Google's Digital Tools for Education: A Selection of Tools

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Abstract

The article delves into the pivotal role and significance of digital tools in the realm of educational activities, exploring their impact on various aspects of the learning process. Focusing on the analysis of Google Docs, Google Forms, and Google Meet, researchers unearthed valuable insights. Google Docs emerged as a potent catalyst for enhancing student engagement and fostering their creativity within the learning environment. By offering collaborative features and real-time editing, Google Docs empowered students to actively participate in group projects and share ideas, thereby elevating their overall learning experience. The efficacy of Google Forms in tracking academic performance came to the fore, as educators found it to be an invaluable tool for generating assessments and surveys. Furthermore, Google Meet emerged as a versatile solution for enabling seamless video conferencing, transforming distance education by facilitating convenient and dynamic communication between students and instructors. This platform fostered meaningful interactions, ensuring a sense of community and social connection in virtual learning environments. In conclusion, this study serves as a stepping stone for the continued advancement of digital tools in education. By leveraging the potentials of Google Docs, Google Forms, and Google Meet, educators can foster active student engagement, enhance academic performance monitoring, and enable effective communication. However, to truly harness the transformative power of technology, a dedicated focus on accessibility, inclusiveness, student well-being, and adaptability to rapidly changing technologies is imperative. Embracing these principles will undoubtedly pave the way for an enriched and future-ready educational landscape.

Keywords: digitalization, modern education, innovative technologies, distance education, Google

1. Introduction

1.1 Introduce the Problem

In the age of digital learning, modern education offers new opportunities and challenges, helping to create stimulating and interactive learning environments. One of the key factors that is changing the landscape of education is the use of digital tools to support learning and promote active student engagement. In this context, the tools developed by Google can transform an ordinary classroom into a stimulating intellectual arena (Kutsyk, Bachynskyi, Kuzminska & Chabaniuk, 2022).

The deep end of the last century saw an era when education unequivocally turned its gaze to fundamental principles and practices. It has entered a new definition of itself - the digital transformation of education, in which the virtual merges with the real, interactivity and dialogue are deeply fused, and the boundaries of learning are expanding.

1.2 Explore Importance of the Problem

In the past century, education has undergone evolutionary changes that have opened up a new way to acquire

knowledge and skills. Digital education was born - an evolutionary quantum leap in the way we learn and transfer knowledge. Digital education is a paradigm in which the virtual is merged with the real, and computerized tools become key factors in the fulfillment of educational tasks.

Digital education can be characterized as a transformation of learning practices based on the use of computer technologies that embody a high degree of interactivity, promote collaborative interaction, and open up limitless learning horizons. Digital education expands the idea of learning, turning it into an integrated process in which people, knowledge, and technology interact. This is a world where virtual spaces become a platform for learning, collaboration, and the creation of new knowledge (Androsova, 2023; Sayed, 2023; Saeed & Al Qunayeer, 2022).

Digital education, based on innovative technologies, information networks, and software, enables the personalization of learning, increased accessibility, and flexibility in the learning process. It opens the way to new pedagogical approaches that ensure more active student participation, stimulate their creativity, and promote the development of key competencies required in the modern digital world (Al-Khaled et al., 2022).

The era of digital education has been marked by the birth of new hopes and expectations. It has supported the perception of learning as a living organism, ready to adapt to change and stimulate the development of critical thinking, creativity, and collaboration. At this juncture in time, digital technologies are unrivaled partners that can remove barriers that separate knowledge and foster the birth of new ideas and concepts.

1.3 Describe Relevant Scholarship

The development of the digital learning environment opens up unlimited potential for students. It introduces the abstractness of cyberspace into the learning process, where the possibility of interaction and cooperation has no boundaries and does not depend on physical location. This is a new approach that is being implemented everywhere, reflected in electronic platforms, online courses, virtual reality, and other digital tools that make learning more accessible, effective, and engaging (Shara & Silalahi, 2022).

The article examines the phenomenon of the digital education era in the context of the challenges and opportunities it creates for human learning and development in the digital world. The role of Google's digital tools for education is analyzed in detail, focusing on the selection of the most effective tools for learning and teaching. The opportunities they provide for creating interactive and engaging lessons, improving the quality of learning, and developing students' creativity and critical thinking are explored (Novikova, Bychkova & Novikov, 2022).

Digital education is a transition to a new stage in human learning and development, where technology is becoming an integral part of the learning process and contributes to improving the quality of education. Considering these processes, it is possible to explore how the use of Google's digital tools for education can contribute to the development of the future generation and the formation of knowledge and skills necessary for successful functioning in the digital world.

The choice of digital tools requires a comparison of many factors, ranging from the needs of students and educators to the opportunities offered by these technologies. Google's series of tools for education, such as Google Classroom, Google Drive, Google Docs, and others, provide a wide range of features aimed at facilitating the learning process and real-time collaboration. Incorporating these tools into the learning environment opens the way to deep intellectual development, promotes active student engagement and the development of critical thinking and teamwork skills (Brandford Bervell et al., 2021). In today's digital world, information technology is rapidly penetrating all areas of life, including education. The use of Google tools in preschool education is becoming more and more common, as these tools offer a variety of opportunities to improve the learning process and development of children in this age group (Haliuk, 2022).

Google tools allow preschool teachers to create and customize interactive learning materials and use them in their work with children. For example, with Google Presentations, you can create interesting slides with images, audio, and video materials. These files help preschool children to better perceive information and educators can successfully use them in their classes with preschool children. The Google-art application provides access to images of works of art (Bondar, Bachynska, Novalska, Kasian, Kuchnarov & Pylypiv, 2020). This opens up the possibility for educators to take children on virtual excursions to museums and art galleries. Educators of preschool children can use the Google Jamboard interactive whiteboard in their work with children. This application allows the teacher to demonstrate key information on a projector or computer screen in the form of a slide using images, drawings, texts and allows editing them (Krymets, 2022).

Google's services help educators not only to conduct training sessions. They also help teachers prepare for classes. With the help of the Google Docs word processor, educators can create, edit, and save class notes and other texts

necessary for their teaching work (Gumenyuk, Kushnarov, Bondar, Haludzina-Horobets & Horban, 2021). Google Drive helps educators store, edit, and synchronize files necessary for their teaching work. It also provides file sharing and the ability to edit files together. Google Calendar helps educators with time management, helps to plan events, tasks, meetings, thematic classes, and holidays (Suharto, Junaedi, Muhdar, Firmansyah & Sarana, 2022).

Google services also help educators with professional communication. The free Google Gmail service provides access to mailboxes, which allows educators to communicate with each other via email. With the help of the simplified, free hosting service Google Sites, educators can create a website for their professional activities to share their pedagogical work with other educators and make it accessible to the public. Google Meet, a video phone and video conferencing service, supports the demonstration of one user's desktop to others. It creates an excellent opportunity for video conferences, video seminars, and meetings between teachers for their professional activities. Table 1 Provides a visual comparison of Google tools with their respective analogues (Kassim, 2024).

Table 1. Comparison of Google Tools with Relevant Analogues

Functionality	Google Classroom	Google Docs	Google Slides	Google Search	YouTube	Analogues
Create online courses	✓	×	×	×	×	Moodle, Canvas, Edmodo
Collaboration on documents	✓	✓	✓	×	×	Microsoft 365, Dropbox Paper
Presentations	×	×	✓	×	×	Microsoft PowerPoint, Prezi
Search for information	×	×	×	✓	✓	Bing, DuckDuckGo
Video tutorials	×	×	×	×	✓	Khan Academy, Udemy
Comments and ratings	✓	✓	✓	×	✓	Moodle, Canvas, Edmodo
Communication and discussion	✓	✓	✓	×	✓	Moodle, Canvas, Edmodo
Track your progress	✓	✓	✓	×	✓	Moodle, Canvas, Edmodo
Free to use	✓	✓	✓	✓	✓	Moodle, Canvas, Edmodo, Bing, DuckDuckGo, Khan Academy, Udemy (with restrictions)
Paid plans	✓	✓	✓	×	×	Moodle, Canvas, Microsoft 365, Prezi

One of the most important aspects of using Google's digital tools is their ease of use and accessibility for all participants in the educational process. The intuitive interface and extensive integration with other platforms and software make these tools easy to use regardless of the level of technological readiness of users (Gillet, Vonèche-Cardia, Farah, Hoang & Rodríguez-Triana, 2022).

In addition, their use contributes to the individualization of learning, allowing teachers to tailor materials to the needs of each student. With features such as personalized assignments and real-time feedback, teachers can create individualized learning paths and support students in their personal development.

The purpose of the article is to study the effectiveness of Google tools in the educational process.

2. Method

A research design defines the overall strategy and plan by which a research study will be conducted. An effective research design is a key element in obtaining reliable and meaningful results. Table 2 shows the stages of this study.

Table 2. Stages of the Study

Stage	Duration	Contents
Search and theoretical	June-August 2023	conducting a theoretical analysis of the literature in various scientific fields. Developing a questionnaire methodology and identifying significant research criteria. Preparation for data collection. Formation of the sample. The main criterion for inclusion was the respondents' education at a higher education institution. Formation of control and experimental groups. The participation of students was voluntary. The sample was selected by drawing lots.
Stating	September - October 2023	Conducting a questionnaire, collecting and analysing data, making calculations and identifying statistically significant results. Conducting a pedagogical experiment during which the use of various Google tools in the learning process was introduced for the EG. Over the next six months, students in the experimental group had access to the following Google tools: Google Classroom Google Docs Google Slides Google Search YouTube
Summarising	November 2023	Summarising the results and drawing conclusions

2.1 Participants

The survey was conducted at the National University of Water and Environmental Engineering. Respondents were selected by drawing lots among students of the Faculty of Foreign Languages. The research and experimental work involved students of 3–4 years of study, a total of 100 people, including 25 boys and 75 girls. The students were divided into control and experimental groups after testing their digital competences. The experimental group (EG) included students with high and medium digital competences, and the control group (CG) included students with low competences. The study also involved a group of experts consisting of 20 lecturers from the department. The same faculty conducted theoretical and practical training with the groups. Such a sample, the number of respondents and the way the control and experimental groups were formed contribute to obtaining objective data.

2.2 Instruments

In the course of the survey, Google Forms and Viber messenger were used to collect responses. Software tools such as Microsoft Excel and SPSS Statistics 19.0 were used to enter and process the data. All the results of the analysis are presented as a percentage of the total number of respondents, which provides a more understandable and relative view of the findings.

2.3 Data Collection

1. Questionnaire method. Questionnaire for studying students' digital competence (Annex A). The questionnaire was used in the study to assess the level of students' digital competencies in a group of issues related to the use of Google tools in education. The purpose of using the questionnaire was to collect objective and quantitative data to get an average view of the level of mastery of Google tools among the study participants. Each question in the survey covers a specific aspect of digital competencies, ranging from computer skills to knowledge of online communication applications and services. The survey results allow for a comprehensive analysis of the level of students' digital competence.

2. The method of a controlled pedagogical experiment allowed us to investigate the effectiveness of using Google tools to complete educational tasks. Comparing the results with the control group helped to determine the effectiveness and advantages of the proposed pedagogical conditions. The Cronbach's alpha coefficient was 0.78.

2.4 Analysis of Data

1**. *Student's criterion***, calculate the value of the t-statistic:

$$t = \frac{\overline{x_1} - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}, \quad (1)$$

Where X1 and X2 denote samples;

n1 - the number of respondents at the entrance control;

n2 - number of respondents in the final control;

s denotes the standard error:

$$s_x = \sqrt{\frac{1}{(n-1)n} \sum_{i=1}^{n} (x - x_i)^2}, \quad (2)$$

2. ***Correlation analysis***. Correlation analysis is a method used to determine the degree of relationship between two or more variables. The main purpose of correlation analysis is to determine the extent to which a change in one variable can affect a change in another. The r coefficient is determined by the Pearson formula:

$$r = \frac{n(\sum XY) - (\sum X)(\sum Y)}{\sqrt{[n\sum X^2 - (\sum X)^2][n\sum Y^2 - (\sum Y)^2]}}, \quad (3)$$

Where n is the number of observations,

∑ - the sum of all values,

X and Y are the values of two variables.

3. ***The Alpha Cronbach's reliability coefficient*** *describes the internal consistency of the test items. The Alpha Cronbach's coefficient is calculated by the formula*:

$$\frac{N}{N-1}\left(\frac{\sigma_x^2 - \sum_{i=1}^{N} \sigma_{Y_i}^2}{\sigma_x^2}\right); \quad (4)$$

Where σ_x^2 – variance of the entire test score; $\sigma_{Y_i}^2$ – variance.

2.5 Ethical Criteria

The ethical criteria in this study are defined to ensure that the rights, welfare, and dignity of participants are protected and that the results and conclusions are credible. Adherence to ethical standards is an integral part of research and is based on a number of key principles. Research must ensure that participants fully understand their rights and how the data will be used. Confidentiality and anonymity are important aspects. It should be conducted using fair and objective methods, with all results presented objectively, even if they do not meet expectations or preliminary hypotheses. The research must adhere to the principles of equity and take into account possible impacts on different socio-cultural groups. Participants should provide informed consent before taking part in the research.

3. Results

The distribution of respondents by levels of digital competence reflects a wide range of skills and knowledge in the field of digital technologies. Figure 1 shows the distribution of students by level of digital competence.

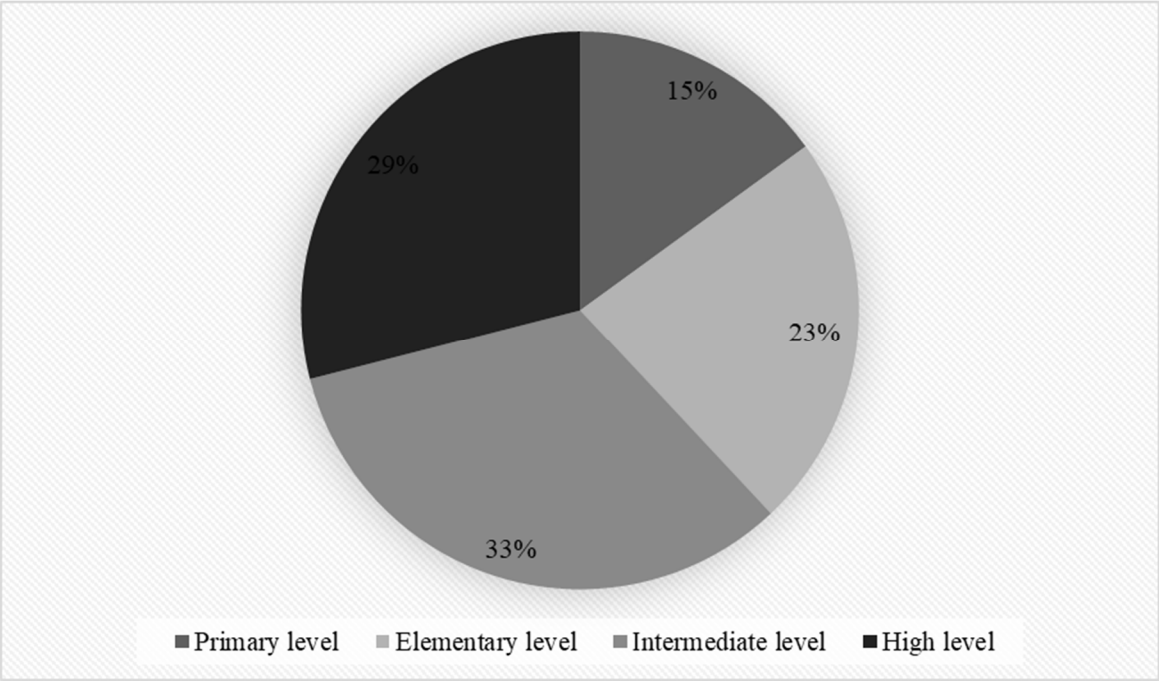

Figure 1. Distribution of Students by the Level of Digital Competence

The distribution of students by levels of digital competence indicates the diversity of skills and knowledge in this area among the audience. According to the data, the following conclusions can be drawn. The majority of students are at the basic and elementary levels of digital competence, which indicates basic or limited skills in working with digital technologies. A third of students have an intermediate level of digital competence, which indicates fairly developed skills, although they need to improve in some aspects. Approximately one third of students have a high level of digital competence, which indicates that there are students with significant skills in the group who are ready to use digital technologies for a variety of tasks. The analysis of this distribution is the basis for further correlation analysis. Thus, 62 students were included in the experimental group and 38 in the control group. Table 3 shows the results of a controlled pedagogical experiment that assessed the impact of Google tools on the dynamics of students' academic performance.

Table 3. Dynamics of Students' Academic Performance

Group	Number of students	Average performance (M)	Standard deviation (SD)	t-value	p-value
EG (using Google tools)	62	85	7.2	4.88	< 0.001
CG (without using Google tools)	38	78	6.8		

The table shows that students in the experimental group (EG) who used Google tools had an average grade of 85, while students in the control group (CG) who did not use these tools had an average grade of 78. The difference in mean scores is 7 points in favour of the EG. The standard deviation for the EG (7.2) and CG (6.8) is similar, indicating similar variability in results in both groups. The t-test value (4.88) and p-value (< 0.001) indicate that this difference is statistically significant, i.e. the use of Google tools did indeed improve students' academic performance, which confirms the hypothesis of this study.

4. Discussion

The study focuses on the crucial role and importance of digital tools in the field of educational activities, examining their impact on various aspects of the learning process. By focusing on the analysis of Google Docs, Google Forms

and Google Meet, valuable generalisations were found.

Digital tools in modern education play an important role in the organization of learning activities, opening up new opportunities for teachers and students. They are becoming an integral part of the learning process, helping to introduce innovative approaches and improve the quality of education (Bondar, Humenchuk, Horban, Honchar & Koshelieva, 2021; Liubarets, Bakhmat, Kurylo, Spitsyna & Biriukova, 2022). Their role is to facilitate effective communication, collaboration, and information sharing between teachers and students. Thanks to digital tools, it is possible to create virtual classrooms where teachers can provide assignments, study materials, and receive student responses in real-time (Bondar, Humenchuk, Horban, Honchar & Koshelieva, 2021; Liubarets, Bakhmat, Kurylo, Spitsyna & Biriukova, 2022). This promotes active interaction, joint editing, and discussion of documents and presentations, which develops students' critical and creative thinking. Table 4 shows digital tools for organizing the educational process from Google (Al-Maroof et al., 2024).

Table 4. Google Digital Tools

Google's digital tool	Description
Google Classroom	A platform for creating virtual classrooms, managing the learning process, communicating with students, and providing assignments and materials.
Google Docs	An online document editor that allows you to collaborate on text documents, edit and comment on them in real-time.
Google Slides	A tool for creating and demonstrating presentations with the ability to collaboratively edit and comment.
Google Forms	A service for creating surveys and data collection forms that allows you to receive responses in real-time and analyze them.
Google Drive	Cloud storage for storing and sharing files, including documents, presentations, images, and videos.
Google Calendar	A calendar service for scheduling events, meetings, and deadlines that allows you to collaboratively manage schedules and reminders.
Google Meet	A video conferencing platform for online meetings, webinars, and remote lessons with messaging and screen sharing.
Google Earth	A web application that allows you to explore the globe, delve into the details of places, explore the map of the planet and receive geographic data.
Google Jamboard	A virtual whiteboard for collaboration and creativity where users can overlay drawings, text, photos, and notes.

The importance of digital tools in the process of organizing learning activities lies in their ability to create accessible conditions for learning and cneltynsd development. They allow individualizing learning, enabling each student to choose their own pace and learning style. This helps to increase students' motivation, independence, and self-regulation, develops their self-discipline and ability to solve problems independently.

As indicated in the studies by Mashrabovich (2022), Bondar et al. (2020), Shevchenko (2022) and Maier & Klotz (2022), Google Docs has proven to be a powerful catalyst for improving student engagement and developing their creativity in the learning environment. This study demonstrated that by enabling collaboration and real-time editing, Google Docs enabled students to actively participate in group projects and share ideas, which enhanced their overall learning experience (Gumenyuk, Kushnarov, Bondar, Haludzina-Horobets & Horban, 2021). The effectiveness of Google Forms in tracking student performance has come to the fore as educators have highlighted it as an essential tool for creating assessments and surveys (Prokopenko, 2021; Iliev & Filipova, 2022; Rak-Młynarska, 2022), which is supported by the results of this study.

It has also been found that Google Meet is a universal solution for providing continuous video communication, transforming distance education through convenient and dynamic communication between students and teachers. Such results are mentioned in Tsekhmister (2021), Prokopenko, Omelyanenko, Ponomarenko & Olshanska (2019) and Sas et al. (2023). This platform fostered strong interactions, providing a sense of community and social

connection in virtual learning environments (Bondar, Humenchuk, Horban, Honchar & Koshelieva, 2021; Andri, 2022).

The findings of this study serve as a cornerstone for the further development of digital tools in education. By harnessing the potential of Google Docs, Google Forms, and Google Meet, educators can keep students actively engaged, improve academic monitoring, and ensure effective communication (Santoso, Murod, Winata, Kusumawardani & Muhtadin, 2023; Prokopenko, Omelyanenko, Ponomarenko & Olshanska, 2019). However, in order to truly bring about transformation through technology, it is important to focus on accessibility, inclusivity, student well-being, and adaptability to rapidly changing technologies. Implementing these principles will undoubtedly pave the way for an enriched and future-ready educational landscape.

Google's digital tools, such as Google Docs, Google Forms, and Google Meet, play a significant role in the educational process. They facilitate the convenient organization of learning, collaboration, monitoring of academic performance, and interaction between teachers and students. However, it should be noted that the development of digital tools is a process over time, and there are many promising areas for future research. One of them is to improve the interface and functionality, in particular through the introduction of artificial intelligence and machine learning. This could improve the learning and development process of students by providing more individualized approaches and recommendations. Research can also focus on the impact of digital tools on students' academic performance, motivation, and engagement in the learning process. This can help teachers and educational institutions choose the most effective methods and approaches to implementing digital technologies. In addition, it is worth considering the impact of digital tools on the social aspect of learning, including changes in communication and interaction between participants in the educational process. This may require analyzing ethical issues and developing guidelines for the use of digital tools for educational purposes.

Research on future prospects for the use of digital tools in education may also consider aspects of accessibility and inclusiveness. It is important to examine how digital tools can be made accessible to all students, regardless of their special needs, socioeconomic status, or location. Developing inclusive platforms and expanding the adaptability of digital tools can help reduce inequalities in access to quality education. Additionally, it is important to explore the impact of digital tools on students' health and well-being. Technology use can lead to screen time, affecting sleep and physical activity. Future research could focus on developing strategies and guidelines to ensure the balanced use of digital tools in the learning environment. Ultimately, future research may focus on adapting digital tools to the rapid development of technology. The development of artificial intelligence, virtual and augmented reality, blockchain technologies, and other innovations may bring significant changes to the future educational environment. Research in these new areas will help to identify the potential of digital tools in providing quality and progressive education.

The study has several limitations that should be taken into account. First, the elements of inclusivity and accessibility need to be taken into account. Analysing how digital tools can be made accessible to all, regardless of their socioeconomic status, place of residence or special needs, could be a promising area for future research. Increasing the adaptability of digital tools and creating inclusive platforms can help reduce inequalities in access to quality education. Digital tools also have an impact on students' health and well-being. Future research should focus on developing methods and guidelines to ensure that digital tools are used appropriately in learning environments.

5. Conclusion

The study showed the high efficiency of using Google's digital tools in education. These tools, such as Google Classroom, Google Docs and Google Meet, as demonstrated by the results of this study, can significantly improve the organisation of the learning process, increase interaction between teachers and students and make learning materials more accessible. Students were given more opportunities to collaborate, share knowledge and develop their digital skills when these tools were incorporated into the learning process. The use of Google's digital tools has also increased student motivation and engagement in the classroom, which has had a positive impact on their academic performance.

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Appendix A

QUESTIONNAIRE FOR STUDYING STUDENTS' DIGITAL COMPETENCES

Thank you for taking part in our survey. Your answers will help us to get more information about the level of students' digital competences.

1. Do you know how to work with a desktop computer?
2. How fast do you type on a desktop computer keyboard?
3. Do you find it easy to work with computers and other equipment?
4. How fluent are you with search engines?
5. Do you or do you not use cloud storage?
6. Do you know how to use office software?
7. Do you or do you not use word processing software?
8. Do you know how to work with spreadsheet processors?
9. Do you know how to work with presentation software?
10. Do you know how to use graphic editors?

11. Do you or do you not use reference and search engines?
12. Do you or do you not use information security services?
13. Are you interested in new applications, programmes, resources?
14. Do you know how to create digital content?
15. Do you have a presence in social media and messengers?
16. How often do you receive new information in the field of information technology?
17. Do you or do you not know the basics of databases?
18. Do you know or do you not know such programmes as: Zoom, Skype, Discord, Google Hangouts, MS Teams and their functionality? (from "0" - do not know any to "5" - know everything)

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