more extensive, international research. But the research presented may provide good foundations for further work.

Data Analysis

The data were analysed according to the scientific inquiry dimensions and analysed according to five characteristics, namely the number of methods used in scientific inquiry, the collected data based on scientific knowledge, knowing the difference between experiment and observation in scientific knowledge process, recognizing the difference between subjectivity and imaginations in scientific research, knowing the difference between data and evidence collected for scientific knowledge. According to these characteristics, quantitative observation data were analysed using frequency, arithmetic average, descriptive and inferential statistics (t-test), paired sample t-test, Cohens d to indicate the standardized difference between two means and ANOVA.

When appropriate, the direct results were used to present finding, pseudonyms were assigned for each one of the participants, so their identity is not relevant.

Research Results

The research questions at low-level construal (related to the idea of information society) were: does the use of ICT (DC 1.0) affect the learners' interest/motivation in participation, the relationship between students, or the relationship between students and teachers, and what is the opinion of students about their own digital competence? To what extent does thinking about teacher training for the digital age lead to a necessary reflection on changing current education paradigms (DP 1.0 to DP 2.0)?

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Research Results of Approach No.1

Table 1
Results of Differences between the Initial and Final States according to the Group (teachers - T, students - S) for DC 1.0 / 2019

Opinion of teachers/ students	Group	Arithmetic mean	Standard deviation	Arithmetic mean difference	Arithmetic mean difference test		Cohen's
		$\bar{x}$	*SD*	$\lvert\bar{x}_z - \bar{x}_k\rvert$	*t*	*p*	*d*
Motivation	T	45.522	3.863	7.174	-7.364	.001	1.191
	S	38.348	8.182				
Attitude	T	80.500	8.315	7.217	-5.190	.001	.29
	S	73.283	11.475				
Development	T	30.217	3.126	4.196	-7.446	.001	.943
	S	26.022	5.775				
Atmosphere	T	157.109	11.850	19.391	-8.514	.001	1.128
	S	137.717	22.535				

Based on these findings, the opinions of teachers and students about their digital competence 1.0 were analysed. The focus was on three areas, namely the students' and teachers' social, communication and work skills (competences). The term *work skills* refer here to the respondents' mastery of ICT. The results are shown in Table 2.

Table 2
Final State of Skill Mastery DC 1.0 ***(2019)***

Skills of teachers/ students	Group	Arithmetic mean	Standard deviation	Two sample t-test for difference of means	Test for homogeneity of variants (ANOVA)
		$\bar{x}$	SD		
Social	T	4.686	0.411	3.476	3.704
	S	4.055	0.588		
Communication	T	4.024	0.853		
	S	2.944	0.596		
Work skills (DC 1.0)	T	4.566	0.356		
	S	4.037	0.494		

Using a similar methodology, this research examined how teachers and students perceived motivation and atmosphere during and after the pandemic period, as shown in Table 3.

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Table 3
Results of Differences between the Initial and Final States according to the Group (teachers - T, students - S) DC 2.0 (2020-2021)

Opinion of teachers/ students	Group	Arithmetic mean	Standard deviation	Arithmetic mean difference test	
		$\bar{x}$	*SD*	*t*	*p*
Motivation	T	38.348	8.182	1.639	.105
	S	35.478	8.609		
Attitude	T	73.283	11.475	-0.812	.419
	S	75.283	12.136		
Development	T	26.022	5.775	0.917	.362
	S	24.804	6.911		
Atmosphere	T	137.717	22.535	-0.350	.727
	S	139.348	22.105		

Finally, the attitude of teachers' and students' own digital competence (personal data protection, cyber security and ethical dilemmas, communication skills, and mastery of technologies that support distance learning) was analysed after the one-year period of the pandemic (in March 2021). The results served as a starting point for answering the questions: what are the learning (and professional development) needs of teachers for the digital age (competence DP 2.0)? Results are shown in Table 4.

Table 4
State of Skill Mastery - DC 2.0 (2021)

Skills of teachers/students	Group	Arithmetic mean	Standard deviation	Two sample t-test for difference of means	Test for homogeneity of variants (ANOVA)
		$\bar{x}$	*SD*		
Social	T	2.269	0.643	0.470	0.353
	S	2.115	0.552		
Communication	T	3.470	0.750		
	S	3.324	0.735		
Work skills (DC 2.0)	T	3.447	0.605		
	S	3.300	0.593		

Research Results of Approach No.2

The results of this survey showed that initially the ratio between in-person and distance learning was 70:30. During the course of performing this survey, the ratio increased in favour of distance learning (30:70), before finally returning to 70:30 after the final round of questionnaires (March 2021).

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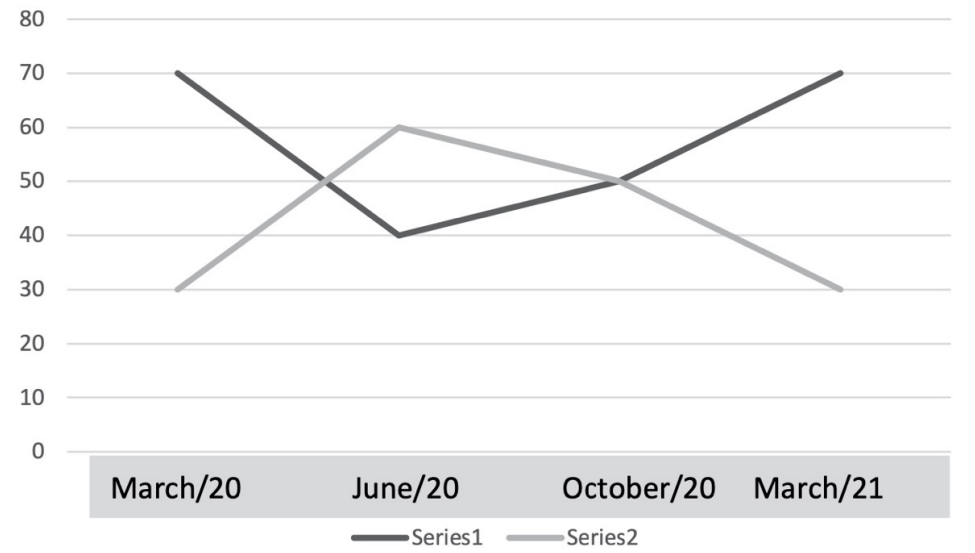
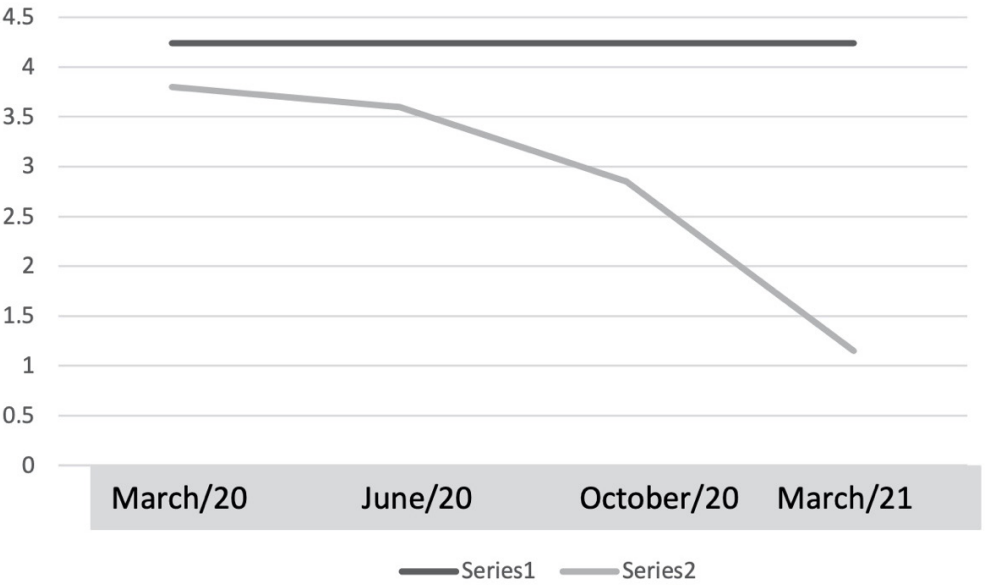
Figure 2
Ratio between In-person and Distance Learning



Legend: (Series 1 – in-person learning; Series 2 – distance learning)

A similar effect was observed with regard to the attitude towards distance learning (Series 2), which dropped from the initial value of 3.8 on the 5-point Likert scale (March 2020), to the value of 1.14 at the end of the period (March 2021). The attitude towards in-person learning (Series 1) was 4.42 all the time.

Figure 3
Attitude towards Distance Learning



Legend: (Series 1 – in-person learning; Series 2 – distance learning)

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The attitude towards in-person learning stayed more or less constant, from 4.19 in March 2020 to 4.25 in March 2021.

With regard to the students' attitude of their own competence, the values varied from the initial 4.17 in March 2020, to a decrease in June 2020 to 3.05, to an increase in October 2020 to 3.5, and finally to another increase in March 2021 to 3.92. At the beginning of the period under investigation, most students were generally indifferent, or neutral, in terms of their attitude of their own competence. Later on, many expressed fears about the new technologies (lack of confidence in mastering them). At the end of the period, their opinion about their own mastery of digital competence was quite high. It should be pointed out, however, that the survey conducted as part of this research did not analyse all the necessary new competences, such as social competence (taking into account personal data protection, cyber security and ethical dilemmas, communication skills), but only the respondents' general opinion about their mastery of technologies that support distance learning.

Discussion

According to our longitudinal survey, students initially expressed a neutral attitude toward distance learning, which later dropped from the initial value of 3.8 to the value of 1.14 at the end of the examined period. This is probably a consequence of "Zoom fatigue", which Bailenson (2021) described as a consequence of prolonged use of videoconferencing platforms. This kind of fatigue does not occur simply because students become bored; it has deeper psychological origins. Bailenson mentioned four of them: excessive amount of close-up eye contact (highly intense), constantly seeing yourself during the video conference in real time (which is unnatural and fatiguing), reduced mobility, and higher cognitive load in processing nonverbal communicational clues. The problem of Zoom fatigue is perceived as a serious psychological issue, and researchers (from Stanford University) are already preparing a tool for diagnosing and measuring its level: the Zoom Exhaustion and Fatigue Scale (ZEF Scale). The ZEF Scale consists of 15 items, revealing five dimensions of fatigue: general, social, emotional, visual and motivational fatigue (Fauville, 2021). The results of this research are consistent with the results of the Stanford investigation: the frequency and duration of Zoom meetings were associated with a higher level of fatigue, and fatigue was associated with negative attitudes towards the Zoom meetings.

These findings can be observed in the context of measuring students' opinions about Judgment of Learning (JoL), which can be defined as "judgments made by participants at the end of a learning trial regarding the likelihood of remembering the acquired information on a subsequent memory test". JoL refers to an item-specific prospective metamemory judgement. JoL, as measured in a study performed by Norman and Furnes (2016), showed M = 4.60 (SD =0.57) for learning from text on paper, and M = 4.24. (SD =0.50) for learning from text on screen, which is coherent with the results of this research. It confirms students' judgement of their digital competence before and after a longer period of using it in a real situation. Results revealed a lack of students' digital knowledge (shortly after the beginning of the 'distance learning' condition). To put it in philosophical terms: the students realized that they 'do not know', and this insight triggered the process of an intense search for knowledge, which is necessary for a more competent use of technology in their learning process. The curve began to raise significantly after that (Norman & Furnes, 2016).

The results of descriptive statistics for DC 1.0 and low-level construal in comparison with results of high-level construal, which is more abstract and more remote for teachers and especially for students, are especially important (and alarming) when interpreted from the point of view of previous research, which reveals a close interdependence of motivation and academic achievement. A decade before the world switched to distance education, Radovan (2011) already explored how and to what extent students' motivation is interrelated with their academic success, focusing especially on distance-learning environments, where the motivation derives almost exclusively from student's intrinsic motivation and less from teachers' didactic intervention. Radovans' research discovered correlations between motivation, self-regulated learning dimensions, and students' success in a distance-learning programme. His sample consisted of 319 university students and used the Motivated Strategies for Learning Questionnaire (MSLQ), developed by Pintrich and colleagues (Pintrich, et al., 1991), an instrument to measure students' motivational orientations and their use of different learning strategies in comparison to their academic performance. This instrument uses a social-cognitive approach to motivation and learning, which means that it focuses on the interconnectedness of cognitive and emotional components of learning. According to Radovan, motivational factors strongly influence the learning outcomes in tertiary education. The multiple regression analysis showed that

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goal setting, task value, self-efficiency and effort regulation are the main strategies that lead to better academic achievement in distance learning programmes.

The research results regarding the communication competence were anticipated and are consistent with previous research. Similarly to this research, Youngs' study (2006) found that students in an online learning environment rated teaching behaviours (such as facilitating the course effectively, communicating effectively, motivating students to do their best, and being visible and actively involved in the learning process) as highly effective. The reason why these results differ from those of the teaching stuff is mainly in the fact that social networks in general, as well as distance learning, are closer to students, who feel more comfortable using them in comparison to the teachers.

Both teachers and students reported a decrease in their work competence, which is logical since they were exposed to completely new learning environments. Both teachers and students were faced with the issue of mastering these learning environments, however, in addition to this, the teachers also had to adapt their didactic methods to these new learning situations overnight. With regard to working competence, results showed that teachers and students are generally less proficient in new technologies (phase one, or *"I don't know that I don't know"*) and do not think about potential problems related to their use.

The results of this research referring to social competences pointed to a dramatic decline in social competences in both teachers and students, which is consistent with previous research.

A study conducted by Stodel, et al. (2006) revealed what learners perceived as missing in their online learning experience: "perceiving and being perceived by the other", and "getting to know others".

In Northrup's research (2002), different attributes of interaction in online learning environment were studied. Northrup focused on the content interaction, conversation and collaboration, intrapersonal/metacognitive skills, and need for support. Students reported that interpersonal and metacognitive skills related to self-directedness are the most important. This self-directedness referred to cognitive guidance on assignment expectations. Also highly rated were timeliness of response (corresponding with instructor/peers), and peer discussions. The conclusions of this study reiterated the importance of different aspects of interaction in online learning "primarily because it is important to learner satisfaction and motivation" (Northrup, 2002: 225).

As regards work competences, the results were unfavourable: while schools are adequately equipped for learning, distance learning environments (individual environments of individual students) are not. In this category, the standard deviation increased, therefore it can be concluded that the differences between students were considerable, depending on what their "home" learning-and-working environment was like. An in-depth analysis of this issue showed that teachers and students positively assessed their skills for using entirely new learning environments. Understanding how such learning environments function from the point of view of personal data protection, cyber security and ethical use of such technologies, was not perceived as a serious problem at all, or not a problem at all. Again, this stems from the philosophy of psychological proximity: the problems they were exposed to were concrete and close, while the problems of ethical use, cyber security, and personal data protection were abstract and remote.

The reason is mainly that social networks in general, as well as distance learning, are closer to students, who feel more comfortable using them in comparison to the teachers. Both teachers and students reported a decrease in their work competence, which is logical since they were exposed to completely new learning environments. Both teachers and students were faced with the issue of mastering these learning environments, however, in addition to this, the teachers also had to adapt their didactic methods to these new learning situations overnight.

Conclusions and Implications

The research shows that neither teachers nor students are sufficiently qualified to work in the society of the future, in society 5.0. Motto of future school could be, *'to provide educators with the skills and competences that will not only enable them to survive in this rapidly changing society, but also to be able to lead and manage these changes and lead our society towards progress and prosperity.*' It is not enough to just point out that we are a society of knowledge: The presented research can serve as a first step towards becoming an advanced society.

Based on the above, it is extremely difficult and, above all, unreliable, to predict or plan based on the existing situation (DC 1.0), what and in what way is going to happen in the future (e.g., DC 2.0). However, the pandemic situation has provided a quick insight into the future (2024-2025) and – especially with reference to the field of education – it has allowed the requirements of Society 5.0 to be defined. This research clearly shows that master-

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ing technology itself is no longer enough. Society 5.0 also requires an understanding of how technology works, as well as knowledge about personal data protection, cyber security and especially about ethical dilemmas of introducing modern AI-based technologies, particularly for extremely sensitive areas such as education. In order to achieve this, entirely new digital competences, DC 2.0, and a new way of thinking and educating, are needed.

Above all, it should not be forgotten that the purpose of education is not only to provide learners with different kinds of knowledge, but also to develop various social competences, especially in university-level teacher-training programs. Therefore, distance learning in teachers' education cannot be considered merely as an "alternative" to normal schooling, and this research supports this claim.

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Declaration of Interest

The authors declare no competing interest.

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