



Information technology and Gen Z: The role of teachers, the internet, and technology in the education of young people

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ABSTRACT

Technological progress has influenced the way we acquire knowledge and learn. On the other hand, the Internet provides fast access to information technology in different fields and thus, improves efficiency and saves time. The importance of online technology is especially emphasized in new methods for learning and education. This is particularly important among Generation Z ("Gen Z"), which derives knowledge from the Internet and is focused on a quick search of information. The aim of this paper is to determine how technology and the Internet affect the acquisition of knowledge by Generation Z, and which forms of knowledge acquisition this generation prefers. In our paper, the problem concerns various forms of learning and acquiring knowledge. Research was conducted among 498 young people actively using an online peer-to-peer knowledge-sharing community. The results of ANOVA analysis showed the respondents being more partial towards learning via mobile applications and video content over the traditional form. It also discovered that the students tended to emulate their teachers who integrated modern technologies into their curriculum and used it outside classroom hours for learning. The results of this research make several important theoretical contributions to the gap in knowledge acquisition by Gen Z, and provide several important practical recommendations for educators.

1. Introduction

Modern society, with its rapid scientific and technological advances, has seen an exponential rise in accessible knowledge and continuously changing and emerging technologies [1] such as 'the cloud' [2]. Namely, knowledge is extremely important for the progress of the community. Thereby, community may be explained as a mini society where members share similar goals and hopes, help each other in various ways, and learn together [3]. In such a society, education plays a critical role in developing citizens whose confidence, awareness and advanced knowledge as well as skills, enable them to cohabit the planet in such a way as to cherish sustainability and prosperity for all [4]. Deeply rooted knowledge and local wisdom support communities well and offer feasible solutions for development, maintaining a stable identity in the face of rapid social change [5]. On the other hand, in order to provide

knowledge which will contribute to the community, motivation to acquire knowledge is of extreme significance. Specifically, motivation plays a crucial role in learning and represents the central factor in the effective management of the learning process. Motivation may influence what we learn, how we learn and when we choose to learn [6]. Some theories claim that students are motivated by material rewards, desire to increase their power and prestige in the world, interesting work, enriched environments, recognition or being respected as an individual [7]. Without a doubt, students' motivation is an essential element necessary for high-quality education. Motivation is optimized when students are exposed to a large number of motivating experiences and variables on a regular basis, that is, ideally, students should have many sources of motivation in their learning experience from each class [8,9]. Williams & Williams further state that students bring varying degrees of both intrinsic and extrinsic motivation to the learning arena. Intrinsic

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motivational factors found to be at work with most students include involvement (the desire to be involved), curiosity (finding out more about their interests), challenge (figuring out the complexity of a topic), and social interaction (creating social bonds) [7]. Extrinsic motivational factors include compliance (to meet another's expectation, to do what one is told); recognition (to be publicly acknowledged); competition; and work avoidance (avoiding more work than necessary) [7]. The most effective extrinsic motivation is the probability of finding a job [10], which is related to financial situation.

The Internet represents an important place as a “source of expanding horizons”. Namely, due to its prevalence, the network provides fast access to information technology in numerous fields. Information systems improve efficiency and save time, becoming an important tool for business management, decision-making, competition, development, and they especially stand out in new methods for learning and education. The “flood” of information and resources provided by revolutionary technological development, completely changes the way people learn, educate themselves, run businesses, maintain contacts, access information in a fast and efficient way [11]. The Internet has been long used for educational purposes and a number of prominent models of Internet-based education have emerged over the past 20 years. Forms of online content sharing involve the open distribution of educational content that has been created by individuals as well as institutions. For example, the YouTube EDU service offers access to millions of educational videos produced by individual educators and learners [12]. Similarly, Apple Computers' collection of educational media — the so-called iTunes U — is designed to allow learners to circumvent traditional educational lectures and classes in favor of on-demand, free mobile learning [12]. Specifically, in a time when children handle digital information, communicate with others via mobile technologies and play more games than previous generations [13], game-based learning might be a more appropriate approach to teaching and engaging children in education in a more successful way than traditional learning methods [14]. These programs and projects are indicative of the variety of ways in which education and the Internet have coalesced over the past 20 years. Yet perhaps the most significant forms of Internet-based education are the completely informal instances of learning that occur in the course of everyday Internet use. In this sense, the Internet's implicit support regarding various forms of informal learning could be seen as its most substantial educational impact [15]. Therefore, in the case of young people, the basic place to acquire knowledge is school, but the Internet is an important supplement and a source of broadening horizons. However, not everyone uses it. Among students who have access to the Internet, limiting factors may be credibility or the general ability to use such sources. Because of that, teachers play an important role and they are role-models at the training stage. They determine the behavior of their students. For these reasons, there is a growing need for teachers to use new technological solutions in teaching, in order to set an example for students to use technology independently for educational purposes. Thus, for example, by using mobile devices in the classroom, teachers play a more active role and they become designers of learning experiences for their students [16]. That is, the competencies of teachers for information and communication technology remain a crucial element in the development of education because they have a challenge to include new technological solutions in their routines, to become role-models and raise students' motivation to use technology and the Internet as learning tools. Teachers can be either motivated or limited by the new innovations in the use of technology, and they may develop a negative or positive attitude towards mobile technology in teaching and learning activities because of their beliefs. This means that there will be no change in education without a transformation in the attitude of teachers [17].

However, the way students are brought up and educated affects their perception of formal learning, and this helps in creation of different learning styles for a particular generation [18], therefore, in order to meet the learning needs of students, it is important to know the

preferences and expectations of a certain age group. In this sense, there are currently 5 general trends and social patterns that sociologists identify: *Traditionals*, *Baby boomers*, *Generation X*, *Generation Y*, and *Generation Z* (“Gen Z”) [19,20]. These generations grew up in different socio-economic conditions and have different preferences and expectations as learners [21]. The latter decade has been marked by a generation that represents the current youth of our society and that has started tertiary education the demand for new adaptive learning methods growing [22]. This is because members of this generation (Gen Z) use the Internet and social media very often, and this is becoming a part of their daily lives and socialization. Today's modern youth represents digital natives because they have never experienced life before the Internet [14]. Pallei states that no generation has shown a level of expertise or comfort with technology at such an early age as Gen Z [23], confirming the claim that no other generation has lived in an era where technology is so readily available at such a young age [14]. It is clear that today's youth is not more intelligent or smarter and does not know more than the other generations; young people today just have multiple sources of information and know how to use them the right way, and in addition, how to do this incredibly fast.

Therefore, the aim of this paper is to determine how technology and the Internet affect the acquisition of knowledge by Gen Z and which forms of knowledge acquisition this generation prefers. Although several studies on Gen Z have been published so far and there are some studies in which the frequency of using technology and the Internet to acquire knowledge by members of this generation is examined, according to the authors' knowledge, there is a lack of research comparing the significance and suitability of Internet-based learning methods in the traditional education systems. Furthermore, it is not sufficiently explored whether and in which form the Internet-based learning platforms can be incorporated into the traditional educational system, what the potential benefits would be and what would be the role of teachers in that process. This is recognized as a literary gap that the authors wanted to fill, serving as a motive for this study.

In order to achieve the aforementioned aim, we partnered with one of the world's largest peer-to-peer e-learning platforms, operating in 35 countries and opted to test our hypotheses in its largest market: India. Such a partnership gives us direct access to students who are already using modern e-learning tools in their education on a large scale, increasing the validity of our research. Thus, it is expected that we will generate theoretical insights proving to be useful for future researchers who investigate the e-learning landscape in India. The findings of this study are also expected to provide significant practical implications. It should reveal to what extent it is desirable teachers to include Internet-based learning tools in formal education curriculums and which of these tools are especially suitable in order to improve the quality of teaching methods and adapt them to the needs and requirements of generation Z. This topic is of great significance considering the fact that greater application of Internet-based learning tools in the formal education may increase the interests and concentration of generation Z members during classes, which makes the amount of acquired knowledge greater. Additionally, the usage of Internet-based technologies in formal classes by professors would help pupils to easier differentiate reliable Internet sources from those not. This can motivate pupils to search for materials available on the Internet outside formal classes, which can lead to children's higher level of education compared to that provided by the traditional (formal) education system. Hence, this research is also very helpful for teachers to create their educational curriculum as it will help make decisions on how technology can be more or less integrated, so as to get students more engaged.

The paper is organised into 6 sections. Following the introduction, in the second section, a review of the theoretical background was conducted, which includes the presentation of the results of previous research, as well as the literature review motivating this study. This section also contains an explanation of the main characteristics of Gen Z, the importance of knowledge for individual progress, as well as the

significance of motivation in the desire to acquire knowledge. The availability of content on the Internet was emphasized as an important addition to the acquisition of knowledge, especially in the context of Gen Z behavior. The value of teachers' competencies in information and communication technology which are important factors in educational development today, was especially emphasized. Also, this part provides hypothesis development. The next section provides methodology. Namely, in this part, we have included a description of the research methodology, i.e. data collection, simple measures and instrument validation. In the fifth part, the results of research are presented and then the obtained results are discussed. The final section includes concluding remarks, a review of implications, an elaboration of research limitations as well as recommendations for further research in this area.

2. Literature review

2.1. Theoretical background

Gen Z, is the first born in the world of Internet-connected technology [24]. However, there is no unique definition regarding the term of Gen Z members' birth. Some authors consider them to be those born after 1995 [25,26], others state that they are born from 1997 onward [27], while some authors argue that as generation Z members can be considered only those who were born after the year 2000 [28]. What all these statements have in common is that generation Z includes young people, most of which are nowadays pupils of primary and high schools, while the oldest members of this generation are undergraduate university students (hence, the term "young people" used in the paper refers to the members of Z generation).

In the literature, we may also recognize several nicknames that characterize this generation, and the most impressive are certainly [19]: N generation (for Net), D generation (for digital), V generation (for viral) or Google generation. Cruz further states that all these nicknames have a common denominator — information and communications technology (ICT) [29]. We conclude that technology is what enables them to become active participants in civil society, while the Internet, which they use 24/7, is a global network that forms their consciousness [30]. Furthermore, Prenski believes that the name "Digital Natives" is the most compatible label for the generation of young people who live a life immersed in technology [14]. Gen Z's interests are not limited to specific issues and topics. They are aware of everything new, they rely on their own authorities, but they are equally interested in global problems: from local incidents or news from friends, to incredible stories happening on the other side of the world [30]. Because they are versatile and broadly oriented, one major trait of the members of Gen Z is the reduced ability to pay constant attention [22]. They think globally, communicate globally and consume information from all over the world [30]. Unlike previous generations, Gen Z prefers digital media over that traditional, and has a constant need to receive new, different types of information.

What additionally characterizes GenZ is that they are tech-savvy and favor communication via technology rather than direct contact with people [19]. With technological development in multimedia, such as tablets, smartphones, social media and flat screen TVs, young people of Gen Z have become accustomed to interaction and communication in a world that is connected at all times [31]. Today's Gen Z prefers multiple flows of information, frequent and fast interactions with content, technological and collaborative experiences that show clear goals, increase motivation and include authentic activities [32,33].

Bearing in mind the fact that they have been using different technologies from a young age, it is clear these are an undoubtedly integral part of their lives. High-school pupils and university students who currently attend classes are characterized as experts in understanding technology, they are socially open through the use of technology, fast and impatient, as well as interactive and resilient multi-taskers [29], as was observed in the research of Singh et al. [34] who investigated adoption intention and effectiveness of digital collaboration platforms

for online learning in Indian students. It has been shown in research that the brains of Gen Z are structurally different from the brains of all previous generations [14,21]. Thus, the part of the brain responsible for visual ability is far more developed, resulting in visual forms of learning being more efficient [21]. On the other hand, Poláková and Klímová emphasize that compared to previous generations, the attention span of Gen Z is limited, which is caused by continuous interaction with a multimedia environment, predisposing the brain to shortened attention span [19]. To be precise, the average attention span of Z generation members in the classroom may be estimated as a period of 7–10 min because young people today want to read less than 20% of a text, wanting to get to the point as fast as possible [19]. They have a very low tolerance for being without digital resources, because technology is very important to them, as they use it to find information from all different areas of their lives, including education. This is why they favor learning via the Internet over using paper-based materials [21]. Hence, it is evident that the thinking patterns of the new generation have changed significantly [14]. Schroer further confirms this statement and points out that the very diverse environment and pupils' interaction with it make schools more diverse than ever [35]. An effective teaching process in a traditional classroom largely depends on discussion and interaction, both between teachers and students, and among peers [36]. Likewise, scholars recognize interaction to be an important element in achieving the objectives of online learning [37]. This significance of interaction in e-learning is affirmed by the most current studies [34] in which the adoption intention and effectiveness of digital collaboration platforms (DCPs) for online learning in India has been investigated. It was discovered that interactivity has formed positive attitudes towards usage and intention to adopt e-learning.

According to the stated characteristics of Gen Z, the role of technology and the Internet is extremely important for education. Network convenience and interactivity results in increasing time and location flexibility; e-learning has become the development trend of education and learning [38]. Furthermore, the emergence of various computer technologies enables the usage of multimedia content and multimedia communication for education, and provides anywhere, anytime access to learning content [39], as was observed by Hamidi & Chavoshi [40] and Panigrahi et al. [41]. Technology, therefore, has the potential to improve many aspects of our daily lives, including learning and self-education. Technology has been shown to increase student engagement as well as learning outcomes [42], while improving quantitative reasoning [43]. However, all generational groups have their own unique characteristics that are the result of the time period in which they grew up and despite sharing some characteristics, there is no solution for adapting learning aptitudes for all generations, as they are generally different when it comes to learning styles [19]. Seemiller and Grace point out that the focus of Gen Z, when it comes to college, is to learn and acquire the skills needed for their future careers, but that learning for them is significantly different than that of previous generations [44]. Everything that Gen Z students basically want to know may be accessed with one click. As mentioned earlier, this new generation of students grows up in a very different environment from previous generations, and as a result, opinions, inclinations, expectations and learning styles have completely changed [14,35]. Nonetheless, the adaptation of learning aptitudes and application of Internet-based learning tools requires certain adjustment, even amongst the members of this generation. As revealed in the research by So et al. [45] and Hubalovsky et al. [46], there are significant differences in the ability to effectively use these tools among young people, especially amongst pupils of primary schools. Thus, the role of teachers remains very important, through emphasizing their assistance to pupils in finding and using digital materials and resources [47].

Digital learning replaces traditional educational methods on a daily basis. Incorporating digital learning into classrooms may range from simply using tablets instead of paper to using complex software programs instead of the traditional use of a pen. No matter how much

technology is integrated into the classroom, digital learning has become crucial in education. Unlike traditional teacher-centered classroom learning, digital learning, such as learning through mobile applications, offers a “learner-entered self-paced learning environment” [48]. The use of fun is found to be a stimulating motivator for pupils of all ages [49, 50], as games are very popular with every age group. Abdullah & Ward [51] achieve similar conclusions, who via a quantitative meta-analysis of 107 papers, discovered enjoyment to be one commonly used external factors of the Technology Acceptance Model (TAM) within the context of e-learning adoption. Game-based learning has been used for many different disciplines of education with varying degrees of success. One of the principal assets of games when compared to other educational programs is motivation, especially of primary school students. Motivation, which has always been an important issue in educational programs, is associated with young people’s desire to participate in activities [52]. In line with the above, research on students’ learning reveals that self-efficacy and goal setting are highly related to learning motivation [53,54], where a special place belongs to edutainment. In addition to highlighting entertainment in the learning process, there are tremendous research findings which indicate total development towards the integration of mobile phones as well as other mobile technologies to enhance the efficiency and eminence of learning via mobile devices [55]. The advancement of learning patterns from the conventional classroom method to electronic learning has created a new learning outline based on mobile devices, which is known as m-learning [56,57]. Mobile learning is considered to be a self-directed approach, in which small and portable smart and wireless devices are used [58]. Although learning via mobile phones may take longer compared to computers [56, 59], the learners feel a greater sense of freedom of time and place, so that they can devote their spare time to acquiring knowledge when and where they feel fit [60]. Despite this, mobile learning is still in the early stages of its development and is yet to mature, as many issues have not been addressed in previous research [61].

Despite the development of modern and fun learning methods, the competences of teachers in information and communication technology remain a crucial element for the development of education, because they are challenged to include technology (mobile phones) in their routines, to become role-models and to motivate young people to use technology and the Internet as a learning tool. Similar statements can be found in the work by Awadhiya & Miglani [62] who, in their research on challenges encountered by Indian teachers during mobile learning, discovered a lack of support for instructional design regarding m-learning, lack of institutional policy for m-learning and lack of infrastructure/technological support to be the biggest challenges. In addition, it has been revealed in several studies that there is some resistance encountered by teachers who see the use of mobile devices in the classroom as detrimental to learning due to their disruptive nature, which may be related to an inadequate competence and teachers’ lack of confidence in the field of ICT [25,63]. In their study, Rachmadtullah et al. [64], point out that the inadequate competences of teachers are often reflected in poor software management skills which are need to create media suitable for the implementation in formal education. Similarly, Putri et al. [65] indicate that teachers, especially at the primary school level, often face lack suitable online media translated into the native language of their pupils, which makes its adaptation difficult and time-consuming, while Lin et al. [66] emphasize the importance of online media adaptation not only to the local language, but also to the specificities of pupils’ culture. Additionally, Osakwe et al. [67] state that teachers often lack institutional support required for the implementation of Internet-based technologies as a new teaching tool in schools. Watanabe et al. found that while ICT-advanced countries have embarked on a co-evolution of ICT as well as education and trust, the ICT growing countries have not been successful in this due to a vicious cycle between ICT and trust [68]. Habbi and Zabardast concluded that ICT technology positively contributes to economic growth, regardless of a country’s development level [69].

Mobile learning may take place both in the classroom and outdoors, across formal and informal settings. As mobile learning can also be conducted outside the classroom, without any teacher supervision, it may be regarded as a threat by the teacher [70]. In formal learning, the teacher has difficulties in choosing the right application, one that suits the particular level of their pupils and students [63]. If the mobile application is designed and based on the needs of young people, it is considered effective in improving their performance and contributes to positive learning outcomes [71]. As technology begins to permeate educational programming, teachers, school psychology trainers and practitioners alike need to identify the most promising and helpful tools that can be deployed readily within classroom contexts to assist in supporting the education of pupils and university students [42]. There is a need to formulate appropriate pedagogical models and to develop innovative strategies to integrate mobile applications in learning and teaching [72]. In addition, there is a growing trend that Gen Z members prefer self-learning, especially through online content, which should also be taken into consideration when creating educational programs. While there is no doubt that technology is readily available for learning, implementation, maintenance and ongoing monitoring remain a challenge [73].

2.2. Conceptual framework and hypothesis development

As indicated in the previously cited study, more and more people make information available online [38], and therefore, traditional forms of learning and one-sided acquisition of knowledge are less and less attractive to young people and cannot meet the needs of the information society. Namely, the Internet has become a kind of characteristic of the global society [11]. Since the 1990s and its technological progress, the Internet has played a characteristic role in the lives of young people, which has been reflected especially in maturation of Gen Z. Their technology readiness refers to their propensity to embrace new technologies for accomplishing goals in learning [74]. Today, most pupils and university students are digital natives and use technology proficiently [14]. In accordance with the above, the following hypothesis has been defined:

H1. Gen Z uses Internet-based technologies more often than traditional forms of acquiring knowledge.

Today’s young people represent a generation that has grown up with new technology. They have spent their lives surrounded by many digital tools that are an integral part of their lives. As a result of this environment, today’s students think and process information differently from their predecessors [19]. Although members of previous generations may prefer applied learning, for Gen Z, 2 special aspects are prominent. In their research, Seemiller and Grace discovered that Gen Z member are observers. That is, they like to watch others perform a task before applying learning themselves [44]. For example, they state that one student said, “To learn something, I would rather watch someone do it right, and then try to do the same”. From the above, we may conclude that members of Gen Z have an affinity for seeking information through videos. Furthermore, in addition to the hidden desire for applied learning, Gen Z members have a preference for intrapersonal learning. The individual nature of technology has helped Gen Z become comfortable and accustomed to learning independently [44].

The younger generation of learners require multiple streams or prefer inductive reasoning, they want frequent and fast interactions with content and also have exceptional visual literacy skills; characteristics that stick to the approach of game-based learning [75]. In a review of literature on mobile learning, a number of researchers have recognized that games can be motivators for Gen Z members to learn; hence, game-based learning has great potential [42]. In the studies analysed by Girard, Ecalle and Magnan, it is also suggested that games motivate students more than traditional approaches [76]. Thus, this generation prefers mobile applications, interactive games, collaborative projects,

challenges and everything that may be tried or seen [21]. On the other hand, these new methods of learning are tools that can complement traditional learning [77]. In accordance with the above, the following hypothesis has been defined:

H2. *Gen Z prefers mobile applications over audiovisual content available on the Internet.*

Today's generation of young people, growing up accompanied by highly sophisticated media, is granted more Internet savvy than their forebearers [19] and prefer interactivity. On the other hand, the overuse of information and communication technologies by young people distinguishes them from previous generations of learners, and the differences are so pronounced that the nature of education must change in order to adapt it to the skills and interests of the new generation [14]. Thus, for example, today, mobile devices and applications are effective tools for teachers to engage and encourage young people to expand their knowledge and skills, with the main goal to make learning more meaningful and efficient. The correlation between knowledge sharing and perceived ease of use might be explained by the fact that Gen Z would perceive the M-learning systems as easy to use when these systems provide users with the capability of sharing their knowledge [78]. The implementation of mobile devices for educational purposes promotes learning by facilitating communication and information exchange, which also increases creativity and motivation among students, because it supports interaction between peers [79,80]. Thus, this interaction is very important because the communication practice itself, as a learning process, represents a meaningful phase in the transfer of knowledge [36] and increasing the participation of young people in educational activities [81]. The same was found to be true in a recent work [34] on research into adoption intention and effectiveness of digital collaboration platforms (DCPs) for online learning in India. Interactivity, cost-effectiveness and the core TAM constructs were discovered to form a positive attitudes towards usage and adoption intention. In accordance with the above, the following hypothesis has been formulated:

H3. *Those who are more interested in online learning will prefer more interactive forms of education.*

In the past, books and teachers were the most common sources of information. This has changed drastically, as Gen Z members prefer technology to books and expect the same to be the case in the educational process. In this regard, teachers need to update traditional teaching methods and adapt the learning environment to modern requirements [19]. Technological resources have become an indispensable segment of society, therefore, it is necessary for teachers to use them to improve the learning experience in the classroom [82]. In hope that Gen Z members will use their personal devices for learning purposes, it is important that teachers use mobile devices in the classroom to improve learning, but also to model their use for learning in general [63]. Ultimately, teachers should be responsible for helping and guiding young people, especially pupils at the primary level of education, during the acquisition of knowledge and motivating them to develop their current level of skills [83], because the primary key to developing pupils' digital competences is certainly determined by teachers' technological and pedagogical skills. Hence, there is a growing need for teachers to use new technological solutions in education, setting an example for young people to use them independently for educational purposes. This is true not only for learning at school, but also outside it. Most teachers still require more time to access new knowledge and know how to incorporate information technologies tools in their lessons [75]. With mobile devices in the classroom, teachers play a more active role and they need to become designers of learning experiences for their students [84]. In accordance with the above, the following hypothesis has been erected:

H4. *If teachers show pupils how to use new technologies and if they use new technological solutions in class, these young people will be more likely to use them on their own.*

The conceptual model, based on these hypotheses, is presented in Fig. 1 below.

In order to obtain objective answers to these hypotheses, multivariate analysis was applied to the survey data.

3. Methods

Bearings in mind the motives and goals of the study, the defined hypotheses, results of previously published research on the problem concerning various forms of learning and acquiring knowledge of Gen Z, as well as assessment of theoretical models, the authors created a questionnaire. Research was conducted among young people actively participating in the knowledge-sharing online community. Therefore, participation in the study was voluntary, respondents did not receive any remuneration. The data was collected by the Brainly company on their website. The invitation to participate in the questionnaire was displayed to users who left the website, that is the world's largest peer-to-peer learning community for students, and specifically, those who viewed the section of questions related to learning English. The portal operates in 35 countries under different names, with its largest user-base being in India. Only registered users who accepted the terms and conditions as well as privacy policy were allowed to participate in the research. The study was conducted in accordance with the guidelines of quantitative research on young people [85,86] and with the guidelines of the ethical committee of our institution. It was not compulsory to answer all the questions. The questionnaire was started by 18,453 users, 1304 pupils completed it, while 498 respondents answered all the questions. The survey was carried out in July 2019. In order to maintain psychological realism, the questions referred directly to the selected issue - English learning. Only completed questionnaires were used for further analysis; among pupils aged 11–17, residents of India, where learning English is common, obligatory and verified in annual language tests, but at the same time, those who did not indicate English as their first language.

There are several reasons for choosing these requirements in the sampling procedure. First of all, as there is no unique definition regarding the term of Z generation birth in the literature, and whether those people born in late '90s belong to it, the selection of respondents amongst pupils fulfils the condition that they are member of the Z generation, as they were all born after the year 2000. Additionally, conducting research based on the Brainly company's website enabled to survey pupils, i.e. respondents who were actively involved in the formal education system and, at the same time, use online-based platforms for learning. Thus, they are able to compare the specificities of formal teaching and online-based learning, as well as to provide insight into the perceived benefits of applying Internet-based learning tools in formal classes at school. Apart from that, these requirements made it possible to

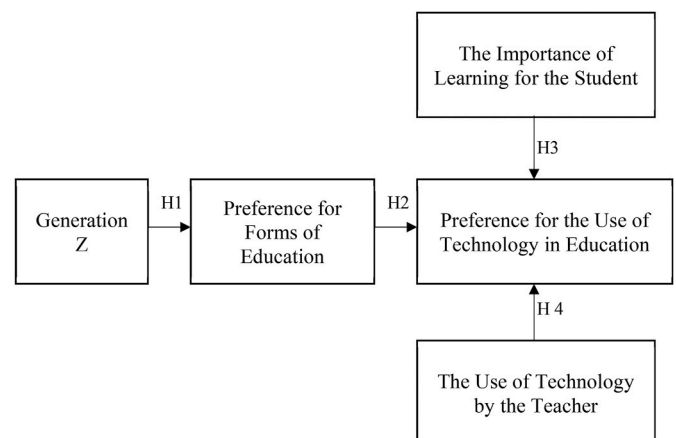


Fig. 1. Research model.

conduct research among the participants learning a language not being their native tongue. However, as learning a new language using online-based platforms is not characteristic for only pupils, but of those who completed school as well, this makes possible to draw some general conclusions regarding the benefits and advantages of online learning. Moreover, by the way the questionnaire was distributed, it may be assumed that the respondents had access to the Internet and used out-of-school sources to expand their knowledge, which was the basis for further conclusions.

At the state of data analysis, 498 respondents who met the above assumptions were included in further research. Among the respondents, 52% were aged 13–15, while 25% pupils between the age of 11–12, and 23% - 16–17. Hindi was indicated as the first language by 46%, the others included Bengali, Kannanda, Marathi, Nepali, Punjabi. The majority of respondents (381) declared that they had received more than 80% on their last language test.

In order to assure validity of the questionnaire, a focus group comprising 23 pupils and 3 experts in the field was organised after the development of the first version of the questionnaire. The presence of the pupils in the focus group assured that the respondents would properly understand the questions, while the experts helped to modify the questions, bearing in mind the ultimate aim of research. Hence, based on all the comments and suggestions obtained from the focus group members, the final form of the questionnaire was created. The complexity of the questions and the length of the questionnaire were adjusted to the pupils' age. The main part of the questionnaire consisted of questions related to the behavioural dimension and the application of various methods of using knowledge sources. On a 7-point Likert scale (1-meaning "I strongly disagree", 7 - indicating "I strongly agree"), the participants on responded to the statements. The questions concerned the use of private lessons (*I take private lessons for English outside of School to improve English*), mobile applications (*I use applications on my mobile device/tablet to improve English*), audio-video online materials (*I watch online video tutorials to improve English*). Additionally, the questions related to the experiences acquired at school (*My English teacher uses some online digital tools/materials to enhance my learning experience*), the importance of the analysed area of research for the respondent (*Learning English is important to me*), and based on the mean division, the respondents were classified into 2 groups. However, it should be noted that the questions referred to the existing state and not to the preferences, perceptions or opinions of the respondents. Therefore, they are not considered as a scale.

4. Results

Based on the collected data, quantitative analysis using single-factor repeated measure analysis of variance was conducted. Assumptions about distribution sphericity were checked based on the Mauchly test and it was indicated that the assumption of sphericity has been violated ($W(2) = 0.922, p < 0.001$). Thus, the Greenhouse-Geisser correction was used in our analysis. The research allowed to reveal a significant statistical difference between the use of different forms of knowledge acquisition ($F(1.855, 931.74) = 56.167, p < 0.001, \eta^2 = 0.033$) (Table 1). Therefore, post-hoc tests were conducted to compare the use of mobile applications, online videos and private lessons (Table 2). The average

Table 1
Results of repeated measures ANOVA.

Cases	Sum of Squares	df	Mean Square	F	p	η^2
Use of digital tools/materials by the school teacher	582.825	1	582.825	87.158	<.001	0.101
Residuals	3316.729	496	6.687			

Note. Type III Sum of Squares.

level of use of mobile applications ($M = 3.108, SD = 1.991$) was higher than the use of online videos ($M = 2.679, SD = 1.921; t(497) = 6.171, p < 0.001, d = 0.277$), and higher than private lessons ($M = 2.239, SD = 1.882; t(497) = 9.871, p < 0.001, d = 0.442$), thus hypothesis 2 was confirmed (Fig. 2). The difference between private lessons and video materials was statistically significant ($t(497) = 5.05, p < 0.001, d = 0.226$), therefore hypothesis 1 was also confirmed.

Next, the impact of learning importance for students based on the use of modern technologies was examined. Because of failure to meet the assumptions about group equality (60 vs. 438 pupils), the Mann-Whitney non-parametric test was used (Table 3). Assessment did not reveal statistically significant differences (Fig. 3), neither for online videos ($W = 11347, p = 0.07$, Rank-Biserial Correlation = 0.14) nor for mobile applications ($W = 12273, p = 0.39$, Rank-Biserial Correlation = 0.07). Therefore, hypothesis 3 was not confirmed.

Following, the impact of applying online digital tools/materials (i.e. mobile applications and online videos) by teachers in the classroom on the level of using these tools outside the school by students was analysed. Research revealed that the analysed factor significantly influenced the independent variable ($F(1.496) = 87.158, p < 0.001, \eta^2 = 0.418$), which means that hypothesis 4 was confirmed (Fig. 4). A series of *t*-tests was performed, the results of which are presented in Table 4, showing that all combinations varied statistically.

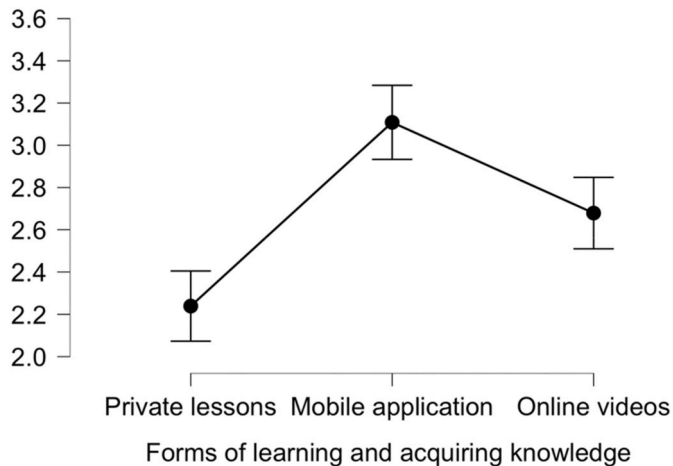
5. Discussion

In this paper, the authors aimed to determine how technology and the Internet affect the acquisition of knowledge by Gen Z, and which forms of knowledge acquisition this generation prefers. Having analysed the data obtained from 498 respondents, the research allowed to confirm hypothesis 1 indicating that, when outside school, individuals representing Gen Z did indeed prefer new technologies and modes of education over those considered traditional. We believe such findings were achieved due to Gen Z being considered digital natives and accustomed to using technology, it being so readily available from a young age [14]. The pupils of this generation also prefer to obtain information fast due to impatience, they are interactive, resilient and lean towards multi-tasking [29], which is why we consider the convenience and location flexibility of new technologies and modes of education more attractive. Another factor that may play a key role in the pupils' preference towards new technologies is the ability to enable the usage of multimedia content and multimedia communication in education, providing students with anywhere, anytime access to learning content [39]. Having delved deeper into the data obtained from the respondents, the researchers also discovered a strong preference for learning via mobile applications over audiovisual content available on the Internet, confirming hypothesis 2. Such a strong affiliation may be caused by Gen Z having a shortened attention span [19], which makes the self-directed learning approach provided by mobile apps [58] much more appealing. Another reason why the respondents opted towards mobile apps, which usually take a longer time to learn from when compared to computers [56,59], is their ability to provide a greater sense of freedom of time and place, so that they can take the advantage of spare time to learn a second language whenever they want and wherever they might be [60]. Another reason for preferring mobile apps to acquire knowledge might lie in the gamification, rankings and interaction possibilities offered as research on pupils' learning revealed that self-efficacy and goal setting are highly related to learning motivation [53,54]. Mobile apps provide access to the most useful features of the said app on account of the limited screen real estate and is a possible reason for the research by Ref. [34], discovering no relationship between the device and the perceived usefulness of e-learning to Indian pupils and students. One also has to factor in the high popularity and easy availability of mobile devices in a geographical location such as India, where the research was conducted in order to understand the favourable attitudes observed towards learning on mobile apps.

Table 2

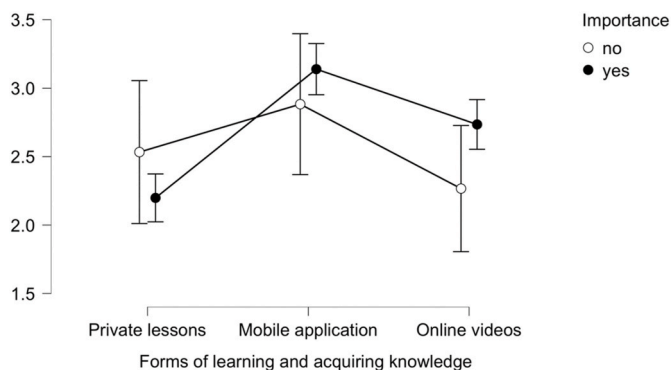
Post Hoc Comparisons - Forms of learning and acquiring knowledge.

		Mean Difference	SE	t	Cohen's d	P holm
Private lessons	Mobile application	-0.869	0.088	-9.871	-0.442	<.001
	Online videos	-0.440	0.087	-5.050	-0.226	<.001
Mobile application	Online videos	0.430	0.070	6.171	0.277	<.001

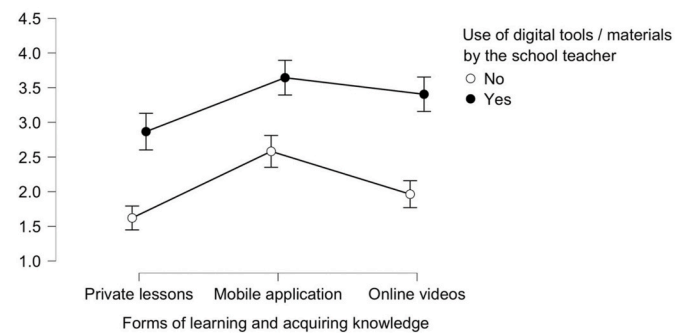
**Fig. 2.** Using different methods of acquiring knowledge by a student.**Table 3**

Descriptive of forms of learning and acquiring knowledge versus importance.

Forms of learning and acquiring knowledge	Importance	Mean	SD	N
Mobile application	no	2.883	1.992	60
	yes	3.139	1.991	438
Online videos	no	2.267	1.784	60
	yes	2.735	1.934	438
Private lessons	no	2.533	2.021	60
	yes	2.199	1.861	438

**Fig. 3.** Using different methods of acquiring knowledge by a student depending their level interests in learning.

Analysis of data obtained for hypothesis 3 to confirm whether more involved young people prefer more interactive forms of education was rejected as it did not reveal statistically significant differences for both online videos or mobile applications. Our analysis of data used to confirm hypothesis 4, however, was a success, as pupils were found to be more likely to use new technologies in their learning if their teachers did the same when in the classroom. Among others, as stated by Rutherford [87], teachers must learn how to locate appropriate sources of information and link them effectively to the topics being studied; know how

**Fig. 4.** Using different methods of acquiring knowledge by a student depending on the teacher's behavior at school.**Table 4**

Post Hoc Comparisons - Use of digital tools/materials by the school teacher * Forms of learning and acquiring knowledge.

		Mean Difference	SE	t	P holm
No, Private lessons	Yes, Private lessons	-1.24	0.16	-7.60	<.001
	No, Mobile application	-0.96	0.12	-8.32	<.001
	Yes, Mobile application	-2.02	0.16	-12.34	<.001
	No, Online videos	-0.34	0.12	-2.97	<.001
Yes, Private lessons	Yes, Online videos	-1.78	0.16	-10.88	<.001
	No, Mobile application	0.28	0.16	1.74	0.08
	Yes, Mobile application	-0.78	0.12	-6.68	<.001
	No, Online videos	0.90	0.16	5.51	<.001
No, Mobile application	Yes, Online videos	-0.54	0.12	-4.63	<.001
	Yes, Mobile application	-1.06	0.16	-6.48	<.001
	No, Online videos	0.62	0.12	5.35	<.001
	Yes, Online videos	-0.82	0.16	-5.02	<.001
Yes, Mobile application	No, Online videos	1.68	0.16	10.25	<.001
	Yes, Online videos	0.24	0.12	2.05	0.08
No, Online videos	Yes, Online videos	-1.44	0.16	-8.79	<.001

to help pupils use computers and the Internet effectively within the context of course content; learn how to deal with the difficult and sensitive matters of security; how to use computers on behalf of their own continuing education; and how to become a participant in an active network of professional colleagues for sharing experiences on the use of modern technologies in instruction. This affirms the work of [84], who indicated that teachers, when equipped with mobile devices in the classroom, play a more active role in the learning process, and need to become designers of learning experiences for their pupils. Doing so is

important as technological resources have become an indispensable segment of society [82] with teachers needing to update their teaching methods from those traditional, in order to create a learning environment catering to the needs of modern pupils [19]. A good example of this is how the use of mobile devices within the classroom can facilitate communication and information exchange, further increasing creativity and motivation among pupils, because this supports interaction between peers [79,80]. These findings are confirmed in a studies by Rachmadtullah et al., Yates et al. and Deursen et al., suggesting that the implementation of Internet-based technologies in primary schools are of great importance, especially for students having concentration or certain socio-emotional problems [47,64,88]. It is also interesting to note that the usage of modern technologies increases pupils' interest in private lessons, confirming Gen Z's partiality towards modern methods of education and not those traditional.

6. Concluding remarks

6.1. Research contribution towards theory and practice

Aimed at alleviating the academic gap on how the usage of modern technology and the Internet affects the acquisition of knowledge by Gen Z and the forms of knowledge acquisition preferred, this research makes two key theoretical contributions. The first is that pupils from Gen Z, as a generation which has not lived in the pre-Internet era, are steering clear of the traditional learning approaches, taking ownership of their own learning outside the classroom using new technologies such as mobile apps. The second is confirmation that the usage of modern technologies such as mobile apps and online videos in the classroom by teachers can encourage pupils to do the same: a finding which we hope will rekindle academic interest in discovering appropriate pedagogical models and innovative strategies to integrate modern technological tools in learning and teaching. With regard to practical contributions, the findings of this research should serve as a rousing call for teachers who are tasked with learning delivery towards pupils from Gen Z. The respondents involved in this study, have made it abundantly clear that they prefer learning via modern technological means and not the traditional methods that have been used by generations before them. The findings also allow to indicate that teachers who use such modern technologies, are more likely to encourage pupils to do the same. This emulation of learning styles by pupils from their teachers is all the more a reason for educators to upgrade their teaching styles and means via the integration of modern technological methods. Doing so would kick-start and support the self-directed learning journey undertaken by pupils outside school hours, and can only lead to continued learning success.

Bear in mind the previously discussed results of this study, a few more important practical implications for teachers, as well as for other decision-makers regarding the organisation of formal education systems, should be considered. Namely, the obtained results reveal the necessity of combining traditional forms of teaching with modern, Internet-based learning tools, as this leads to greater concentration and involvement of pupils, which positively affects the scope of acquired knowledge. Additionally, it is necessary to educate young people which online learning platforms they can use independently in order to expand their knowledge in areas of interest. In this manner, they will be trained to more easily identify reliable Internet sources of information compared those considered unreliable. At the same time, pupils will be encouraged to independently conduct research and learn about topics that are not at all or not sufficiently represented by the curriculum implemented at school. This is especially significant in circumstances which imply a greater effort of students in the process of searching for materials and acquiring knowledge, while the teachers play the role of a moderator in this process, which is the case in almost every country worldwide during the COVID-19 pandemic. However, in order to achieve the stated positive effects of ICT implementation in formal education, it is necessary to organise appropriate training for teachers and

professors, so that they will be able to adapt teaching methods to the requirements of generation Z and the specificities of online learning. Additionally, staff training is important due to finding an appropriate teaching model that would allow pupils and students to use computers and mobile devices during classes exclusively for acquiring knowledge and not for other purposes.

6.2. Limitations of research

We must also address the limitations of our study, the first of which is the fact that in our study, we did not manage to test the pupils on all modern educational technologies due to their wide range, focusing on the usage of mobile applications, online videos and private classes. The second limitation is that, in this study, we did not consider whether the private lessons or online content were paid or free. Apart from this, pupils who are keen on access to educational materials via the Internet, whether paid or free, they must be able to find them. The third limitation is that in this paper, we only analysed the behaviour and partiality towards modes of learning of the respondents and not their perception of factors such as effectiveness and efficiency. We should also highlight that the results obtained from our study on Indian pupils cannot be generalised to pupils from other countries. The collected data are also based on self-reporting and could be subject to social desirability bias. The final limitation that we consider emphasizing is that the distributed questionnaire was intended to gain information on fundamental knowledge, attitudes, and a limited set of behaviours related to our topic, thus, it is possible that the answer might have been shaped by personal beliefs.

6.3. Future research

The limitations mentioned above lay ground for several interesting implications towards future research on an extended version of this paper. The rejection of hypothesis 3, which the authors posited based on previous research, raises an interesting avenue for further research on understanding how the source of motivation towards learning can have impact on the usage of modern tools in learning. Another interesting area of future research that could stem from this is analysis of how the increased opportunities for online education post-COVID-19 could influence how pupils undertakes learning and the role modern technology plays in it, using fsQCA as was done in the work by Ciampi, Demi, Magrini, Marzi and Papa [89]. Such an course of research could raise some very interesting discoveries that may prove to be very helpful to educators adjusting their teaching styles and mediums in the post-COVID-19 world.

6.4. Conclusion

Our findings make it clear that traditional methods of education are not suitable for educating the Z generation who prefer to use modern technology to support and direct their learning. Modern means of education allow them to undertake learning at a pace suitable for them, via a variety of means such as games, mobile apps, videos or even podcasts. Providing the facilities to do so and setting an example of using such means within the classroom by teachers, will go a long way towards encouraging and supporting a pupil's learning journey as we discovered. Such actions are important as the pupils from Gen Z possess shorter attention span, they are impatient, consume information from all over the world from a variety of sources, preferring digital media to traditional media and have a constant need to receive new, different types of information. This is confirmed as the questionnaire applied in this study was produced to the respondents whilst they were actively seeking answers to their most pressing educational questions on the world's largest peer-to-peer learning platform.

Author statement

We confirm that this article has not been published or is under consideration in another journal outlet, and that we will not submit this article to another journal. We appreciate your guidance at this stage of the process, and we look forward to hearing from you. Thank you for considering our manuscript for publication in the Technology in Society.

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