

INFORMATION TECHNOLOGIES IN THE OPERATION OF PRIMARY SCHOOLS

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***Abstract:** This article examines various aspects of the use of new technologies in the primary school didactic process from a theoretical and a practical perspective. As a basis for this article, the authors used the materials and data obtained during a pedagogical experiment and an analysis of relevant theoretical sources. The pedagogical experiment was carried out in a primary school setting so that practical uses of technology in education, and progress taking place in the teaching process determined by new technologies, could be illustrated. The theoretical analysis looks at the most important factors that determine the effectiveness of the teaching process utilizing IT. Although as such, these factors lie beyond the scope of the methodological process, they undoubtedly constitute indispensable components of the teaching process. The factors include school administration informatization, the teacher's mental and practical approach, the operation of the school library and new literature forms. The article concludes with the results of the research carried out, which quite unambiguously confirm the initial assumptions of the experiment.*

Keywords: new technologies, alternative education, information competencies, Primary School

INTRODUCTION

The progress of digitalization and technology in education undoubtedly has an effect on pupils' cognitive acts and assimilation. However, we should not forget about teachers who also need cognitive and accommodation skills to be able to use new technologies in teaching. The distinctly different character of information processed by computers (text, images, sound, animation) determines changes in one's way of thinking, perception of events and life situations. It extends one's possibilities for activity, for obtaining and communicating information. The introduction of interactive programs, simulators, the promotion of educational virtual spaces, increasingly better classroom equipment all contribute to increasingly widespread use of the educational functions of new technologies. Grants from the government

and commercial organisations provide technical opportunities for the development of new technologies in education, and as a result schools receive new equipment as the need arises. Teachers and staff are given training opportunities. On the other hand, pupils not only take advantage, in an indirect way, of the knowledge acquired by teachers but also directly - as the Millennial generation - they have the opportunity to learn in their natural digital environment. As it turns out, the quality of the knowledge acquired does not depend on technical proficiency in using new technologies, but on one's information competency, including the ability to search for information. The education of young people is the final result and key goal of the operation of an educational establishment. Education quality, which is an essential aspect of the operation of educational institutions, is determined by such factors as the effectiveness of school administration, involvement in development projects as well as teachers', pupils' and their parents' mental and practical familiarity with novel teaching methods as well as information technologies. It is therefore worth considering the afore-mentioned aspects in the context of using new technologies and the level of information and search competency.

USE OF OPPORTUNITIES AFFORDED BY IT IN THE DIDACTICS-RELATED ENVIRONMENT OF THE PRIMARY SCHOOL

The didactics-related environment of the primary school is understood as classroom technical equipment, school administration, teachers' work, operation of school libraries as well as all the institutions that contribute to the proper operation of an educational establishment and, consequently, proper delivery of education. In the 21st century, from a technical point of view, it is hard to imagine a primary school operating completely without technologies. For they support not only day-to-day administrative activities but also, above all, support teachers and pupils in their fulfilment of their responsibilities. But above all else, for the present generation of pupils, media are a primary source of information, an information base for versatile activities and independent learning. That is why such great importance is accorded to the material educational environment as a component of the instructional process, this environment being taken to mean appropriate equipment for classrooms and a necessary media framework (Kasperowicz, 2005: p. 99). Provision of extra equipment for classrooms and additional training for teachers is envisaged in such governmental programs as *Digital School*, *Digitally Safe* or *Safe Internet*. Administrative staff in schools have at their disposal the mandatory Educational Information System (SIO) and either the VULCAN program or other products. A number of measures aimed at the technologization of the Polish education system were specifically designed to improve information competencies and raise Polish schools to European Union level. These included narrowing development gaps between Poland and the more developed countries by funding extra equipment based on new technologies for classrooms, by training staff and changing their work methodology, improving skills to search, process, collect, transfer and internalise information. One of the first initiatives to promote new technologies in education

worldwide was the “Safer Internet” program. In 1999 The European Commission, having become interested in the issue of “media impacting children on multiple levels and it being sometimes difficult to clearly state whether given TV or computer content is good or bad”, launched a program targeted at children, aimed at preventing media addiction (Karczmarczyk, 2013). The program was not designed to totally cut off young people from new technologies; rather it was intended to show them how to appropriately use Internet resources or devices themselves. Funding under the “Connecting Europe Facility” EU program is now available in each European Union member state. In Poland a Safety Internet Centre was established in 2005. The centre represents a joint effort of the Empowering Children Foundation and the Research and Academic Computer Network organisation (NASK). Three main forms of support are offered: a telephone helpline and online support: [Dyzurnet.pl](http://www.dyzurnet.pl) and [Saferinternet.pl](http://www.saferinternet.pl) websites (Website of the Polish centre for the program Safer Internet; <http://www.saferinternet.pl/pl/home/program-saferinternet-w-polsce>: [accessed on 10.03.2017], an educational portal for children with a focus on Internet safety <https://sieciaki.pl/>: [accessed on 10.03.2017].

In 2012 the Ministry of National Education jointly with the Ministry of Administration and Digitization launched a pilot program called “Digital School”. The entire project was divided into four main components: e-teacher, educational e-resources, e-school, e-pupil. A public initiative “Digitally safe - a safe school” is another example of a project co-funded by the Ministry of National Education. The activities planned for the years 2015-2018 include three projects spaced one year apart. The project activating components include: school digital safety days, a “digitally safe” contest, a consultation point, nationwide Safe School conventions, training for school digital safety mentors, the portal cyfrowobezpieczni.pl.

As mentioned above, the teacher's potential and competencies are as important as classroom technical equipment. As technology advances, teaching methodology also evolves, embracing new technologies. To a large extent, thanks to the governmental programs, quite many possibilities are now available to teachers to manage teaching methods by means of technical equipment. Features of the education system that have become almost regular include interactive whiteboards in early elementary education classrooms, foreign language learning (instalink.pl) or specific subject teaching (rebel.to) using smartphones, tablets as well as further education itself (edukator.ore.edu.pl, ECDL.pl, openeducationeuropa.eu) and online teacher communication (edu.info.pl, awans.net, publikacje.edu.pl). Besides, teachers and students also have access to such equipment as PCs, e-book readers, tape-recorders, radios, school public address systems, DVD players, cameras, projectors, Internet links. Another aspect worth mentioning is teachers' dual approach to new technologies: there is a quite a large number of teachers who, at professional level, completely ignore both technologies and the opportunities they offer. This does not necessarily result from low information and search competencies, but rather from a mistaken belief that media have a malignant influence on young minds. Consequently, young people are highly skilled in operating equipment but

demonstrate very low information and search competencies. By contrast, students whose teachers are open to modern education and dialogue as well as keeping a broad perspective on knowledge acquisition and internalization, have a different set of competencies. Obviously, this method also has its disadvantages, as it carries with it the risk of generating side effects of misunderstood stress-free education. This clear division between teachers surprisingly deepens in direct proportion to advances in technology. It may be due to “nine levels of the teacher's IT competencies, grouped on three global planes (three on each).” (Smyrnova-Trybulska, 2013): basic level (elementary), intermediate level (system), advanced level (functional).

Nevertheless, irrespective of the level demonstrated by teachers, it is important to bear in mind that teaching is a set of processes aimed primarily at activating certain thought systems and emotional attitudes, satisfying young people's cognitive and psychomotor needs. Therefore it is necessary to reclassify teaching methods so that they should be more convenient for Millennials. The current young generation does not appreciate the fact that schools are equipped with latest technologies. And it is not because they deliberately ignore the changes that have happened in Polish education over the past decades. The reason is that they simply have not consciously witnessed the changes. From the M generation's perspective, the ubiquity of technology is so natural that it is more difficult for them to develop hand motor skills when learning to write than when using a tactile device (so-called smart thumbs).

Studies on various determinants factors of the use of ICT and mobile devices in primary schools have been carried out by many research teams in various countries. For example, the needs of the new learner generation are described in detail in (Morze, Smyrnova-Trybulska, Umryk, 2015). Rodriguez, Riaza, Gomez, (2017) discuss studies on the integration of ICT technologies in the teaching and learning process at primary school level. The results of the studies confirm that information and communication technologies provide tools and channels that multiply opportunities for joint projects, ensuring quality of shared use and communication. The experiences described both prove and challenge the prevailing methodology based on the assumption that the teacher should still be the sole source and transmitter of knowledge. A study by Danish academic T. Schilhab (2017) describes quality research based on interviews with 10 pupils from schools in the Copenhagen area in order to examine subjective experiences relating to determinant factors for the use of iPads by pupils during breaks, made available by the local authorities. The results of the study indicate that there are significant differences in experiences between particular age groups. The study suggests that schools help pupils acquire (develop) a certain technological knowledge that allows them to engage in social-emotional learning during breaks between classes.

The studies described further below in this article successfully proved that students naturally and very eagerly use technologies in learning, both when preparing for classes at home and finally in the classroom. Table No 1 sets forth web portals that are the most popular with pupils

Table 1.

Web portals most popular with pupils

Name	Access type	Owner	Type of resources	Purpose for which pupils use website content
Interklasa.pl	Free/access to the forum or educational paths requires setting up an account and logging	Polish-American Freedom Foundation and Ministry of Education	Educational content, compliant with the core curriculum.	Learning and developing one's interests
Ce.org.pl	Unpaid, free	Civic Education Centre	A knowledge base about competitions, development programs for young people and other youth activities, e.g. volunteering.	Developing one's skills and interests, expressing readiness to participate in contests, to take up volunteering, take part in community initiatives
Squla.pl	Free in demo version only. The user is required to register their account	Commercial educational platform. Owned by the Dutch company futurewhiz media.	Educational platform with games, closely related and compliant with curricula in the countries concerned. Intended for children at 1st education stage	In Poland, according to children, this website provides entertainment
Odrabiama.pl	Free; more active users can pay to purchase paid services	Commercial website owned by Makalu media sp. Z o.o. in Cracow	A homework help website, allowing for exchange of information between users.	Doing homework; it is hard to call this site an educational portal – essentially it does homework for pupils
Sieciaki.pl	Free, but requires parents to register accounts	A government project co-organised by Safer Internet, Ministry of Education and the Nobody's	Deals exclusively with media education, focussing on Internet threats; Safe source of	Entertainment function: games, music, community etc.

		Children foundation	entertainment for children	
Websites dedicated for course-books	Availability to the student depends on the publisher	The publisher of the course-book that a given school uses e.g. Nowa era, WSiP, etc.	Multimedia version of course-books, also dedicated for use with interactive whiteboards	Learning, doing homework

Source: Own work (D. Zegzuła, Information technologies in the functioning of primary schools: an MA thesis written under the academic supervision of E. Smyrnova – Trybulska. Cieszyn. WEiNOE, 2017, pp. 37-38.

At this point it is important to emphasise that two generations are brought together. On the one hand there are young people growing up in a digital world, and on the other hand, there are young people's teachers and parents who are also learners - learning to use new technologies. A perfect combination comes to mind: while not limiting access to technologies, improving both groups' information and search competencies in a systematic and skilful manner. All of the aforementioned aspects form the basis of the activities of school libraries which have already evolved from dust-covered book collections into school multimedia information centres. Therefore, the modern school library both provides content-related support and functions as an information competencies enhancement centre for teachers and students. In the main, the school library operates on the following planes:

- school information community: understood as cooperation between students, teachers and librarians to make information available, which results in the transfer and internalization of knowledge together with the ability to use it for practical purposes,
- the school library as an institution: its technical and organisational potential in the context of a multimedia and information centre: the quality and quantity of information should be sufficient to satisfy users' needs, helping them both to follow the core curriculum and pursue extra-curricular interests. Providing support for in-class activities, developing competencies, providing entertainment.

The school library is also the office of the librarian: the office of an individual responsible for searching for information, collecting it, cataloguing and making it available. However, the modern librarian should possess certain qualities that set them apart: constant, systematic willingness to pursue further self-education in multiple areas, patience and enormous empathy, as well as characteristics that the other school staff member not necessarily have: this generosity in sharing her or his knowledge with others - generosity that attracts teachers and students to the library and school information centre. Because they should have access to "the library's automated information facilities, other libraries' databases, copying equipment and

multimedia computers” (Cybulska, 2005). And such availability should be ensured within time limited only by the library's opening hours, but without any limitations in terms of quality. In a nutshell, the librarian should act as a coordinator for school media activities with a view both to implementing the core curriculum and providing education and entertainment opportunities such as: new literature forms (e-books, audio-books), Rebel.to, Sieciaki.pl, digital storytelling, digital libraries and other formats.

METHODOLOGY OF RESEARCH

During the time period December 2013 - June 2014 a pedagogical experiment referred to as “At school with technology” was carried out in two primary schools in a town. The schools were selected deliberately because they boast similar academic performance and degree of technological advancement. One of the schools set up an experimental group of 35 pupils, the other school was a control group of 34 pupils. Each of the respondents started school at the age of 7. To qualify for the experiment, they had to meet the following requirements: having basic computer literacy and software skills, attending a representative form of a given birth year group and considering participation as non-mandatory. The purpose of the experiment was to illustrate the practical utilization of technology in teaching and learning, and to give an idea of the progress being made in these processes. Indirectly the school environment was also studied, so teachers from the two schools were asked to complete a questionnaire. The experimental group comprised 20 teachers, and the control one - 16. A diagnostic survey was carried out to determine the degree of a given school's technical advancement. The main research problems served as a basis for formulating a hypothesis, identifying and assuming dependent and independent variables as well as selecting adequate research methods, techniques and tools. The following hypotheses were formulated:

H1: Systematic IT use in an educational establishment helps it operate more efficiently. The pre-requisites for that are staff training and further self-education.

H2: Systematically accustoming children to IT has a favourable effect on the quality of knowledge acquired as well as development of pupils' interests and future occupational aptitude.

H3: Using IT in parent-teacher communication contributes to improved cooperation in educating children.

H4: The teacher's systematic further self-education, attending training courses and use of IT in her/his daily work improve productivity and make teaching more efficient. Besides, such activities help improve both teacher-pupil and school-parent communication.

H5: There are areas of school operation where informatization is currently not recommended at all, areas where no IT solutions have been implemented, where IT solutions operate poorly or where informatization hinders effective operation.

H6: If schools implement and participate in IT-related projects, this significantly facilitates school informatization and increases pupil involvement.

However, the researchers' unstated aim was to demonstrate that what determines the quality of instruction is not the presence of technologies as such but the way they are used. In the study strictly related to pupils a pedagogical experiment was used, accompanied by field observation. The experiment was performed in a number of stages. During the first stage, pupils' familiarity with IT was investigated by holding a school contest for the most technologically advanced project. The second stage of the experiment involved a series of classes designed to improve pupils' information and search competencies as well as competencies in technology. The series consisted of one class per month, held during time slots dedicated to computer lessons provided for in the curriculum. In total, there were four thematic components, taught chronologically in this order: copyright on the Internet, safe Internet, educational opportunities provided by available equipment, and programs for audio and video editing programs. During the third, last stage a school contest for the most technologically advanced project was held again. At all times during the three stages the respondents were subjects of field observation. At the second stage of the experiment, the control group attended standard computer lessons. A diagnostic survey and a questionnaire turned out to be sufficient tools for investigating the other experiment participants. The questionnaire contained 15 closed- and open-ended questions.

RESULTS OF RESEARCH

PEDAGOGICAL EXPERIMENT

In summarizing the results of the experiment, it is necessary to compare the experimental group's information and search competencies before and after the experiment as well as comparing these with the control group's results. In order to ensure that the data analysis is correct, 8 control items for the experiment were identified. The first two are control questions, while an analysis of the other 6 is designed to verify the hypotheses made. The results of the experiment are discussed below.

The experimental group consisted of 35 children: 14 boys, accounting for 40% of the children and 21 girls, which accounted for 60% of the children. The control group consisted of 34 children: 15 boys, accounting for 44.1% of the children and 21 girls, which accounted for 55.9% of the children. Each child had a computer, a tablet or a similar device available at home. Bar charts 1-7 show selected questionnaire results and positive responses of respondents, i.e. pupils in the control group and in the experimental group, to survey questions.

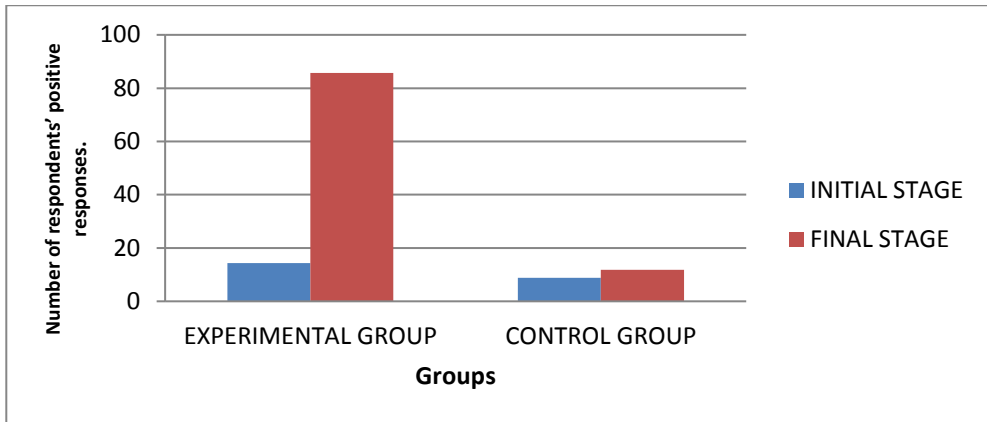


Figure 1. Number of positive answers given by respondents - pupils who know and use the freecommons website when preparing for class and learning
Source: Own work

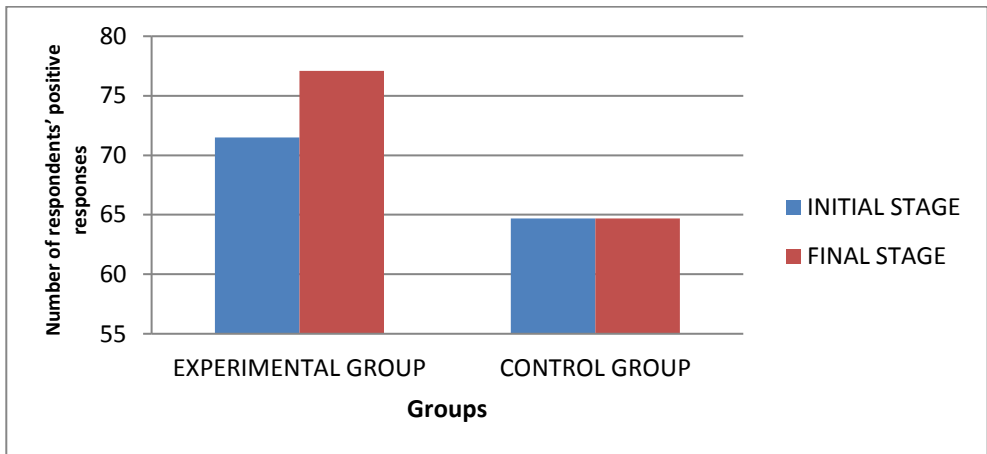


Figure 2. Number of positive answers given by respondents - pupils who know and use safe Internet pages on Sieciaki.pl
Source: Own work

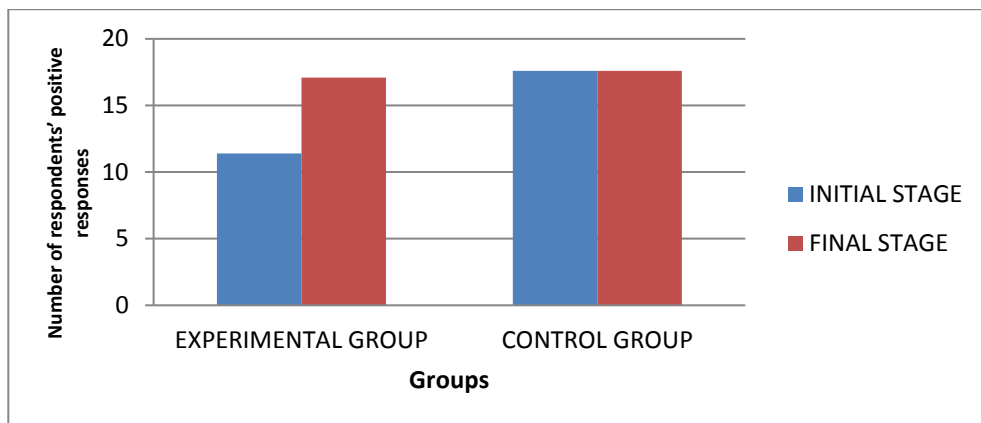


Figure 3. Number of positive answers given by respondents - pupils who know and use safe Internet pages on Cyfrowobezpieczni.pl

Source: Own work

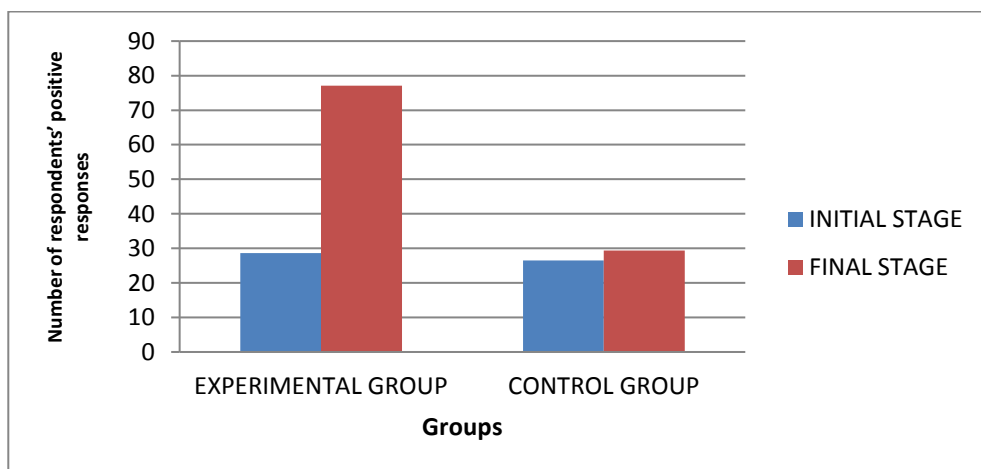


Figure 4. Number of positive answers given by respondents - pupils who know the rules for safe Internet usage

Source: Own work

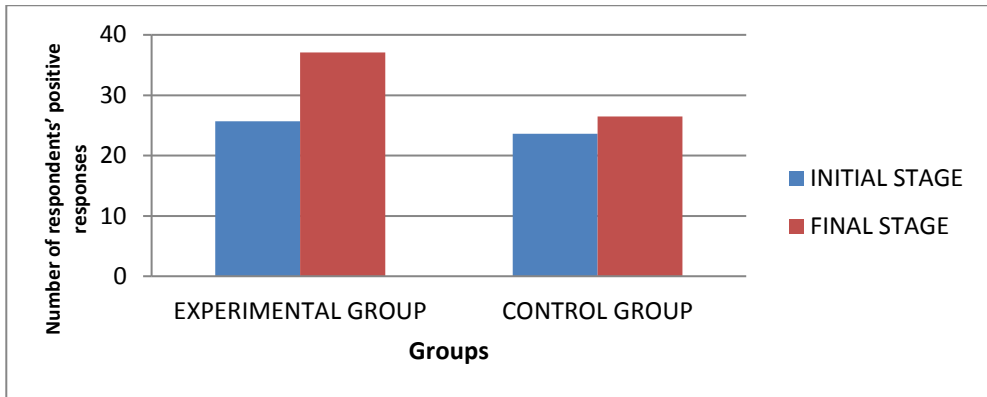


Figure 5. Number of positive answers given by respondents – the most common ways in which pupils use tablets, smartphones, braintrainers, camcorders, digital cameras, computers, multimedia blackboards for learning Multimedia materials for coursebooks

Source: Own work

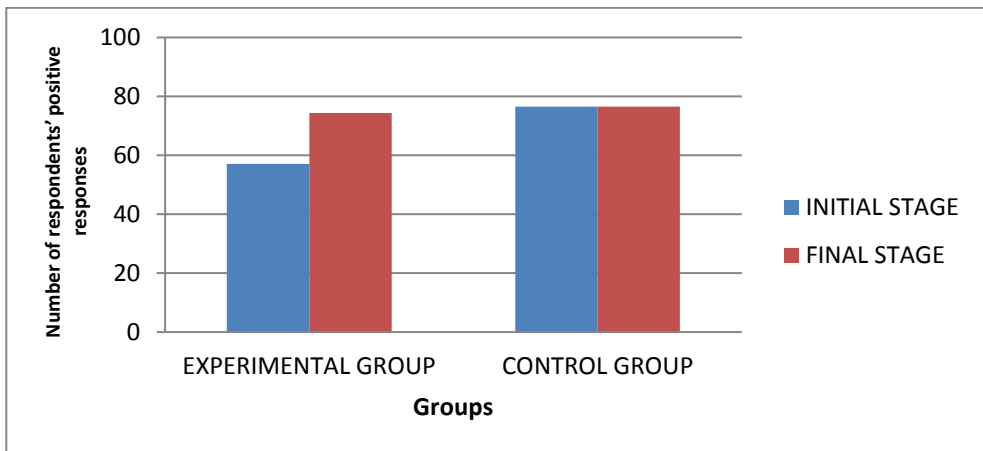


Figure 6. Number of positive answers given by respondents - pupils who are familiar with software for processing images, text, music and movies and use them for learning

Source: Own work

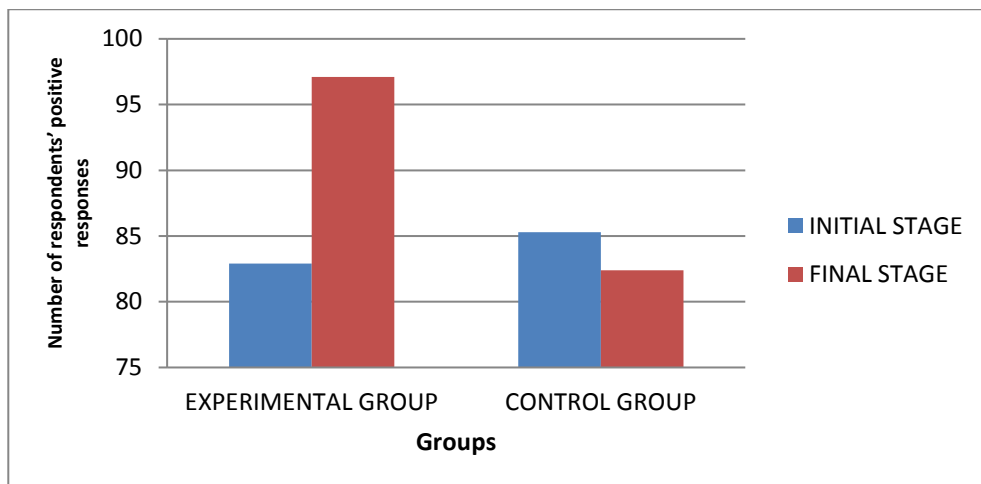


Figure 7. Number of positive answers given by respondents - pupils who are of the opinion that using new technologies improves their functioning in the school environment and facilitates learning

Source: Own work

In order to verify the hypothesis, the Kolmogorov–Smirnov test was used for dependent data.

Null hypothesis: $H_0: n_1 = n_2$

where n_1 : sample absolute frequency f_1

n_2 : sample absolute frequency f_2

Alternative hypothesis: $H_0: n_1 < n_2$

where n_1 : sample absolute frequency f_1

n_2 : sample absolute frequency f_2

Topic 1: Copyright on the Internet – or how to listen to music and not to get into mischief? The Kolmogorov-Smirnov λ asymptotic distribution table provides us with the critical value of statistic λ for the assumed significance level of $\alpha 0.05 = 1.36$. As $\lambda_0 = 2,9868762 \geq \lambda 1.36$, there are good grounds for rejecting the null hypothesis that the distributions in the populations are identical. However, at the same time, there are grounds for confirming the alternative hypothesis, which, anyway, was expected at the end of the experiment.

Topic 2: Safe Internet – is REALLY my best friend! The Kolmogorov-Smirnov λ asymptotic distribution table provides us with the critical value of statistic λ for the assumed significance level of $\alpha 0.05 = 1.36$. As $\lambda_0 = 2,3886643 \geq \lambda 1.36$, there are good grounds for rejecting the null hypothesis that the distributions in the populations are identical. However, at the same time, there are grounds for confirming the alternative hypothesis, which, anyway, was expected at the end of the experiment.

Topic 3: Educational potential of our equipment – or whatever you have on hand: the Kolmogorov-Smirnov λ asymptotic distribution table provides us with the critical value of statistic λ for the assumed significance level of $\alpha=0.05=1.36$. As $\lambda_0 = 1,67332 \geq \lambda_{1.36}$, there are good grounds for rejecting the null hypothesis that the distributions in the populations are identical. However, at the same time, there are grounds for confirming the alternative hypothesis, which, anyway, was expected at the end of the experiment.

Topic 4: Audio-visual editing programs – or how do they do that: the Kolmogorov-Smirnov λ asymptotic distribution table provides us with the critical value of statistic λ for the assumed significance level of $\alpha=0.05=1.36$. As $\lambda_0 = 2,0330838 \geq \lambda_{1.36}$, there are good grounds for rejecting the null hypothesis that the distributions in the populations are identical. However, at the same time, there are grounds for confirming the alternative hypothesis, which, anyway, was expected at the end of the experiment.

Summarising the above data, one can say that the assumptions of the experiment were correct. The method that was used contributed to the increased information and search competencies as well as technical competencies of those covered by the study. On one hand, the experimental group increased their practical familiarity with websites based on free licences, and safe Internet rules as well as demonstrating their increased awareness of the use of new technologies in education. On the other hand, there was a decrease in non-educational, purposeless use of Internet resources by the experimental group pupils. Indisputable confirmation of the assumed hypothesis is provided by the sample analysed using the Kolmogorov-Smirnov test.

DIAGNOSTIC SURVEY OF TEACHERS

A total of 36 teachers took part in the survey. 85% of the teachers at the first school were women, 15% - men. At the other school female teachers accounted for 81.75% of those surveyed, and the remaining 18.75% were men. At both schools the teachers represented a cross-section of all teacher career stages. Chartered teachers accounted for the majority of teachers in the experimental group, while the majority in the control group were appointed teachers. At both schools the following participants volunteered to take part in the survey: early elementary education teachers, specific subject teachers, librarians as well as after-school club and administrative staff. Conclusions drawn from the survey are clear and indicate readiness to use new technologies at work. The following aspects were taken into account: Internet (20% and 25% of the teachers), Office suite (20 and 18.75% of the teachers), educational movies (15% and 18.75% of the teachers), educational portal resources (20% and 6.25% of the teachers); slightly fewer teachers use dedicated website resources (10% and 6.25%) as well as free materials provided by publishers (15% and 12.5% of the teachers). The teachers from both schools rated their information and search competencies as quite high. As many as 40% of the experimental group teachers and 43.75% of the control group teachers indicated that their familiarity was definitely

good or quite good (35% and 37.5% respectively). Only 25% and 18.75% demonstrated moderate familiarity, which might indicate that there is a need for relevant training. As far as equipment availability for teachers is concerned, 36.8% and 43.3% of the teachers pointed to traditional office equipment as being most easily accessible. Availability of the other equipment is not an issue either: 29% and 30% of the teachers responded that they had access to a computer at work, 23.7% and 20% - access to multimedia interactive equipment, 10.5% and 12.5% - access to multimedia and computer rooms. The issue of inconvenience associated with the use of information and communication technologies at school was one of the key survey issues, as equipment availability determines, to a large extent, successful IT implementation in schools.

As many as 40% and 51% of the teachers pointed to limited access to hardware and software. The percentages for the other survey questions ranged from 6.25 to 25% and were comparable: unavailability of attractive software, no training in information and communication technologies, insufficient number of computers, excessive class size.

CONCLUSIONS

The aim of the research undertaken was to confirm or refute the hypotheses that jointly or comprehensively addressing the use of ICT in education. Having carried out a comparative analysis of the results produced by the research tools, one can preliminarily confirm the correctness of the statement resulting from the hypothesis that H1: systematic IT use in an educational establishment helps it operate more efficiently. This is contingent on personnel training and continued education itself. However, what is more relevant for confirming the primary hypothesis is the fact that the secondary hypotheses have not been refuted. H2 claimed that systematically accustoming children to IT has a favourable effect on the quality of knowledge acquired as well as development of pupils' interests and future occupational aptitude. That is why a series of lessons for the experimental group, well-thought-out in terms of methods and didactics, was included in the pedagogical experiment as an important constituent part. The outcome is reflected by the results, shown on the bar charts, that were accomplished after the series of lessons. In order to verify hypotheses H3 and H5 a diagnostic survey and a questionnaire were conducted among the parents and, above all, among the teaching staff of the establishments involved. Thus both hypotheses were confirmed, as is shown by the data shown above. Field studies and observations of the educational establishments that accompanied the pedagogical experiment also contribute to the confirmation of hypothesis H6. As the information obtained indicates, a significant portion of the new technologies that the establishments now have at their disposal was acquired with state subsidies or was obtained through participation in grant projects.

As the survey results indicate, information and communication competencies possessed by teachers and school administrative staff are still insufficient. This has

an impact on the quality of the teaching process and relationships with children. What also merits attention is teachers' low level of motivation to continue self-education and to change the existing education system into an "open" education system. Undoubtedly, a condition that contributes to that state of affairs is teachers' poor awareness of the advantages of the technologies. By contrast, as the teachers point out, schools are well equipped with, and continue to be provided with, new technologies.

In summary, one can say that in the 21st century new technologies are an adequate and, by all means, appropriate tool for use in education. Obviously, the preceding sentence reflects oscillation between fascination with teaching resources that not so long ago were unavailable, and fear of the unknown. Therefore the key success factor is the provision of systematic training for teachers coupled with improvements in the education system and in school equipment. The circumstances (and their results) in which pupils function were the most significant component of the survey. Based on the survey results one can draw two opposing, and quite surprising conclusions: in general young people exhibit a high level of technological advancement; unfortunately, however, this, only to a slight degree, translates into information and search competencies. Still, this trend is very changeable, being determined by availability of knowledge on proper use of modern information sources, which requires additional, systematic, comprehensive and thorough research.

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