COMPUTER GAME-BASED TEACHING APPROACH AND PRESCHOOLERS' ACTIVE PARTICIPATION IN LEARNING EARLY YEARS SCIENCEIN PUBLIC PRESCHOOLS IN LAGOS STATE

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Abstract

This study investigates the use of a computer game-based teaching approach by caregivers to promote active participation of preschoolers in early years science learning activities in public preschools in Lagos state. The study utilised a descriptive survey research design with a correlational approach and applied a multistage sampling technique. A stratified sampling approach was employed to choose four Local Government Education Authorities (LGEAs) in Lagos State. A simple random selection procedure was employed to choose four preschools from each Local Government Education Authority (LGEA). The researchers employed the purposive sampling approach to choose 7 caregivers from each of the selected preschools. The study utilised two research tools. The instrument's reliability was assessed using the Cronbach Alpha approach, yielding a coefficient value of r = 0.74. The acquired data were analysed using descriptive statistics and the inferential statistic of Pearson Product Moment Correlation (PPMC) at a significance level of 0.05. The study suggests that introducing a range of computer games that are suitable for the age group, educational, and captivating can enhance the teaching of early childhood science in preschools. This approach can complement traditional teaching methods and accommodate the unique learning needs and interests of preschoolers. The study recommends providing computer games and other modern technology tools that are appropriate for the age group to public preschools in Lagos state. This will facilitate the teaching and learning of early childhood science activities.

Keywords: Computer, Game-Based; Teaching approach; Preschoolers; Active Participation; Early, Years Science Activities.

Introduction

Integrating early years science activities into a game format is one of the innovative ways used in public preschools to teach early years science concept and activities. This enable preschoolers to actively participate and communicate with the game in order to acquire scientific knowledge and cultivate science inquiry skills. Preschoolers can improve their comprehension of early years science concepts and activities by participating in computer games that enable them to actively engage in real-life events. These activities mostly revolve around the inquisitiveness of preschoolers in the field of early years science inquiry (Hirsh-Pasek, 2020).

Introducing a computer game-based teaching method in preschool education can improve the motivation, engagement and active participation of preschoolers in classroom activities while they learn about science early in life. This pedagogical approach also enables preschoolers' learning of early years science activities that may be useful for them throughout their lifetimes (Priyaadharshini, et al., 2020). Utilising computer game-based teaching strategy is regarded as a sophisticated approach to cultivate the curiosity of toddlers in trending scientific education. This is accomplished by including preschoolers in game-based science activities (Priyaadharshini, et al., 2020). The notion involves the use of computer games as an educational tool and approach to enhance learning and participation by actively involving preschoolers in classroom activities (Li et al., 2021). A phenomenon which is often known as gamification.

Gamification in preschool education is an instructional approach that integrates game components, such as competition, time constraints, badges, points and rewards, into the educational activities to provide engaging and stimulating learning environments (Turan et al., 2016). The goal of gamification is to enhance the motivation, engagement and participation of preschoolers in classroom activities by utilising the natural attraction of games for preschoolers. Therefore, there is a need for skilled design and execution of a computer game-based instructional approach that will enhance the teaching methods of caregivers and the academic achievement of preschoolers in early tears science education.

Creating and executing engaging educational games for preschoolers is a commendable action towards incorporating a game-based teaching and learning method in early years science education. Strategically developed computer games provide preschoolers with the opportunity to develop and enhance their own knowledge and abilities while playing (Yu, 2019). Engaging educational games enhance the involvement of preschoolers in early years science learning activities in public preschools to promote creativity, generate curiosity, support discussions and foster a competitive spirit of inquiry.

Computer game-based activities, such as entertaining educational games, have the ability to simulate various real-life activities. These activities can include driving a motor vehicle, playing football, performing addition and subtraction of numbers, identifying and colouring pictures and solving puzzles. By engaging in these activities, preschoolers are able to explore and make decisions in a safe environment without facing any practical or real-life consequences (Toh & Kirschner, 2020). Utilising a computer game-based approach in teaching and learning of early years science activities will introduce essential motivational mechanisms, fostering a learning environment that enhances preschoolers' motivation to engage in classroom activities (Hartt et al., 2020).

Implementing a pedagogical strategy that use computer game-based approach as a medium for teaching and learning early years science and integrating essential game design components such as cooperation, decision-making, and evaluation, positively impacts the degree of involvement of preschoolers in scientific activities conducted in preschool educational settings (Wang et al., 2022). Preschoolers actively and determinedly participate in computer game-based educational activities in the classroom, therefore, caregivers should utilise several approaches to incorporate computer game-based teaching in the early years science classroom for preschoolers, taking advantage of the active involvement, persistence and excitement of preschoolers during science playtime to improve classroom activities. Preschoolers can participate actively in early years science educational events because of their heightened imagination and natural

curiosity about the world around them, leading to high levels of engagement and involvement in early years science learning process. Caregivers and preschoolers can actively engage in computer game-based teaching and learning of early years science activities throughout early years period, which is more successful than the traditional approach to teaching and learning of early years science activities (Hamari et al., 2016; Karram, 2021).

Computer game-based teaching and learning approaches can successfully bridge the gap between theoretical concepts and practical applications in early years scientific education. This method allows caregivers and preschoolers to utilise their gained information in a practical setting, promoting a more thorough educational experience (Barz et al., 2023). The main objective of early years science education is to foster the development of critical thinking skills and scientific inquiry abilities in preschool age children. Preschoolers can participate in computer game-based learning that enable them to grasp essential scientific concepts and build technological skills via interesting and engaging activities. Moreover, these activities promote the growth of teamwork and productivity.

Incorporating narratives, point accumulation and rapid response elements into game descriptions might heighten the active involvement of preschoolers in scientific learning activities during early years science learning activities. Barradas et al. (2020) suggest that these stages offer a valuable option for developing critical thinking and scientific inquiry skills in preschoolers and function as a great means for preschoolers to augment their creativity and problem-solving aptitudes. Caregivers has the capacity to develop cartoons, simulations, interactive stories and games that engage preschoolers in early years science activities aimed at fostering scientific learning during early years science learning. Game-based learning encourages preschoolers to actively participate in classroom activities, using visually attractive interfaces and immersive environments to gain scientific information. Several pedagogical approaches may be utilised to integrate interactive computer game-based strategies into early years science teaching for preschoolers. This technique enables both caregivers and preschoolers to enhance their teaching and learning capacities, while also fostering their active participation in early years science activities and engagement in the science learning process throughout early years (Park et al., 2020; Hooshyar et al., 2021).

While computer game-based teaching of early years science concepts and activities has great promise for learning, the creation of educational games may be very complex and exorbitant. Moreover, there are significant challenges that it faces, including caregivers inadequate knowledge of early years science content, lack of technological proficiency in using computer game-based approach in teaching early years science and insufficient financial resources and inconsistencies in government policies regarding technology use in preschool education, inadequate hardware and software equipment and unequal distribution of modern technology tools leading to a digital divide (Boyle et al., 2016). Computer game-based teaching and learning of early years science in public preschools is an effective technology tool that improves early years science learning by making it more enjoyable, easier and more effective (Boyle et al., 2016; Hafeez, 2022). Implementing a computer game-based teaching and learning technique in preschool education can provide an engaging, exciting and intellectually enriching environment for preschoolers (Hwang et al., 2014).

Research on the use of computer game-based approach in teaching and learning early years science in public preschools, provide significant insights into the current progress in using game-based methods for teaching and learning early years science in public preschools. Research has yielded insights into the use of interactive computer game-based approaches in preschool education, particularly in the domain of instructing and acquiring knowledge in early years science within preschool settings. However, the field of preschool education is always changing, and there is an increasing range of games that can improve preschoolers' knowledge and skills in early years science and scientific inquiry abilities (Kusuma et al., 2021). Computer game-based strategies of ieaching early years science enhance the growth of collaborative learning across many skills and concepts, while also fostering critical thinking and teamwork. Preschoolers can acquire understanding of procedural steps, data structures, network systems, scientific inquiry and programming languages by creating and evaluating their own games and simulations. This method is particularly effective in the field of early childhood science, as demonstrated by the research conducted by Kalderova et al. in 2023.

The aim of this study is to tackle the problem of preschool children's low involvement in scientific learning activities. This is mostly caused by the caregivers' weak understanding of early years science and their lack of proficiency in using computer game-based methods in teaching early years science concepts and activities and consequently, the traditional instructional approaches, which frequently depend on repetitive memorization, this is known as rote learning. This problem continues to exist since the traditional instructional approach known as rote learning prevents preschoolers from actively engaging in science learning activities throughout their early years and deprives them of important scientific knowledge, which forms the foundation for future formal science education.

Consequent upon this, preschoolers clearly demonstrated a deficiency in the essential qualities needed for scientific learning activities in the early years, including hand-eye coordination, a willingness to take risks, and problem-solving skills, among others. On this realization, the government took concrete measures to tackle the issue, including supplying new educational computer games to public preschools in Lagos state and conducting capacity building workshops for caregivers. Nevertheless, the desired result has not been achieved. It is against this background that this study seeks to examine the relationship between the use of computer game-based teaching approaches and the extent of active participation of preschoolers in early years science learning activities in public preschools in Lagos state.

Objectives of the Study

I. To determine the impact of computer game-based teaching approach on preschoolers' active participation in early years science activities.

II. To determine the role of computer game-based teaching approach on preschoolers' science inquiry skills development.

III. To determine the place of computer game-based teaching approach in developing preschoolers' aptitude for collaborative learning.

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Research Questions

RQ1 – Is there any significant impact of computer game-based teaching approach on preschoolers' active participation in early years science activities?

RQ2 – Is there any significant role of computer game-based teaching approach on preschoolers' science   inquiry skills development?

RQ3 –Is there any significant place of computer game-based teaching approach in developing   preschoolers' aptitude for collaborative learning?

Hypotheses

H01: There is no significant relationship between computer game-based teaching approach and preschoolers' active participation in early years science activities.

H02: There is no significant relationship between computer game-based teaching approach and   preschoolers' science inquiry skills development.

H03: There is no significant relationship between computer game-based teaching approach and developing preschoolers' aptitude for collaborative learning.

Methodology

The study utilised a descriptive survey research methodology using a correlational approach. The research population consisted of carers of preschool-aged children. A total of 112 carers were included in the sample for this study, and a multistage sampling process was used. A simple random selection approach was employed to choose four local government education authorities in Lagos State, namely Alimosho, Amumo-Odofin, Ojo, and Badagry, from a total of 57 local government education authorities. A simple random selection procedure was employed to choose four schools from each Local Government Education Authority (LGEA). The researchers employed the purposive sample strategy to choose 7 carers from each of the schools. The study utilised two research instruments: the Interactive Game-Based Teaching Method and Preschooler's Aptitude for Collaborative Learning Questionnaire (IG_bTMaPACLQ) and the Interactive Computer Game-Based Teaching Method and Preschooler's Manipulative Skills Questionnaire (IG_bTLMPMSQ). The instrument's reliability was assessed using the Cronbach Alpha approach, yielding a coefficient value of r = 0.74. The acquired data were examined using descriptive statistics and the Pearson Product Moment Correlation (PPMC) as an inferential statistic, with a significance threshold of 0.05.

Results

Answers to research questions
Research question 1: Is there any significant impact of computer game-based teaching approach on preschoolers' active   participation in early years science activities?

Table 1: Showing the Impact of Computer Game-Based Teaching Approach on Preschoolers' active Participation in Early Years Science Activities

S/N Items	SA	A	D	SD
Mean St.D				
1. Computer game-based teaching and learning	45	44	13	10
3.10 .933				
approach have no impact on preschoolers' active participation in early years science activities.	(40.2)	(39.3)	(11.6)	(8.9)
2. Computer game-based teaching and learning	31	40	23	18
2.75 1.03				
method incorporates hands-on experiences that supports preschoolers' active participation in early years science classroom activities.	(27.7)	(35.7)	(20.5)	(16.1)
3. Computer games do not provide positive	17	12	30	53
1.93 1.09				
reinforcement for encouraging preschoolers active participation in early years science activities.	(15.2)	(10.7)	(26.8)	(47.3)
4. Computer games with simple language	47	45	10	10
3.15 .922				
and visual clues encourage preschoolers active participation in early years science activities.	(42.0)	(40.2)	(8.9)	(8.9)
5. Computer game-based teaching approach	11	13	40	48
1.88 .965				
does not provide inclusive learning environment that inspire preschoolers to active participation in early years science activities.	(9.8)	(11.6)	(35.5)	(42.9)
Grand Mean = 2.56				

Source: Field Survey, 2024

Table 1 presents the effects of using computer game-based teaching methods on the level of engagement of preschoolers in science activities during early years. The detailed analysis found that computer games with simple language and visual clues encourage preschoolers to actively participate in early years science activities, with an average score of 3.15. However, the use of computer game-based teaching approaches has no impact on preschoolers' active participation in early years science activities, with an average score of 3.10. Additionally, the incorporation of hands-on experiences in computer game-based teaching approaches supports preschoolers' active participation in early years science activities, but to a lesser extent, with an average score of 2.75. It was also observed that computer games do not provide positive reinforcement for encouraging preschoolers' active participation in early years science activities, with an average score of 1.93. Furthermore, the computer game-based teaching approach does not provide an inclusive learning environment that inspires preschoolers to actively participate in early years science activities, with an average score of 1.88.

Research question 2: Is there any significant role of computer game-based teaching approach on preschoolers' science inquiry skills development?

Table 2: showing the role of computer game-based teaching approach on preschoolers' science inquiry skills development

S/N Items	SA	A	D	SD	Mean	St.D
1. Computer game-based teaching approach develops preschoolers' science inquiry skills	32 (28.6)	36 (32.1)	20 (17.9)	24 (21.4)	2.67	1.10
2. Good interaction with science equipment occurs among preschoolers' taught with computer games	42 (37.2)	26 (23.2)	30 (26.8)	14 (12.5)	2.85	1.06
3. Computer game-based teaching approach does not enable preschoolers to make scientific inquiries	24 (21.4)	20 (17.9)	36 (32.1)	32 (28.6)	2.32	1.10
4. Computer game-based teaching approach makes early years science inquiry very interesting	55 (49.1)	40 (35.7)	10 (8.9)	7 (6.3)	3.27	0.87
5. Interactive computer game-based teaching approach hinders preschoolers' inquiry skill acquisition in Years Science learning activities	12 (10.7)	10 (8.9)	40 (35.7)	50 (44.6)	1.85	0.97

Grand mean = 2.6

Source: Field Survey, 2024

Table 2 presents the impact of using computer game-based teaching methods on the development of science inquiry abilities in preschoolers. The analysis showed that using computer games as a teaching method makes science learning in early years more engaging (mean = 3.27). Preschoolers who were taught with computer games also had better interaction with science equipment (mean = 2.85). Furthermore, this teaching approach helped develop the science inquiry skills of preschoolers (mean = 2.67). However, it did not enable them to ask intelligent questions (mean = 2.32) and hindered their understanding of early years science activities (mean = 1.85).

Research question 3: Is there any significant place of computer game-based teaching approach in developing preschoolers' aptitude for collaborative learning?

Table 3: showing the place of computer game-based teaching approach in developing preschoolers' aptitude for collaborative learning

S/N Items	SA	A	D	SD	Mean	St.D
1. Computer game-based teaching approach does not develop preschoolers' aptitude for collaborative learning.	10 (8.9)	12 (10.7)	54 (48.2)	36 (32.1)	1.96	0.88
2. Computer game-based teaching approach engenders communal learning of early years science among preschoolers.	43 (38.4)	37 (33.0)	20 (17.9)	12 (10.7)	2.99	0.99
3. Teamwork among preschoolers is underpinned by computer game-based teaching approach	60 (53.6)	35 (31.3)	13 (11.6)	4 (3.6)	3.34	0.82
4. A sense of community is not been promoted among preschoolers by interactive computer game-based approach.	5 (4.5)	18 (16.1)	26 (23.2)	63 (56.3)	1.68	0.90
5. Collaborative learning among preschoolers is Facilitated by interactive computer game-based approach.	56 (50.0)	32 (28.6)	10 (8.9)	14 (12.5)	3.16	1.03

Grand mean = 2.62

Source: Field Survey, 2024

Table 3 displays the role of computer game-based teaching method in enhancing the collaborative learning skills of preschool children. The detailed analysis found that the use of computer game-based teaching approach supports teamwork among preschoolers (mean = 3.34). It also facilitates collaborative learning among preschoolers (mean = 3.16). However, the computer game-based teaching approach does not effectively develop preschoolers' ability for collaborative learning (mean = 1.96). Additionally, it does not promote a sense of community among preschoolers (mean = 1.68). Furthermore, the computer game-based teaching approach fosters communal learning of early childhood science among preschoolers (mean = 2.99).

Hypotheses Testing

H01: There is no significant relationship between computer game-based teaching approach and preschoolers' active participation in early years science activities.

Table 4 Summary of Pearson Product Moment Correlation showing the relationship between computer game-based teaching approach and preschoolers' active participation in early years science activities.

Variable Remark	Mean	Std.D	N	r	Sig.
Inclusive learning environment for active participation in classroom activities	12.830	4.555			
significant			112	.996**	000
Computer game-based teaching approach	30.776	11.050			

** correlation is significant at the 0.01 level (2 tailed)

Table 4 presents compelling evidence of a robust and statistically significant positive connection (r=.996; p<0.05) between the use of computer game-based teaching approach and preschoolers' active participation in early years science activities. This implies that the utilisation of computer game-based techniques is linked to the preschoolers' active participation in early years science activities. The positive association indicates that students actively participate in classroom activities by utilising computer-based game-based teaching techniques, therefore refuting null hypothesis 1.

H02:   H02: There is no significant relationship between computer game-based teaching approach and preschoolers' science inquiry skills development.

Table 5 Summary of Pearson Product Moment Correlation showing relationship between computer game-based teaching approach and preschoolers' preschoolers' science inquiry skills development

Variable Remark	Mean	Std.D	N	r	Sig.
Early years science activities	12.991	4.793			
significant			112	.997**	000
Computer game-based teaching approach	30.776	11.050			

** correlation is significant at the 0.01 level (2 tailed)

Table 5 presents compelling evidence of a robust and statistically significant positive connection (r=.997; p<0.05) between the use of computer game-based teaching approaches and preschoolers' science inquiry skills development. This implies that there is a correlation between computer game-based activities and preschoolers' science inquiry skills development. The preschoolers' science inquiry skills development during computer game-based teaching approach shows a beneficial relationship. Therefore, null hypothesis 2 is disproven.

H03:   There is no significant relationship between computer game-based teaching approach and developing preschoolers' aptitude for collaborative learning.

Table 6 Summary of Pearson Product Moment Correlation showing relationship between computer game-based teaching approach and developing preschoolers' aptitude for collaborative learning

Variable Remark	Mean	Std.D	N	r	Sig.
Team work among preschoolers	13.141	4.202			
significant			112	.989**	000
Computer game-based teaching approach	30.776	11.050			

** correlation is significant at the 0.01 level (2 tailed)

Table 6 demonstrates a substantial and favourable correlation between the utilisation of computer game-based teaching approach and developing preschoolers' aptitude for collaborative learning. The correlation coefficient was found to be 0.989, with a significance level of $p<0.05$. This suggests that the use of computer game-based technique is associated with developing preschoolers' aptitude for collaborative learning. The presence of a positive association indicates that when preschoolers collaborate as teams, they perform effectively while employing a computer game-based education strategy. As a result, null hypothesis 3 is rejected.

Discussion

The analysis of hypothesis one reveals a notable positive correlation between the use of computer game-based teaching approach and preschoolers' active participation in early years science activities. This suggests that the use of computer game-based teaching approach is associated with an inclusive learning environment that promotes preschoolers' active participation in early years science activities. The correlation suggests that toddlers engage in classroom activities through the use of computer game-based methods, which promote their cognitive growth and facilitate the acquisition of diverse scientific abilities. This aligns with the findings of Boyle et al. (2016) and Hafeez (2022), who assert in their research that the use of interactive computer game-based teaching methods is a powerful technological approach in preschool education. These methods enhance the enjoyment, ease and efficiency of learning, while fostering an inclusive learning environment that encourages active participation of diverse preschoolers in science-related classroom activities during early years science activities.

The analysis of hypothesis two reveals a strong positive correlation between the use of computer game-based teaching approach and preschoolers' science inquiry skills development. This suggests that there is a connection between using computer games as a teaching approach and the ability of preschoolers' to develop science inquiry skills. Preschoolers' comprehension of computer game-based teaching approach and development of science inquiry skills during early years scientific activities in the classroom is indicative of a favourable correlation. This aligns with the findings of Hartt et al. (2020), who argue that using computer game-based approaches to teach early years science activities in preschool education can enhance preschoolers' development of science inquiry skills.

The analysis of hypothesis three reveals that the null hypothesis is rejected because of the notable positive correlation between computer game-based teaching approach and developing preschoolers' aptitude for collaborative learning. This suggests that the use of

computer games-based teaching approach is associated with the development preschoolers' aptitude for collaborative learning. The positive correlation indicates that when computer game-based approach is used in teaching preschoolers, they collaborate as teams and actively engage in classroom activities related to early years science. This approach, also referred to as collaborative learning, aligns with the findings of López-Fernández et al. (2021) and Mezentseva et al. (2021). According to these studies, using computer game-based teaching methods has the potential to improve the effectiveness of carers' instruction and enhance preschoolers' academic achievement in early years science activities.

Conclusion

In conclusion, research supports the connection between using computer games as a teaching method for the active involvement of preschoolers in early years science activities. Computer game-based teaching approach have the potential to increase motivation, engagement and the acquisition of concepts, hands-on exploration, cooperation and social connection. By intentionally choosing and incorporating computer game-based activities into early years science curriculum, caregivers can provide a dynamic and engaging learning environment that encourages active involvement and fosters the growth of scientific knowledge and skills in preschoolers.

Recommendations

Based on the findings of this study, the following recommendations were made:

- It is recommended that computer games and other age-appropriate modern technology tools be provided to public preschools in Lagos state for ease of teaching and learning early years science activities.

- Besides, capacity building workshop or professional training programmes are very important and should be organized for caregivers to update their knowledge of computer game-based approach to teaching early years science activities and to develop their manipulative skills on the use of modern technology tools in teaching preschoolers.

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