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SOFTWARE AND HARDWARE IN THE WORK OF THE MODERN TEACHER IN THE INFORMATION SOCIETY

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Abstract

A modern school requires the use of modern information and communication technology (ICT) solutions. Incorporating hardware, software, and websites (e-services) into teaching practice has become a matter of course. The technical layer of the digitization of school is becoming as essential as teachers' attitudes to new media and the digital skills of both pedagogues and students. It is therefore important to reflect on the types of solutions that can be used in education today. This area in particular is crucial in understanding the technical determinants of the digitisation of schooling.

This text is part of an attempt to show the multifaceted development of media pedagogy, as well as the practical sphere related to the integration of hardware and software in the daily activities of educators. The aim of the text is to draw attention to the technical layer, which is the everyday background of the activities of all teachers using ICTs as teaching resources. Given the intensity of the development of e-services and hardware, the article shows the needs, expectations, and concrete solutions available to facilitate the achievement of teaching goals using ICT. The paper addresses rarely discussed issues that are crucial for every teacher.

The article is anchored in a qualitative pedagogical research methodology. For the study, 1005 students from five universities in Poland were invited to provide answers to the question In your opinion, what digital technologies, in terms of devices (computer, tablet, smartphone, etc.) and platforms and/or applications (online environments/services) could be fruitfully used in the teaching/learning process? The qualitative data collected was analysed and categorised. The analysis and categorisation of the statements made it possible to identify eight thematically related areas, such as: 1) Improvement of methodical operations; 2) Mobility and simplicity; 3) Miniaturisation; 4) The potential of smartphones; 5) Universality of ICT; 6) Communication; 7) Specific software; 8) Negation of ICT as an effective learning tool. The text is not solely a phenomenological attempt to show the complexity of the process of the digitization of the school, but it can also be useful in the praxeological layer as a set of guidelines for the modernization of school facilities.

Keywords: software, hardware, teachers, school, information society, modernization.

1 INTRODUCTION

The process of computerisation of education has now taken on a new dimension. Due to the pandemic time, stakeholders focused on education have recognised the potential of using new media. The last several months have been an intensive period of implementing new technologies, testing software and hardware in order to implement curriculum content for both formal and non-formal education. Every teacher and learner has recently had the opportunity to see how new technologies can be realistically used in the process of teaching as well as learning. This state of affairs has triggered a lot of reflection on the use of media in education, which is reflected in many new concepts and research results related to media in education, or in the creation of guide packages on the use of particular tools based on information and communication technologies (ICT) [1] [2] [3] [4].

Assumptions developed since the mid-1990s within the framework of an intensively developing media pedagogy have had the opportunity to be fully implemented in recent months. The pandemic accelerated the implementation of ICTs in education, becoming a milestone in the digitization of education, while allowing both positive and negative sides of digitization to be highlighted [5]. Due to the accumulation of variously characterised experiences related to the digitization of education, the current time is a period of renewed reflection on the directions of ICT implementation in both K12 and higher education. This reflection is particularly relevant to the training of new pedagogical staff, which will soon become another key element for the implementation of changes related to the digitization of education.

This text is an attempt to capture the post-pandemic stage of development of media pedagogy in the area of effective use of ICT. The research results presented in the empirical part have been narrowed down to the group of students of pedagogical faculties for several reasons. Firstly, this group has relatively fresh experiences of being a student during the pandemic period. Secondly, some students will soon become active teachers, with a baggage of both positive and negative experiences. Thirdly, the collective of teaching students differs in many areas in their style of new media use from the older group of educators [6] [7] [8]. The insights presented by the teachers also become an interesting point of reference for the modernisation of academic programmes, which need to be modified due to the rapidly changing conditions associated with the development of the information society [9].

2 METHODOLOGY

The research results presented in the text aimed to answer the question - *which digital technologies, in terms of devices (computer, tablet, smartphone, etc.) and platforms and/or applications (online environments/services) could be fruitfully used in the teaching/learning process?* This aim was related to showing the multi-layered nature of ICT use in the perspective of future teachers' opinions. The research is part of the discussion on the directions of the opportunities paradigm of media pedagogy [10] [5]. The research is not only a simple diagnostic, but also has implications for the modernisation of preparation programmes for future teachers in the information society.

The research was conducted in the period January - April 2022, so in the post-pandemic time. Collecting data in Q1 2022 is an adequate time due to the intensity of ICT use in education (from March 2020), among other reasons due to the high level of ICT implementation. The research was conducted among 1005 students of pedagogical faculties at: Pedagogical University in Kraków, WSB University in Dąbrowa Górnicza, Nicolaus Copernicus University in Toruń, and University of Silesia. An online survey questionnaire (Lime Survey system) was used to collect the data [11]. It was possible to fill in the questionnaire after fulfilling the following criteria: being a first or second degree student of pedagogy, giving consent to participate in the study, using Polish language.

All collected data were subjected to: 1) Interpretive phenomenological analysis of statements; 2) Categorization due to the common denominator. The research was anchored in grounded theory. This was due to the fact that rapid socio-technical transformations have significantly changed the style of ICT use in education in the last several months, which in turn has contributed to the outdatedness of selected assumptions of media pedagogy. Moreover, the purpose of this text was to fill the gap in the presentation of current research results showing the issues related to the evaluation of hardware and software in education in the perspective of the opinions of future teaching staff and current students of pedagogy.

3 RESULTS

Media pedagogy is a sub-discipline of the pedagogical sciences that draws on both the social sciences and the humanities, as well as very much on information technology. It is the technical sciences that have brought many challenges and opportunities in recent years. On the one hand, every teacher and student understands the necessity of using ICT due to the characteristics of the information society, where the Internet and IT devices are elementary tools for work and entertainment. On the other hand, the rapidly growing IT industry brings new opportunities for the use of ICT, redefining the perspective on the conditions for implementing new media in various sectors (including education). Based on the collected statements among future educators, eight basic areas relating to the multi-level evaluation of IT software and hardware were noted. The collected results go beyond an intuitive understanding and description of IT capabilities, enabling a more constructive understanding of the potential inherent in the practical layer of media pedagogy.

The surveyed student-future pedagogical staff have a multifaceted reflection on hardware and software. The successful implementation of ICT in this collective is linked to seven main categories. The first is related to the improvement of teaching resources for specific subjects. The second relates to mobility and ease of use of modern hardware and software. The third group is related to the miniaturisation of devices that can be used in any teaching and educational circumstance. The fourth group of statements refers to the potential of smart phones, which should not be banned in education because they are high-performance devices with great potential for application. The fifth group of statements accentuates the universality of the use of ICTs in education, which are only limited by the creativity of the learners and the teacher. The sixth category is related to the implementation of ICT as an effective tool for peer and student-teacher communication. The seventh group of statements refers to the increasing range of

available software, which is growing exponentially due to the intensive development of the information society. The last category identified is in opposition to the previously mentioned. There is also a group of students who deny the logic, efficiency and legitimacy of ICT use. All categories emerged from the statements are illustrated in figure number 1 and discussed in detail in the results section.

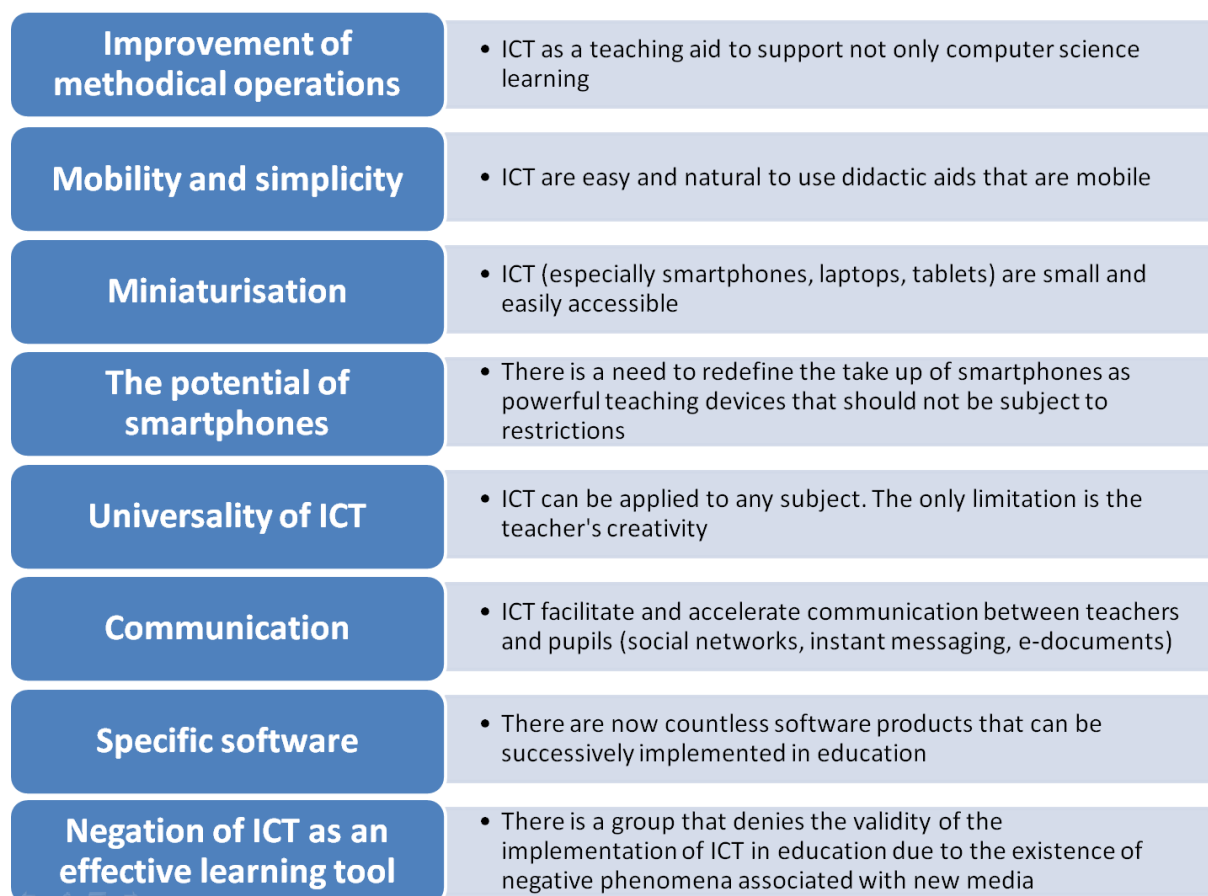


Figure 1. Eight categories related to the use of IT software and hardware in education.

3.1 Improvement of methodical operations

According to the students surveyed, ICT is one of the elementary means of teaching. Software and hardware can actually be implemented without much restriction at different educational stages, as well as within different subjects. ICT enhance involvement, which is typical for the use of active methods and forms of work. Justification of the above statement is provided by several quotations below.

There are many different forms of methodological support, for example, a graphics tablet for drawing children e.g. geometrical figures, which the early years classes are trying to learn, a computer with audio capabilities e.g. during music education.

An ebook reader and good speakers, mobile phones in foreign language lessons for using online dictionaries, and much more.

The child is eager to solve e.g. a crossword puzzle on an interactive whiteboard, because this form is more attractive in terms of its form.

The respondents underline that ICT are also useful from the perspective of enhancing the motivation of young people not only to learn the basic scope of the core curriculum, but also to broaden their general knowledge on IT.

In the teaching process it is good to use both technologies, which are close to children, as they are familiar with them and it is possible to increase their level of difficulty (e.g. create more and more perfect presentations), as well as devices, which they do not encounter on a daily basis, in order to encourage them to get to know new technologies.

ICT has become a permanent fixture in the teaching palette. Nowadays, it is not surprising that already in the early school age children develop elementary skills not only by using very important and irreplaceable analogue didactical means, but also by using software and IT hardware. Regardless of the educational stage, the use of ICT is an increasingly natural process embedded in the permanent resources of didactic means.

3.2 Mobility and simplicity

Respondents notice many features connected with mobility and ease of use of smartphones, tablets and laptops. According to the respondents these devices are small, handy and can be used everywhere. These features are arguments in favour of widespread use of this type of solutions. Examples of statements confirming such assumptions are presented below.

In my opinion, such devices could be smartphones and laptops, because they are small in size, can be used anywhere at work, and are easy to use and do not require special IT skills.

Phones, because you can always have them with you and use them even in class, for example during quizzes.

Tablet - taking notes, reviewing documents, it is also very handy.

A laptop would be better than textbooks as everything is in one place and platforms are quizzes to consolidate knowledge.

On a smartphone we can study on the way to school, e.g. on the bus, on a computer we can comfortably make presentations.

The respondents draw attention to yet another issue related to the health and safety of using mobile devices. This postulate is related not only to the implementation of mobile devices, but also to the formation of skills of self-control over the time spent in the company of digital media. Thus, the use of ICTs should not only include their intensive implementation, but also the provision of soft competences.

Mobile devices as learning aids. Children use them every day, so the school should teach how to use them well. At school, for example, a monochrome screen to avoid distractions.

Mobility and intuitive usage are one of the main arguments for using ICT not only in education. These are features that should foster even greater integration of smartphones, tablets and laptops both in formal and non-formal education..

3.3 Miniaturisation

Another category of contributions is linked to mobility and ease of use. It concerns the issue of miniaturisation. Today's devices (in particular smart phones and tablets) are very small and powerful. The components used make it possible to run entertainment content (films, music, games) as well as more complex software. Small digital devices also offer the possibility to store a large amount of information, useful for learning. This thesis was supported by the following answers.

The tablet could replace children's/young people's notebooks and books (everything in one place, no burden on the back - reducing back disorders).

A phone, due to its compactness, could be the most convenient option for learners.

Tablet - is something between a laptop and a smartphone, very easy to use and no problem to carry with you at all times. You can have multiple books with you in pdf format without any unnecessary weight. You can also consult the internet at any time and find answers to your questions.

Miniaturisation is a specific feature of modern computing devices. High performance and small size foster the development of the BYOD concept - Bring your own device (BYOD), which is not one of the ideas of media pedagogy, but something that is increasingly obvious to most teachers.

3.4 The potential of smartphones

Among the didactic tools that arouse much discussion nowadays are smartphones. These devices, as mentioned earlier, are in the possession of almost every student, being both handy and powerful microcomputers. From the data collected, for example, by the EU KIDS Online international survey [12] we know that these devices are currently much more popular among young people than desktop

computers. The performance and popularity of smartphones are therefore becoming an argument among future teaching staff for their mass implementation into the teaching process. Examples of techno optimists [13] noticing the educational value of smartphones are presented below.

Pupils carry mobile phones to school, so maybe it is worth using them in lessons, show their usefulness and not only "fight" with them on the school premises.

The smartphone - everyone always has it with them - does not require a complicated approach.

I personally used a smartphone in high school to help with counting (calculator) or checking data. I think a smartphone could be used for a while.

In my opinion, an undervalued tool that virtually every child has these days is a smartphone. If not all children have one, you could organise work in pairs or groups.

I think that with a simple smartphone you can make lessons more enjoyable by using songs that children will learn or dance to.

I think that tablets and smartphones could be very attractive to use in the educational process, as they are often forbidden to use during lessons (disenchanted them). Moreover, they allow for greater mobility than a computer or even a laptop. Consequently, applications could be used, for example, to identify plants or offer various outdoor games.

Technology could go beyond the school building and still be under a certain "supervision" of the teacher.

On the one hand, smart phones represent the realisation of the idea of fast and cheap computers for all. On the other hand, there are quite a few risks that this type of device brings. There is an opinion among teachers that their implementation requires simultaneous critical and constructive preparation of children and young people to use them safely.

3.5 Universality of ICT

ICT is characterised by a high level of universality. New media have a multifaceted use, which favours their implementation in the development of various skills (not necessarily related to digital competence), as well as knowledge transfer. Nowadays, ICT can be used for organising learning activities, creating learning spaces, transferring messages, evaluating learning outcomes or cooperative learning. As emphasised by the interviewees, ICT only requires consideration of the context of application in order to be used effectively.

In my opinion, any digital technology can be fruitfully used in the teaching/learning process if we use it at the optimal time.

All devices that allow you to open files. The most important thing is that the prepared material can be opened both on the computer and on the phone.

The best device used by teachers in my opinion is a laptop, projector.

Shared google drive (joint creation of notes, storing and sharing them), facebook groups (to post important information for the group), onenote (similar to google drive, but a bit different form and possibilities), shared calendar (saving the dates of credits, etc), virtual whiteboard application (presenting the content, (content presentation, joint creation and organisation), mind maps (visualisation of connections), quizzes, fiches, etc. (simply learning), youtube (podcasts and videos helping to understand the given content), books in epub format in a more convenient form and wider access (a big facilitation in learning, sources of information in a more convenient form and easier access).

The universality of the use of ICT is of great importance today. In the initial period of development of media pedagogy, the use of computers was limited to computer classes. Currently, such a limitation does not exist, which is evidenced by the cited statements.

3.6 Communication

The original premise of the Internet and computers was to facilitate the processing of large amounts of data, as well as to improve communication between individuals accessing network services. This assumption is now taking on a new meaning due to the functionality of instant messaging and specialised online platforms. For students and teachers, as well as parents, efficient communication is one of the elements characterising high quality education or the efficiency of an educational institution.

New media have significantly transformed the possibilities for communication between students and teachers.

For me, the easiest and fastest way is to use a phone, then a laptop. Facebook and Messenger make communication with teachers very easy.

Social media (quick contact via messenger or WhatsApp for example)

As far as digital technologies are concerned, which are helpful to use in the teaching process, especially the electronic journal, for example mobiDziennik, educational platforms such as Teams

In the teaching process you should use a computer and various interesting platforms to communicate with students, e.g. Class Dojo.

I have a multimedia whiteboard at work and in my opinion it's a great idea, because if I want to show something to a group (25 children) on a laptop, it's hard for each of them to see it.

The above presented statements show the potential and diversity of communication processes realised by new media. Of course, the fact that there are possibilities does not mean that social networking sites and instant messaging are used in everyday education. Nevertheless, the mentioned informal communication channels should, according to new pedagogical staff, be taken into account in modern education.

3.7 Specific software

Future teachers are able to indicate many types of software that can be useful at different educational levels. Among the indications, solutions oriented exclusively towards didactic activities dominate, but there is also universal software, e.g. included in an office package. Students of pedagogical sciences mention both paid and free software. Students indicate websites as well as software installed on the computer, although the first type of software is dominant. The listed software is used to create teaching materials and may allow for storage of educational content or evaluation of learning outcomes. Also in the responses there are indications of specific digital learning environments that have gained popularity during the pandemic period. The following answers mainly emphasise the fact that ICT can be implemented at any stage of the teaching process.

I know few such applications, but I think that e.g. PhotoMath, Fiszoteka.

While using different platforms/applications, I really liked Prezi and I think it has a lot of potential and can be used on a computer, tablet, smartphone, etc.

Using a device such as a computer gives more opportunities to use apps/platforms e.g. Learning apps, Canva to add variety to assignments/lectures.

Applications fruitfully used in the learning process: Word, Excel, LearningApps, Canva.

Teams (for meetings) discord (creating a channel with sorted information and notes and free space for discussion could be interesting for students), Prezi Canva (presentations)

As far as applications are concerned, for example Moodle, Webquest, Answergarden, Teams. These are easy to use and work on both computer and smartphone.

Quizziz, Prezi, Kahoot, Canva, Microsoft Teams, Genially, Classroom.

Quizziz, Kahoot, Messenger, Google Drive, Excel.

Word, Canva, Wordwall, Kahoot, Quizzzme, PowerPoint, Paint; because they are easy to use and perfectly able to convey the most important information, notes, issues, etc.

Tablet and laptop, because they are handy and ensure good preparation of materials by the teacher.

With the help of a computer or smartphone - the Microsoft Teams platform, further a lot of possibilities for chatting, posting materials and uploading assignments.

Kahoot, Canva, Wordwall, Facebook, Edu-mach (courses), various Instagram accounts and Pinterest as inspiration.

Apps like Duolingo could be useful for language teaching, created courses for students on the memrise platform.

CamScanner, NicePlan, Geometry, synonym dictionary.

Tablets as well as computers/laptops and smartphones could be used. For creating presentations and other visual content, Canva is useful, as well as Genial.ly (also for creating interactive tasks for children). For creating engaging exercises, sites such as Learning Apps and Wordwall are useful. For translating a flat form into 3D (e.g. a drawing), the app/website QuiverVision.com can be used. Interactive online whiteboards can be used, e.g. with various tools useful for maths (i.e. ruler), e.g. Whiteboard. You can also use Canva, Genial.ly, but also Jamboard, Padlet to co-create with other participants. You can also add variety to the classes by using applications where you can attach your own proposals, e.g. WordArt page, thanks to which words typed in create an illustration in a specific shape.

I think that interactive whiteboards are a valuable successor to screens and projectors, precisely because of their interactivity (for example the ability to write on them). Personally, I like to use Canva to create graphics and visually appealing worksheets. I also often use the Centre for Education Development's worksheet generator because of its ability to generate school writing (letter patterns for learning to write). Valuable applications are Kahoot, Quizziz and Genial.ly, which influence higher levels of student engagement and attention.

Based on the responses from prospective teachers, a response cloud was generated (Figure 2) containing the most popular educational software. The responses can both inspire the modification of the content of the labs and exercises that prepare for the use of ICT in education.

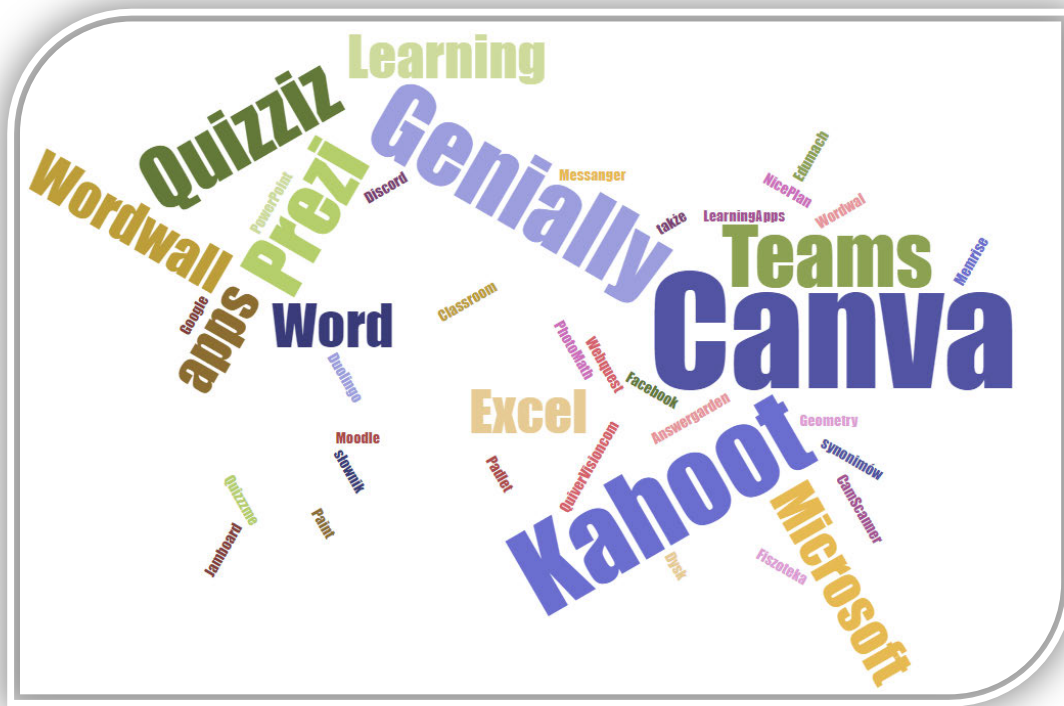


Figure 2. Word cloud - Popular software among pre-service teachers.

It is not only software that is mentioned by prospective teachers as solutions that serve and support education. In the indications there are also specific hardware solutions that can contribute to the improvement of the teaching process.

The following digital technologies could be fruitfully used: multimedia whiteboard, interactive floor, educational robots, visualisers, 3D pens, digital cameras. All these technologies mentioned by me could make classes more interesting and encourage children to participate actively in classes.

In this category of answers, it is important to note the existence of techno realist attitudes [13], which emphasize that ICT should be selected appropriately to the content, age. However, this is a skill that requires an appropriate level of digital didactic competence as well as appropriate IT facilities in the school setting.

I think all digital technologies can be useful in the learning process. I think that all applications and platforms that I am familiar with can also be useful in the teaching/learning process.

Appropriate to the age and the teaching activity, all elements of digital technology can be used.

Of course, the reality of the pandemic has shown us that without such technology, teaching at this time would be impossible. It is worth being able to use technology, as it is our future.

The contributions presented show the versatility and richness of educational software. This category was the most rich in terms of length and variety of responses from future teachers. This demonstrates, on the one hand, a great interest in the use of ICT in education, and also provides a reference point for discussing the catalogue of necessary software and hardware in a modern school.

3.8 Negation of ICT as an effective learning tool

Analysing the statements of future pedagogical staff, a group opposite to the previous categories also emerged. In this category we can find statements negating the need for ICT in education. These statements are connected with negative phenomena mediated by specific features of new media. An example of justification of the lack of need for new media in education can be found below.

None. Pupils during their commute to school are so stimulated by checking all possible applications on their phones and for this reason, in my opinion, they will not assimilate knowledge given in the same way.

I think that any of the given devices can act as an aid. However, I think that for pre-school and early school age children, it should be limited to using a computer so as not to bombard the child with stimuli and the time they will spend looking at the screen of several devices throughout the day. The computer is not a device that the child can carry with them, so they use it to a limited extent. It is not necessary for contact with parents or peers. This gives the child more opportunities to "disconnect" from the digital world.

The last category of statements represents a naturally existing group of teachers, or future teachers, who can be classified as techno-pessimists [13]. Representatives of this collective perceive the dangers of too widespread and excessive use of ICTs in both leisure and education. This group appreciates the potential of classical didactic means more than that of new media.

4 CONCLUSIONS

ICT has made its way into K12 teaching and higher education for good. Recent months (pandemic period) have only confirmed the possibilities inherent in educational software as well as IT hardware [14]. The slow implementation of ICT in educational processes over the past years is now gaining new importance due to the intensive development of the information society and increasing fields of application of new media in education [15]. Educational application areas of the Internet are currently limited only by the creativity and digital competence level of contemporary teachers [16], as well as by the equipment of educational institutions [17].

The present research results are part of the discussion on the dimensions of computerization of education. The opinions of future teaching staff presented in the text make it clear that more and more educational software is appearing on the market, which can be effectively used in almost any K12 subject or academic course. Moreover, versatility, multimedia, performance and miniaturisation mean that smartphones and tablets are no longer just attractive educational gadgets, but relatively cheap and widely available solutions.

Factors associated with digital exclusion relating to the technical layer (cost of hardware and software) reducing the frequency of ICT use in education are now losing their importance [18] due to the widespread use of smartphones and the abundance of free educational software on offer. On the other hand, the issue of lifelong learning skills [19] [20], which is linked to the permanent improvement of digital competences, is becoming more important [21] [22]. IT hardware and software alone is a useless matter without the ability to methodically exploit the potential of ICT. Therefore, the modification of academic courses preparing future teachers is now of particular importance. Such courses should take into account a number of considerations relating not only to the formation of the universal dimension of digital competence [23] [24], but also reinforce the natural integration of ICT with operational objectives.

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