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ICT Use in Preschool Science Education: A Case Study of Some Private Nursery Schools in Ekiti State

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Abstract
This research reveals ICT uses in Ekiti preschool education and explores this use of ICT for science education. This case study is part of a wider research project concerning the use of Information and Communication Technologies (ICT) for teaching main natural science's concepts and mathematics in early year's classroom. The study was conducted during 2013-2014 school year and pupils participated in the study. The integration of ICT into preschool education has become a high priority for everybody involved in the learning process. The Mathematics and Science Achievement Test was given to pupils and semi-structured interviews with young children were conducted in 16 preschool classes in Ekiti state. Pupils in the control group received only the traditional science instruction about natural sciences (solubility, recycling) and mathematical concepts (comparison, classification and general knowledge of numbers). Pupils in the experimental group received only the science instruction with the use of ICT for the same topics. Both the experimental and the control groups consisted of classes from the same participating schools. The incorporation of ICT in early year's classes in private schools in Ekiti state should be considered as a means of an obligatory modernization of learning and teaching methods.The results of the research showed that teaching and learning through ICT as an innovative teaching method can be successful for understanding the concept of numbers and natural sciences phenomena at preschool level.
Keywords: Preschool Education, Mathematics, Solubility, Recycling, ICT.

INTRODUCTION

In the context of preschool education, studying science with the use of ICT seems to be a very challenging process. In some preschools in Ekiti state, pre-primary classrooms are organized with separate 'corners', including a 'science corner', which the teachers are expected to design and equip the activities. Because science is so engaging for children, it serves as an ideal content area for supporting children's learning and development. It is well known that children learn faster in an interactively functioning learning environment. This is probably the most important advantage of ICT use in the teaching process against traditional teaching methods. Science education at the preschool level with the use of ICT (Information and Communication Technologies) that emphasizes active learning, may be expected to promote higher student motivation than what occurs in traditional classroom settings with teacher oriented learning. Numbers and natural phenomena invoke the interest of children from a very young age (Geary, 1994; Bryant 1997; Chen, 2009). The research reveals ICT uses in Nigerian preschool education and explores this use of ICT for science education

STATEMENT OF THE PROBLEM

During the preschool years , children learn at different rates and with different styles. Children also learn a lot in the abstract at the preschool level and as such students tend to have foundational problems in learning. They also lose interest in learning because they feel it is boring and uninteresting. This has contributed to the poor performance of children at the preschool level. Without ICT in teaching and learning, children may find it difficult to master certain tasks. They often experience frustration, anger, low self-esteem and even depression. ICT is perceived to make a great impact in preschool level learning.

PURPOSE OF THE STUDY

This study seeks to conduct a study on ICT use in preschool education using some designated schools in Ekiti State

RESEARCH QUESTION

Will children taught using ICT perform better than children taught without using ICT?

RESEARCH HYPOTHESIS

There will be no significant difference in children taught using ICT and children taught without using ICT.

THEORETICAL FRAMEWORK

Children construct their knowledge of the world on the basis of two information sources-observations of the world

and explanations given by other people (Vosniadou, 2002; Kikas, 2003). Scientific concepts may be hard to grasp even by adults; however, this does not mean that children cannot think abstractly about scientific concepts. On the contrary, literature shows that children are able to think about even complex concepts (Zimmerman, 2000). Learning theories now accept the importance of learning processes at this age and, moreover, research studies have provided strong evidence that appropriate teaching interventions can help preschool children accept basic scientific ideas concerning common phenomena of the natural world (Ravanis, 1994).

Pupils' responses to events involving changes of state and dissolving have been studied in a variety of contexts over the past two decades. For Slone and Bokhurst (1992) the child is be able to consider both variables, the sugar and water, simultaneously (dependent on preservation), must understand direct and inverse relations (dependent on liquefaction or atomism), and must have the ability to assign numbers to the amounts of sugar and water and to compare the ratios. According to Prieto, Blanco and Rodriquez (1989), ideas held by 11 to 14-year-old Spanish students about solutions and the process of dissolution attach a good deal of importance to the mechanical actions and manipulations involved in dissolving the substances (e.g., stirring, shaking, heating, etc.). Lee et al. (1993) have reported about 50% of a sample of 11 year olds demonstrating an understanding of particle explanations for states, change of state, expansion and dissolving. For Papageorgiou and Johnson (2005) particle ideas helped with the development of 10/11 years old pupils' understanding of phenomena of changes of state and mixing.

In addition environmental education is recognized as an educational process that significantly promotes all aspects of an overall and balanced personal development of young children, in the psychological, emotional, cognitive, social and psychomotor sectors (Flogaitis, Daskolia & Liarakou, 2005). However, although the significance of environmental education in early childhood education has been recognized early on internationally (Tilbury, 1994) and efforts have been made for its inclusion in kindergarten schools, research in the field remains largely limited. Despite the fact that environmental education's general conceptual and methodological framework is widely accepted by the Nigerian educational community, the matter of its interpretation by national educational policy-makers and the approaches they promote for the application of environmental education at each educational level remains open (Flogaitis, et al., 2005).

The adequate preparation of teachers at all school levels in environmental education is considered, even today, to be lacking. The main emphasis has been primarily placed on the inservice training of teachers with the thought that most practitioners have not received any relevant pre-service training in environmental education (Flogaitis, et al, 2005).

A vast number of studies relate the appropriate use of computers with the ability of students to understand more efficiently the different mathematical and science notions (Dunham & Dick, 1994; Groves, 1994). Thus, it becomes obvious that kindergarten emerges as a very attractive environment of investigating the computer use in mathematics education. Indeed, various research results show a positive interrelation between the use of computer and the development of mathematical thinking in kindergarten (Clements, 2002; Clements & Sarama,2004). It is considered necessary to think of planning various activities related to science and technology, so that preschoolers would broaden their field of experiences and construct certain primary representations, which would later on form the background to build up scientific concepts (Solomonidou & Kakana, 2000). Science education at preschool level with the use of ICT that emphasize active learning, may be expected to promote higher students motivation than occurs in traditional classroom settings with teacher-directed learning.

ICT use has been applied experimentally at the preschool level on a wide scope of skills and knowledge acquisition. Results demonstrated a significant contribution of ICT use in the classroom as a learning tool (Clements & Nastasi, 1992; Clements & Sarama 2003; Vernadakis et al., 2005). It is well known that children learn faster in an interactively functioning learning environment. This is probably the most important advantage of ICT use in the teaching process against traditional teaching. Moreover, the use of computers as a teaching tool allows children to learn at their own individual pace (Zaranis & Oikonomidis,2009). Upon achieving one level of knowledge they can proceed to the next, which is not the case in traditional teaching.

Generally speaking, in order to maximize the benefits of ICT use in education, all the educators should keep in their minds this question: 'Can we use technology to teach the same old stuff in the same way or can we capitalize on the benefits of technology by using integrated computer activities to increase achievement? (Clements & Sarama, 2002).

METHODOLOGY

The research study uses Early Mathematics and Science Achievement Test (EMSAT) about solubility and recycling to explore the use of ICT in preschool classroom for teaching basic mathematical and natural sciences concepts. The EMSAT is a task orientated test which attends to measure the level of early mathematical competence. The test was developed for kindergarten and consisted of forty items. The EMSAT consisted of eight parts and the tasks were spread over these parts in group of five. The EMSAT was examined individually. The components of the EMSAT where the study focused were: concepts of comparison, classification and general

knowledge of numbers.

The semi-structured interviews focused especially on: solubility and recycling. The following questions were examples of what the students were asked: Does lentils, beans, chickpeas, rice, sugar, salt, pepper, and, coffee dissolved in water? What do you think when you hear the word recycle? What is recycling? Recycled camera? Recycled food cans, plastic bottles, stones? What is it made with the scissors, books, and bottles? Which buckets dump the plastic bottles, newspaper, and metal teapot? Recycled food? Draw a trashcan and a material that we throw into it when you do not need it anymore.

The study was conducted during 2013-2014 school year and 260 pupils participated. The EMSAT and audio-recorded semi-structured interviews were conducted one-tone in private and were given to children, aged from 4 to 6 years randomly selected, in 16 preschool classes in Ekiti State. It took about half an hour for each interview or test and they were given to the children as a pre-test and post-test before and after the teaching intervention. There were two groups in the study, one control and one experimental. In the control group there was not a computer available for pupils' use, while in the experimental there was one. The research study was conducted from November 2013 to April 2014.

Pupils in the experimental group received only the science instruction with the use of ICT for the same natural sciences phenomena and mathematical concepts. Both the experimental and the control groups consisted of classes from the same participating schools.

The teaching process for both groups consisted of four weekly syllabus. The control group was coordinated with traditional teaching that included a story about the three little pigs that had three bags with sugar, beans and salt and passed through a great river. Another story was of recyclable materials, bottles, cans and paper that were neglected at the beach and they were very sad because they had been used and felt useless, until one day the newspaper brought the good news of recycling. Group and individual activities were given to children every day in order to understand what materials were recycled in the yellow bin, which the green and what in the blue bin. In addition they did experiments which dissolved in water, various materials as sugar, salt, beans, chickpeas, lentils, coffee, etc. Moreover, there were quizzes given periodically and procedures were given at the conclusion of each number form one to ten.

The experimental group covered the same material at roughly the same time, but spent one class hour per week with the computer. The software was designed using the Flash CS3 Edumode professional environment and consisted of six distinctive counting activities for numbers from one to ten. Each one of them implicated pupils into different aspects of counting situations.

More accurately, pupils were asked to reach solutions to problems, in which counting played an integral role. The computer activities were selected according to the kindergartens' curriculum and complements what children had been previously taught in class. The general environment of the software could be described as open ended, which allows pupils freedom of use and navigation, although there were some drill and practice features as well.

Concerning the natural sciences phenomena the teaching intervention of experimental group used software which included stories and activities about solubility and recycling.

The role of the main teachers was to be facilitators to help children solve any problems, but only when children really needed help. The data analysis from the tests was carried out using SPSS (ver.19.0).

POPULATION

The population of the student consists of some preschool students in Ekiti state

SAMPLE &SAMPLING TECHNIQUES

The sample was made up of 260 pupils in 16 pre-school classes in Ekiti state. The sampling technique used was the simple random sampling technique.

INSTRUMENT

The instrument used for the study is the Early Mathematics and Science Achievement Test (EMSAT) about solubility and recycling to explore the use of ICT in preschool classroom for teaching basic mathematical and natural sciences concepts.

RESULTS/ANALYSIS OF DATA

The EMSAT and interviews were taken by 260 pupils. One hundred and thirty two of the pupils were males and one hundred and twenty eight were females. Data analysis was done by the SPSS statistical analysis program. Independent samples and paired samples t-test were carried out.

The independent variable had two categories the experimental group (132 children) and the control group (128 children). The dependent variable was the total pupil's score from the semi-structured interviews about natural sciences phenomena (solubility and recycling) and mathematical concepts (comparison, classification and

general knowledge of numbers).

The t-test for equality of means was not significant (t = -0.680, p = 0.490), indicating no significant differences initially, in numeracy and natural achievements between the experimental and control groups. Though the experimental group had a mean score (m=25.820) slightly higher than the control group (m=25.510), the mean difference was less than -0.300. The results of this pre-test are summarized below (Table 1):

Table 1: Independent Samples Test of pre-test

	t	Df	Mean difference	Sig. (2-tailed
PRE-TEST	-0.680	206	-0.300	0.490

In order to determine if the performance of the experimental group was significant, a paired t test was performed using the grades of this group for a comparison between pre-test and post test of the scores. The mean grade for the pre-test of the study was 25.80 (SD= 4.30) compared to 35.30 (SD= 2.41) of the post-test. At $\alpha = .05$ and df = 131, the critical value of the t ratio was less than 0.001 (Table 2). Therefore, the post-test score was significantly different from the pre-test score in the experimental group.

Table 2: Paired Samples Test of pre and post tests in the experimental groups

	t	Df	Mean difference	Sig. (2-tailed
Pair 1 pre-test- posttest	-29.030	131	-9.530	0.000

Similarly, to determine if the performance of control group was significant, a paired t-test was performed using the grades of this group for a comparison between pre-test and post-test of the scores. The mean grade for the pre-test in the study was 25.50 (SD=2.51) compared to 34.65 (SD=3.20) for the post-test. At $\alpha = .05$ and df=136, the critical value of the t ratio was less than 0.001 (Table 3). Therefore, the post-test score was significantly different from the pre-test score in the control group.

Table 3: Paired Samples Test of pre and post tests in the control groups

	T	Df	Mean difference	Sig. (2-tailed
Pair 1 pre-test- posttest EMSAT	-31.511	136	-9.130	0.000

Finally, an independent sample t-test was conducted. The t-test for equality of means was significant (t = -2.007, p = 0.046), indicating significant differences, in the scores between the experimental and control groups. The results of this post-test are summarized below (Table 4):

Table 4: Independent Samples Test of post-test

	T	Df	Mean difference	Sig. (2-tailed
POST-TEST	-2.007	268	-0.700	0.046

Results of this study expand the research on the effects of appropriate programs embedded in a computerized environment for mathematics and natural science (Ravanis, 1994; Dunham & Dick, 1994; Groves, 1994; Solomonidou & Kakana, 2000; Clements, 2002; Clements & Sarama, 2004; Flogaitis et al., 2005).

CONCLUSIONS - DISCUSSION

Results of this study tend to confirm that ICT can be an effective method for teaching selected beginning scientific concepts and skills. Initially, there was no significant difference between the experimental and control group achievements. However, throughout the study, the experimental group had higher achievement than the control group. Despite that, both the experimental and control group had great achievements between the starting and the final level.

Using ICT appropriately with young children for science teaching is vital in early childhood settings. Pupils like to use ICT mostly because it is something new compared to a traditional science lesson. Providing computers in each preschool classroom does not mean that the teacher will incorporate effectively ICT for science teaching. It is essential that early years teachers should be trained in the ability to apply ICT and to interact with the children during the learning process. Attending training programmes and keeping an open mind are the keys to a teacher's success.

The results of this study may be used to further the research of other related studies (Ravanis 1994, Solomonidou & Kakana, 2000; Chen, 2009) with the use of computers in the classroom. The study supports other research conclusions that computers can be an effective method for teaching science concepts (Nastasi & Clements, 1994; Clements, 2000, 2002; Kramarski &Mevarech, 2003; Zaranis & Oikonomidis, 2009; Kalogiannakis, 2010). The first indicative results show that teaching and learning through ICT is an interactive process for children at preschool level and has a positive effect for science education. The educational software for this research provides a way of investigating science concepts that will assist some students to better understand these concepts

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