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Incorporation of Electronic Educational Games and Mental Skills Development in Preschoolers in Public Early Child Care Centres in Rivers State

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Abstract
The study examined the relationship between the incorporation of electronic educational games and mental skills development in preschoolers in public early child care centres in Rivers State. The study had two objectives, two research questions, and two corresponding null hypotheses. A correlational research design was adopted, targeting a population of 7,589 preschoolers in nursery three (transition class) in 521 public early child care centres in Rivers State. A sample of 755 preschoolers was selected using a stratified random sampling method. Data were collected using two researcher-designed instruments: The Brain Games Observational Checklist (BGOC) and the Mental Skills Checklist (MSC). The instruments were validated by three experts in Early Childhood/Primary Education, yielding reliability coefficients of 0.83 and 0.78, respectively, established using the split-half method and the Spearman formula. The collected data were analyzed using descriptive statistics (mean and standard deviation) to answer the research questions and inferential statistics (Pearson's product-moment correlation and multiple regression analysis) to test the null hypotheses at a 0.05 significance level. Findings revealed a significant positive relationship between the use of electronic educational games and the enhancement of mental skills, particularly in counting and reasoning. However, memory games exhibited a weaker relationship with counting due to potential distractions. Based on the findings, recommendations include the modification of electronic educational games to incorporate local content and ensuring that supervisors examine all game materials for age-appropriateness before implementation in early child care centres.

Keywords: Electronic Educational Games, Mental Skills Development, Preschoolers, Counting Skills, Reasoning Enhancement

Introduction

Electronic educational games are special kinds of games that exercise the mind while the play is ongoing and through that exercises the body and improve one's intelligence. Shafer (2016) described them as a set of quick, fun activities that build core executive function and self-regulation skills. Karapetsas et al. (2014) noted that electronic educational games can be described as games that employ electronics to create an interactive system with which a player can play. The electronic device used can be a computer, a gaming device or a mobile phone. It involves the presentation of a variety of shapes and colours to children while they are asked to either match the shapes or colours or describe what is presented within a time limit. Mental skills such as counting and reasoning are essential in preparing preschoolers for future learning; therefore, they have to be developed before transitioning to the formal education system. Teaching deep thinking and mathematical solutions aimed to help children overcome the phobia associated with mathematics that usually plague people in the subject. Early childhood education ideas and activities are laden with activities that encourage counting and other important mental skills that are useful in learning. Mathematically speaking, numeracy skills are fundamental to the child's calculation capacity and further scientific knowledge acquisition. It constitutes the base for scientific exploration and adequate functioning in the ICT-driven contemporary world. This skill can be

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developed using several electronically played educational games such as colour word, visual game, optical illusion, memory games and shadow brain teaser.

Optical Illusion Puzzle is one of the many electronic games used to enhance mental skills in children. The puzzle aimed at making counting and mathematical skills easy for children by providing a reason to think deeply and provide solutions to mathematical problems. Gonzales (2019) described optical illusions as a style of visual art that creates images that look as if they are moving or blurring, using shapes, colours and patterns in a special way that gives the viewer the impression of movement or that there are hidden images, flashing and vibrating patterns. Some even show swellings, bends or patterns that are twisted out of shape. He also claimed that optical illusions help to make the brain sharper by making individuals deeply think about how something can be possible, helps discern the working of the human brain and the intriguing part of the brain when it exposes the difference between 'looking' and 'seeing' (Gonzales, 2019). Optical illusion provides the viewer with lots of food for thought which escalates as well as enhances ones thinking process and in the case of the early child, towards counting what the art presents (Gonzales, 2019; Career guide, 2020) likened counting or numeracy skill to the ability of the child or learner to use, interpret and communicate mathematical information for the essence of solving life problems. It is associated with the knowledge of basic mathematical skills like addition, subtraction, division and multiplication. For Sophian (2009), counting skill is the dexterity of qualitative reasoning that is exercised in addition, subtraction, multiplication and division. Going by this line of description, counting skills then becomes the lubricant of the national and international quest for multiple advancements in scientific discoveries. In some quarters, it is the hope for an improved economy. Thus, it may not be unconnected with the national high premium placed on science subjects in the nation's institutions of learning, especially since science students cannot excel without quality numerical skills.

Another major method of inculcating this skill into children is through the electronic nursery game of number puzzle. In playing this game, full view of an elephant is exposed on the television screen and the children are asked to count and identify the number of legs of the elephant. This puzzle is used to enhance the children's counting skills and other skills that may be developed from the use of the game. This idea corroborates the opinion of Sophian (2009), who adduced that the consideration of children's numerical knowledge acquisition provides an important foundation for the establishment of early childhood education. In tune with its necessity, the use of a scientific approach based on the overwhelming ICT and scientific revolution facilitates a headway. Counting is a typical brain exercise that can be achieved in educational games with learning activities when started at the appropriate age. The New Jersey State Department of Education Preschool Teaching and Learning Standards (2014) also commented on supportive, developmentally appropriate teaching practices when they said that it produces positive outcomes in preschoolers, with long-lasting implications for the future. Thus, with the early childhood education aimed at stimulating emergent skills that maximize young children's learning and development as well as future school success, it becomes necessary to provide them with experiences that build a better foundation for current and future school success in counting, to ensure as well as promote understanding of mathematical concepts. This may explain the brain behind the introduction of teacher-made games by Gayle's Preschool Rainbow (2020), which is claimed to aid children in improving their counting skills. Some of these teacher made games are birthday cake counting game, ice cream cone match game, math muffin tins, caps and cans, number hunt, beanbag fun, comparisons, apples, Christmas, counting finger play, counting speckled frogs, the donut shop game reinforcing address and telephone numbers to mention but few. All these games are non-electronic educational games, yet they can attract children's attention and provide fun learning experiences for them. However, the fun is greater when the games are played electronically as the children are motivated to stay longer with electronic games, being that they like the virtual world. If preschoolers in public early child care centres in Rivers State engage with electronic educational games that incorporate counting activities, their reasoning and mental skills development can be enhanced through interactive problem-solving and numerical challenges.

Formal education is aimed at the total development of the child or the learner. Among these tripartite spheres of human development, the cognitive domain which (Bygraves, 2019) defined as the mental process by which external or internal input is transformed, reduced, elaborated, stored, recovered and used tends to occupy the central focus of human development and involves a variety of functions such as perception, attention, reasoning, planning and execution of actions involve in problem solving. Though this does not undermine the importance of the affective and psychomotor domains, the cognitive domain constitutes the major facilitating domain of human knowledge acquisition. This idea, which may not be far from the truth, stems from the fact that every process of human function, including knowledge acquisition, emanates from the cognitive domain as observed by the

researcher. This is why it is pertinent that all the skills involved in the proper operation of this domain need to be enhanced for ultimate functioning. Be that as it may, skills enhancement does not occur in a vacuum. Skills are gained from experience or training, which in some cases may involve some hands-on activities. Acquisition of mental skills cannot just happen but with brain exercises. This is when electronic educational games such as those used in this study, of which shadow brain teaser is one, actively come into play. The use of a shadow brain teaser (like other games in this study) in the enhancement of mental skills in children is highly goal-oriented as it touches most aspects of the mental skills. The game can be played by one or more children at a time. In the shadow brain teaser puzzle, the players are presented with one picture or an image and another four similar-looking pictures or images in a shadow (Kumar, 2018). Then, the player or players are requested to find the correct picture or image in the shadow. However, there is only one shadow that exactly matches with the given picture or the puzzle image and the player is expected to identify the same. Observation and identification of the similar image involves the exercise of all the mental skills under study. The same goes for other games in this category, which are taugh to enhance one mental skill or the other, such as the Colour Words, Visual Games (spot the difference) to mention but few; where the players are expected to identify variations in images presented to them or the different colours in some of the games motivating the preschoolers to learn and benefit from educational programmes (Adawiah & Intan, 2012).

Associated with the cognitive domain are the different mental skills of reasoning or the intellectual capacity of the child or learner. In the opinion of Kelly (2019), mental skills are brain-based skills which every individual needs to carry out any task or any activity of daily living. He also opined that the ability to carry out both simple and complex tasks has nothing to do with the level of knowledge that an individual has acquired but rather with how people learn and remember things, go about solving individual and collective problems and pay attention to vital issues to the use of the reasoning faculty. Arora (2018) identified reasoning as one of the higher-level mental skills and described it as the ability to think through problems and proffer solutions to them. While attention is seen as the power to focus on an aspect of the environment, forgetting others (Mazarin, 2013). It is pertinent to note that when kids learn to reason, they become able to apply actual thinking whenever it is necessary (Arora, 2018). Reasoning skill is the therapy of problem solving, and it's fundamental to children's development and knowledge acquisition; hence, it acts to improve the child's competencies and for future academic success. Reasoning is critical in the activities of daily living as it involves the ability to infer, compare results and establish relationships between two or more things. This makes one see cause-effect relationships in events as he tries to solve a problem. It is also needed to filter the information that bombards children's sense organs daily, to determine what is right or wrong, as well as to know and make the right choices depending on the developmental stage of the child. For instance, a two-year-old child presented with a chocolate in a cup and spoon will only eat the chocolate and drop the cup and spoon.

Without losing sight of the children's age bracket involved, cognitive stimulation can be done to develop these very important skills in children. Another method that can be used to stimulate cognition vis-a-vis mental skills is the numerous educational games, some of which may involve a step-by-step activity presented as exercises that require correct identification of the sequence of performing a task or identification of some key elements of an object. Matching and sorting games using coloured balls, cards, and toys are other nursery games for improving children's reasoning. Galinsky (2010) pointed out that today's rapidly changing world requires children to learn apart from root learn, do many more things like make sense of information they hear and generate higher order thinking of analyzing, contrasting and making inferences. Games have been found to increase smartness in mammals. This is seen in a study carried out to assess the effectiveness of play on brain development in rats. It was discovered that rats that were reared in a simulated environment with plenty of toys had bigger brains and were able to manipulate their ways more intelligently than those raised in a deprived environment (Gwen, 2014). Also, Eichenbaum et al. (2014) observed that games these days are much more than simple fun and entertainment for people as they now offer new methods of teaching children complex mental skills. Thus, putting educational games into action will, amidst entertainment, foster reasoning that focuses on problem solving, improved self-control and knowledge pursuit that will span all domains of learning. Children need the right nudge to start thinking right. When the foundation for active reasoning is laid at the preschool stage, the child will develop with it and begin to grasp everything quickly as he progresses in his learning. *With this skill developed at the early stage, preschoolers will become* elastic in their thinking process and well open to changes that they will meet as they transit to the later levels of development, which will ensure a more successful outcome. This has made electronic educational games relevant in the inculcation of this all-important attribute, especially as the play strategy is the official method for implementing the early childhood education curriculum.

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Statement of the Problem

The early years of a child's development are crucial for cognitive growth, particularly in acquiring foundational skills such as counting and reasoning. Research has shown that interactive learning experiences, including electronic educational games, can play a significant role in enhancing these skills. However, in public early child care centres in Rivers State, traditional teaching methods remain predominant, often relying on rote memorization rather than interactive and engaging learning approaches. This raises concerns about the effectiveness of existing teaching strategies in fostering preschoolers' mental skills development. Despite the growing global adoption of electronic educational games as a tool for enhancing cognitive abilities in young learners, there is limited empirical evidence on their impact within the Nigerian context, particularly in Rivers State. It remains unclear whether specific types of electronic educational games such as Colour Words, Visual Games (Spot the Difference), Shadow Brain Teasers, Memory Games, and Optical Illusion have any significant relationship with preschoolers' ability to count and reason effectively. Furthermore, while studies suggest that gamified learning environments can improve engagement and cognitive performance, there is insufficient research on how these tools influence early childhood education outcomes in public institutions. Given the need for innovative and effective teaching methods to support preschoolers' mental skills development, this study seeks to examine the relationship between the incorporation of electronic educational games and the improvement of counting and reasoning skills among preschoolers in public early child care centres in Rivers State.

Aim and Objectives of the Study

The study aims to examine the relationship between incorporation of electronic educational games and mental skills development in preschoolers in public early child care centres in Rivers State. Specifically, the study seeks to:

1. Determine if (Colour Words, Visual Games (spot the difference), Shadow Brain Teasers, **Memory Games &** Optical Illusion) has any relationship with improvement of counting in preschoolers in public early child care centres in Rivers State.
2. Identify the relationship between (Colour Words, Visual Games (spot the difference), Shadow Brain Teasers, **Memory Games &** Optical Illusion) and the enhancement of reasoning among preschoolers in public early child care centres in Rivers State.

Research Questions

The following research questions were posed to guide the study:

1. What is the relationship between the use of electronic educational games (Colour Words, Visual Games, Shadow Brain Teasers, **Memory Games &** Optical Illusion) and improvement of mental skills in terms of counting in preschoolers in public early child care centres in Rivers State?
2. What is the relationship between the use of electronic educational games (Colour Words, Visual Games, Shadow Brain Teasers, **Memory Games &** Optical Illusion) and the enhancement of mental skills in terms of reasoning among preschoolers in public early child care centres in Rivers State?

Hypotheses

The following hypotheses were tested at a 0.05 level of significance:

$H0_1$: There is no significant relationship between the use of electronic educational games (Colour Words, Visual Games, Shadow Brain Teasers, Memory Games & Optical Illusion) and improvement of mental skills in preschoolers in terms of counting in public early child care centres in Rivers State.

$H0_2$: There is no significant relationship between the use of electronic educational games (Colour Words, Visual Games, Shadow Brain Teasers, Memory Games & Optical Illusion) and enhancement of mental skills in terms of reasoning among preschoolers in public early child care centres in Rivers State.

Methodology

The correlational research design was adopted for the study to establish the relationship between the incorporation of electronic educational games and the development of mental skills (counting and reasoning) among preschoolers in

public child care centres in Rivers State. The design was relevant in this study because the researcher wanted to establish the relationship between the two major variables under study. The study was conducted in Rivers State. All the 7589 registered preschoolers in nursery three (transition class) in the 521 public early child care centres in the state made up the population for this study. This population was found in all the public early child care centres in the State (Rivers State Universal Basic Education Board, 2018). 755 preschoolers constituted the sample of the study, selected through the stratified random sampling method. To select this sample, the entire 23 local government areas (LGA) in the state were stratified into three strata of urban, rural and riverine, based on their topography. Then 20% of the LGAs in each stratum were randomly selected; this yielded two local government areas from each stratum, giving a total of six local government areas that house 177 public early child care centres. Two instruments, the Brain Games Observational Checklist (BGOC) and Mental Skills Checklist (MSC), were used to generate data for the study. Then, an electronic educational game, which are a set of games that are presented electronically to the children, for play, entertainment as well as learning were used as stimulus. Mental Skills Checklist (MSC), a researcher-designed instrument containing 18 items covering the variables under study, was used to obtain information on the children's performance as they responded to the actions and questions posed in the games during the study. The instrument has a 3points option of 3, 2 and 1 for the responses based on the performance of the children while watching the games. If the child performs the expected action all the times, he scores 3, if sometime he scores 2 and if he did not perform the action at all he scores 1. The Brain Games Observational Checklist (BGOC), also a researcher-designed instrument, was also used to obtain data on the children's performance while playing the games. The instrument contained 25 items, measuring the activities carried out by the children and also had a 3-point score of 3 when the children perform the actions very easily, 2 when actions were just performed easily and 1 when they hardly perform the actions.

The instruments were shown to the researcher's supervisor and two other experts in the department of Early Childhood/Primary Education, who made corrections and very useful inputs. The same was effected before the pilot testing of the instruments was done. The instruments were finally approved by the research supervisor for used as a tool for data collection. The split-half method was used to determine the reliability of the instruments. A total of 30 copies of the instruments were administered on 30 preschoolers in a public early child care centre in Andoni Local Government Area, who were not part of the study. The items of the instruments shared into two based on even and odd numbers items and were first correlated using the Pearson Product Moment Correlation, then the Spearman formula established the reliability of the instruments to obtain indices of 0.83 and 0.78 for Brain Games Observational Checklist (BGOC) and Mental Skills Checklist (MSC) respectively. The instruments were administered on a one-on-one basis by the researcher and five trained early childhood experts. The letter of introduction was submitted ahead of time to the head teachers and the caregivers in the different schools, and a particular date for the data collection was chosen. On the agreed date, the researcher and assistants arrived at the centre with the instruments, which included a laptop, overhead projector and a piece of white material that acted as a screen. The participants were grouped into three in all the schools visited to enable the assessors to have smaller groups to deal with. The games were then projected on the screen for the children to watch and play with while the researcher and assistants observed and ticked the checklists. At the end, all the children in the classes used were appreciated, and all instruments and data were gathered and taken home for coding and analysis. All the instruments were screened for completeness before data entry and analysis. Quantitative data from the instruments were coded and entered using the Excel data entry program. Research questions were answered using Pearson Product Moment Correlation, while hypotheses were tested using multiple regression analysis.

Results

Research Question 1: What is the relationship between the use of games (Colour Words, Visual Games (spot the difference), Shadow Brain Teasers, **Memory Games &** Optical Illusion) and improvement of mental skills in preschoolers in terms of counting in public early child care centres in Rivers State?

Table 1: Summary of Pearson's correlation matrix on the relationship between the use of games and improvement of mental skill (counting) in preschoolers in public early child care centres in Rivers State

SN	Variable	N=753	1	2	3	4	5	6
1	Visual Game	Pearson Correlation	1					
		Sig. (2-tailed)						
2	Optical Illusion	Pearson Correlation	.698**	1				
		Sig. (2-tailed)	.000					
3	Shadow Brain Teaser	Pearson Correlation	.705**	.681**	1			
		Sig. (2-tailed)	.000	.000				
4	Colour words	Pearson Correlation	.415**	.040	.401**	1		
		Sig. (2-tailed)	.000	.277	.000			
5	Memory Games	Pearson Correlation	.429**	.333**	.318**	.317**	1	
		Sig. (2-tailed)	.000	.000	.000	.000		
6	**Counting**	**Pearson Correlation**	**.594****	**.406****	**.494****	**.308****	**.065**	**1**
		Sig. (2-tailed)	.000	.000	.000	.000	.075	

**. Correlation is significant at the 0.01 level (2-tailed).

The result from Table 1 shows the summary of Pearson's correlation matrix on the relationship between the use of games use of games (Colour Words, Visual Games (spot the difference), Shadow Brain Teasers, **Memory Games, &** Optical Illusion) and improvement of mental skill (counting) in preschoolers in public early child care centres in Rivers State. It shows that there were positive and strong relationships between the use of games and enhancement of mental skill in terms of counting in preschoolers in public early child care centres in Rivers State (Colour Words, r=0.308, Visual Games (spot the difference), r=0.594 Shadow Brain Teasers, r=0.494, & Memory Games, r=0.065). There is, however, a weak relationship between Optical Illusion (r=0.065) and improvement of mental skill (counting) in preschoolers in public early child care centres in Rivers State.

Research Question 2: To what extent do games (Colour Words, Visual Games (spot the difference), Shadow Brain Teasers, Memory Games & Optical Illusion) lead to the enhancement of mental skills in terms of reasoning among preschoolers in public early child care centres in Rivers State?

Table 2: Summary of Pearson's correlation matrix on the relationship between games and enhancement of mental skill (reasoning) among preschoolers in public early child care centres in Rivers State.

SN	Variable	N=753	1	2	3	4	5	6
1	Visual Game	Pearson Correlation	1					
		Sig. (2-tailed)						
2	Optical Illusion	Pearson Correlation	.698**	1				
		Sig. (2-tailed)	.000					
3	Shadow Brain Teaser	Pearson Correlation	.705**	.681**	1			
		Sig. (2-tailed)	.000	.000				
4	Colour words	Pearson Correlation	.415**	.040	.401**	1		
		Sig. (2-tailed)	.000	.277	.000			
5	Memory Games	Pearson Correlation	.429**	.333**	.318**	.317**	1	
		Sig. (2-tailed)	.000	.000	.000	.000		

6	**Reasoning**	**Pearson Correlation**	**.673****	**.444****	**.375****	**.278****	**.365****	**1**
		Sig. (2-tailed)	.000	.000	.000	.000	.000	

**. Correlation is significant at the 0.01 level (2-tailed).

The result from Table 2 shows the summary of Pearson's correlation matrix on the relationship between **the** use of games (Colour Words, Visual Games (spot the difference), Shadow Brain Teasers, Memory Games, & Optical Illusion) and the enhancement of mental skill (reasoning) among preschoolers in public early child care centres in Rivers State. It shows that there were positive and strong relationships between games and the enhancement of mental skills in terms of reasoning in preschoolers in public early child care centres in Rivers State. (Colour Words, r=0.278, Visual Games (spot the difference), r=0. 673, Shadow Brain Teasers, r=0.375, Memory Games, r=0.365 & Optical Illusion, r=0.444)

Hypotheses Testing

$H0_1$: There is no significant relationship between the use of the use of games (Colour Words, Visual Games (spot the difference), Shadow Brain Teasers, **Memory Games &** Optical Illusion) and improvement of mental skills in preschoolers in terms of counting in public early child care centres in Rivers State.

Table 3: Summary of multiple regression analysis on the relationship between the use of games and improvement of mental skill (counting) in preschoolers in public early child care centres in Rivers State.

Model	R=.646, Adjusted R-squared=.413 F5, 747=106.762, p=0.00	**Unstandardized Coefficients** **B**	**Std. Error**	**Standardized Coefficients** **Beta**	**t**	**Sig.**
1	(Constant)	.548	.078		7.032	.000
	Visual Game(X_1)	.719	.061	.568	11.757	.000
	Optical Illusion (X_2)	-.003	.036	-.004	-.081	.935
	Shadow Brain Teaser (X_3)	.123	.041	.137	3.000	.003
	Colour words (X_4)	.082	.031	.097	2.657	.008
	Memory Games (X_5)	-.194	.024	-.252	-7.926	.000

a. Dependent Variable: Counting, $\boldsymbol{Y= .548-719X_1+.003X_2+.123X_3+.082X_4-.194\ X_5}$

The result from Table 3 shows the summary of multiple regression analysis on the relationship between the use of games and improvement of mental skill (counting) among preschoolers in public early child care centres in Rivers State. The result showed that there is a significant relationship between the use of games and improvement of mental skill (counting) among preschoolers in public early child care centres in Rivers State (R=0.646, F=106.762, p=0.00). The Adjusted R-squared of 0.413 showed that the when the independent variables jointly contributed 41.3% to the changes in the mental skill in term of counting among preschoolers whereas the remaining 58.7% unaccounted for might have been as a result of extraneous variables to the present study. The result further showed that Visual Game (spot the difference) (Beta=.568), Shadow Brain Teaser (Beta=.137) and Colour Words (Beta=.097) partially contributed positively to the changes in the mental skill in terms of counting among preschoolers. The null hypothesis $H0_1$ was rejected at a .05 level of significance in each case.

$H0_2$: There is no significant relationship between the use of games (Colour Words, Visual Games (spot the difference), Shadow Brain Teasers, **Memory Games &** Optical Illusion) and enhancement of mental skills in terms of reasoning among preschoolers in public early child care centres in Rivers State.

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Table 4: Summary of regression analysis on the relationship between the use of games and the enhancement of mental skill (reasoning) among preschoolers in public early child care centres in Rivers State.

Model	R=.694, Adjusted R-squared=.478 F5, 747=138.721, p=0.00	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.507	.063		8.012	.000
	Visual Game(X_1)	.826	.050	.756	16.615	.000
	Optical Illusion (X_2)	.021	.029	.033	.712	.477
	Shadow Brain Teaser (X_3)	-.169	.033	-.219	-5.074	.000
	Colour words (X_4)	.015	.025	.021	.597	.551
	Memory Games (X_5)	.062	.020	.093	3.110	.002

a. Dependent Variable: Reasoning, $\boldsymbol{Y= .507+826X_1+.021X_2-.169X_3+.015X_4+.062X_5}$

The result from Table 4 shows the summary of multiple regression analysis on the relationship between the use of games and the enhancement of mental skills (reasoning) among preschoolers in public early child care centres in Rivers State. The result showed that there is a significant relationship between the use of games and enhancement of mental skills (reasoning) among preschoolers in public early child care centres in Rivers State (R=0.694, F=138.721, p=0.00). The Adjusted R-squared of 0.478 showed that the when the independent variables jointly contributed 47.8% to the changes in the mental skill in term of counting among preschoolers whereas the remaining 52.2% unaccounted for might have been as a result of extraneous variables to the present study. The result further showed that Visual Game (spot the difference) (Beta=.756), Optical Illusion (Beta=.033), Colour words (Beta=.021), and Memory games (.093) partially contributed positively to the changes in the mental skills in terms of reasoning among preschoolers. The null hypothesis $H0_2$ was rejected at a .05 level of significance in each case.

Discussion

The result from Table 1 showed that there were positive and strong relationships between the use of electronic educational games and enhancement of mental skill in terms of counting in preschoolers in public early child care centres in Rivers State (Colour Words, r=0.308, Visual Games (spot the difference), r=0.594 Shadow Brain Teasers, r=0.494, & Memory Games, r=0.065) There is however a weak relationship between Memory Games, r=0.065) and improvement of mental skill (counting) in preschoolers in public early child care centres in Rivers State. When put to statistical test, the result of multiple regression analysis on Table 3 showed that there is a significant relationship between the use of electronic educational games and the improvement of mental skill (counting) among preschoolers in public early child care centres in Rivers State (R=0.646, F=106.762, p=0.00). The Adjusted R-squared of 0.413 showed that the independent variables jointly contributed 41.3% to the changes in the mental skills in terms of counting among preschoolers, whereas the remaining 58.7% unaccounted for might have been as a result of extraneous variables to the present study. The result further showed that Visual Game (spot the difference) (Beta=.568), Shadow Brain Teaser (Beta=.137) and Colour Words (Beta=.097) partially contributed positively to the changes in the mental skills in terms of counting among preschoolers. The null hypothesis $H0_1$ was rejected at a .05 level of significance in each case. The simple explanation of the less than average contribution of the games to the improvement in mental skills especially in terms of counting could be because of the colorful nature of the games which attracted the children so much so that they lost count of what was required of them, which was the development of counting skills by counting the birds in memory games, sporting and counting the differences in visual games etc. However, the 41.3% gain in improvement in counting cannot be said to be a poor achievement, judging from the age of preschoolers involved in the study and the nature of children, who just play with everything.

Another possible interpretation of the way this result turned out, especially in respect of memory games which has been contributing positively to all the mental skills but failed in counting is the fact that children like to follow birds as they fly across the sky as observed by the researcher; and the memory games has some flying birds that could have caused some distractions of the children's attention away from what they were asked to do, which is counting and providing answer on the number of birds they see. The flying birds attracted the children's attention and other skills but distracted them from responding to the game the way they should, making it difficult to adequately enhance one of the mental skills (counting) under study. From the above result, the use of the memory game did not significantly boost the children's mental skill, especially in counting, which showed a weak relationship because the children could not even concentrate to count the birds or other objects involved in the game. However, the present findings still agree with the earlier findings of Aparna (2018), which established that memory games are a great course of action in boosting different aspects of a child's development and skills acquisition. This other aspect of development in the researchers' thinking could be social skills because the children were talking and reporting how they felt about the pictures to each other, which is what helps in the development of social skills. In a related view, Braddick and Wattam-Bell (2011) reported that visual development can be accomplished with the use of electronic nursery game and remained a key to understanding and assessing early brain development in children because it is the channel through which children can perform all the sensory processes that leads to the development of information about objects and spaces outside their body surface while trying to understand the world and develop socially. Though the findings of this study showed a significant relationship between electronic educational games and the mental skills under study, the relationship between memory games and mental skills development in terms of counting was not significant, even though it formed part of the consideration for the establishment of early childhood education (Sophian, 2009). The use of a scientific approach based on the overwhelming ICT and scientific revolution facilitates a headway for knowledge acquisition, especially children's numerical knowledge acquisition, which provides an important foundation for future learning. Counting is a typical brain exercise that can be achieved in educational games using play-based learning activities when started at the appropriate age.

The result from Table 2 showed that there were positive and strong relationships between electronic educational games and enhancement of mental skills in terms of reasoning in preschoolers in public early child care centres in Rivers State. (Colour Words, r=0.278, Visual Games (spot the difference), r=0. 673, Shadow Brain Teasers, r=0.375, **Memory Games, r=0.365 &** Optical Illusion, r=0.444). When put to statistical test, the result of multiple regression analysis from Table 4 showed that there is a significant relationship between the use of electronic educational games and enhancement of mental skills (reasoning), among preschoolers in public early child care centres in Rivers State (R=0.694, F=138.721, p=0.00). The Adjusted R-squared of 0.478 showed that when put together, the independent variables jointly contributed 47.8% to the changes in the mental skills in terms of counting among preschoolers, whereas the remaining 52.2% unaccounted for might have been as a result of extraneous variables to the present study. The result further showed that Visual Game (spot the difference) (Beta=.756), Optical Illusion (Beta=.033), Colour words (Beta=.021), and Memory games (.093) partially contributed positively to the changes in the mental skill in terms of reasoning among preschoolers. The null hypothesis $H0_2$ was rejected at a .05 level of significance in each case. The findings showed that Visual Game (spot the difference) (Beta=.756) enhanced the required skill more than any of the electronic educational games used, which may be as a result of the fact that the player has to think critically to arrive at the difference in the diagrams presented in the game. The present findings is in agreement with an earlier findings of (Gonzales, 2019) who asserted that optical illusion puzzle helps to make the brain sharper by making individuals think deeply about how something can be possible, helps discern the working of human brain and the intriguing part of it when it exposes the difference between 'looking' and 'seeing'. In looking, the individual tries to comprehend what he or she is observing, while seeing connotes observation and comprehension. He also claimed that the puzzle provides the players with lots of food for thought, which escalates as well as enhances one's thinking process. This activation is seen mostly at the posterior parietal cortex, which is the region responsible for the actual identification of the differences in the objects or images. This point is further buttressed by Michelon (2008), who opined that both the frontal and the two parietal lobes of the brain are responsible for the ability to remember the features in the pictures and keep them in short-term memory. This probably explains why the visual game is more active in the enhancement of the particular skill.

Conclusion

The findings of this study provide empirical evidence supporting the positive relationship between the use of electronic educational games and the enhancement of mental skills, specifically counting and reasoning, among preschoolers in public early child care centres in Rivers State. The results indicate that while most electronic educational games

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contributed significantly to the improvement of counting skills, memory games exhibited a weak relationship in this regard. This suggests that certain game features, such as moving visual stimuli, may divert children's attention away from numerical tasks, thereby affecting their ability to focus on counting. However, the overall 41.3% contribution of electronic educational games to counting skill development remains substantial, considering the cognitive development stage of preschoolers. The study revealed a strong positive relationship between electronic educational games and the enhancement of reasoning skills, with Visual Games (spot the difference) contributing the most to this cognitive domain. The study's findings align with previous research, emphasizing the role of interactive and visually engaging educational tools in stimulating brain function and promoting cognitive processing in young children. Although electronic educational games were found to be effective in enhancing preschoolers' mental skills, the study also highlights the importance of careful selection and structuring of game activities to maximize learning outcomes. The observed distractions in memory games indicate that game designs should be tailored to maintain children's focus on intended learning objectives while still engaging their natural curiosity and playfulness. Electronic educational games serve as valuable instructional tools for early childhood education, offering significant contributions to cognitive skill development. Future research should explore further refinements in game design to optimize their effectiveness in enhancing specific mental skills. Additionally, educators should integrate these games into early childhood curricula in a way that balances engagement with structured learning, ensuring maximum cognitive benefits for preschool learners.

Recommendations

Based on the findings of the study, it was recommended that:

1. All stakeholders should see to it that all electronic educational games to be used for entertainment and teaching in early child care centers are modified to have a touch of our local contents in the form of occupation, language, and culture of our people.
2. Supervisors should examine all electronic nursery game items or materials to be presented to the children and ensure that they are appropriate for their developmental age.

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