INTEGRATING GRAPHIC TABLETS INTO THE TEACHING AND LEARNING PROCESS IN PRE-SCHOOL EDUCATION

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Résumé : *Les enfants d'aujourd'hui vivent immergés dans un monde numérique où ils établissent à la fois des liens sociaux et des liens avec leurs centres d'intérêt. L'intégration de la technologie dans le processus d'enseignement et d'éducation pourrait sans aucun doute offrir diverses possibilités de créer un environnement éducatif propice à un apprentissage réaliste, original, engageant et en phase avec les intérêts des enfants d'aujourd'hui. Comment la technologie pourrait-elle influencer l'apprentissage préscolaire? L'objectif de cet article est d'identifier l'impact de l'utilisation de tablettes graphiques sur le niveau de performance académique des enfants de l'enseignement préscolaire public. Les résultats de la recherche soutiennent l'impact positif des tablettes graphiques intégrées dans l'enseignement sur les côtés cognitif et affectif-motivationnel des enfants préscolaires en ce qui concerne le processus instructionnel-éducatif.*

Mots clés: *tablette graphique, intégration, processus didactique, éducation préscolaire, moyens d'améliorer le processus instructionnel-éducatif, performances scolaires.*

Overview

Technology is regarded as a renowned learning tool to promote the social, linguistic and cognitive development of young children. Nowadays, teachers ask countless questions about the use of technology in education. Keeping up with the new technologies that can be integrated into the classroom as well as with the current generation of digital natives is a constant challenge for teachers, as they are aware that through technology they can enhance children's ability to learn, communicate, participate in problem solving, stimulate their interest, creativity, etc. Thus, teachers are no longer asking to what extent

technology should be integrated into the instructional process, but how this should be done (Cramariuc & Dan, 2021).

In educational establishments around the world, computers, graphic tablets, interactive whiteboards and other digital devices are used as an integral part of the educational process. In recent years, new technologies associated with M-learning have emerged to support student learning, such as stylus tablets for writing or drawing. A diverse range of mobile technologies has been used for educational purposes. A number of such touch-screen devices, accompanied by a stylus (pen), have been discovered in educational research, specifically designed to facilitate the teaching-learning process through one-to-one instruction.

Graphics tablets can be tools for developing children's writing and drawing skills, abilities and skills. A graphics tablet is similar to a laptop touchpad, but larger in size. These tablets are important because with the help of writing accessories, i.e. the stylus (an ergonomic pencil with a pressure-sensitive tip), pupils can write, draw, colour, do graphic exercises and even digitise handwriting. The popularity of tablets has grown and led to interest in educational apps, especially in schools. As with many digital classroom resources, the use of tablets has the potential to enhance learning, for example by contributing to increased motivation, knowledge acquisition and inquiry-based learning (Berque, 2008: 113-135). However, new technologies, such as graphic tablets accompanied by stylus, have been and are only selectively integrated into educational establishments, as found in the 2013 International Computer and Information Literacy Study (ICILS). Initially, the introduction of tablets in educational settings was limited to high school and university establishments, with Barton and Collura (2003) finding that they can improve high school students' writing and organizational skills. Over time, these technologies were also introduced into secondary and primary education, and then into pre-school education, where they generated positive effects. For example, Chang, Mullen and Stuve (2005) reported that preschoolers using stylus-interfaced tablet technology showed a high degree of engagement and could easily manipulate the stylus in writing and drawing activities. In addition, a review of the National Educational Technology Standards also reveals the potential of stylus-interfaced technology as a learning tool and as a means of implementing technology standards in early education.

Clements & Sarama (2002) indicate that technology has positive effects on both young children and teachers. On the one hand, it encourages preschoolers' thinking, gives them opportunities for active control and problem-solving, and on the other it provides educators with a window into children's multilateral development.

In their research, Vernadakis, Avgerinos, Tsitskari and Zachopoulou (2005) indicated that the integration of tablets in pre-school education opens up favourable prospects as technology is evolving day by day and becoming more accessible. Tablets provide sights and sounds to support the natural ways in which preschoolers learn. Another example is provided by Arrowood and Overall (2004), who found that the use of tablets in writing activities led to increased children's motivation towards the writing process and the development of fine motor skills.

However, the study by Ferrer et al. (2011) is perhaps one of the most relevant as the results indicate that the academic performance of students in a public school in Spain increased following the integration of graphic tablets into the teaching and learning process. In addition, Candeias et al. (2019) conducted a case study aimed at investigating

the benefits of using tablets in the development of pre-school children's pre-reading skills. The researchers propose a system to support the teaching and learning of pre-writing skills composed of hardware (tablet and stylus) and software (server and client) components. This system includes a set of exercises/games proposed by the teacher. As the tasks are solved directly on the tablet, each pre-schooler is connected to the system based on a personal account. Data on the number of attempts, time spent on each exercise, etc. are automatically stored for presentation to parents. Thus, another benefit of the use of the graphic tablets in the educational environment is the possibility for parents to see the academic results of their children. According to the results of the study, there was also a significant improvement in the development of writing skills of children who had contact with the stylus tablets, accompanied by a reduction in the number of attempts to solve the task and the time spent on completing the task.

Given the ease with which preschoolers use these digital devices and their high level of interest and engagement, the graphics tablet appears to be a potential learning tool for young children. Ultimately, what matters about technology and learning is how teachers use it (Cramariuc & Dan, 2021).

1. THE RESEARCH GAP

The choice of the theme was motivated by the fact that the integration of technology in the instructional-educational process has the chance to offer, without a doubt, a variety of opportunities to create an educational environment conducive to learning, realistic, original, attractive and in line with the interests of today's children. At the same time, there are studies that have highlighted the benefits of integrating graphic tablets into the teaching-learning process in educational establishments, which means that there are researchers concerned about the impact of these devices on children. For example, Richardson (2012) argues in his paper that the use of tablets in the educational process increased children's interest in learning and stimulated their curiosity and attention for a longer period of time.

In their research, Bonneton-Botté et al. (2020) state that digital technologies are increasingly used to support school learning, but few studies have evaluated the effectiveness of these new teaching aids for 5-6 year olds. From the study, the researchers showed that a tablet app with a stylus (i.e. the "Kaligo" app) can support handwriting learning in kindergarten children.

Although Berque (2008) states that the future of stylus-interfaced tablet technology seems bright in education, there have not been many studies examining the use of this technology with very young children and its potential for raising school performance levels, especially in Romania.

Thus, the objectives of this paper are:

- To know the relationship between graphic tablets with stylus integrated in the instructional-educational process and the level of school performance.
- To establish the correlation between the level of satisfaction and the level of school performance of children.
- Identify the relationship between the graphic tablets with stylus integrated in the educational process and the level of satisfaction of preschoolers.
- To establish the relationship between the digital medium and the time spent on the proposed exercise.

2. RESEARCH QUESTIONS/AIMS OF THE RESEARCH

The basic research questions are:

- Does the use of graphic tablets with stylus in the instructional-educational process increase children's school performance?
- Is there a correlation between the level of satisfaction and the level of children's school performance?
- Does the use of stylus tablets in the instructional-educational process increase the level of satisfaction of preschoolers?
- Is there a relationship between the digital medium and the time spent on the task?

The need for research on the influence of technology in education is increasingly felt. Thus, the following statements describe the hypotheses of the proposed research:

I_1: Preschoolers who participated in activities using the digital medium show a higher level of school performance than those who were involved in traditional activities.

I_2: There is a significant positive correlation between preschoolers' satisfaction and their school performance.

I_3: Preschoolers who participated in activities using digital media show a higher level of satisfaction than those who were involved in traditional activities.

I_4: Preschoolers who were involved in digital activities completed the post-test in a shorter time than those who participated in traditional activities.

3. RESEARCH METHODS

3.1. PARTICIPANTS

The proposed study is based on two samples: experimental and control. Both the experimental sample (in which instructional activities were carried out using stylus tablets) and the control sample (in which the traditional method - using paper and pencil - was used) comprise the same number of preschoolers, i.e. 10, who are enrolled in the same educational unit, namely the Văratec Kindergarten of the "Aurelian Stanciu" Salcea Secondary School, in an urban environment. The research participants in both samples are homogeneous in terms of age, level of schooling and nationality, and their level of psychological development is heterogeneous.

3.2. MATERIALS AND INSTRUMENTS

The method used in this research is the experiment. The first instrument used is the Nepsy battery subtest, which measures fine motor speed and hand-eye coordination accuracy.

In the subtest, children had to use their preferred hand to draw a line in a given path. After completion, the preschoolers received a score. This score was acquired by counting the number of errors made by overshooting the edge of the line. The route is divided into segments, and each edge of a segment that is exceeded represents an error. In the example below, three errors can be seen because the line drawn by the child is outside the edge of the route for three segments (see Figure 1). Also, any segment of the route not completed within 180 seconds is considered an error.

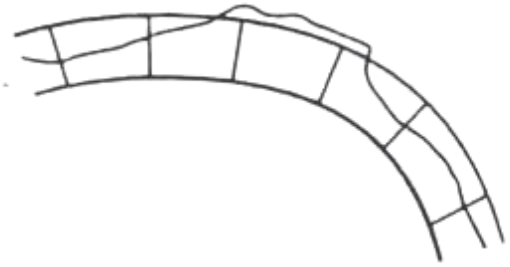

Figure 1. Example of errors encountered on the Nepsy battery test route

At the end, the total time and the number of errors on both drawings were added up. The Gross Total Score was determined using the time used to complete the drawing (speed) and the number of errors (accuracy). The maximum score for time is 360 seconds, while the maximum score for errors is 210.

Another instrument used in this research is the pre-test/post-test given to preschoolers in both samples before the experiment and the traditional activities and after the activities. The pre-test/post-test depicts some age-specific graphs of the subjects. Their task is to trace - with a writing instrument - the outline in detail of the graphical exercises on the sheet. This instrument contains 6 items scored as follows: item 1 - 16 points, item 2 - 31 points, item 3 - 8 points, item 4 - 8 points, item 5 - 8 points and item 6 - 8 points. Thus, by means of this pre/post-test developed by the present research coordinators, pre-schoolers can obtain a maximum score of 79 points.

The proposed experiment consists of three activities in which children have to perform some graphs in order to improve their graphomotor skills and visual perception in a fun way. A worksheet corresponds to each activity. The first worksheet contains items 1 and 2 from the pre-test/post-test, the second is constructed using items 3 and 4 and the last is based on items 5 and 6. Each item is duplicated on the worksheets, but only the item that the pre-schoolers score higher on will be chosen.

For the children in the experimental group, the three worksheets will be opened in Paint and completed on the tablet with stylus, while the preschoolers in the control group will solve them with pencil on paper.

In addition, to measure the level of satisfaction, the children will be given a worksheet on which is written the question "How satisfied/satisfied are you with the work you did?" and on which is represented a Likert-type scale from 1 to 5 (where 1 means very dissatisfied, 2 - dissatisfied, 3 - neutral, 4 - satisfied, 5 - very satisfied). Each value corresponds to an emoji, and children have to colour the emoji that is in line with their level of satisfaction.

In order to centralize the data collected through the experiment and to confirm or refute the proposed hypotheses we used the SPSS statistical analysis software, performing Pearson correlations and T-tests for independent samples.

3.2. PROCEDURE

First, all research participants were given a subtest of the Nepsy battery to assess fine motor speed and hand-eye coordination accuracy. Next, all subjects took a pre-test in

order to find out their level of pre-writing/graphomotor skills, followed by the experimental group taking part in three activities in which stylus tablets were used to make various graphs, and the control group taking part in traditional teaching-learning activities in which the preschoolers performed various exercises to stimulate written communication (graphical exercises) using paper and pencil. After each of the three activities, the children completed a scale designed to measure their level of satisfaction in order to identify the degree of satisfaction of the preschoolers.

After the experiment, both samples repeated the test given initially to identify possible improvements in the preschoolers' fine motor speed, eye-hand coordination accuracy, graphomotor skills and visual perception.

4. RESULTS

4.1. RESULTS

I_1: Preschoolers who participated in activities using the digital medium show a higher level of school performance than those who were involved in traditional activities.

According to the results obtained, there is a significant difference between the mean level of school performance of children who participated in activities using the traditional medium (N=10; M=14.90; SD=3.38) and the mean level of school performance of children who participated in activities using the digital medium (N=10; M=24.20; SD=4.70): [t(18)= -5.073, p=0.000], as shown in Table 1 and 2. Thus, the results show that the medium used influenced the level of school performance. In other words, preschoolers who took part in the three activities where the graphic tablet with stylus was used show a higher level of school performance than those who were involved in traditional activities. The hypothesis is confirmed.

Table 1. T-test for independent samples: level of children's school performance and medium of instruction used

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Level of children's school performance	Equal variances assumed	2,826	,110	-5,073	18	,000	-9,300	1,833	-13,152	-5,448
	Equal variances not assumed			-5,073	16,331	,000	-9,300	1,833	-13,180	-5,420

Table 2. Statistics on children's school performance by medium of instruction

Group Statistics

	Medium of instruction	N	Mean	Std. Deviation	Std. Error Mean
Level of children's school performance	Traditional	10	14,90	3,381	1,069
	Digital	10	24,20	4,709	1,489

I_2: There is a significant positive correlation between preschoolers' satisfaction and their school performance.

According to Table 3, there is a significant positive correlation between the proposed variables: [r=0.429; N=20; p=0.029]. Thus, increasing the level of preschoolers' satisfaction leads to an increase in their school performance. The hypothesis is confirmed.

Table 3. Pearson correlation for children's satisfaction and school performance levels

Correlations

		Preschoolers's satisfaction level	Preschoolers's performance level
Preschoolers's satisfaction level	Pearson Correlation	1	,429*
	Sig. (1-tailed)		,029
	N	20	20
Preschoolers's performance level	Pearson Correlation	,429*	1
	Sig. (1-tailed)	,029	
	N	20	20

*. Correlation is significant at the 0.05 level (1-tailed).

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Preschoolers's performance level	Pearson Correlation	,429*	1
	Sig. (1-tailed)	,029	
	N	20	20

*. Correlation is significant at the 0.05 level (1-tailed).

I_3: Preschoolers who participated in activities using digital media show a higher level of satisfaction than those who were involved in traditional activities.

According to the results, there is a significant difference between the mean level of satisfaction of the preschoolers who participated in the experiment and were involved in the activities using the traditional medium (N=10; M=12.20; SD=1.81) and the mean level of satisfaction of those who took part in the activities using the stylus graphic tablet (N=10; M=14.10; SD=0.73): [t(11,900)= -3.069, p=0.010], as shown in Table 4.

Table 4. Statistics on the level of pre-schoolers' satisfaction according to the teaching medium used

Group Statistics

	Medium of instruction	N	Mean	Std. Deviation	Std. Error Mean
Preschoolers's satisfaction level	Traditional	10	12,2000	1,81353	,57349
	Digital	10	14,1000	,73786	,23333

Thus, the results indicate that the method used influences the level of preschoolers' satisfaction (see Table 5). In other words, pre-schoolers who used the graphic tablet in the activities have a higher level of satisfaction than those who used pencil and paper. The hypothesis is confirmed.

Table 5. T-test for independent samples: level of satisfaction of preschoolers and medium used

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Preschoolers's satisfaction level	Equal variances assumed	6,720	,018	-3,069	18	,007	-1,90000	,61914	-3,20076	-,59924
	Equal variances not assumed			-3,069	11,900	,010	-1,90000	,61914	-3,25024	-,54976

I_4: Preschoolers who were involved in digital activities completed the post-test in a shorter time than those who participated in traditional activities.

According to the results, there is a significant difference between the mean minutes devoted to the completion of the post-test sheet by children in the expressive group (N=10; M=8.60; SD=1.71) and the mean minutes devoted to the same post-test by children in the control group (N=10; M=12.70; SD=2.90): [t(18)= 3.842, p=0.001], as shown in Table 6.

Table 6. Post-test time statistics by medium of instruction

Group Statistics

	Medium of instruction	N	Mean	Std. Deviation	Std. Error Mean
Post-test time	Traditional	10	12,70	2,908	,920
	Digital	10	8,60	1,713	,542

Thus, the results indicate that the teaching medium used influences the time taken to solve the post-test (see Table 7). In other words, preschoolers who used the graphic tablet in the experiment activities solved the post-test in a shorter time than those who used pencil and paper during the experiment. The hypothesis is confirmed.

Table 7. T-test for independent samples: post-test time and medium used

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Post-test time	Equal variances assumed	4,166	,056	3,842	18	,001	4,100	1,067	1,858	6,342
	Equal variances not assumed			3,842	14,574	,002	4,100	1,067	1,820	6,380

5. DISCUSSIONS

According to Ferrer et al. (2011) and Richardson (2012), the integration of graphic tablets into the instructional-educational process in educational establishments contributes to increasing students' academic performance, increases children's interest in learning and stimulates their satisfaction, curiosity and attention for a longer period of time.

For this reason, the research demonstrates that the use of graphic tablets in pre-school activities in kindergartens has led to increased levels of children's performance and has shown that a high level of pre-schoolers' satisfaction will in turn lead to a high level of school performance. At the same time, it was identified that preschoolers who participated in activities using the graphic tablet showed a higher level of satisfaction than those who engaged in paper pencil writing activities, as the digital medium contributed to stimulating, engaging and motivating children. Finally, it was observed that the digital medium contributed to a decrease in the time spent in order to solve the proposed task.

Therefore, the results obtained add to the positive image of graphic tablets integrated into the instructional-educational process in pre-school establishments. A primary benefit of this research is that it contributes to demonstrating the potential of

tablets in education, in relation to school performance, children's satisfaction level and time spent solving tasks.

At the same time, in this case, the fact that preschoolers were assigned to the two groups (experimental and control) according to their scores on a standardized subtest of the Nepsy battery may be another advantage, as the children were divided so that the samples were equivalent in terms of fine motor speed and eye-hand coordination accuracy.

Another strength of the research is that the pre-schoolers were observed during several activities, allowing conclusions to be drawn not only about their performance but also about their attention, engagement and motivation.

There are also limitations to the present research. For example, the study has a small number of participants, 10 in each group, and the results were low at pre-school level, as only 4-5 year olds participated.

Also in the category of limitations is the fact that the activities in which the preschoolers in the experimental group participated were carried out using a single graphic tablet, which meant that the pupils took turns solving the worksheets, the activities themselves taking longer than the traditional ones in which all the children were involved at the same time.

Nevertheless, the research described highlights the benefits that graphic tablets integrated into the instructional-educational process in educational establishments can have on preschoolers.

CONCLUSIONS

If we do not change, others will change us and make us obsolete or, worse, irrelevant. These words highlight that if pedagogy does not keep pace with technology, students, teachers and the educational process will suffer. As technology is rapidly evolving and students are expressing an affinity for it, its integration into educational establishments is essential.

Among the devices that can be used in the instructional-educational process, we mention graphic tablets, which seem to have the potential to improve the learning process. They offer the possibility of developing a new teaching tool that can stimulate children's attention, interest, motivation, satisfaction and school performance.

Despite the fact that graphic tablets are rarely used in Romanian educational establishments and that their benefits in the field of education are not widely known, the present research may provide an incentive for teachers who want to make the teaching-learning process an attractive, enjoyable and understandable activity for digital natives.

In conclusion, this study has highlighted important aspects of integrating graphic tablets in the educational domain. The results obtained have the power to encourage teachers and managers of educational establishments to give greater importance to the integration of devices in the instructional-educational process, especially graphic tablets, as they stimulate the interest, curiosity, attention and motivation of preschoolers, contribute to increasing the level of satisfaction of children and optimize school performance. For this reason, we argue that the present research should be deepened and extended to other educational cycles. Therefore, in the future, it is necessary to develop the theme by conducting experiments, at other age levels, using graphic tablets in order to identify other possible benefits of them in education.

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