Digital Competence of Digital Native Students as Prerequisite for Digital Transformation of Education

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Abstract—Current students of higher education institutions are referred to as digital natives and so they are expected to have a good level of digital competence. The aim of the paper is to examine whether digital native students of non-technical study programs consider themselves ready for the digital transformation of education and whether, from their point of view, they meet the preconditions for such digital education. A survey (questionnaire) was conducted for this purpose. The results showed that most students have appropriate technical support for online education (technical equipment, internet connection and access to the necessary software). Most students have a positive attitude towards the use of digital technologies in general and specifically in education too. This result is consistent with the characteristics of digital natives. Consistency was also found in their self-assessment of their own level of technical skill (77.4% of students do not need help working with digital technologies or only to a small extent and 84.4% of students can actively participate in online education). The results also indicate students' propensity for multitasking as a feature of digital natives (during online education, 77% of students use multiple devices at once and a total of 85.2% of students also engage in other activities during online learning). Most students are also satisfied with the support of the subjects they study in the form of e-courses. However, the preference for a particular form of study materials (printed or digital) is not such ambiguous.

Keywords—digital competence, digital natives, generation Z, students' perception and self-evaluation, digital transformation of education

1 Introduction

Information and communication technologies (ICT) are integrated into all sectors and areas of our lives and are becoming ubiquitous. At the same time, their integration affects the implementation of activities in individual areas and the functioning of society. The ways of communication, the way of working, the way of spending free time and much more are changing. According to [1], we can talk about a "digital society". It is a technological society in which information and communication are core concepts.

It is possible to say that ICT transform the world into digital, respectively create a new virtual space. The concept of digitalization, or digital transformation, is becoming more and more used and common. This is happening even more after the outbreak of the COVID-19 pandemic, the measures of which limited the physical encounter of people and moved activities even more into the virtual environment. The field of education is no exception. The Covid-19 pandemic accelerated the adoption of online education by higher education institutions (HEIs) around the world [2]. In the era of digitalization, distance education using ICT is seen as one of the possible solutions to the problem of ensuring that both lecturers and students remain healthy on the one hand (physical distance), and that the curricula on all levels of education is realized successfully (the quality of education) on the other [3].

However, the digital transformation of education is not just an issue of the current pandemic situation. A long-term factor is the development of society and the students for whom the education is provided. It is necessary to consider that today's students are not the same as those in the past [1, 4]. When today's students come into the classroom instead of copying down notes written on the whiteboard, they are more likely now to take a snapshot using their smartphone or tablet, instead of going to the library to search for information, they use Google to search the Internet [4].

Individual behaviour can be affected by demographic factors – one of them is the time of birth [5]. People born within the same time span tend to have similar characteristics and attitudes [6]. According to the year of birth, current students of HEIs are classified in the Z generation. They were born in a digital age and technologies are an integral part of their lives [4]. These students grow up surrounded by digital devices, they are accustomed to them, and they are fond of them [7]. For this reason, they are also referred to as digital natives [8]. They are also assigned other designations, such as internet generation or mobile and app native generation, because they were born at a time when the Internet and smartphones was already widespread [5]. The use of ICT at home, at school or during their leisure time is a common matter for them [9]. According to [10] and [11], students of the Z generation consider technology as the main tool to acquire their knowledge.

Their thinking and learning approaches have also changed from the methods of the former generations [4, 7, 8]. They do not need to memorize knowledge anymore, since knowledge is always just click away, and they are permanently connected and able to find it on the internet [12].

In fact, today's students are no longer the people our educational system was designed to teach [4]. Therefore, we cannot apply the education of yesterday to the students of tomorrow. Students have changed and pedagogy must find new ways to teach in ways that are appropriate for the new generation [12]. Digital technology can help modernize the education process and make it more effective, assuming that digital technology is used to motivate students to learn or to make learning more time efficient [13]. It is evident that the traditional teaching methods must be modified by using new techniques to motivate students. The modernization of university teaching methods is inescapable [7].

Therefore, it seems clear that the digital transformation of education is a challenge especially for teachers and educational institutions than for the digital native students

themselves. Whether this is really the case is worth judging. For the digital transformation to be feasible, digital competence also plays an important role for its participants. The positive claims about the characteristics of digital natives are also supplemented by [14], in where is stated that it is possible to observe an increase in the number of students with a high level of digital competence. On the other hand, in [9, 15, 16] is pointed out that digital competence may not be self-evident for all students and that the reality of its level may vary for students. According to [12] and [13], although digital natives grow up in an online world and spend thousands of hours by using technology, their knowledge and skills are limited to the possibilities and use of basic office suite skills, emailing, using social sites, and surfing the Internet. They are thus digital users and consumers of content rather than its creators.

On the one hand, there are claims that characterize current students as digital natives, for whom it is natural to work with digital technologies, and on the other hand, there are claims that their good skill in working with technologies may not apply in all cases. In this paper, we found out from university students studying nontechnical study programs in Slovakia, whether their attitudes and behaviour coincide with the description of digital natives and what is their self-evaluation in terms of their level of ability to work with digital technologies and to use them in the educational process.

2 Digital competence

Digital competence is one of the important competencies in today's digital age. In [18] is referred to it as one of the so-called 21st century skills that should be acquired by all citizens. According to [19] is digital competence even referred as a basic need if we are to function in society, as an essential requirement for life, or even as a survival skill. The importance of digital competence is also attached by European Commission [20] that included it among eight key competences essential to citizens for personal fulfilment, a healthy and sustainable lifestyle, employability, active citizenship, social inclusion, and lifelong learning. In the case of education, digital competence is perceived as a required skill when classes are conducted online [21] but also in general (not only online) for technology enhanced learning.

Common characteristics can be found in the definitions of digital competence. Based on them, digital competence can be described in the abstract as a set of certain elements which are necessary for an individual to be able to perform a certain activity. It can be observed in the definitions that they agree on a set of three main elements:

- skills – are defined as the ability to carry out processes and use the existing knowledge to achieve results [14, 15, 19, 20, 22, 23],
- knowledge – is composed of the concepts, facts and figures, ideas and theories which are already established, and support the understanding of a certain area or subject [15, 19, 20, 22-24],
- attitudes – describe the disposition and mindset to act or react to ideas, persons or situations and to adapt to new requirements [15, 19, 20, 22-25].

In addition, other elements constituting digital competence are added in the definitions: abilities [14, 19, 22], values [22], strategies [19], awareness [19], computer literacy [14].

The activities that are defined in the definitions that such a digitally competent person can perform are:

- using of digital media for participation, work and problem solving, independently or in collaboration with others in a critical, responsible, and creative manner [15],
- managing the demands of the knowledge society [23],
- self-confident, critical, and creative using of digital technologies at work, in our profession, in learning, in our free time and in our social life too [22],
- using of electronic educational resources for educational and professional activities [14],
- correctly applying digital technologies to solve various functional tasks [14],
- effective using of digital technologies and obtaining real practical results [14],
- creative acting necessary to work in online applications and digital services [14],
- confident using of electronic resources for the implementation of educational and future professional activities [26],
- confident, critical, and responsible using of, and engagement with, digital technologies for learning, at work, and for participation in society [20],
- using of ICT and digital media to perform tasks, solve problems, communicate, manage information, behave in an ethical and responsible way, collaborate, create, and share content and knowledge for work, leisure, participation, learning, socializing, empowerment, and consumerism [19],
- utilising a digital setting, such as using the graphical user interface, understanding audio-video settings, and compiling their assignments in the necessary software [21],
- applying resources to everyday life - it concerns the individual's capacity to use technology for the purpose of learning, leisure, working and being social [24].

In addition, European Commission [27] created a digital competence framework called DigComp 2.1. Within the framework, five areas of digital competence are defined: information and data literacy, communication and collaboration, digital content creation, safety, problem solving.

Digital competence is a bridge between traditional form of education and progressive education of today's digital era [28]. The success of professionally oriented educational activities depends on the level of formation of students' digital competence and their ability and readiness to apply it in information-intensive practical activities [29]. Digital competence thus becomes a prerequisite for successfully managing the digital transformation of education, adapting the students in such a transformed educational process, and successfully managing the study, as well as applying oneself in professional practice.

3 Digital natives and digital immigrants

The terms digital natives and digital immigrants were introduced by Prensky [8, 30]. The terms refer to two groups of people according to the time they were born and their ability to work with digital technologies. The term digital natives thus refer to people who were born into a time full of technology. This term also refers to current students of HEIs. Digital natives grow up and spent their entire lives surrounded by and using computers, videogames, music players, cell phones and all the other digital technologies, which have integrated into their lives. They are "native speakers" of the digital language of computers, video games, the Internet and other technology. Digital activity is like a mother tongue for them [1]. Digital natives have higher level of IT skills, experience, use, access, and positive attitude to digital technology [31, 32]. Digital natives spend more time with computer and other tools of digital technology and use it in higher scale in leisure time and for entertainment [32]. Digital natives are assumed to be inherently technology-savvy [33].

Conversely, digital immigrant refers to those who were not born into the digital world but who adopted new technologies at some later point in their lives [8]. They are essentially different from digital natives in the sense that they must learn what digital natives grow up knowing as a mother tongue [1]. They speak DSL (Digital as a Foreign Language) and like people who learn a foreign language, they have an "accent" [1, 34]. Digital immigrants don't spend so much time with computer and other tools of digital technology and use it in lesser extent than digital natives [32]. Digital immigrants are usually assumed to have some difficulty with information technology or even to resist new technology [33].

The division of people into digital natives and digital immigrants according to their year of birth may not be unambiguous. To state that digital natives are all people belonging to a specific generation (e.g., X, Y, Z, or another) or that they are people born in a certain range of years would be too simplistic. According to [33], besides age and accessibility factors there are psychological, organizational, and social factors which influence it. Similarly, [34] draw attention to the fact that the birth of digital age may vary from country to country due to varied economic progression and ability and willingness to adapt to the digital age. There are many young people in some parts of the world with no access to technology and hence they can hardly be described as digital natives [33].

The digital natives label thus not refer to a specific generation or to specific years of birth but refer to people who have grown up with technology since they were young and are therefore expected to meet the characteristics typical of digital natives. The environment can therefore be the dividing factor. According to [8], people growing up in an environment full of technology think and process information fundamentally differently. He even states that it is very likely that their brains have physically changed. He explains this by saying that brains that undergo different developmental experiences develop differently, and that people who undergo different inputs from the culture that surrounds them think differently [30]. Similarly, in [31] is stated that human brains change in response to repeated experiences, and this might be the reason why digital natives are different from the digital immigrants. Ref. [35] adds that

because students' lives today are saturated with digital media at a time when their brains are still developing, they have a distinctive set of abilities, preferences, and attitudes about learning that set them apart from previous generations.

These characteristics, which are reported to be typical of digital natives [1, 4, 8, 30, 31, 33, 34, 36], include:

- intuitive mastery of informatics and electronic devices and adaptable to the emerging technologies,
- short attention spans and multitasking (parallel processing),
- preference for teamwork and collaboration,
- expectations of immediate result, instant gratification, and frequent rewards,
- random-access and "hypertext" approach to accessing knowledge,
- used to receiving fast information and a huge amount of information,
- used to a multiplicity of communication modes,
- empirical approach to learning,
- preference for learning through visual and graphics,
- preference for creating and constructing their own knowledge rather than being instructed,
- preference for a variety of active learning methods and constructivist principles,
- preference for learning in flexible, personalized, and customized schedules.

4 Methodology

4.1 Purpose of the study

The aim of the paper is to examine, whether the current students of HEI consider themselves ready for the digital transformation of education and whether, from their point of view, they meet the requirements for such digital education. Based on the characteristics of digital natives among which they are included, it is assumed that they have sufficient digital competence to cope with the digital transformation of education. Due to this fact, we focused in more detail on selected characteristics of digital natives, we examined students' attitude to the selected areas and their own self-assessment. Specifically, we focused on the following areas:

1. what is the suitability of students' technical equipment for the purposes of online education,
2. what is the attitude of students to the use of digital technologies in general and in teaching in particular,
3. what is their self-evaluation in terms of their level of ability to work with digital technologies and to use them in the educational process,
4. what is their ability to concentrate and the ability of multitasking during online education,
5. what attitudes students have towards the use of digital learning materials in education.

4.2 Instruments and procedure

For this purpose, a survey was conducted to examine the students' attitude to researched issues. The survey was held with the method of questionnaire. The questions of the questionnaire can be divided into five areas: availability of technical equipment, attitude towards the use of digital technologies, level of technical skill, ability to concentrate and multitasking in education, learning materials.

The questionnaire was implemented in electronic form using Microsoft Forms. All the questions were Multiple-choice questions and Likert scale were used, only one did not use the Likert scale. Participants names were not recorded. Respondents completed the questionnaire independently at home after school or at any time convenient to them. The questionnaire took place at the end of the academic year 2020/21. This academic year was affected by a coronavirus COVID-19 pandemic. Due to the measures against coronavirus COVID-19 (e.g., ban on meetings, mass events, etc.) teaching in presence form (face-to-face) could not be implemented and HEIs had to come up with an emergency solution. The teaching process throughout the academic year was carried out just online without any personal contact between teachers and students.

4.3 Participants

Undergraduate students of Faculty of Economics and Management, Slovak University of Agriculture in Nitra, Slovakia, were selected as respondents. Students whose field of study is not technically oriented were deliberately selected. Fields of study of selected participants are focused on economics and management. The sample of respondents consists of a total of 243 students who voluntarily participated in the survey. 77% of respondents are female a 23% are male. In terms of the age of respondents, these are students belonging to the Z generation and they can be described as digital natives. 15% of respondents are students aged 19 years, 40% of respondents are students aged 20 years and 45% of respondents are aged 21 years.

5 Results and discussion

The results are divided into five research areas according to objectives arising from the purpose of the study.

5.1 Availability of technical equipment

An important to necessary factor for the digital transformation of education and for the possibility of implementing an online form of education is the availability of technical equipment for students. In this research area, we found out the basic elements of technical support, specifically whether students have the appropriate technical equipment, suitable Internet connection and what was the availability of software needed for their educational purposes.

In all three areas, positive results were found in most students. A total of 87.7% of students expressed they have an adequate technical equipment for online education (see Figure 1). A total of 79.8% of students stated they have a suitable internet connection (see Figure 2). According to 89.3% of students, they were able to easily access the software needed for education during the academic year (see Figure 3).
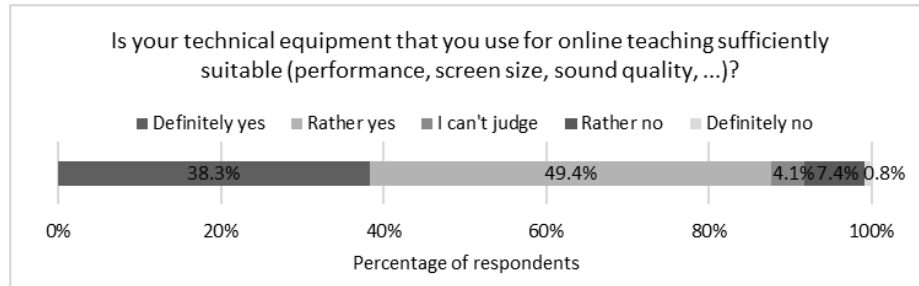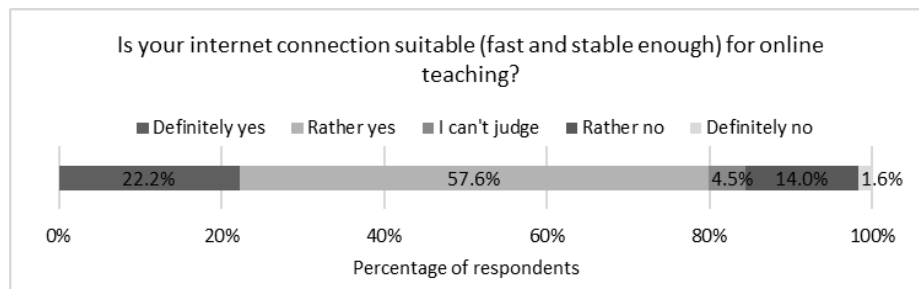

Fig. 1. Suitability of students' technical equipment for online education

Fig. 2. Suitability of students' internet connection for educational purposes
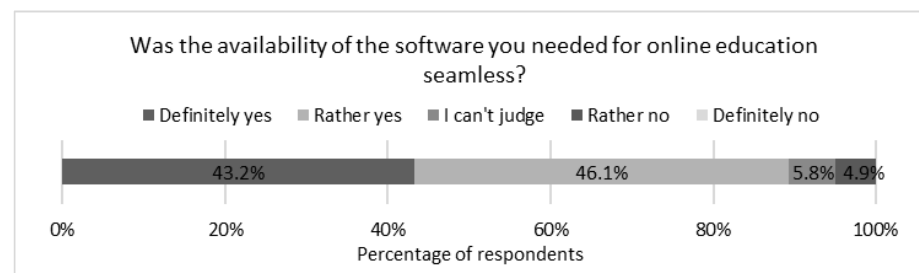
Fig. 3. Availability of software needed for online education

5.2 Attitude towards the use of digital technologies

According to the description of the characteristics of digital natives, which is described in the third chapter of the paper, digital natives have a positive attitude towards the use of digital technologies. This was also confirmed in the results of our

survey. Most students (total of 90.1%) stated a positive attitude towards the use of digital technologies in general (see Figure 4). A positive result in this area is also presented in [32]. They state that digital natives have positive attitude to technology, spend more time with computer and other tools of digital technology and use it in higher scale in leisure time and for entertainment.
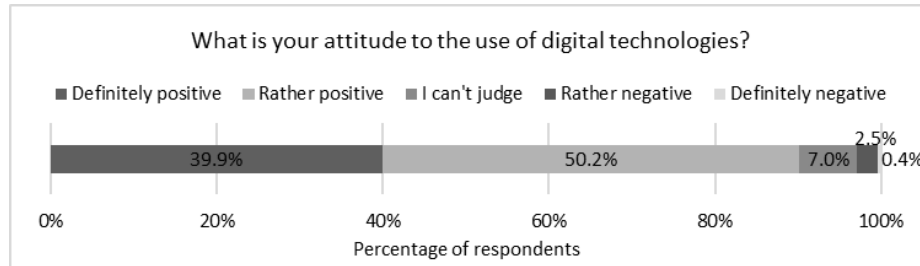

Fig. 4. Students' attitude to the use of digital technologies in general

In our survey, students also expressed positive attitude towards the use of digital technologies specifically in education (see Figure 5). The same positive result was achieved in [23]. In [23] was recorded positive attitudes of Slovenian student teachers towards using digital technologies in education too. Such a result indicates students' interest in using digital technologies not only for entertainment and leisure time, but also in other areas of their lives. Although the positive attitude in this case of our survey was expressed by majority of students (total of 74.1%), in comparison with the result from the previous question regarding their attitude to the use of digital technologies in general (see Fig. 4), a decrease of 16% can be observed. This may be due to even higher expectations of students from the implemented online way of learning than they encountered during the academic year. In this academic year, the education took place exclusively in online form for the first time as a result of an emergency solution, due to measures against the coronavirus (e.g., ban on physical meetings, mass events) without any longer-term preparation for such a form of education. Over time and by gaining experience, the quality of online education at HEIs can increase.
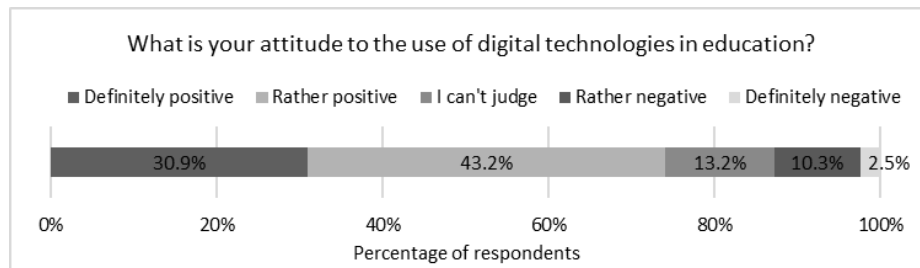

Fig. 5. Students' attitude to the use of digital technologies in education

5.3 Level of technical skill

In addition to students' interest in digital technologies and their availability, students' ability to use these technologies is also an important factor for the success of online education. We determined the level of technical skills of students based on their evaluation of the degree of necessity to use assistance in working with digital technologies. A total of 77.4% of students stated that they did not need help at all or only to a small extent (see Figure 6). Only 0.8% of students stated that they often or still need help working with digital technologies.
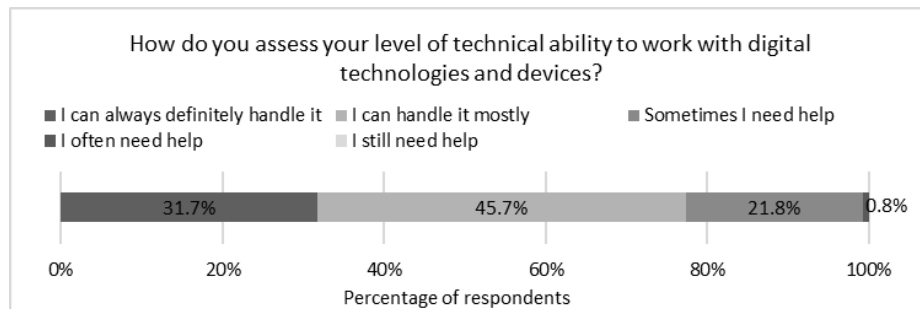

Fig. 6. Students' self-evaluation of their technical skill

In order to consider online (distance) education as a suitable alternative to presence (face-to-face) education, it is necessary to maintain mutual interaction between teacher and student. In the case of online education, it is important not only for ability to verbally respond to teacher questions or to verbally react to the curriculum, but also for ability to screen sharing by students or for ability to solve tasks in addition to just participating the teaching. Even this issue of active involvement in education, according to students, is not a problem for them. A total of 84.4% of students stated positively that thanks to their technical equipment, they were able to take an active participation in online education (see Figure 7).
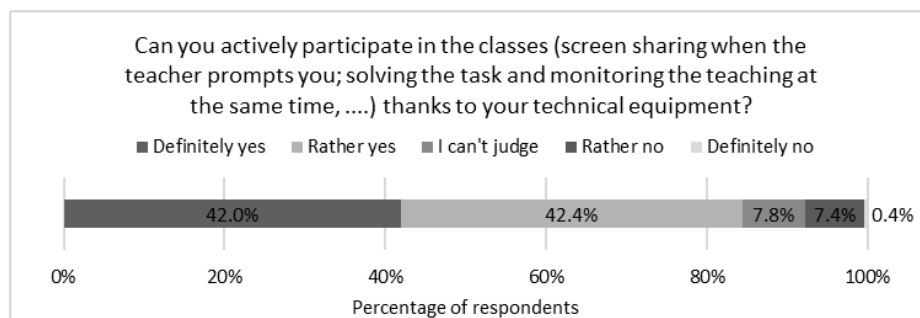

Fig. 7. Ability of students to actively participate in online education

These results show that students, according to their own self-evaluation, have sufficient skills to be able to participate in online education, to actively interact during it and to be able to solve any problems on their own devices too. Therefore, even this research area should not be problematic for digital native students. This result is consistent with claims about digital natives and their technical skills. The similar finding was found in [37]. Ref. [37] noted an improvement in the self-assessment of students' ability to work with digital technologies in 2014 (digital natives) than it was for students in 1998 (digital immigrants). Despite these findings, digital competence of students requires even more attention and review by other methods. Ref. [1] also pointed out this, claiming that the abilities of digital natives do not mean that they all are specialists, inventors, designers, developers, but rather they are digital users. Similarly, the results of [23] showed that though Slovenian student teachers predominantly hold positive attitudes towards using digital technologies in education, they assess themselves as low-level users. However, student teachers' attitudes towards using digital technologies in education were proved as an important predictor of their level of proficiency in using digital technologies.

5.4 Ability to concentrate and multitasking in online education

One of the typical characteristics of digital natives that we present in the second chapter is multitasking. Following on the previous research area focused on students' technical equipment, we found out in this research area whether students used several devices at the same time during online education – e.g., two screens/devices, where on one screen/device student can work with conference system to connect to online education and watch what the teacher is doing and on the other screen/device work in parallel according to the teacher's instructions, or write notes, etc. In this case, it is not necessary to switch between the displayed windows of the running software, or it is not necessary to reduce the dimensions of the open windows to such dimensions that they can be viewed on one screen at the same time.

Our expectations have been met and most students (a total of 77%) use a certain combination of several devices at the same time. More specifically, 45.3% of students used a laptop along with a smartphone, 11.9% of students used a computer with a smartphone, 6.2% of students used a laptop with an additional second monitor, 5.3% of students used a computer with a monitor and a laptop at the same time, 4.1% of students used a laptop and a tablet, 2.1% of students used a computer with more than one monitor connected, 1.2% of students used a computer and a tablet, 0.4% of students used a laptop with an additional monitor connected together with a smartphone and 0.4% of students used two laptops along with a smartphone. 23% of students did not use any combination of devices.

In addition, a total of 85.2% of students stated that they engage in other non-teaching activities during online education. Of these, 20.6% of students stated that they often engaged in other activities during online education and 64.6% of students just occasionally. 14.8% of students stated that they did not engage in any other activity during online education.

The results thus show that the interviewed students use multitasking during online education, which is in line with the results of [35]. At the same time, however, the results also indicate the existence of an issue in terms of concentration and distraction during online education. According to [38], approximately 80% of the students were having difficulties in concentrating during the online classes. They justify it by saying that it could be either because of the lack of study atmosphere in home or because similar proportion of students also mentioned difficulty in understanding the concepts online which was much better in a physical classroom environment. On the contrary, according to [35], digital natives have ability to manage distraction. They can multi-task in situation where they have excess cognitive capacity, but also, they can focus on a single task when the task is demanding. However, [17] stated an idea, whether multitasking can exist in case of digital natives and in case of humans in general. They compare the meaning of the word multitasking with that used in multicore processors in computers, where multiple cores can process multiple tasks at the same time. The problem here is that the human brain is single core and this architecture of the human cognitive system (i.e., how our brain functions) – as is the case for a single-core computer – only allows for very quick shifting or switching between the different tasks. It occurs so quickly that performance seems to occur simultaneously. Similarly, two concepts are distinguished in [39], namely multitasking and continuous partial attention (CPA). While multitasking can be defined as doing several things at once to increase one's productivity, CPA entails a constant fragmented attention to multiple online information and communications channels that is motivated not by productivity but by an insatiable desire for connectedness. It is caused by desire to miss nothing, individual's status of constant connection, readiness, and willingness to hear the recent news, meet someone new or join a new activity.

5.5 Teaching materials

The use of digital technologies in education can also affects the form in which teaching materials can be made available to students. In addition to the printed form, the teaching materials can also be in digital form using various multimedia formats too. A total of 71.2% of students stated that they are satisfied with the support of the subjects they studied in the form of e-courses for these subjects, together with teaching materials in digital form (see Figure 8).
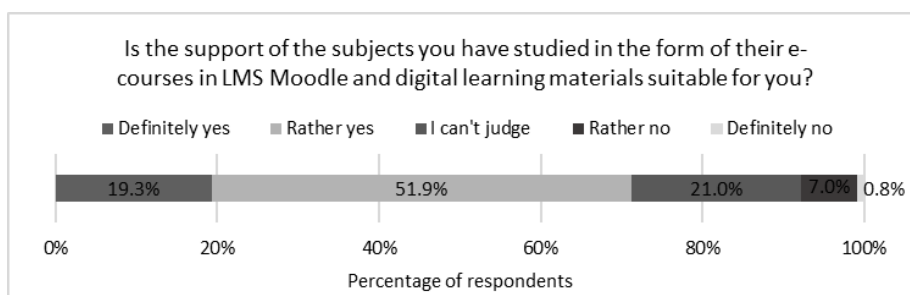

Fig. 8. Preferred form of support for subjects attended by students

On the other hand, when asked specifically about the preferred form of teaching materials (whether in printed or digital form), students' answers were not so clear in favour of digital form. More than half of students (52.3% in total) stated that the teaching materials suited them in printed form and a total of 35.8% of students were in favour of digital form (see Figure 9).
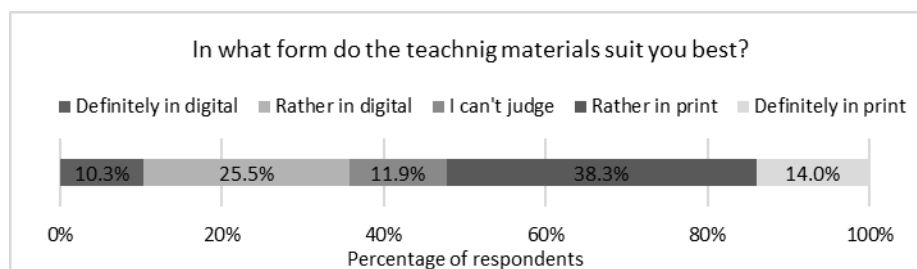

Fig. 9. Preferred form of teaching materials

These results may suggest that digital teaching materials may be more convenient for students as a source of information, also because of their easier/more convenient availability (e.g., directly from the e-course in a learning management system instead of visiting the library or bookstore in person). Subsequently, after the processing of information sources, teaching materials in printed form may be preferred by students for the learning process (they can print them from digital source).

6 Conclusion

The aim of the paper was to provide an overview of the attitudes and self-assessment of current students of HEI as digital natives in the field of their digital competence and in relation to digital technologies. This is important in terms of their readiness for the digital transformation of education. Survey participants whose study program is not technically oriented were deliberately chosen. The results show that students have a positive attitude towards digital technologies in general as well as towards their use in education. For this reason too, it makes sense to consider the implementation of digital technologies in education and to continue their implementation. The results of the survey also confirmed other assumptions important for online teaching and digitalization of education, such as sufficient technical equipment of students, suitable internet connection and availability of software needed for education. Assumptions regarding good technical skills of students as digital natives were also confirmed, as well as their ability to multitask. However, there is also the issue of student concentration, which requires further attention. Students are also satisfied with the support of the subjects they study in the form of their e-courses. However, the preference for a particular form of study materials (printed or digital) has not been unequivocally confirmed.

These findings indicate the readiness of current HEI students for the digital transformation of education. However, the obtained results are associated with the follow-

ing limitations. Survey participants are from only one HEI. It is appropriate to extend the sample of participants to include students from other HEIs, or from other countries too. Another limitation is that the findings provide a subjective perception of the students. An objective assessment of their real technical skills was not the subject of the research. It may be the subject of further research.

7 Acknowledgment

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