The Importance and the Role of Technology in the Education of Generation Z

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Abstract: The paper focuses on the importance and the role of digital technologies in the education of Generation Z, which is growing up in an environment heavily influenced by technological advances. The aim of this paper is to identify the most commonly used digital devices in higher education and to explore the attitudes of Generation Z university students towards electronic study materials. Particular emphasis is placed on the perceived role of modern devices - computers, laptops, tablets and smartphones - in the learning process of this generation referred to as the 'digital generation'. The research was carried out at the Faculty of Mass Media Communication at the University of Ss Cyril and Methodius in Trnava. The sample consisted of 863 respondents - full-time students of bachelor's and master's degrees. The research set was non-probabilistic, purposive, and the criterion for inclusion in the research was belonging to Generation Z and active study at the faculty. The research focused on three main areas: (1) Devices used to study materials in electronic form. (2) Perceptions of the role of technology in education. (3) Preference regarding the study of electronic materials. The research was guided by an attempt to answer the following research questions: What digital devices do Generation Z university students use most often in their studies? How do Generation Z students perceive the role of modern digital devices (computers, laptops, tablets, smartphones) in the learning process? What are the preferences of university students regarding the use of electronic learning materials? Are there differences in preferences across years of undergraduate study? The results show that that digital technologies are an integral part of Generation Z education. The most prominent position is occupied by the laptop as the primary tool for working with electronic learning materials. Smartphones also play an important role, and particularly for quick access to more concise study materials such as worked-out questions. Conversely, the use of desktop computers and tablets remains rather marginal, reflecting the continuing trend towards a preference for smaller screens on mobile devices such as smartphones.

Keywords: Devices, Education, Electronic Study Materials, Generation Z, Technologies.

1. Introduction

The integration of digital technologies into education represents a complex and dynamic area of research that is particularly relevant in the context of Generation Z - a cohort born into an environment of rapid technological advancement. This generation, often referred to as "digital natives", exhibit specific learning preferences and behaviours that require a rethinking of traditional pedagogical approaches. As pointed out by older or more recent research (e.g., Cilliers, 2017 or Yu, 2020), Generation Z's high affinity for technology not only influences their learning styles but also brings new challenges and opportunities for educators in effectively engaging them in the classroom.

Traditional teaching methods often fail to meet the needs of this generation, who prefer fast-paced, visually stimulating and interactive content (Čekrlija, 2024). At the same time, research suggests that technologies such as generative artificial intelligence, virtual reality, and adaptive learning systems are transforming the way learners acquire and process information (Hernandez-de-Menendez et al., 2020; Ameen et al., 2023). However, despite the potential benefits, experts also warn of risks, such as over-reliance on technology and related ethical issues (Chan & Lee, 2023).

An essential part of the successful integration of technology into the educational process is the role of educators, who often face obstacles such as a lack of digital competences or resistance to change. Targeted professional development and systematic support in digital literacy are key to increasing their readiness to use technology in education (Islawati et al., 2025).

While digital technologies can significantly enrich education and the learning process of Generation Z through personalising content, increasing engagement and supporting skills development, their effective use requires a balanced approach. Indeed, overloading with information, complex tools or uncritical adoption of AI outputs can lead to cognitive overload and weaken independent thinking skills, as pointed out by several authors (e.g. Onjewu et al., 2024 or Chardonnens, 2025).

Last but not least, the availability of technology plays an important role. In environments outside of formal learning, especially in the home, students often do not have access to advanced digital tools. This raises

questions about which devices they use for self-study and whether the smartphone, as a ubiquitous and easily accessible device, also plays a dominant role when working with electronic learning materials.

The aim of this paper is to identify the most used digital devices during university study and to explore the attitudes of Generation Z undergraduate students towards electronic study materials. Emphasis is placed on the perceived role of modern devices - computers, laptops, tablets and smartphones - in the learning process.

2. Literature Review

Generation Z represents the first truly digitally native cohort that grew up with smartphones, social media and constant access to information. This technological context has fundamentally influenced their behaviour, cognitive processes and expectations in the learning environment. In the literature, we can find several studies that address the importance, role and position of technology in the education of this generation.

Older and more recent studies indicate that Generation Z students show a strong preference for the incorporation of technology into formal education (Cilliers, 2017; Vinh, 2020). The use of technology not only promotes academic performance but also the development of soft skills such as autonomy, collaboration or digital literacy (Hernandez-de-Menendez et al., 2020; Marzuki et al., 2024). Research shows that students of this generation prefer independent and personalized learning using technology over traditional teaching formats (Vinh, 2020; Robertson, 2019).

A key feature of Generation Z is also a strong affinity for visual, multimedia and interactive content. This is highlighted by Miller, Murphrey and Alvis (2012), for example, who point to the effectiveness of interactive technologies in holding students' attention. Similarly, Andheska and Sari (2022) point out that digital forms of learning increase interest in learning literature with visual elements. However, the effectiveness of these forms is significantly influenced by the quality of the design - Mandau and Lakulu (2022) point out the need for optimising the user interface (UI) in m-learning applications.

Several studies have looked at the specific information-seeking habits of Generation Z and their preferred digital platforms. Tick (2018) noted a shift in the behaviour of early Generation Z, who no longer rely primarily on traditional sources but seek information online, often favouring a blended learning model. Nasution (2020) highlights the importance of social media as tools to increase student engagement - platforms such as Facebook, WhatsApp, Twitter and Instagram can be transformed into digital classrooms or discussion forums.

However, this trend requires new communication approaches. Wulandari et al. (2023) highlight the need to adapt communication styles to the preferences of Generation Z, who tend towards short, visual and dynamic forms of communication, while maintaining an emphasis on security and privacy.

Despite the general enthusiasm for technology, there are also challenges that need to be taken into account. Yu (2020) points out that universal access to online education is ineffective due to varying levels of digital literacy. Interactive and multimodal formats are needed that enable real-world interactions and contribute to the development of communicative competence. Ivenz and Poláková (2024) add that technology is perceived positively, especially if it provides flexibility and the opportunity to learn at one's own pace.

Ameen, Hosany, and Taheri (2023) identified significant gaps in research on Generation Z behavior in the context of new-age technologies such as generative AI, quantum computing, and metaverse. They also propose a new research framework that incorporates interdisciplinary approaches and collaborative research strategies.

Technology can have a positive impact on students' intrinsic motivation and confidence. Robertson (2019) documents the successful use of instant feedback systems that allow students to anonymously check their knowledge and compare themselves to peers. At the same time, Wajdi et al. (2024) remind us that characteristic of Generation Z, such as multitasking, creativity and inclusivity, require innovative pedagogical strategies and greater responsiveness on the part of educational institutions.

The above overview of studies and literature provides important insights into the relationship between Generation Z and technology in education. Despite identifying significant positive aspects, such as a preference for technology, the development of soft skills, and adaptation to visual content, critical analysis reveals important gaps and contrasting perspectives that require further research.

Studies that address the need to focus on security, privacy, and digital inequality do not provide an in-depth analysis of these issues. In this context, it is essential to recognize that uncritical acceptance of technology can have significant negative consequences. For example, the use of social media and other platforms in education

raises questions about the protection of students' personal data. A critical perspective should examine the ethical implications of collecting and analysing data on student behaviour in online environments.

Furthermore, studies emphasizing the importance of technological formats over traditional ones raise the question of whether traditional forms of teaching are truly outdated or simply need to be innovatively linked to digital tools. Although multimedia and visual content can increase interest, there is a risk that it will lead to superficial processing of information. Traditional methods, such as reading textbooks, lectures, and discussions, are key to developing deep analytical thinking. In addition, excessive use of digital platforms, such as social media discussion forums, can limit the development of nonverbal communication and empathy.

Current research rightly points to a gap in the study of the impact of new technologies in education, such as generative artificial intelligence (AI), quantum computers, and the metaverse. These tools represent a radical change. Future research should focus on how Generation Z students use them and how teachers can integrate them into their teaching strategies. Such insights can bridge the gaps between different disciplines and provide a more comprehensive view of the interactions between technology, students, and teachers.

3. Methodology

The aim of this paper is to identify the most commonly used digital devices in higher education and to explore the attitudes of Generation Z university students towards electronic study materials. Particular emphasis is placed on the perceived role of modern devices - computers, laptops, tablets and smartphones - in the learning process of this generation referred to as the 'digital generation'.

The research was carried out at the Faculty of Mass Media Communication at the University of Ss Cyril and Methodius in Trnava. The sample consisted of 863 respondents - full-time students of bachelor's and master's degrees. The research set was non-probabilistic, purposive, and the criterion for inclusion in the research was belonging to Generation Z and active study at the faculty.

Data collection was conducted between September 24 and October 7, 2024, through an electronic questionnaire. The questionnaire was anonymous, and completion was voluntary. Respondents were informed of the purpose of the research and the voluntary nature of participation prior to the start of the questionnaire.

The research focused on three main areas:

1. Devices used to study materials in electronic form.
2. Perceptions of the role of technology in education.
3. Preference regarding the study of electronic materials.

The data obtained were analysed using descriptive statistics. The research was guided by an attempt to answer the following research questions (RQ):

RQ 1: What digital devices do Generation Z university students use most often in their studies?

RQ 2: How do Generation Z students perceive the role of modern digital devices (computers, laptops, tablets, smartphones) in the learning process?

RQ 3: What are the preferences of university students regarding the use of electronic learning materials?

RQ 4: Are there differences in preferences across years of undergraduate study?

4. Results and Discussion

Our research focused on what devices university students use when studying electronic materials, how they perceive the role of technology in education, and their preferences regarding the study of electronic materials.

We classified the devices used for studying electronic materials into the following groups: laptop, desktop, tablet, smartphone, while we classified the materials themselves into the following categories: books, textbooks, presentations by educators, worked-out questions, and case studies.

We classified the role of technology in education into the following groups: positive perception (technology makes learning easier), neutral perception (technology does not bring any major advantages or disadvantages in education) and negative perception (technology makes learning more difficult, more challenging and less accessible for me).

Preferences about studying electronic materials were examined by expressing the degree of agreement/disagreement with the following statements: (1) Electronic materials are more suitable for studying and preparing for exams than printed materials. (2) Electronic materials are easier to learn from than printed materials. (3) I would like all study materials to be available in one place, along with case studies and links to other resources. (4) I would like study materials to be available in a single place (for example, as a website).

A number of interesting findings emerged from the results of the investigation regarding the use of different digital devices by Generation Z university students when studying electronic study materials. The most commonly used device for studying electronic learning materials is a laptop, which students primarily use to study presentations from educators and electronic books or textbooks. There is also a significant presence of worked-out questions, but students are surprisingly more likely to use a smartphone to study them. The least used devices are the desktop computer and the smartphone. More detailed results are shown in Figure 1.

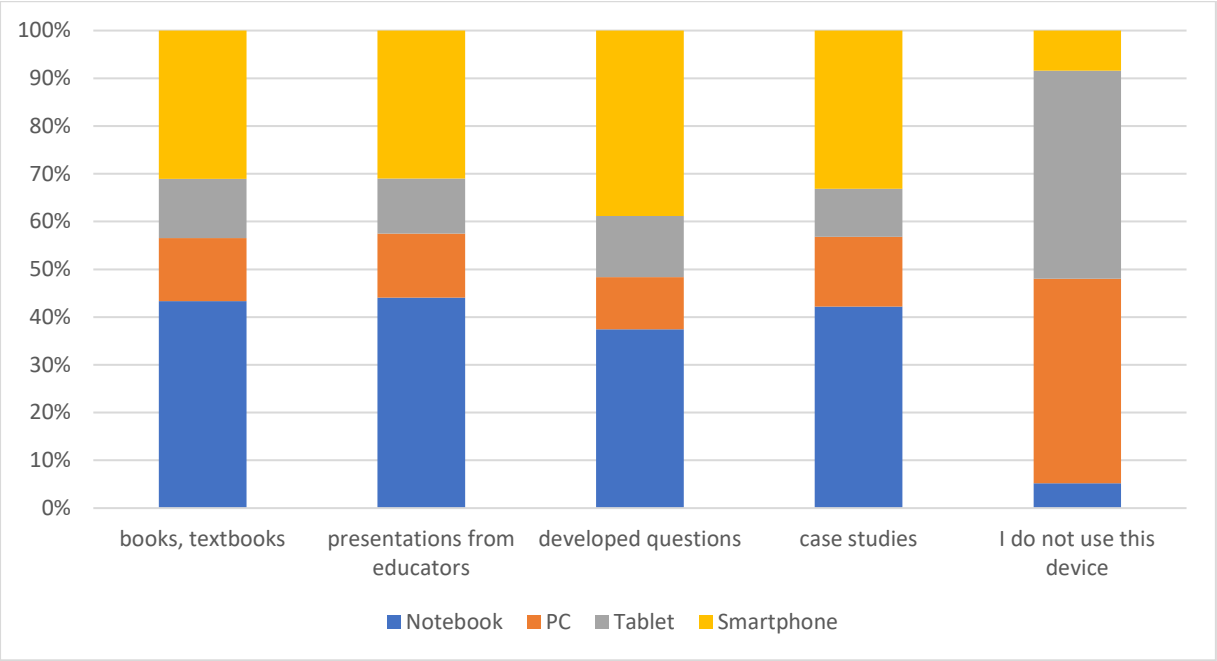

Figure 1: Devices used for studying materials in electronic form (n = 863 respondents).

Comparisons between different years of study also yielded interesting results. In the case of the laptop, although it is the most used device, we can observe a slight decrease in usage in the higher years, especially at Master level. On the contrary, desktop and tablet, although their usage is marginal, in the case of PC we can observe its most frequent usage in the 1st year of the Bachelor's degree. Tablet on the other hand has the highest usage in the 3rd year of Bachelor´s studies. In the case of the smartphone, as with laptops, there is a slight decline with higher years. Figure 2 shows the results in more detail.

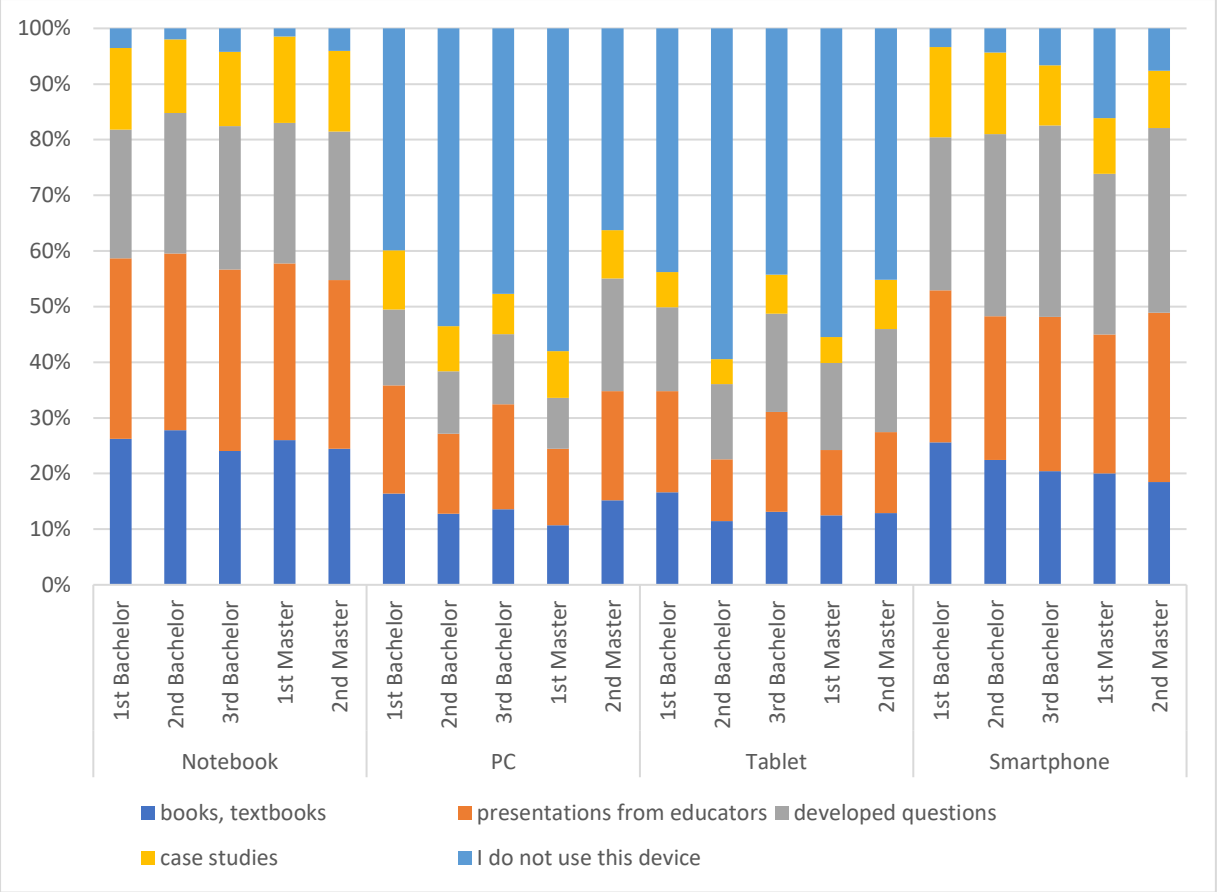

Figure 2: Devices used for studying materials in electronic form by year of study (n = 273 respondents - 1st Bachelor, 191 respondents – 2nd Bachelor, 212 respondents – 3rd Bachelor, 99 respondents – 1st Master, 88 respondents – 2nd Master).

The results of the investigation indicate the preferred facilities and the trend of development among university students, which can be summarized in Table 1.

Table 1: Type of device and trend of its usage.

Devices	1st Bachelor	3rd Bachelor	2nd Master	Notes
Notebook	Dominantly used device	Slight decrease in device usage	Slight decrease in device usage	Most used device in all years
PC	Moderately used, rather complementary	Little used device	Device minimally used	Device heavily replaced by portable devices
Tablet	Low usage rate	Relatively highest usage rate among all grades	Equipment minimally used	Complementary nature
Smartphone	Very frequent use	Consistently high use	Slight decline in device use	Quick access to questions and presentations

In terms of perceptions of the role of technology in education, a significant proportion of students perceive the role of technology positively. Thus, technology is not only accepted but actively perceived as beneficial and essential for effective higher education. However, an interesting finding is the slight trend of a decrease in the positive perception of the role of technology with increasing year and level of study. Figure 3 shows the results in more detail.

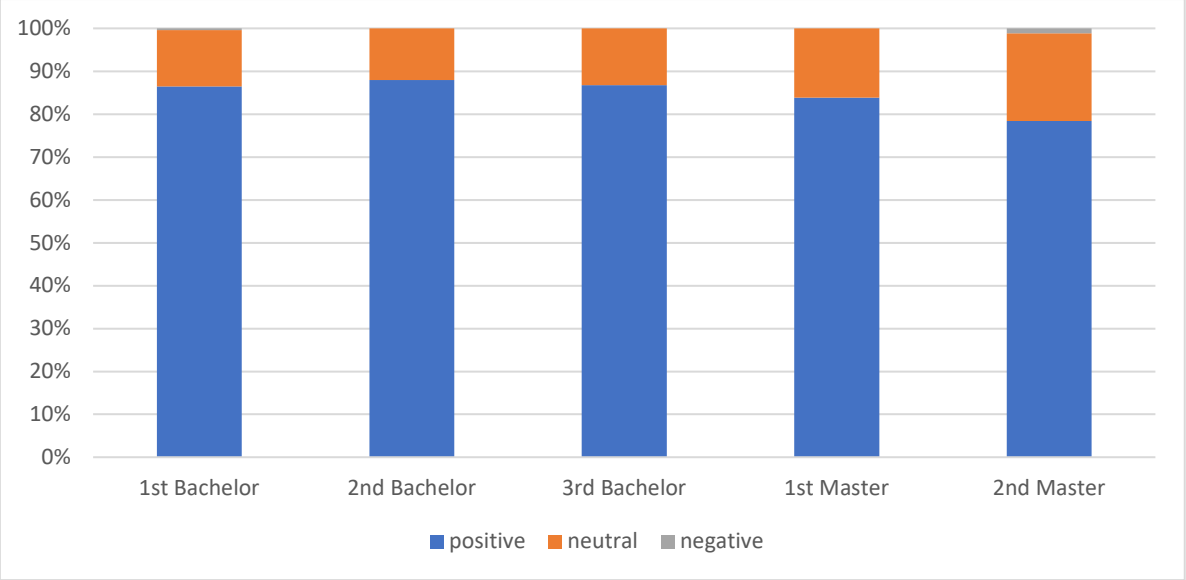

Figure 3: Perceptions of the role of technology in education by year of study (n = 273 respondents - 1st Bachelor, 191 respondents – 2nd Bachelor, 212 respondents – 3rd Bachelor, 99 respondents – 1st Master, 88 respondents – 2nd Master).

In terms of the use of electronic learning materials, the results highlighted a number of interesting findings. The majority of students only partially agree with the statement that "electronic materials are more suitable for studying and preparing for exams than printed materials", suggesting a degree of ambivalence or conditioning. Generation Z students, although they are a digital generation, still prefer printed materials to some extent, which may be related to a better ability to study the text and retain the material. This is confirmed by the respondents' answers to the second question. The majority of students disagree or only partially agree with the statement that 'it is easier to learn from electronic materials than from printed materials'. This suggests that many students still prefer or need a combination of both forms. We can assume that reading from a screen is not natural or comfortable for everyone, and some students may perceive advantages to printed text (e.g., ability to underline, better focus). Almost all students agree or partially agree with the statement 'they would like all the study materials to be available in one place, along with case studies and links to other resources'. This suggests a need to improve the organisation and accessibility of learning resources in electronic form, e.g. via e-learning platforms or university portals. This is confirmed by the agreement of almost all respondents with the statement "that they would like learning materials to be available in a single place

This is confirmed by the agreement of almost all respondents with the statement "that they would like the study materials to be available in a single place (e.g. in the form of a website)". Table 2 shows the results in more detail.

Table 2: Generation Z university students' preferences regarding studying electronic materials by year of study.

	1st Bachelor	2nd Bachelor	3rd Bachelor	1st Master	2nd Master
Electronic materials are more suitable for study and exam preparation than printed materials.					
I agree	62	40	50	15	21
I partially agree	173	113	106	49	36
I disagree	38	38	56	35	31
It is easier to learn from electronic materials than from printed materials.					
I agree	50	40	38	13	18
I partially agree	130	85	84	37	28

	1st Bachelor	2nd Bachelor	3rd Bachelor	1st Master	2nd Master
I disagree	93	66	90	49	42
It is easier to learn from electronic materials than from printed ones.					
I agree	243	170	184	79	70
I partially agree	27	19	24	19	12
I disagree	3	2	4	1	6
I would like the study materials to be available in a single place (e.g. in the form of a website).					
I agree	241	173	188	84	73
I partially agree	29	17	23	15	13
I disagree	3	1	1	0	2
SUM	273	191	212	99	88

5. Conclusion

The results of the research presented here confirm that digital technologies are an integral part of Generation Z education. These findings are confirmed by both older and more recent studies (e.g. Vinh, 2020 or Čekrlija, 2024). The most prominent position is occupied by the laptop as the primary tool for working with electronic learning materials. Smartphones also play an important role, and particularly for quick access to more concise study materials such as worked-out questions. Similar findings are reported by Poláková and Klimova (2019), whose study emphasizes that mobile technologies, including smartphones, significantly improve language learning for Generation Z students. These students, accustomed to the digital environment, benefit from interactive and multimedia content that is in line with their learning preferences. Research suggests that the use of mobile applications in the classroom has a positive effect on vocabulary retention and makes learning more enjoyable compared to traditional methods. Conversely, the use of desktop computers and tablets remains rather marginal, reflecting the continuing trend towards a preference for smaller screens on mobile devices such as smartphones.

Perceptions of the role of technology in education are overwhelmingly positive among respondents, who see digital technology as a means of making learning easier and more efficient. However, an interesting finding is a slight decline in positive perceptions of technology in the upper grades. This may be related to either increasing demands on studying or a more critical view of digital technologies in the learning process based on personal experience, for example due to potential procrastination and lack of focus. Although Generation Z is digitally proficient, the results suggest that a significant proportion of students still attribute greater effectiveness to printed materials, especially when studying for exams or learning more deeply. This implies that even among the digital generation, traditional forms of learning cannot be completely replaced, and the coexistence of both approaches is necessary for effective learning. A similar view is shared by Pikhart and Klimova (2020), who argue that blended learning approaches, which combine traditional teaching methods with digital tools, have proven effective in engaging Generation Z students. These methods allow for flexibility and accessibility, enabling students to learn at their own pace and in their preferred style.

However, the need for centralised access to digital materials became very apparent. Students are clamouring for systems that, through integration and organisation, allow easy and clear access to all the resources they need in one place. Thus, the current challenge and key task will be not only to integrate the technologies but also to strategically grasp them in a way that promotes not only efficiency but also students' own or critical thinking, focus and independence. However, it will also be important to balance technological innovation with the human dimension of learning, so that technology is not an end in itself, but a means that truly enriches the learning process in order to improve its quality and success. An interesting perspective on the different uses of technology by Generation Z members in education is provided by Bullen et al. (2011) and Lai and Hong (2015), who argue that Generation Z students tend to use a limited set of digital tools, primarily driven by factors such as knowledge

and cost. This suggests that although they are proficient in using technology, their usage patterns are not as diverse as is often assumed.

Based on the findings, it is possible to formulate several basic comprehensive recommendations for educational institutions and teachers. The most suitable approach to educating this generation may be to make all study materials available in a single centralized digital environment with a clear structure, whose design and functionality is adapted to both laptops and smaller screens such as smartphones and tablets. Another related recommendation is to prepare and provide students with study materials that are optimized for viewing on laptops, smartphones, and tablets. A suitable approach may also be to provide key text materials in printable form, which can support note-taking and concentration while eliminating digital overload. In connection with the aforementioned concentration, it is also possible to generally recommend dividing larger study topics into smaller logical parts and creating recommended time blocks for studying a given part of the topic.

Although the results of the investigation carried out provide interesting findings and highlight important aspects, the study has several limitations that need to be mentioned. This is primarily due to the focus on one group of university students, which may not reflect the preferences of all Generation Z university students. Future research in this area should therefore be extended to other groups of university students and the results compared with each other. Conducting qualitative research through individual interviews or focus groups may also be an appropriate way to better understand the results and to understand the reasons for preferences for particular technologies, the specific ways in which they are used in the learning process and, most importantly, to explore their limitations and barriers in more depth. It would also be useful to analyse the influence of the field of study on the choice of information technologies and the preference for electronic learning materials. In this respect, preferences may differ significantly. It is also important to investigate how these preferences change over time, e.g. during the transition from bachelor to master's degree or through the impact of technological innovations.

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Ethics and AI Declaration

Ethical clearance was not required for the research. No artificial intelligence tools were used in the creation of this paper.

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