East African Journal of Education and Social Sciences
EAJESS May-June 2022, Vol. 3, No. 3, pp. 56-62
ISSN: 2714-2132 (Online), 2714-2183 (Print). Published by G-Card
DOI: 1 https://dx.doi.org/10.4314/eajess.v3i3.179

Effect of Concept Cartoons on Kindergarten Pupils' Numeracy and Science Performance in Sagnarigu-Tamale, Ghana

Alexander Hero Yawo Asare
Orcid: https://orcid.org/0000-0002-5113-4549
Department of Science Education, Bagabaga College of Education, Tamale, Ghana
Email: heroasare@gmail.com

Adam Mumuni Jeremiah
Orcid: https://orcid.org/0000-0001-7500-0193
Department of Mathematics and ICT, Bagabaga College of Education, Tamale, Ghana
Email: achuloamj@yahoo.com

***Frederick Ameyaw**
Orcid: https://orcid.org/0000-0003-0877-1507
Department of Science Education, Bagabaga College of Education, Tamale, Ghana
Email: kirkf67@gmail.com

Daniel Nti
Orcid: https://orcid.org/0000-0001-8176-2231
Department of Science Education, Presbyterian Women College of Education, Aburi, Ghana
Email: danielnti706@gmail.com

***Corresponding Author**: kirkf67@gmail.com

Abstract*:* This study sought to establish the effect of Concept Cartoons on Kindergarten Pupils' Numeracy and Science Performance at a demonstration primary school in Sagnarigu-Tamale, Ghana using the experimental research design. The population of the study was 100 KG-2 A and B Pupils in the school. A purposive sampling technique was used to select an intact class of 58 pupils that had difficulty in participation and performance in natural science and numeracy. A pre-test was conducted to determine the initial performance of pupils before the intervention that was done through teaching with the support of the concept cartoons. The analysis of the first two objectives involved mean scores and standard deviation. Pre-test and post-test scores were analysed to address the two objectives. The study established that the use of concept cartoons significantly improved the pupils' achievement in natural science and numeracy lessons. Therefore, the use of concept cartoons as a teaching aid is a powerful approach to improve the performance of pupils in sciences and numeracy. The study recommended that teachers of sciences and numeracy in early primary education ought to use the concept cartoon approach in order to improve the performance of pupils in the subjects.

Keywords: Kindergarten, Concept Cartoon, Natural Science, Numeracy, Performance, Pupils.

How to cite: Asare, A. H., Jeremiah, A. M., Ameyaw, F. and Nti, D. (2022). Effect of Concept Cartoons on Kindergarten Pupils' Numeracy and Science Performance in Sagnarigu-Tamale, Ghana. East African Journal of Education and Social Sciences 3(3), 56-62. Doi: https://dx.doi.org/10.4314/eajess.v3i3.179.

Introduction

In the 21st century, the educational system demands new approaches to teaching and learning at all levels. Critical thinking, problem-solving, creativity, metacognition, communication, digital and technological literacy, civic responsibility and global awareness are all considered 21st-century essential teaching and learning skills (Dede, 2010). While learner

cantered approach has taken over from the teacher-cantered approach of teaching and learning (Brown, 2003; Crick & McCombs, 2006; Harris & Cullen, 2008), Concept Cartoons is one of techniques for the pupil-cantered approach. Concept Cartoons were first developed in the 1990s as a result of an effort to enlighten the relationship between theoretical underpinnings and classroom application (Keogh & Naylor 1999).

Concept cartoon is one of most popular means of instructional media (Subhan & Lilia, 2010). Tamblyn (2002) claims that concept cartoons promote intrinsic motivation and reduces boredom, academic stress and anxiety. Naylor and Keogh (2013) posit that science concepts are often abstract and are difficult to grasp, especially for children, but with the help of concept cartoons, it becomes easier for learners to understand the concepts. According to Kabapinar (2009), concept cartoons help pupils build scientific ideas and questions within the teaching-learning process. Dabell (2004) posits that concept cartoons can be used by learners to test their ideas, broaden their horizons and perceive things better from different perspectives. In their study, Balım, İnel and Evrekli (2008) used concept cartoons with a 7th-grade science class and established that the concept cartoons improved the learners' opinions, allowing them to share new knowledge with their peers more effectively.

The use of cartoons connects the conceptual and abstract world of mathematics with the real-world scenarios and therefore it is a critical teaching strategy in KG numeracy as it connects conceptual and abstract ideas with real-life situations of children (Choi, 2011). According to Keogh and Naylor (2007), concept cartoons are cognitive drawings that convey mathematical discussions inside speech bubbles. Sexton (2010) found that cartoons can be successful teaching and learning tools by increasing students and teacher's insights in the mathematics classroom. Sengül and Dereli (2010) conducted a study with 61 seventh grade students in Turkey to find out how instruction with cartoons relates with mathematics anxiety. The study found that instruction employing cartoons lessened students' mathematics anxiety in contrast to traditional instructional methods. The use of cartoons adds a visual stimulus potentially allowing learners greater confidence. Concept cartoons thus enable learners to become more engaged in their learning with a greater focus on the concept presented rather than memorization (Davidson & Askew, 2012).

The performance of Ghanaian children in science and mathematics has been a subject of concern due to poor achievement (Ministry of Education, 2014).This could be due to the fact that pupils are taught without any hands-on activities and this might be due to inadequate learning resources, time and the right pedagogical skills. The abstract nature of content delivered has made learners perceive science and mathematics as difficult and this has affected their performance in science and mathematics as they move along the educational ladder. The poor results in early grade mathematics assessments indicate that teaching of mathematics focuses mainly on memorization of facts, rules and formulas. The poor performance in science and mathematics has raised a lot of concerns among the Government, NGOs and other stakeholders countrywide. In response to this, concept cartoons have been designed as potential tools for effective teaching and learning.

Literature Review

Balim, inel and Evrekli (2008) argue that in constructivist approach, learners become active in the construction of knowledge and the use of visual tools provides them ability to actively participate in the learning process. Concept cartoon is one of the tools that can be used in the constructivism approach. Eker and Karadeniz (2014) define cartoons as funny drawings with positive depictions. Cartoon humour is one of the most popular forms of instructional media that is abundantly and easily available (Hamidon, Subhan & Lilia, 2010). Ideas conveyed through cartoons are easily understood, specifically through the action of the cartoon character.

Cartoons are an effective tool used to teach and advise and are even more interesting. Concept cartoons are a highly visual and a stimulating approach in science teaching and learning (Morris, Merritt, Fairclough, Birrell, & Howitt 2007). Cartoons are easy for children to recognize. Learners first concentrate on the line in the cartoon, then think about every detail, make comments by establish connections and weave a story in their minds by putting out the contrast and association between objects. Cartoons may assist coaching in optimistic learning, contextual learning, social skills,

collaborative learning, essential wondering and small organization learning.

Concept cartoons elicit ideas from learners and are an effective tool for developing students' ideas. When Concept Cartoons are used, learners readily engage in discussion and as they attempt to justify their ideas, they expose their views to the possibility of being challenged by their peers. Learners frequently come to recognize for themselves more productive ways of understanding situations while looking for evidence and constructing appropriate arguments to justify their ideas (Naylor & Keogh 2013).

The use of concept cartoons in classroom can reveal learners' misconceptions about specific concepts (Dabell, 2004). Concept cartoons question learners' ideas, improve their thinking skills and help them analyse events from various perspectives. According to Ibili and Sahin (2016), cartoons are a door that opens to an imaginary world from the real world and children can freely fictionalize themselves in this realm while transferring what they learn or see in this world into real life. Doring (2002) advocated for the use of cartoons in the classroom, claiming that they prevent learners from engaging in destructive behaviors. Cartoons alleviate boredom and increase the amount of interest and connection, all of which contribute to the creation of a positive learning environment. The use of cartoons in a class increases the amount of interest and connection, thus aiding in the development of a positive learning environment.

In primary science, concept cartoons appear to be an effective stimulus for a type of systematic reasoning in support of an idea, action or theory (Naylor, Keogh, de Boo, & Feasey 2001). The use of concept cartoons in science education encourages students to inquire about their knowledge and discuss various ideas about the subject depicted in these cartoons, allowing them to actively participate in the learning process. The use of concept cartoons in science education is thought to encourage active learning by directing learners' attention to the lesson (Balim, inel, & Evrekli, 2008).

According to Kabapinar (2009), science concepts should be presented by connecting them to real-world events. In this way, learners can see the connection between science concepts and everyday life. Science concepts can be applied to learners of all ages. Alternative thinking will gain validity and credibility as a result of concept cartoons usage.

Kabapinar (2009) investigated on the potential benefits of concept cartoons in teaching. A number of case studies were conducted in various primary science classes to establish the effectiveness of concept cartoons. Individual written probes and classroom interactions were used to determine students' ideas. In that study, concept cartoon was found to be an effective tool in facilitating focused discussions in which the reasoning behind students' misconceptions can be explored through teachers' thought-provoking questions and concept-based teaching.

Concept cartoons have been seen as a good tool for assessment. According to Stephenson and Warwick (2002), concept cartoons can be used for formative assessment where learners can learn by looking back and they can see where their learning comes from. Keogh and Naylor proposed concept cartoons as an alternative assessment tool within the context of constructivist learning approaches (Korkmaz, 2004). Concept cartoons facilitate learning by providing opportunities for feedback in the classroom against alternative ideas that have been processed (Dabell, 2008).

According to Keogh and Naylor (1999), the concept cartoon approach improves motivation, provides a purpose for practical work, reduces classroom management problems, allows the discovery of learners' ideas prior to teaching and provides a manageable way to plan and carry out the teaching based on students' ideas. Concept cartoons provide intense stimulation to arouse students' prior knowledge and experience.

Methodology

Design

The study employed the experimental research design to explore the effect of Concept Cartoons on Kindergarten pupils' numeracy and science Performance in order to achieve the research objectives and therefore address the research problem.

Population and Sampling

The population of the study was 100 KG-2 A and B Pupils in the school. A purposive sampling technique was used to select an intact class of 58 pupils that had difficulty in participation and performance in natural science and numeracy.

Instrument

A test was used to collect data on pupils' performance before and after the intervention. The Pre-test was conducted to measure pupils' initial achievement before the intervention. Thereafter researchers delivered the lessons with concept cartoons. They created the cartoons as worksheets which were projected on a screen with a projector and then printouts were distributed to pupils. Each concept cartoon was accompanied by a short story or a call to action.

The cartoons depicted characters who reported their ideas on various topics in the form of stories and problems to be solved. Pupils were divided into groups and given the concept cartoon papers with a brief introduction to help them understand how to use the cartoons. Five-person homogeneous groups were formed to allow pupils create a social learning environment and discuss the concepts more thoroughly. Each group was also given a worksheet to complete while the lesson was being taught. After observing the phenomenon, the learners discussed the cartoons' points of view, identified the cartoon they thought had the correct point of view and provided reasons for their choice. Participants were tested after the intervention to find out if the intervention was successful. The test was marked and collated for analysis.

Statistical Treatment of data

The analysis of the first two objectives involved mean scores and standard deviation. Pre-test and post-test scores were analysed to address the two objectives. Finally a hypothesis was tested through paired sample t-test to establish the difference between the pre-test and the post-test results.

Ethical Considerations

Permission was sought from the Principal of Bagabaga College of Education. The Head teacher of Bagabaga demonstration school and the respective class teacher were also informed about the nature of the study, what it sought to achieve and how data would be handled. Consent of parents was also sought through the chairman of the Parents Teacher Association.

Results and Discussions

Data was presented and analysed in accordance with three objectives that guided the study:

Objective 1: To establish the performance of pupils in numeracy and natural science before the intervention.

A pre-test was conducted to 58 pupils as results are seen in Figure 1 which presents frequencies and percentages of pupils' performance in the pre-test. The performance was grouped in a class interval of 0 to 3, 4 to 6, 7 to 9, 10 to 12 and 13 to 15. The highest possible performance was 15. The figure indicates that most (47%) of the pupils scored between 1 and 3. These were followed by 43% who scored between 4 and 6. The least of the pupils (10%) performed between 7 and 9 while no students performed above 9. Therefore, the pupils were initially lacking the basic knowledge and understanding about the concept of Natural Science and numerals as indicated by their performance.

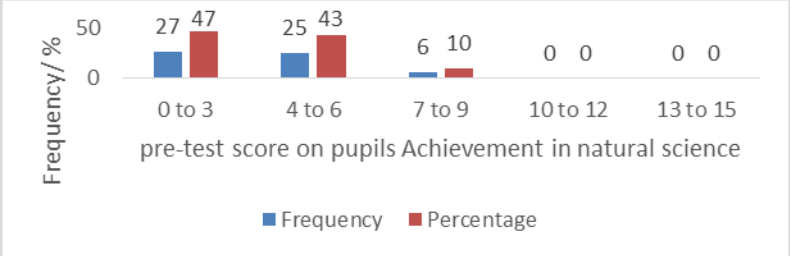

Figure 1: Pre-test results of pupils' performance

Objective 2: To establish the performance of pupils in numeracy and natural science after the intervention.

In response to the second objective, a post-test was conducted to 58 pupils as results are seen in Figure 2 which presents frequencies and percentages of pupils' performance in the post-test. The performance was likewise grouped in a class interval of 0 to 3, 4 to 6, 7 to 9, 10 to 12 and 13 to 15. The figure indicates that the least of students (5%) scored between 0 and 3, followed by 16% who scored between 4 and 6.

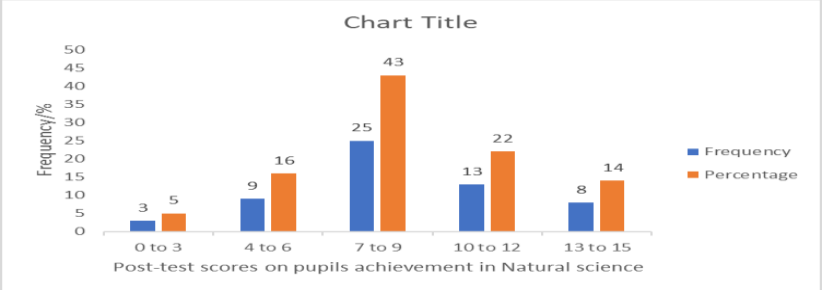

Figure 2: **Figure 1: Post-test results of pupils' performance**

Table 1: Paired sample Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	1.6379	58	.66750	.08765
	Posttest	3.2414	58	1.04815	.13763

Table 2: Paired Sample T-test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Pretest - Posttest	-1.60345	.64725	.08499	-1.77363	-1.43326	-18.867	57	.000

Majority of pupils (25%) scored between 7 and 9. The rest of pupils scored between 10 and 12 (22%) and between 13 and 15 (14%). These results indicate an upward trend of pupils' performance as most of pupils performed between 7 and 15 which sounds different from the first test whereby the majority scored between 0 and 6. Therefore, the post test results suggest an improved performance due to the intervention undertaken.

Objective 3: To establish the difference in the performance of pupils in numeracy and natural science before and after the intervention.

The third objective sought to establish whether there is a significant difference in pupils' performance between the pre-test and the post-test. This objective called for testing of the null hypothesis which stated: there is no significant difference in the performance of pupils in numeracy and natural science before and after the intervention. The comparison was done through the Paired Sample T-test as indicated in table 1 and table 2.

As seen in table 1, the pre-test score had the mean score of 1.6379 with the standard deviation of .08765 while that of the post-test was 3.2414 with the standard deviation of .13763 suggesting that the post-test outperformed the pre-test. The higher standard deviation in the post test indicates that performance was more scattered than in the pre-test.

The paired sample t-test in table two indicates a Sig of .000 which is lesser than the critical value meaning that the difference between the pre-test and the post-test is statistically significant. Thus, the null hypothesis is rejected. This leads us to maintain the fact that there is a significant difference in the performance of pupils in numeracy and natural science before and after the intervention. This means that the intervention done through the use of concept cartoons significantly improved the performance of pupils. The results are supported by what Kabapinar (2009) established that concept cartoons are effective tools in facilitating focused discussions in which the reasoning behind students' misconceptions can be explored through teachers' thought-provoking questions and concept-based

teaching which bring about improved performance. Therefore, the use of concept cartoons in the teaching and learning of numeracy and sciences is very important for maximized results.

Conclusions and Recommendations

Conclusions

Based on the findings, the study concludes that the use of concept cartoons significantly improved the pupils' achievement in natural science and numeracy lessons. Therefore, the use of concept cartoons as a teaching aid is a powerful approach to improve the performance of pupils in sciences and numeracy.

Recommendations

Based on conclusions of this study, it is recommended that teachers of sciences and numeracy in early primary education ought to use the concept cartoon approach in order to improve the performance of pupils in the subjects.

References

Balım, G. A., İnel, D., & Evrekli, E. (2008). The effects the using of concept cartoons in science education on students' academic achievements and enquiry learning skill perceptions. Elementary Education Online, 7 (1), 188-202.

Brown, K. L. (2003). From teacher-centered to learner-centered curriculum: Improving learning in diverse classrooms. *Education*, 124, 49–54.

Choi, Y. (2012). The Use Cartoons as Teaching a Tool in Middle School Mathematics.

Crick, R. D., & McCombs, B. L. (2006). The assessment of learner-centered practices surveys: An English case study. *Educational Research and Evaluation*, 12, 423–444

Dabell, J. (2004). *The maths coordinator's file-Using concept cartoons*. London: PFP Publishing.

Dabell, J. (2008). Using concept cartoons. *Mathematics Teaching Incorporating Micromath*, 209, 34-36.

Davidson, S., & Askew, M. (2012). Concept cartoons as a way to elicit understandings and encourage reasoning about decimals in Year 7. In J. Dindyal, L. P. Cheng, & S. F. Ng (Eds.), *Proceedings of the 35th Annual Conference of the Mathematics Education Research Group of Australasia* (pp. 218 - 225). Mathematics Education Research Group of Australasia.

Dede, C (2010) Comparing frameworks for 21st century skills. In: Bellanca, J, Brandt, R (eds) *21st Century Skills: Rethinking How Students Learn*. Bloomington: Solution Tree Press, pp.51–76.

Doring, A. (2002). *Effective Teaching and Learning at University: The use of Cartoons as a Teaching and learning Strategy*. Australian Catholic University.

Eker, C. & Karadeniz, O. (2014). The Effects of Educational Practice with Cartoons on Learning Outcomes. *International Journal of Humanities and Social Science* 4 (14)

Hamidon, K., Subhan, M., & Lilia, H. (2010). Teachers' perception towards usage of the cartoon in teaching and learning physics. *Procedia – Social and Behavioural Sciences*, *7*(c), 538–545.

Harris, M., & Cullen, R. (2008). Learner-centered leadership: An agenda for action. *Innovation in Higher Education*, 33, 21–28

Ibili, E., & Sahin, S. (2016). The use of cartoons in elementary classrooms: An analysis of teachers' behavioral intention in terms of gender. *Educational Research and Reviews, 11*(8), pp. 508-516.

Kabapınar F. (2009). What makes concept cartoons more effective? Using research to inform practice. Education and Science 34(154),104-118.

Keogh, B. and Naylor, S. (2007) Talking and thinking in science. School *Science Review*, 88(324), 85–90.

Keogh, B. Naylor, S. (1999). Concept Cartoons, Teaching and Learning in Science: An Evaluation. *International Journal of Science Education* 21(4), 431-446.

Korkmaz, H. (2004). *Alternative assessment aproaches on science and technology*

education. Ankara:Yeryüzü Publishing Company.

Ministry of Education (MOE). (2014) *EGRA and EGMA Report*. Accra: National Education Assessment Unit, GES.

Morris, M., Merritt, M., Fairclough, S., Birrell, N., & Howitt, C. (2007). Trialing concept cartoons in early childhood teaching and learning of science. *The Journal of the Australian Science Teachers Association*, 53 (2), 42-45

Naylor, S. and Keogh, B. (2013) Concept Cartoons: What have we learnt? *Journal of Turkish Science Education*, 10, 3-11.

Naylor, S., Keogh, B., de Boo, M., & Feasey, R. (2001). Formative assessment using Concept Cartoons: Initial Teacher Training in the UK. In R. Duit (Ed.) *Research in Science Education: Past, Present and Future*, pp.137-142. Dordrecht: Kluwer

Sengül, S. & Dereli, M. (2010). Does instruction of "Integers" subject with cartoons effect students' mathematics anxiety? *Procedia – Social and Behavioral Sciences*, 2(2), 2176-2180.

Sexton, M. (2010). Using concept cartoons to access students' belief about preferred approaches to mathematics learning environments. MERGA33-2010: *Shaping the Future of Mathematics Education* (pp. 515-522). Fremantle, Australia: MERGA Inc.

Stephenson, P. Warwick P. (2002). Using concept cartoons to support progression in students' understanding of light. *Physics Education* 37(2), 135-141.

Subhan, M., & Lilia, H. (2010). Teachers' perception towards usage of cartoon in teaching and learning physics. *Procedia – Social and Behavioural Sciences*, 7(c), 538–545.

Tamblyn, D. (2002). *Laugh and Learn: 95 Ways to Use Humour for More Effective Teaching and Training.* New York, NY: AMACOM.