



Impact of Computer Touch Screen and Mouse Input Devices on Counting Skills of Nursery School Pupils in Benue State, Nigeria

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ABSTRACT

The study is an investigation on the impact of touch screen and mouse input devices on counting skills of nursery school pupils in Benue state, Nigeria. Four specific objectives, four research questions and four null hypotheses guided this study. Quasi-experimental design was adopted for the study. The population comprised of pupils in private nursery schools located within Makurdi metropolis of Benue State, Nigeria. The sample consists of 340 nursery three pupils purposively selected from ten private nursery schools in Makurdi. Two experimental groups were formed and subjected to the use of touch-screen and mouse input devices respectively. The exercise lasted for six weeks using a Pupils' Computer Achievement Test (PCAT) designed by the researchers and validated by experts. Data collected was analyzed using mean, standard deviation and t-test statistics and all the hypotheses were tested at a level of significance of 0.05. The results revealed that use of touch screen input device has advantage over using the mouse in all four tasks undertaken by the participants. The tendency of using more than one finger was found among the children that performed the touch screen operation. Also children that used the mouse input device were found to have experienced certain difficulties in performing clicking and dragging operations. The study generally established evidence of the existence of differences in pupils' achievement in computer usage. It was recommended among other things that all nursery schools should be adequately equipped with micro computers to enable children get acquainted with both mouse and touch screen operations so that preschool children can operate these input devices in a play like activity to facilitate acquisition of early computer skills.

ARTICLE INFO

Article History

Received: August, 2020

Received in revised form: December, 2020

Accepted: January, 2021

Published online: April, 2021

KEYWORDS

Computer use, touch screen, mouse input, counting operation and nursery school pupils

INTRODUCTION

As the 21st century brought about changes, especially those related to technology; with particular reference to the

application of computers in education, renewed expectations and hopes especially for the advancement of teaching and learning process become obvious. Olusanjo

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and Buraimoh (2017) observed that technologies such as tablet, smart phones, e-book, iPad, interactive white boards and other information technological devices are increasingly part of children's education in this 21st century. Hence, computers are at present, a big part of the school system and their applications seem to have cut across all levels of schooling from pre-primary to the tertiary institutions. In the light of this, today, children between the age brackets of 3-8 years are becoming extremely familiar with the operations of a computer. This situation has perhaps provide a new line of thought as to; whether computers at this age are essentially effective in teaching pre-school children certain information and skills that they would not have acquired until at the age of adulthood. In other words, the computer can stimulates the child to perform tasks otherwise not developed until the later stages. Traditionally, preschool or nursery school curriculum involves a variety of activities that try to promote a "balance of social, emotional, physical and intellectual stimulation for the young child.

Nursery education is a component of the Nigeria's Universal Basic Education (UBE) programme which is provided in the context of Early Childhood Education (ECE). As pointed out by Aladejana (2013), early childhood refers to the period between zero to eight years of age (0-8 years), while early childhood education (ECE) is the education given in an educational institution to children from birth to eight years old that is in Day care, Crèche, Kindergarten or Nursery and Lower Primary school. School instructional system is now becoming increasingly technological and as such the computer technology is regarded as being very beneficial to preschool children.

COMPUTER TECHNOLOGY AND EDUCATION

The application of computer to the field of education becomes apparent with the advent of Information and Communications Technology (ICT). According to Ogunlade, Fagbola, Ogunlade and Amosa (2015) ICT implies the application of modern information system to meet human needs through the use of contemporary devices such as the internet which is a global network of computers that connects one or more people together to share vital information all over the world. According to Aladejana (2013) ICT in the context of education usually refers to implementing ICT tools and equipment to support teaching, learning and other cognitive activities. Apagu and Wakili (2015) noted that in Nigeria, the Federal Ministry of Education launched an ICT driven project known as 'school net' which was intended to equip all schools in Nigeria with computers and communication technologies. Considering the role of nursery or pre-primary education to nation building, the use of computer devices in the process on instructional delivery becomes imperative; computer utilization by classroom teachers will enhance effective classroom instruction. However, for effective utilization of ICT related devices (such as computers) in teaching and learning depends on their availability and adequacy as well as the technological competence of the classroom teachers. Thus, integration of computer devices in general and teacher education in particular should be the need of the hour as teaching is becoming one of the most challenging profession in today's society where knowledge is expanding rapidly. As new concepts of learning have evolved, classroom teachers are expected to facilitate learning and make it meaningful to individual learners rather than just to

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provide knowledge and skills. This has therefore accentuated the need for teachers to be computer competent, which simply means possessing the ability to use a wide range of computer aided instructional strategies in imparting knowledge to the younger generations. According to Potter and Darbyshire (2005) and UNESCO (2004) ICT (computer) competencies are concerned with the ability to:

1. Knowing when to apply or develop a particular skill in using an ICT (computer) resource
2. Becoming aware of the reasons for using ICT (computer) and its effect on both users and context
3. Having a critical and confident attitude towards learning with ICT (computer) technology.

Computers and other ICT devices tend to have more positive effects on young children especially when used appropriately and not as a replacement to the first hand, direct, multi-sensory experiences offered by other forms of play that enhance young children's cognitive and social ability (Haughland, 2000). Play is without any doubt main medium through which young children can make sense of, and feel at home in the world. Since the time of the classic Greek philosophers, play has been considered the characteristic mode of behaviour of the young child, an expression of the natural spirit of childhood and thus a key defining feature of childhood stage of life (Fromberg and Bergen, 2006). It is a common knowledge that children's play in the 21st century has been largely influenced by the computer technology and as such, children become more educated and advanced in their learning and development. The predominant site of children's free play has now moved from public space on the street to indoor virtual play. Today, children play within their own

bedrooms where indoor play technologies such as television, video, DVDs, game consoles and computer games have proliferated (Bruce, 2001). The computer-aided play is also promoted as offering adventure, freedom, mental and imaginative activity, in a space where players can navigate within networks (Kane, 2004). Today, assistive technologies such as computers and other related electronic machines play an important role in the successful inculcation of new skills and experiences among young children in early childhood education settings as well as supporting all round learning and development of every preschool child. In classroom learning, the computers can provide children with an instant gratification which they can receive when they push a button and they are rewarded. Thus, since the attention span of the preschool child is very short, when a child hit a button and he or she can predict the outcome, the child then feels comfortable and in control. However, Singer (2006) opined that for any computer assisted learning to flourish as a truly enjoyable, cognitive, and socially adaptive human ability, adult support is necessary. A primary consideration in the use of technology such as computers with children, especially for educational purposes, is whether children are actually able to master the machine. Young children may have difficulty learning from software if they first must learn how to operate the computer (Siraj-Blatchford, 2003). A study by Lindsay (2006) has shown that the keyboard can present a very difficult interface for pre-school children. Therefore, in an attempt to improve that interface, this study seek to find out and establish which between the mouse (i.e. indirect pointing) input device and touch screen (i.e. direct pointing) input device may be a more effective input device for young children.

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Computers Technology and Early Childhood Learning

It is very important for learning to meet children's needs, to respect their personalities and care about the quality of learning environment established for the children. Children are like philosophers; curious to learn and never satisfied. Therefore, the new thrust in early childhood education should be to integrate technological tools such as computers in order to help children carry out many of the things that can promote their cognitive, emotional, social and developmental needs. Thus, as pointed by Olusanjo and Buraimoh (2017) early childhood education is now at a crucial moment as new technologies offer opportunities for teaching and learning. According to Aladejana (2013) ICT in particular, deals with the use of electronic computers and computer software to process, convert, store, transmit and retrieve information with the ultimate aim of increase the effectiveness of teaching and learning. In the light of these realities, ICT tools such as computers can be used to deliver content and activities that support strong and productive emotion for children. Thus, computers could eventually serve as the environment and the tools for child's development. Computer can help to expand access to education because of its ability to transcend time and space. The combination of texts, sounds, colours and moving objects can be used to provide challenging and authentic content that will engage and motivate children in the learning process. The use of computers for classroom instructions can help children observe, fix, memorize, describe and share their impressions with peers and other adults. As pointed out by Clements (2002) that computers have the tendencies of assisting young children to develop mathematical ideas, provided the classroom teachers are

able to choose and use proper software tools to explore mathematical concepts and relationships, by way of scaffolding young children's thinking..

Early Childhood Education (ECE) has now been well recognized by stakeholders in education as a very essential stage in the process of building solid foundation for the all round development of children in contemporary human societies. The period from 1980 to date has witnessed a rapid advancement of computers and digital media prevalent within the education sector. Literatures abound on computer usefulness especially in the area of brain development of children and the environments surrounding their learning. The researchers observed that in the last few years there has been a growth in the desires of parent to send their children to quality early childhood education settings, where ample opportunities exist for making children become capable, competent, and informed about the educational role and potential of modern electronic technologies. However, limitations in the use of computers to strengthen the cognitive, communicative and psychosocial competencies of nursery school children may affect parental hopes and desires, thereby raising a growing concern among parents in urban communities. These growing concerns are however not uncommon in Benue state. The researchers therefore felt that there is the need for a study to investigate ways of using the computer machine to build children's learning experiences and interests that will raise the hope of families on usage of modern ICT devices in early childhood education practices and this has formed the basis for this study.

Objectives of the Study

1. To find out if there is significant difference in the Left-Right

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Counting performance of pupils exposed to touch-screen operation and those exposed to mouse operation.

2. To find out if there is significant difference in the Scattered Counting performance of pupils exposed to touch-screen operation and those exposed to mouse operation.
3. To find out if there is significant difference in the Corner Counting performance of pupils exposed to touch-screen operation and those exposed to mouse operation.
4. To find out if there is significant difference in the Stacking performance of pupils exposed to touch-screen operation and those exposed to mouse operation.

Research Questions

The study has the following research questions:

1. Does significant difference exist in the Left-Right Counting performance of pupils exposed to touch-screen operation and those exposed to mouse operation?
2. Does significant difference exist in the Scattered Counting performance of pupils exposed to touch-screen operation and those exposed to mouse operation?
3. Does significant difference exist in the Corner Counting performance of pupils exposed to touch-screen operation and those exposed to mouse operation?
4. Does significant difference exist in the Stacking performance of pupils exposed to touch-screen operation and those exposed to mouse operation?

Research Hypothesis

The study has the following null Hypotheses:

1. There is no significant difference in the Left-Right Counting performance of pupils exposed to touch-screen operation and those exposed to mouse operation.
2. There is no significant difference in the Scattered Counting performance of pupils exposed to touch-screen operation and those exposed to mouse operation.
3. There is no significant difference in the Corner Counting performance of pupils exposed to touch-screen operation and those exposed to mouse operation.
4. There is no significant difference in the Stacking performance of pupils exposed to touch-screen operation and those exposed to mouse operation.

METHODOLOGY

The study is a Quasi-experimental by design. The population of the study comprises of preschool children in private nursery schools in Makurdi metropolis of Benue state, Nigeria. The researchers purposefully selected 10 schools from the various private nursery schools located within Benue metropolis. A total of 34 nursery three male and female pupils were selected through systematic sampling from each of the 10 nursery schools (which involved choosing children based on their background knowledge of computer) and this gave a total of 340 children used as sample. In each selected school two intact classes or treatment groups were formed; one group of pupils exposed to the touch-screen operation and another group of with pupils exposed. The justification of using a considerably large number of children in nursery three is that, the nursery three class

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is a “transition class” after which the children are expected to move to the primary school level. An instrument constructed by the researchers and titled: Pupils Computer Achievement Test (PCAT) was used for data collection in this study. The instrument consists of four tasks which were carried out in the experiment and which involved very simple counting activities. Counting was considered because it is an activity that preschool children practiced very well and enjoy especially when use in a play like activity. The instrument was validated by some experts in the field of early childhood education and ICT in the Faculty of Education University of Uyo, Akwa Ibom state. After validation, corrections were made and the clean copy of the instrument was administered to the pupils by the researchers with the help of some teachers in each of the selected schools. The mouse and touch screen interfaces were presented on microcomputers. Thus, the two groups received instruction via the computer, one group using touch-screen and the other using mouse input device. In each group, children received one individual 20 minute session per week, for 6 weeks simultaneously. After being exposed to treatments the two groups of children had their performances analysed using the mean and standard deviation and t-test statistics.

Treatment Procedure

There were four tasks in the experiment: Left-Right Counting, Scattered Counting, Corner Counting and Stacking. The first three tasks were meant to test children’s ability in selecting an object (i.e. positioning and confirmation). The fourth task required that objects be moved on the screen by children and this provides room for adding of subcomponents of dragging and releasing. In all the tasks, the objects

were white squares displayed on a black screen. Each of the tasks consists of three trials. In the first trial of each task, the experiment demonstrated what the participants were supposed to do. The two trials that followed were experimental trials. The computer’s report file that was automatically created for each participant will show whether the participant selected the right object, selected a blank space (i.e. miss) or selected another object (i.e. wrong object). The main measure in the experiment was the scores awarded.

Left-Right Counting: In the Left-Right Counting task, the initial display was a row of ten white squares with the square on the extreme left highlighted. If a child touch or click on that square, it will returned to white and will have the number ‘1’ printed on it, and then the second most left square (the one next to the first) will be highlighted and so on. At the end of the trial, the whole row of squares will be labeled from left to right with numbers ‘1’ to ‘10’.

Scattered Counting: Scattered Counting was exactly the same as Left-Right counting operation except that the ten white squares were randomly scattered all over the screen. The squares were sequentially highlighted in a “random” order. All of the participants will have a view of the same three orders for the three trials. At the end of each trial, like the Left-Right counting, all of the squares will turn to white and labeled with a number.

Corner Counting: The objects in the corner counting task behaved the same way as in the first two tasks. However, there are only four objects; one in each corner of the screen. Each of the two experimental trials in this task has been composed with three screens that tested different movements across the display. The sequence of highlighting usage will cause the participant child to select objects in each of the following directions: up, down, left, right,

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diagonal up-right, diagonal down-right, diagonal up-left, diagonal down-left. The Corner Counting task was designed to test the children’s ability to select objects moving in these different directions; because there are research findings establishing that young children usually experience problems in processing and producing oblique lines.

Stacking: The Stacking task required the child to move objects. The initial stacking display showed five white square objects, numbered from 1 - 5, arranged on the screen in an invisible cross ('+') pattern. The object numbered '1' is at the center point, while the four others are at the ends of the cross. None of the objects was highlighted. The child had to move the objects to the center according to the numerical order movement of the objects on the screen without any constrain. If the child moved all of the objects to the center, a stack will be formed and the next screen will be presented. The two trials in this task were both composed of two screens of

stacking, one with objects arranged in a '4' and the other with objects arranged in an 'x'. These arrangements allowed the same comparison among different line orientations (down, up, right, left, up/right, up/left, down/left) as was done in the corner counting.

RESULTS

In this study, four null hypotheses were formulated and tested at a level of significance of 0.05. Also, as already pointed out, the pupils involved in this study were divided into two groups i.e. those exposed to touch-screen operation and those exposed to mouse operation. Therefore, in the result analysis, the performances of the participants were considered based on the groupings.

H₀₁: There is no significant difference in the Left-Right Counting performance of pupils exposed to touch-screen operation and those exposed to mouse operation.

Table 1: Differences in the Left-Right Counting performance among pupils in the two groups

Groups	N	X	SD	Df	T – cal	T–Crit	Result	Decision
Touch Screen	170	56.02	8.655	338	12.490	1.96	Sig	Rejected
Mouse operation	170	42.52	11.122					

SPSS Output @ 0.05

The result on table 1 shows that the calculate value of t is greater than critical table value of t at 0.05 level of significance and degree of freedom of 338. The result indicates the existence of a significant difference in the performance of the two groups in the Left-Right Counting exercise. The null hypothesis is therefore rejected; meaning that there is significant

difference in the performance of the two groups of pupils.

H₀₂: There is no significant difference of performance in Scattered Counting task between pupils exposed to touch-screen operation and those exposed to mouse operation.

Table 2: Differences in Scattered counting performance among pupils in the two groups

Groups	N	X	SD	Df	T – cal	T–Crit	Result	Decision
Touch Screen	170	54.45	9.701	338	11.340	1.96	Sig	Rejected
Mouse operation	170	38.65	15.367					

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SPSS Output @ 0.05

Table 2 shows that the calculate value of t is greater than critical table value of t at 0.05 level of significance and degree of freedom of 338. The result indicates the existence of a significant difference in the performance of the two groups in Scattered Counting exercise. The null hypothesis is therefore rejected; meaning that there is

significant difference in the performance of the two groups of pupils.

H₀₃: There is no significant difference of performance in Corner Counting task between pupils exposed to touch-screen operation and those exposed to mouse operation.

Table 3: Differences in Corner counting performance among pupils in the two groups

Groups	N	X	SD	Df	T – cal	T–Crit	Result	Decision
Touch Screen	170	62.76	15.200	338	5.834	1.96	Sig	Rejected
Mouse operation	170	53.61	13.689					

SPSS Output @ 0.05

The result on table 3 shows that the calculate value of t is greater than critical table value of t at 0.05 level of significance and degree of freedom of 338. The result indicates the existence of a significant difference in the performance of the two groups in Corner counting exercise. The null hypothesis is therefore rejected;

meaning that there is significant difference in the performance of the two groups of pupils.

H₀₄: There is no significant difference of performance in Stacking task between pupils exposed to touch-screen operation and those exposed to mouse operation.

Table 4: Differences in Stacking performance among pupils in the two groups

Groups	N	X	SD	Df	T – cal	T–Crit	Result	Decision
Touch Screen	170	54.45	9.701	338	11.340	1.96	Sig	Rejected
Mouse operation	170	38.65	15.367					

SPSS Output @ 0.05

Table 4 shows that the calculate value of t is greater than critical table value of t at 0.05 level of significance and degree of freedom of 338. The result indicates the existence of a significant difference in the performance of the two groups in Stacking exercise. The null hypothesis is therefore rejected; meaning that there is significant difference in the performance of the two groups of pupils.

touch screen and mouse computer input devices, the touch screen was superior in facilitating their achievement when using computer as established by the analysis of all the hypotheses tested in the study.

Testing of the first null hypothesis (as shown on table 1) reveals the existence of significant difference in the performance of the two groups of children in the Left-Right Counting exercise. This difference also reflects in the mean score, where pupils exposed to touch-screen operation, seem to be better up with a mean of 56.02 against the pupils exposed mouse operation, obtaining a mean score of 42.52.

DISCUSSION OF FINDINGS

The results of the experiment showed that although the preschool children were capable of using both the

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The result reveal that children required less time in carrying out computer operations using the touch screen input as compared to using the mouse input device. It also appeared that almost all the children exposed to the mouse input device found it more difficult to operate. This result is in line with the observation of Bayhan et al (2002) who found that selecting an object just requires positioning and confirmation whereas moving the object adds the subcomponents of coordinated dragging and releasing. Brooker and Siraj-Blatchford (2002) found that when children require selecting and/or moving an object over a diagonal path they might have more difficulty than when they had to move such object across the screen horizontally or vertically.

Testing of the second null hypothesis (as shown on table 2) indicates the existence of a significant difference in the performance of the two groups of children in Scattered Counting task. The difference also reflected in the mean scores of the two groups of pupils with pupils exposed to touch-screen operation performing better with a mean of 54.45 compared to pupils who have been exposed mouse operation, obtaining a mean score of 38.65. Based on this, it should be noted that, the most important aspect of touch screen operation for children lies in the fact that its space is united with the space on the display screen. As such, the children could select an object merely by pointing at it; they could move the object just by passing their finger along the desired path on the screen. While in contrast, the mouse required the child to map from a space on the desk to the space on the screen which however tends to provide room for some problems to occur. For example, when the children went to position the cursor, they may have mapped correctly from the cursor to the screen, but because many of them

turned the top of the mouse in the direction they were moving it, they had difficulty putting the cursor on top of the object.

Testing of the third null hypothesis (as shown on table 3) signifies the existence of a significant difference in the performance of the two groups of children in Corner counting exercise. The difference also reflected in the mean scores of the two groups where the pupils exposed to touch-screen operation appeared to have performed better with a mean of 62.76 compared to pupils who have been exposed mouse operation and obtained a mean score of 53.61. This finding of the study reveals that children show practice effect over the treatment using the touch screen input operation and that with sufficient practice and experience, the children would gradually become proficient with the mouse as they were with the touch screen. This finding therefore, lends support to Liu (1996) idea that when preschool aged children have control over software choices, they tend to engage in the activity longer and they do not seem to become bored as easily which in turn makes them become more experienced practitioners.

Lastly, testing of the fourth null hypothesis (as shown on table 4) indicates the existence of a significant difference in the performance of the two groups of children in Stacking exercise. The difference also reflected in the mean scores obtained from the performance of the two groups of pupils and pupils who performed the staking task using the touch-screen input system performed better with a mean of 54.45 compared to pupils who carried out the task using the mouse input device having a mean score of 38.65. This result is an indication that at the initial stage, it may be much easier for children to start using software that can be operated with the touch screen input system instead of the mouse input device. In this connection, the

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touch screen input system is very much likely to put the computer at the disposal of more children.

CONCLUSION

Based on the result of this study, the researchers concluded that use of computers in nursery schools is very essential. The benefits that can be derived from teaching children with computers are numerous. Inculcating new ideas to young children and increasing their learning abilities could be best achieved through the computer usage. It is an established fact that preschool pupils who are opportune to have some sort of computer experiences are more likely to perform better academically than those who do not have such experiences. It is however regrettable that in the Benue state, access to modern technologies such as computers has been largely limited only to children in some nursery schools having ICT tools for instructional purpose.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are:

1. Proprietors of private nursery schools and day care centers in Benue state should ensure that their preschool teachers are adequately trained on how to use play-way-method to involve pupils during computer lessons so as to enhance computer skills of the children entrusted to them.
2. Proprietors of private nursery schools in the state should equip their schools with adequate modern micro computers, to enhance learners' computer operational skills.
3. Nursery school teachers in the state should be conscious in programming learning contents which are computer – aided, by taking into consideration the age of children in their care.

4. Nursery school teachers in the state should note that, computers are wonderful electronic machines that perform wonderful electronic operations through wonderful human intervention as such, the effects of computers on young children can be relatively positive thus, the time spent with or by children on this new technology must be regulated.
5. The Benue state government should equip all public primary schools having nursery and kindergarten classes for early childhood education.

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