

The Impact of Using New Technologies on Student Progress and Development

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Abstract: This paper focuses on the use of new technologies in educational practice. Despite the notion that students' familiarity with technological tools is essential for their learning development, the main question is still the following: does the utilization of technology affects the learning process? The impact of using new technologies and tools on students' learning achievements can be determined based on students' progress in individual cognitive subjects, on students' commitment, as well as on the attitudes, perceptions and readiness of teachers towards the utilization of technology. This paper explores whether and to what extent new technologies contribute to the strengthening of general education, special education and intercultural education (Roma students) students' knowledge and skills. It appears that new technologies in classrooms seem to support educational practices. Teachers realize that their students use ICT as sources of reference, investigation and communication, while the frequent use of these tools effectively motivates students' commitment to learning and development.

Key-words: new technologies, general and special education, Roma students, learning progress and development

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1. Introduction

New technologies are a flexible and powerful way that can contribute to revising existing teaching practices and transforming educational resources to create an efficient and exploratory learning process [1], [2]. Students' need for knowledge development requires the implementation of learning methods with multiple options available, as well as the development of multidimensional learning environments to empower students' active engagement [3], [4].

Students with access to educational technology applications appear to have increased academic performance, compared to groups of students who do not use educational support technologies. Also, students interacting with new technologies strengthen their motivation and the pace of their learning process [5]. They also enjoy

schoolwork and activities, resulting in the strengthening of their commitment to completing their assignments and developing their skills [3], [6]. Integrating technology applications and tools into the learning process directly depends on the teaching goals and the methodological approach followed in the learning environments. While new technologies are becoming more and more popular in the educational process, there is a growing concern for students who rely overly on technological tools and for those who have limited access and/or insufficient possibilities to use new technologies [7], [8]. The present study will investigate whether and to what extent the applications of new technologies contribute to the strengthening of students' cognitive and social-emotional skills, as well as to students' commitment to the learning process. In particular, the paper examines the methods and applications of

new technologies used by students during educational practice, as well as the frequency of their use. Also, an attempt is made to determine the level of utilization of new technologies in primary and secondary school classes, as well as the role of the systematic use of technological applications and tools. The effect of using new technologies for the development of students with different educational needs is comparatively examined, in the context of general education, special education (e.g., students with learning difficulties), and intercultural education (Roma students).

2. Literature review

New technologies in educational practice: Advantages

The importance of implementing new technologies in educational practice is the subject of investigation in numerous studies, which ultimately highlight their usefulness in the learning process. They are not simply an alternative method of approaching teaching practice, but they also support and complement the learning development of the students [9], [10].

Modern educational practice focuses on the development of student-centered, interactive, exploratory and collaborative models of learning and teaching, with the main goal of cultivating cognitive and metacognitive learning strategies in order for students to learn how to learn. Learning emerges as a holistic experience of building knowledge and skills and ceases to be seen as the process of sterile accumulation of knowledge. This type of learning process can be effectively achieved when students are allowed to explore subjects within a collaborative and interactive context characterized by flexibility to adapt to the needs and abilities of the students. New technologies work precisely in the direction of safe experimentation and the creative discovery of knowledge [10], [11].

The formation of learning environments with a positive pedagogical atmosphere is achieved by implementing new technologies, as the role of students in the educational process is upgraded and they evolve from passive receivers of information to active contributors to the learning process. In the modern school environment, students can operate on the principles of self-activity, interaction, inquiry and discovery [12], [13]. Thus, students have the option of choosing between multiple and different ways of participating in the educational process, resulting in the promotion of student experimentation through the use of interactive tools.

Through their exposure to the possibilities of new technologies, students have the opportunity to get to know and effectively utilize different, multimodal and more experiential ways to achieve their learning goals. Also, new technologies contribute to the attractiveness of the learning environment, as well as to the upgrading of the educational material, overcoming the limitations set by the conventional and, in many cases, outdated way of teaching. Students are activated to proceed to problem solving through their interaction with a range of authentic situations, an approach that differs significantly from the limited learning possibilities of textbooks [14], [15]. The introduction of new technologies into the educational process enhances the formation of multimedia learning environments that strengthen the practices of active learning and the student-centered character of modern teaching approaches, simultaneously stimulating students' curiosity and mobilizing the development of interest on their part. Learning is achieved in a positive participatory learning environment where the teacher acts as a supporter of the process of acquiring knowledge [16].

It is realized that new technologies can be used in the context of the teaching and learning process as systems to guide the way of learning through a process of discovery, and as systems of expression, research and communication. More specifically, the applications of new technologies can be implemented as [17]:

- a cognitive research tool that complements educational practice;
- a supervisory tool that helps the pedagogical presentation of curriculum subjects;
- a means of communication used to carry out investigative activities;
- a digital literacy tool through their experiential use.

Teachers, students and new technologies

The integration of technological tools in education can empower teachers and students in the direction of improving and developing the quality of the learning process. For this reason, teachers should contribute to the design of collaborative projects and the development of alternative teaching strategies that include collaborative learning methods with ICTs as a tool.

In the school environment, the skills to utilize new technologies can be acquired equally by teachers and students, with the former acting as assistants and facilitators to the latter. Teachers can influence their students through emotional support and guidance for using technology inside and outside the classroom, while the active participation of teachers is a prerequisite for motivating students to use available technological resources [18], [19].

Awareness and understanding of the role and the importance of new technologies in education can be achieved by students through their access to ICT structures and resources. The availability of technological equipment and educational software helps

students analyze their importance, reflecting their value through using their capabilities [20]. By introducing new technologies into educational practice, students show an increased interest in the subjects where technological tools are used, as they have the opportunity to actively participate by presenting their personal work. Thus, the willingness of students to act on their own by taking initiatives that are consistent with their abilities, needs and inclinations is revealed. Students show interest in working responsibly and cooperatively within the classroom group, and in sharing ideas and experiences spontaneously [21].

In general, students tend to be enthusiastic about using new technologies. However, they seem to be more ambivalent when ICT tools are integrated into teaching practices [22]. Research demonstrates that parameters such as gender, socio-cultural differences and the educational needs of students can widen the digital divide, making it difficult for an educational equality which is considered to be brought about by implementing ICT tools in the classrooms. As a result, in order to exploit the potential of new technologies in educational practice, the factors of tools' content, their interface and the inclusion capabilities they provide should be taken into account [23].

Of course, teachers' expectations for the effective implementation of new technologies in educational practice are stable regardless of students' performance or attitudes towards ICTs [24]. The majority of teachers recognize the necessity of changes in education through using new technologies, accepting the re-definition of their role [25]. However, there are several teachers who have attitudes of reticence, skepticism or indifference regarding the integration of ICTs in the educational practice. Teachers are concerned about

accepting or rejecting changes, as they need to face new parameters regarding the "what and how" of their teaching practices, and are required to apply different methods [26].

New technologies in special & intercultural education

In many cases, students with special educational needs and learning problems perform much better in a pedagogical framework integrating new technologies than in the traditional framework of teacher-centered learning [27]. Through the use of educational software students have the possibility of producing an individual project, adapting activities to their own learning profile, personal pace and special needs, without being pressured to adapt to the rest of the classroom [28].

Also, despite the fact that education is a basic human right, young people from marginalized communities do not often have access to quality educational programs. The application of ICTs as a tool in education, rather than as a solution, has great potential to reduce existing educational gaps, while transferring skills and abilities necessary for economic and social survival in today's connected and digitized societies [29].

With regard to the education of students with disabilities, special educational needs or different cultural backgrounds, ICTs are recognized as tools of inclusion, so that everyone has equal opportunities in learning, accessibility, and training in using general and specialized technological resources, as well as monitoring their self-efficacy. The planning for implementing technology in the education of students with special educational needs or Roma students should have three directions: a) the evaluation of the effectiveness of using ICTs; b) the design of appropriate educational activities; c) the identification of the emotional reactions of students and teachers [30].

ICTs allow students to approach learning in their own way. That is, they contribute to the

self-regulation of learning, which includes: setting goals, learning planning strategies, organizing, encoding and storing the necessary information, monitoring and controlling cognitive functions, developing time management skills, enhancing motivation, evaluating, and reflecting. Self-regulation is important for students with disabilities, special educational needs and different cultural backgrounds in their efforts to cope with various difficulties and to achieve independent and active learning [29], [31], [32].

Constructivism and new technologies in education

It is widely accepted that learning results from the process of processing the experiences that individuals obtain, the stimuli they receive from their environment and of course, from the set of their mental processes. The learning theory based on the utilization of new technologies is constructivism. Based on this theory, knowledge is constructed by the students themselves during the process of integrating new information into the potential of their cognitive background. The construction of knowledge is achieved in an active way through the interaction and communication that students develop with their environment. Thus, knowledge and the learning process become socially constructed processes, with an emphasis on student interaction and collaboration, the development of collaborative tasks and active problem solving [33].

The most common methods of promoting constructive learning in school classrooms are the effort of the discovery process, through the utilization of the techniques of experiment, testing, verification, fallacy, but also experiential pre-planned experiences [34]. The main characteristics of educational software and technological tools that follow the constructivist approach are: a) including defined cognitive domains; b)

providing authentic activities; c) encouraging student expression and active participation in the learning process; d) providing open activities for an exploratory learning process; e) enabling teachers to facilitate students' processes; f) enabling students' communication and interaction with their environment; g) supporting intersubjectivity by providing the possibility of forming multiple representations for each concept, or situation; h) facilitating students' self-regulation and self-evaluation; i) providing students the skills of interpretation, evaluation and synthesis [34], [35], [36].

New Technologies on student progress and development

It becomes difficult to observe or control the learning performance of students, while a degree of confusion prevails about how to determine students' learning progress. On the other hand, the exploitation of new technologies entails the use of evolving applications, the results of which are difficult to isolate and evaluate outside their context. Therefore, the majority of the literature on the relationship between the use of new technologies and the educational progress of students reinforces the ambiguity and contradiction of the results [6]. Studies demonstrate that improving student development is not achieved simply by providing access to applications and tools in classrooms. It is also necessary to develop real opportunities to exploit the new technologies, as well as to offer sufficiently high-quality applications. Ensuring equality in the availability of new technologies is therefore a main condition for reducing the gap in access opportunities and for enhancing the positive impact on learning development and progress [37].

In other studies, it is paradoxically found that the use of new technologies in educational practice can have a negative effect on the learning achievements of

students, as their findings failed to justify the connection between the use of technological tools and achieving high academic performance [38], [39]. The mechanistic rather than organic and holistic composition of learning environments in the application of new technologies clearly entails the risk of substituting the role of the teacher and alienating students from the essence of the learning process [40].

The results of the use of new technologies for students are examined by studies, which conclude that there is a tendency to improve learning, motivation and cooperation between students in order to enhance the creation of a learning culture, at the center of which students and their abilities are placed. The learning model is transformed from being merely reproductive to being more independent and autonomous by promoting critical thinking and creativity [21], [41], [42].

3. The Carried out Study

Research aim

The purpose of this research is to investigate whether and to what extent the applications of new technologies contribute to the cultivation and strengthening of students' cognitive and social-emotional skills, as well as to students' commitment to the learning process. At the same time, an attempt is made to identify potential differences regarding the role and importance of the use of applications and tools for general education, special education and intercultural education classes (Roma students).

The resulting research questions are the following:

- To what extent and how often are new technology tools used in school classrooms?
- In which tasks and classroom activities are the tools of new technologies used by the students?

- In the development and strengthening of which students' skills do teachers recognize the positive impact of using the tools of new technologies in the classroom?
- Is there a difference in the perceptions between teachers of general education, special education and intercultural education (Roma students) regarding the impact of new technologies on the progress and development of students?

Research method & Sample

The research conducted was quantitative, with a closed-ended questionnaire as a tool to explore teachers' perceptions and was given to candidates in a digital form. Initially, the teachers of the sample are asked to answer questions about their demographic and professional personal information and then, they are asked to express their opinions about the use of ICT tools and the frequency of their use in the classrooms, as well as regarding teachers' views on how their students perceive the impact of ICTs on their development and progress.

The population of the present research is the teachers who work in school units in the Greek territory, primary and secondary education in general and special education, as well as in intercultural education classes with Roma students. The sample is defined as the subset of the population i.e., the 157 teachers who responded and answered all the questions in the questionnaire, participating in the research. The method used was convenience sampling with the selection of different school units of each grade from each region of Greece due to the homogeneity of the population under study.

4. Results

Results were calculated by the following formulas:

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i \quad (1)$$

Equation (1) provides the arithmetic mean.

$$\sigma = \sqrt{\frac{1}{n} \sum_{i=1}^n (x_i - \mu)^2} \quad (2)$$

$$\mu = \frac{1}{n} \sum_{i=1}^n x_i \quad (3)$$

Equation (2) provides the standard deviation.

$$F = \frac{\text{between-group variability}}{\text{within-group variability}} = \frac{bgv}{wgv} \quad (4)$$

$$bgv = \sum_{i=1}^K \frac{n_i(\bar{Y}_i - \bar{Y})^2}{K-1} \quad (5)$$

where \bar{Y}_i is the sample mean in the i th group, n_i denotes the number of observations within the i th group, \bar{Y} is the overall mean of the data and K represents the number of groups.

$$wgv = \sum_{i=1}^K \sum_{j=1}^{n_i} \frac{(Y_{ij} - \bar{Y}_i)^2}{N-K} \quad (6)$$

Where Y_{ij} is the j th observation in the i th out of K groups and N is the overall sample size. Equation (4) calculates the F-test statistic.

Let us also consider an observed test-statistic t from an unknown distribution T . Then the p-value is what the prior probability would be of observing a test-statistic value at least as extreme as t , if null hypothesis H_0 were true. Then for a two-sided test we have:

$$p = 2\min\{Pr(T \geq t|H_0), Pr(T \leq t|H_0)\} \quad (7)$$

According to the collected data and the respective calculations, 75.2% of the

participants are women and 24.8% are men. In terms of age, the sample population was mainly between 31 and 40 years old (42.0%) (N = 9). None of the participants are over 60 years old. Examining teachers' educational level, most teachers hold an undergraduate diploma (45.9%) and 40.1% of the sample has a postgraduate diploma. Regarding educational experience, the majority of teachers, participating in this empirical research, are the group with up to 5 years of service (48.4%). Also, 19.1% of the sample indicates that they have 6 to 10 years of educational experience. 32.5% of the participants have over 11 years of educational experience. In terms of the type of school that participants work in, 39.5% serve in a general education school unit, 33.8% serve in a special education structure (teaching students with learning difficulties) and 26.8% serve in the intercultural education (teaching Roma students).

Table 1. Descriptive data: How often do your students use ICT tools in the classroom?

Variables	Mean	Deviation
PC – Internet	3.15	1.049
Office applications (Word, Excel, Power point, etc.)	2.83	1.137
Virtual/augmented reality	1.10	0.361
Simulations	1.13	0.425
STEM software	1.22	0.623
Robotics	1.08	0.375
Multimedia/audio- visual material	3.00	1.373
Interactive Whiteboards	1.54	1.077

Digital repositories/ digital educational platforms	2.38	1.124
Digital educational games	1.83	1.057

According to the responses of the teachers presented in Table 1, it is observed that on average students use PCs - Internet in the classroom about one hour per week (m = 3.15). Also, on average one hour per week students use multimedia/audio-visual material (m = 3.00). On the other hand, tools such as virtual/augmented reality, simulations, STEM software and robotics are on average not used at all by students in the classroom. Office applications (m = 2.83) and digital repositories (m = 2.38) are used by students approximately one hour per month.

Table 2. Descriptive data: I think my students perceive their engagement with ICT tools in the classroom as ...

Variables	Mean	Deviation
Useful	3.67	0.901
Interesting	4.10	0.794
Easy	3.53	1.041
Restful	3.70	1.100
Demanding	2.74	1.122
Indifferent	1.39	0.489
Time-consuming	2.08	1.016

According to the responses of the teachers presented in Table 2, it appears that students perceive as useful (m = 3.67), interesting (m = 4.10), easy (m = 3.53) and relaxed (m = 3.70) their engagement with ICT tools in the classroom. Some students consider their

occupation demanding ($m = 2.74$) and time-consuming ($m = 2.08$). Also, the educators consider that on average students do not perceive their engagement with ICT tools in the classroom as indifferent ($m = 1.39$).

Teachers believe that on average the use of ICT tools in the classroom has a very significant positive impact on students regarding their understanding of concepts, and cognitive subjects ($m = 4.24$), their entertainment ($m = 4.33$), their digital skills ($m = 3.98$) and their attention and memorization skills ($m = 3.90$). They consider that ICTs have a less positive impact regarding students' socialization skills ($m = 3.44$) and their ability to problem-solving ($m = 3.48$).

Teachers based on their personal experience believe that students use ICT tools in the classroom to complete activities that require the skills of analysis, information, prediction, creative thinking and concluding ($m = 3.43$). Also, students use ICTs for about one hour per week to engage in activities that emphasize on complex thinking strategies (e.g., problem solving, decision making, experimentation) ($m = 3.20$). About one hour per week teachers think that students use ICT tools in the classroom to explore alternative solutions to problems/activities that require creative and critical thinking ($m = 3.19$). Less than one hour per week teachers state that their students suggest multiple and alternative ways of utilizing ICT tools in the classroom ($m = 2.82$). Finally, approximately one hour per week students use ICT tools in the classroom to engage in challenging, self-directed learning experiences ($m = 2.97$), to understand the content of the cognitive subjects, and to improve their basic skills (literacy and numerical skills) ($m = 2.98$).

According to the personal experiences of teachers, 24.2% of the participants consider that the engagement of students with ICT tools in the classroom is proved to help students achieve their progress and development as a necessary process. Only 3.8% of the teachers consider it as a guiding process, 42.7% of the teachers consider it as complementary, 24.8% of the participants as supportive and only 4.5% of them consider the implementation of ICTs without a substantial impact on students' progress and development.

A test of analysis variance is carried out to determine if teachers' service school is a factor in differentiating their responses. A differentiation appears in the views of teachers that students use ICT tools in the classroom to explore alternative solutions to problems/activities that require creative and critical thinking ($F = 4.269$; $p = 0.004$), that students suggest multiple and alternative ways of utilizing ICT tools inside the classroom ($F = 5.976$; $p = 0.003$) and that students use ICT tools outside the classroom ($F = 4.978$; $p = 0.004$). The teachers who serve in a general education school unit believe that students use ICTs for the reasons mentioned ($m > 4.00$), compared to the rest of the teachers who serve in a special education structure or in intercultural education.

5. Conclusions

In recent years, research interest has turned to the systematic study of the parameters and conditions for the development of effective learning environments by utilizing the tools of new technologies during the learning process in school classrooms. Indeed, contemporary research and theoretical studies propose various models

for understanding the effective impact of new technologies, with contemporary pedagogy focusing on the influence of constructivist practices and their importance in the field of ICTs in school's learning environment [34].

This present study confirms the spread of ICT tools within school classrooms at every level of education. However, the ways of their utilization and the frequency of their use still seem to be to some extent conventional, with the traditional educational tools of new technologies to be utilized more compared to the most innovative applications. Studies demonstrate that applications of virtual/augmented reality and digital visualizations/simulations can allow students to engage with experimentation and inquiry learning, i.e., with the principles of constructivism, which cannot be efficiently developed within traditional, and conventional learning environments. Of course, the interactivity of multimedia digital tools encourages students to actively participate in the educational practice, while even office applications (e.g., Word, Excel etc.) serve a more collaborative and reflective learning environment [43].

At the same time, it is worth noting that the results of the present study agree with previous research that demonstrates the usefulness of new technologies in the learning process, recognizing their functional role and their dynamics as an alternative teaching approach, but also as a sub- supportive and complementary tool for students' learning progress [9], [10]. Teachers distinguish the upgrading of the role of new technologies in the school classrooms, as they seem to be used cross-curricular in every academic subject of the study programs, both in general education and in special education and intercultural

education. Of course, it is worth noting that the utilization of new technologies does not lead either to the total rejection of the conventional model of educational practice or to the alternative approach to education centered on technological e-applications. The focus remains on enhancing student preparation for knowledge and skill development.

As the previous studies agree on the effect of new technologies in enhancing students' perceptual abilities, their attention, in enhancing memory and metacognitive abilities, the present research highlights the usefulness of ICT tools in students' effort to prepare for learning activities, to experiment, to research, to reflect, to collaborate, as well as to accept teacher feedback and control. And all this, regardless of their level of study, the type of school unit and the learning profile or cognitive background of the students.

Based on the analysis of the results, it appears that teachers place the use of ICT tools in the context of the student-centered approach to the learning process, recognizing that new technologies seem to contribute decisively to the activation of students' interest. According to the participating teachers, students can be involved in exploratory processes of discovering and building knowledge and skills in the context of self-directed learning development, which is also distinguished in previous related research [25], [28], [44].

Without doubt, new technologies are recognized in the present research as cognitive tools to support educational practice. The personal experiences of the teachers mainly demonstrate that the students make use of ICT tools in the classroom to complete activities and tasks that require the skills of complex thinking,

experimentation, analysis, prediction, creative thinking and inference, to explore alternative solutions, to improve their basic skills, to meet the requirements of the study programs and to effectively direct their learning progress and development.

The students of general education school units use the new technologies to explore alternative solutions to problems or activities that require creative and critical thinking, they can propose multiple and alternative ways of utilizing ICT tools in the educational practice of the school classes they attend, as well as tend to use the educational applications of new technologies even outside the school classroom. Special education students and Roma students appear to have limited accessibility and/or insufficient possibilities to use the applications of new technologies [45], [46], [47].

The results of the present research effort are characterized by specific limits and are subject to limitations related to the design of the research process. One of the important limitations is the representativeness of the sample. The plurality and diversity of the demographic and professional characteristics of the sample does not allow the completeness and proportionality of the composition of the sample to generalize the results. Also, the self-made content of the questionnaire and its standardization leads to the incomplete determination of the reliability and validity of the tool, which are partially verified due to the application of an initial pilot study.

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