



WEAK STUDENTS TEACHING DIVISION BY USE ICT

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Abstract:

In recent decades, ICT (Information and Communication Technologies) has played a major role in international education systems. They encourage and improve creativity, critical thinking, pioneer the educational process of teaching and enhance learning. In the present study, 4-6 year old preschool students were taught division by applying levels and using computers and tablets. The purpose of our research was to investigate which group of students (weak, mediocre, excellent) show higher scores in the teaching of division by applying the 3 levels (line level-group level-combination level) and the use of ICT. Preschool students were divided into three groups. Experimental group 1 included students who were taught division using a computer. The experimental group 2 included students who were taught division using smart mobile devices and the control group included students who were taught division using the traditional teaching method and without the use of ICT. The results showed that the students of the experimental groups showed a very significant improvement in their performance in the division at all levels with a higher in the 1st level.

Keywords:

Division, Computer, Tablets, Kindergarten

Introduction

The use of ICT in education can create new attractive learning environments from pre-school to tertiary education, provide teaching methods, complement the traditional way of teaching, improve the quality of education and offer innovations (Toki & Pange, 2012). In the modern school the pedagogical utilization of ICT is necessary (Anastasiadis, 2010).

As technologies evolve, teachers need to explore new attractive teaching tools, to integrate them effectively into the educational process in order to facilitate learning (Buldu, 2006). Anastasiadis (2005) discusses the need to create combinatorial learning environments.

According to the international literature, children aged 3-6 can use computers and smartphones (tablets), both to present their ideas and to seek solutions.

The growing awareness of the importance of mathematics for our society and for children is reflected in curricula around the world (Saracho & Spodek, 2008). Children understand many mathematical concepts before the formal teaching of Mathematics begins in kindergarten (Sophian, Harley, & Manos Martin, 1995).

Researchers believe that teachers should pay special attention to the order in which mathematical concepts are taught. They consider it necessary for children to have understood the prerequisite concepts before being taught more complex and complex mathematical concepts. Studies show that in order for students to succeed in mathematics, they need to understand numbers well enough (Griffin, 2004). The sense of numbers is a powerful basis for solving problems of addition, subtraction, multiplication and division (Douglass & Horstman, 2011).

In terms of division from the age of 3, children begin to divide some objects (up to 4) into two groups. At the age of 4 they can distribute fair items while from the age of 5 they can distribute a larger number of items to more recipients. The results of the research indicate that young children can solve divisions and measurement divisions with more difficult measurement divisions as they are asked to form groups with the same number of objects (Fischbein, Deri, Nello, & Marino, 1985).

Children's thinking and reasoning are important parts of the problem-solving process (Barmby, Harries, Higgins, & Suggate, 2009). The use of practical experiences by the children themselves and their connection with informal calculation strategies helps them to measure more easily, to see clearly the connections between the concepts and their application in finding solutions (Greer, 1992).

Mathematics is problem solving, so problem solving not only improves children's computational skills but also facilitates the understanding of the concept that is important for understanding the concepts of division (Van de Walle, 2004).

Literature Review

Clark & Luckin (2013) characterize as innovative the teachers who use smart mobile devices, providing authentic learning experiences and can construct and share knowledge in a digital environment.

Smartphones offer significant benefits (Johnson, Adams, & Cummins, 2012). Specifically, they help increase motivation (Kinash, Brand & Mathew, 2012), facilitate management and access (Pamuk, Ergun, Cakir, Yilmaz, & Ayas, 2013), enhance children's learning performance (Isabwe, 2012), enable the application of a wider range of teaching strategies (Fernández-López, Rodríguez-Fortiz, Rodríguez-Almendros, & Martizez - Segura, 2013), also enable individualized learning (Mc Clanahan, Williams, Kennedy & Zate, 2012), contribute to encouraging and promoting collaboration between children and between teachers and children (Henderson and Yeow, 2012).

According to Karsenti & Fievez (2013) smart mobile devices help to improve computer skills and mathematical concepts. In addition, they are extremely portable tools (Hill, Nuss, Middendorf, Cervero, & Gaines, 2012). They improve the quality of pedagogical support and facilitate reasoning (Murray & Olcese, 2011).

It is widely accepted that the integration of ICT in mathematics, from pre-school age, can provide opportunities for thought and exploration (Zaranis, Kalogiannakis, Papadakis, 2013). Research results have shown that computer-assisted learning enhances the development of mathematical skills and the cultivation of a deeper perceptual ability for students, compared to traditional teaching (Zaranis, 2011). A significant effect on the mathematical achievements of preschool students was presented to students who participated in a mathematics program and made use of smart mobile devices. After 22 weeks, the students improved their mathematical performance by using appropriate educational software. Students with low performance showed higher results (Schacter & Jo, 2016).

Research on the use of smart mobile devices in kindergarten suggests that applications designed based on learning sciences can improve mathematical achievement and problem solving (Weiss, Kramarski, & Talis, 2006).

Methodology

The purpose of this study was to investigate whether the use of ICT helps to improve the basic mathematical achievements related to division in children aged 4-6 years. Our research compares the level of learning outcomes of students taught division by the application of the 3 levels and the use of smart mobile devices and the computer in comparison with the traditional teaching method.

In particular, the teaching of division in preschool education is advanced and supported through three levels, with increasing degree of difficulty (Van den Heuvel-Panhuizen, 2008). The first level is the line level. At this level both the counting and the calculation of the objects are based on the line frame. The second level is the group level. At this level the counting of objects, their groupings and their calculation are based on the context of the group. The third level is the combination level. In this level the counting of objects and their calculation are based on the combination of line and group levels, creating a table.

In particular, we wanted to investigate whether the children of Experimental Group 1 had a higher improvement in division, after the didactic intervention, about the Control Group, if the children of Experimental Group 2, had a higher improvement in division, after the didactic intervention that took place. , regarding the Control Team and whether there was a specific category of students (weak-mediocre-excellent) of Experimental Group 1 or Experimental Group 2, who had a statistically significant improvement in their performance in the division, after the didactic intervention.

The study population was 183 children, 98 boys (53.6%) and 85 girls (46.4%), preschool aged 4 to 6 years, of whom 165 (90.2%) were born in 2011 and 18 (9.8%) were born in 2012 and attended public kindergartens.

In the first phase, the students were given the TEMA-3, an Early Mathematical Proficiency test designed by H. Ginsburg and A. Baroody in 2003 to assess their level of mathematical

competence. The test was administered individually by the researcher to each child and for reasons of reliability and validity followed an individual interview to complete them with each child.

Indicative tests are shown in Figures (1,2,3) for the 1st, 2nd and 3rd level of the division. In picture 1a the children were asked to divide the 6 apples into 2 baskets: "We have 6 apples and we want to divide them into 2 baskets fairly, that is, as many apples in one basket as there are in the other basket. Distribute the apples in each basket. How many apples will you put in each basket? Some children distributed the apples one by one, while others from the beginning found the right number of apples to place in the first and second baskets. In the 2nd level a corresponding test (see Figure 1b) was the following: "Divide the 10 birds fairly into two trees. How many groups of birds will you have? How many birds will each team have? Respectively in the 3rd level of the division (see Figure 1c) the researcher displayed laminated color images and asked the children to use a marker to draw one or two lines and to divide the corresponding images into 2 or 3 equal parts. This level had a higher degree of difficulty as it was a combination of 1st and 2nd level.

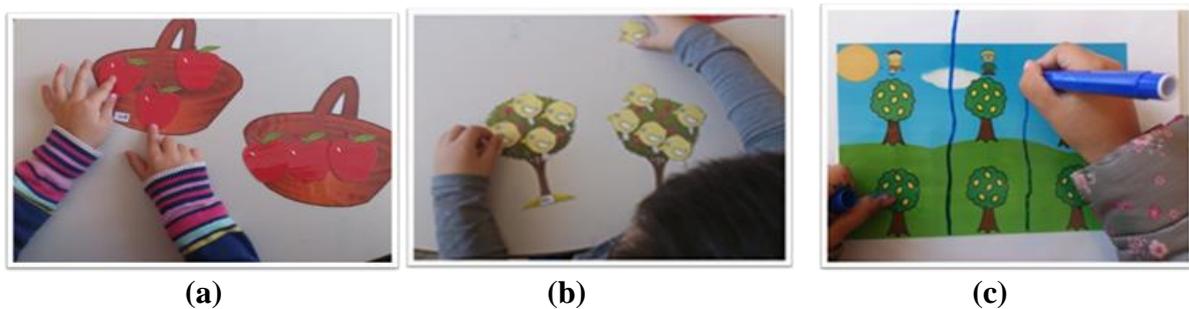


Figure 1 (a, b, c): Test for the 1st, 2nd and 3rd Level of The Division.

The second phase was followed by the intervention using digital and experiential activities. We designed digital educational games based on the 3 levels of division and corresponding experiential games, which were given to the students for 6 weeks. In Experimental Group 1 (Figure 2a) the infants worked in pairs on the computer, which was connected to a projector screen, and broadcast at the same time to the rest of the group of children. In Experimental Group 2 the infants worked in threes or fours (figure 2b, 2c).



Figure 2 (A, B, C): Snapshots from the Intervention in The Experimental Groups.

Indicative digital activity for the 1st level of the division was: "Gigantopolis and Nanopolis". The children were called to help the Giants, who lived in Gigantopolis and were huge and tall,

and the Dwarves who lived in Nanopolis and were tiny with tiny arms and legs to unite their cities with a colorful road. The road was a horizontal line and colorful tiles were placed there. Clear sound instructions were given to the children for the creation of the road "The road should be colorful, the tiles should have the same color and the same number every time".

The story was followed by his "draw and place" strategy. For example the toddler heard the following sound message "Drag 2 yellow tiles and place them at the beginning of the road. Then put the same number of tiles but with a different color. How many different colors are the tiles you put? Press the correct number ". To perform the activity, the numbers from 1 to 10 were at the top of the application. The child was asked to press the correct number each time, depending on what was asked of him. Each correct answer of the child was accompanied by a visual reward with the appearance of an attractive graphic (happy emoticon) as well as an audio reward with the reproduction of applause and verbal reproduction of the word "Well done!" (see Figure 3a, 3b).



Figure 3 (a, b): Snapshots From Digital Activity of the 1st Level of The Division

Results

We initially compared the children's performance between the pre-test and the post-test in the research groups (Experimental and Control). As the data showed, there was a statistically significant difference in the performance of the children of Experimental Group 1 before and after the didactic intervention for the division ($t = -21,860$ $df = 63$, $p < 0.001$). There was also a statistically significant difference in the performance of the children of Experimental Group 2 before and after the didactic intervention for the division ($t = -26,036$, $df = 58$, $p < 0.001$) as well as in the performance of the children of the Control Group before and after traditional teaching ($t = -5,095$, $df = 59$, $p < 0.001$).

It turned out that 6.3% of the students in experimental group 1 achieved low performance (weak students) in the division, before the didactic intervention. 23.4% of the students in the same experimental group achieved moderate performance (average students) and 70.3% of the students achieved high performance in the early mathematical intervention test, regarding the division. Regarding the experimental group 2, 35.6% of the students achieved low performance (weak students) in the test of early mathematical ability for division. 28.8% of students achieved mediocre performance (mediocre students) and 35.6% achieved high performance (excellent students). In control group 35% of students achieved low performance (weak students), 10% achieved mediocre performance (mediocre students) and 55% had excellent performance.

We then performed the ANOVA threeway to investigate whether the Experimental Teams and the Control Team differed statistically significantly in terms of the mathematical level of the students (weak, average, excellent students). There is a statistically significant difference in the groups, $F(2,174) = 146,787$, $p < 0,001$, $\text{PartialEtaSquared} = 0,628$ as well as in the mathematical level of the students (weak, mediocre, excellent), $F(2,174) = 53,087$, $p < 0,001$, $\text{PartialEtaSquared} = 0,379$.

Weak students had a statistically significant difference in their performance from the "mediocre" $p < 0.001$, after the teaching intervention. Also, the "excellent" students had a statistically significant difference from the "weak" students, $p < 0.001$, as well as the "excellent" students from the "average" students with $p < 0.003$.

According to Bonferroni adjustment the statistical analysis showed that there was a statistically significant improvement in both experimental groups relative to the control group. After the teaching intervention, the "weak" students of the experimental group 2 showed better performance in relation to the "average" ($p = 0.001$) and "excellent" students ($p < 0.001$) of the same group. The "weak" and "mediocre" students of experimental group 1 showed statistically significant differences only in relation to the "excellent" students of the same group ($p < 0.001$). In the control group after the teaching intervention, the "weak" and "average" students who are at the same level ($p = 1,000$) showed statistically significant differences only in relation to the "excellent" students with $p < 0.001$ and $p = 0.007$ respectively.

Conclusions

Teaching division using smart mobile devices, based on the application of levels, has a serious impact on the performance of children aged 4 to 6 years. The traditional teaching of division has little effect on the performance of children aged 4-6. The performance of children taught division using computers and smart mobile devices is higher than the performance of children taught the traditional way. So teaching with these techniques helped the children to a great extent, to improve their performance.

The highest difference in its performance in the division, between before and after the teaching intervention, was presented by the group that was taught using smart mobile devices. Weak students are most favored by the teaching intervention, which uses computer and smart mobile devices, in teaching division.

The data are useful for the methodological planning of the didactic division in students from 4 to 6 years old. The overall conclusion of this study was that our model, with math activities and level-based software, helps students with low levels of mathematical performance improve their knowledge of dividing more than students belonging to other levels. This study is a small piece in the puzzle of mathematics education at kindergarten level.

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