Jurnal Gantang X (1) (2025): 167-174

JURNAL GANTANG

e-ISSN: 2548-5547
p-ISSN: 2503-0671

http://ojs.umrah.ac.id/index.php/gantang/index

Effect of flipped classroom models with creative game activities on pupils' mathematics achievement

Büşra Usluoğlu[1], Jamiu Temitope Sulaimon[2*], Veli Toptaş[3] & Palupi Sri Wijayanti[4]

[1,3]Kırıkkale University, Social Sciences Institute, Turkey
[2]University of Ilorin, Nigeria
[4]Universitas PGRI Yogyakarta, Indonesia
*Corresponding Author: sulaimonjamiu7991@gmail.com

Submission: May 17ty 2025; Accepted: May 24th 2025; Published: May 31st 2025
DOI: https://doi.org/10.31629/jg.v10i1.7252

Abstract

This study examined the effect of the flipped classroom model and creative mathematics activities and games on mathematics achievement. Two equivalent 4th-grade students from a public school in Kırıkkale, Turkey, were randomly selected to create experimental and control groups. The experimental group consisted of 25 students, while the control group consisted of 27 students. Before the application, a mathematics achievement test prepared by the curriculum was applied to both groups, while Mathematics game videos following the curriculum were ready for the experimental group. Then, application studies were carried out with the experimental group for 4 weeks. Meanwhile, no intervention was made in the control group, and their traditional teaching continued. At the end of 4 weeks, the mathematics achievement test was re-administered to both groups, and the results were compared. While the difference between the experimental group's pre- and posttest mean scores is 16,68, the difference between the control group's pre and posttest mean scores is 6,37. As a result, it was concluded that creative games and activities combined with the flipped classroom model increased mathematics achievement. The study recommended designing creative activities with the flipped classroom model to increase success in other courses, such as mathematics.

Keywords: creative game; flipped classroom model; mathematics achievement

How to cite: Usluoğlu, B., Sulaimon, J, T., Toptaş, V., & Wijayanti, P, S. Effect of flipped classroom models with creative game activities on pupils' mathematics achievement. *Jurnal Gantang, 10*(1), 167 – 174. https://doi.org/10.31629/jg.v10i1.7252

I. Introduction

The primary level of education is a stage in which learners are exposed to different subjects to develop the foundation phase of education and produce holistically developed individuals. One of the subjects of great importance is primary school mathematics. This is a subject that has great importance due to the integrations it has with different subjects. Mathematics is needed for everyday life; it involves transactions, interaction, and even answering questions. The significance of mathematics cannot be overemphasized. However, a lacuna affecting this subject is the prevalence of poor performance at different levels of education, including preschool, primary, high school, and even university students, which is attributed to the traditional teaching methodology often employed by schoolteachers. Different parts

of the world pay attention to the teaching and learning of mathematics at the foundation phase, emphasizing the benefits of this subject.

However, parents, teachers, policy makers, and administrators are often on the lookout for a possible solution to these performance issues at the elementary level of education (Sulaimon & Manditereza, 2024; Lazic, Knežević & Maričić, 2021; Petrillo, 2016). Therefore, there is a need to find a lasting solution to the problems of poor performance at the elementary level of education because if this stage is well taken care of, it lays the foundation for other levels of education problems.

The general lockdown worldwide due to COVID-19 has led to the introduction of online media and the integration of technology materials in teaching and learning. Several schools, both elementary and high schools, also integrate technology materials in teaching and learning due to the pandemic, which enables the countries to blend both the technology integration and traditional lessons side by side (Toptaş, Usluoğlu & Şengün, 2021). The flipped classroom instructional model is often used side by side with the inverted classroom; it is a form of model which provides learners with prior knowledge of instructional content before the actual learning activities; it is more advanced than the traditional classroom in which teachers deliver all contents physically in the class, while in the flipped classroom models learners are given access to instructional content, via technological devices such as Laptops, phone, televisions, etc. students watch instructional activities prior lesson, then instructional activities commence after the exposure activities. The significance of the flipped classroom model is that it increases learners' collaboration and active participation, reduces teachers' stress, and allows self-paced learning (Cabı, 2018; Al-Samarraie, Shamsuddin, & Alzahrani, 2020). The term "flipped" refers to a method of teaching that reverses the traditional classroom setup, where teachers instruct students in class and assign homework to be completed at home. However, in the flipped classroom model, students are exposed to instructional content outside the classroom and work together to complete assignments and tasks. This fosters student satisfaction with learning, academic success, and real-world learning (Almulla, 2020; Unal & Çakır, 2021; Lin & Gao, 2020; Bahiyah, 2023).

Elementary school children are often exposed to creative game activities due to the incorporation of fun-based activities as a teaching strategy at this level of education. Creative game activities involve sharing materials, experimenting, competing in pairs, developing children's intellectual, social, emotional, and language skills, and promoting holistic development. Mun (2022) posited that creative game activities are fun and interesting activities in classes in which children engage in some activities that involve the use of cardboard, gum, puzzles, scissors, charts, bowls, water, etc., to create collaborative game activities, which in turn raise children's curiosity and level of thinking, develop resilience in the child, arouse their interest in learning, and increase their attention span. Children often engage in creative game activities, including soccer, ABC games, mental sums, alphabet chains, puzzles, bingo, and Monopoly. Creative game activities have been explored by researchers such as Arnab, Clarke & Morini (2019), Mulyono, Kurniadi, Araiku, Otniel & Ratnanenci (2023), and Chatain, Bitter, Fayolle, Sumner & Magnenat (2019) at different levels of education. It has been proven that creative game activities can develop children at all levels of education, i.e., primary, secondary, and higher levels. These activities develop the child's emotional, psychological, intellectual, social, and personality development.

According to Oni (2018), mathematics is a science subject connected to all discipline areas, such as art, business, technology, etc. Mathematics deals with the relationship between numbers, shapes, forms, patterns, geometry, colours, and designs, which develops learners' logical thinking skills. The importance of mathematics for learners cannot be

overemphasized; it develops the child's creativity, problem-solving skills, logical thinking skills, and basic literacy skills. Mathematical knowledge is needed in different activities, such as buying and selling, sharing things, cooking, sewing, and farming activities, to mention a few. All professions and all human interaction activities require mathematical knowledge. Mathematics's importance in pre-primary, primary, secondary, and university education cannot be overemphasized on learner development; however, scholars have reported issues of poor achievement in this subject, which has become worrisome for teachers, administrators, parents, and policymakers to find a long-lasting solution to this issue of poor achievement in mathematics. Notably, the reason for the poor achievement is related to parental factors, language, teaching methods, attitude towards mathematics, and societal problems (Husna et al., 2023; Ugwuanyi, Okeke & Asomugha, 2020; Luo et al., 2023; Sulaimon, Yusuf, Yakub & Syarif, 2023).

Incorporation of game strategies, vocabulary development strategies, problem-solving strategies, brainstorming strategies, and modified flipped classroom strategies are among the bulk of available research, experimental projects, and studies that have been suggested to address the issue of low mathematics achievement among pupils (Sulaimon et al., 2023; Sulaimon, & Mandittereza, 2024; Cabı, 2018; Arnab et al., 2019; Almulla, 2020). Since implementing the aforementioned strategies, there is still evidence of poor math performance among elementary school children. To address these issues, studies have employed the flipped classroom model and creative games activities as novel strategies for tackling poor performances in mathematics; however, no study has combined these two strategies to tackle this ever-growing issue in Turkey effectively.

Research Objective

The main aim of this study is to investigate the effect of a flipped classroom model with creative game activities on pupils' mathematics achievement in a Turkish elementary school.

II. Research Method

The study investigated the effect of a flipped classroom model with creative game activities on pupils' mathematics achievement in a Turkish elementary school. Price, Jhangiani & Chiang (2015) utilized pretest and posttest control groups in quasi-experimental research designs. The design adopted utilized two experimental and control groups, selected randomly. Two government-owned elementary school pupils from Turkey served as participants in this study. Probability sampling using simple random sampling techniques was used to select two government schools for the experiment.

In two randomly selected elementary schools, the experimental group was introduced to a 4-week treatment section (a flipped classroom model and creative game activities). In contrast, the control group was taught using the conventional teaching method without treatment within four weeks. After four weeks of traditional application, the two groups were subjected to an assessment posttest to check if the groups exposed to the flipped classroom model and creative games activities outperformed the group taught with the conventional method.

The two groups assigned for this study in the Kırıkkale province of Turkey were subjected to 4th-grade mathematics achievement. The researcher visited the two schools selected to seek approval. Then, the experimental group was exposed to a mathematics achievement test as a pretest before the 4 weeks of exposure to the flipped classroom model with creative activities, with the assistance of the classroom teacher as a research assistant. While the control group was exposed to the pretest and then taught using the conventional method for four weeks concurrently, the posttest was administered to both experimental and control groups at the end of the four-week posttest.

The test developed by the researchers contains 20 items for topics, units, and

experimental studies based on 4th-grade mathematics course studies. The test includes 4th-grade subjects that students have not yet studied, in light of the academic calendar carefully calculated before the study. These subjects measure time, geometric objects, shapes, and length. The distribution of the 20-item questions applied as pretest and posttest is as follows: 10 questions are about basic concepts in geometric objects, five are about geometric objects and shapes, and 5 are about length measurement. Two lecturers and mathematics teachers at Kırıkkale universities validated the achievement test. At the same time, test-retest reliability was used to establish the instrument's reliability by administering 10 copies of the academic achievement test to some students who were not part of the initial sample, and a reliability coefficient of 0.78 was established, which makes the instrument reliable.

The mathematics achievement test was applied to the experimental and control groups. Before the application, the researchers prepared achievement tests and studies that followed the curriculum, with support from the classroom teacher. Creative mathematics games and activity videos have been prepared with the flipped classroom model based on the 4th-grade curriculum and topics such as measuring time, geometric objects and shapes, and length.

The prepared videos were shared with the experimental group, students, who were allowed to watch them before the lesson. The same games and activities were performed in the classroom with the experimental group of students who watched the videos. The materials used in the games and activities were prepared in advance for the experimental group that watched the videos. Interactive and collaborative teaching is taken as a basis in the classroom. The control group continued traditional instruction. After the 4-week application, a mathematics achievement test was administered to both groups, and the results were compared.

Descriptive analysis was employed to examine demographic information, providing valuable insights into the characteristics of the study population. Furthermore, this research objective was rigorously tested using a paired sample t-test. This statistical method allowed us to discern the differential impact of the intervention on mathematics achievement and attitude while controlling for pretest scores. By employing robust data analysis techniques, we aimed to accurately evaluate the effectiveness of the intervention and draw meaningful conclusions from this study.

After measuring the subjects included in the study, the researchers scored the results obtained from the inventory. The raw scores of the students participating in the experimental and control groups from the pretest and posttest applications were tabulated, and the arithmetic mean, minimum-maximum values, and standard deviation scores of the groups were calculated. The difference between the experimental and control groups' pretest and posttest mean scores was tested in the comments on whether the creative activity and game work applied in the mathematics lesson were practical. The t value was calculated and investigated whether it was significant at the .05 level. The pretest and posttest mean scores of the experimental and control groups were compared with the dependent t-test and examined whether it was significant at the .05 level.

III. Results and Discussion

Table 1. Demographic distribution of respondents based on gender

Groups	Male	Female	Total
Experimental	11	14	25
Control	17	10	27

The table above shows the total number of pupils who participated in the study. The experimental group comprised 11 males and 14 females, totaling 25 pupils. The control group comprised 17 males and 10 females, totaling 27 pupils.

Table 2. Findings regarding the pretest and posttest scores in the experimental group

Statistical Value	N	x	Min.	Max.	sd	t value
Pre Test	25	59,12	34,00	90,00	15,87	-,589
Post Test	25	75,80	36,00	98,00	16,29	

p<0.05

As shown in Table 2, the experimental group's pretest mean score in the mathematics achievement test is observed as (59,12) and the posttest mean score (75,80). This result showed a significant difference in favour of the posttest. In order to determine whether the difference between the students' mathematics achievements before the experiment and their mathematics achievements after the experiment was significant, the pretest and posttest mean scores were compared with the dependent t-test. The calculated t value (-589) is significant at the .05 level. Accordingly, the difference between the experimental group's pretest and posttest mean scores is significant. This result shows a significant difference in mathematics achievement level between the pretest and posttest results of the experimental group of students who participated in the creative mathematics games and activities study conducted with the flipped classroom model.

Table 3. Key findings regarding the control group pretest and posttest scores

Statistical Value	N	x	Min.	Max.	sd	t value
Pre Test	27	58,78	31,00	90,00	15,75	,710
Post Test	27	65,15	29,00	95,00	16,23	

p<0.05

Table 3 shows that the mathematics achievement levels of the control group students are very low compared to the pretest and posttest mean scores. When the pretest and posttest mean scores were tested with the dependent t-test to test the significance of this difference, the t-value was not significant at the .05 level. This result shows no significant difference between the pretest and posttest mathematics achievement scores of the control group of creative mathematics games and activities performed with the flipped classroom model.

Table 4. Findings regarding the differences in the pretest and posttest mean scores of the experimental and control groups

Statistical value	n	pretest x - sd	posttest x - sd	pre-post test *x* diff.	t value
Experimental group	25	59,12-15,87	75,80 - 16,66	16,68	2,21
Control group	27	58,78 - 15,75	65,15 - 16,23	6,37	

p<0.05

As shown in Table 4, the t value of the difference in pretest and posttest score averages was calculated to determine the mathematics achievement levels of the experimental and control groups of creative mathematics games and activities implemented with the flipped classroom model. The calculated t value (2,21) is significant at the .05 level. While the pretest and posttest mean difference of the experimental group is 16.68, the pretest and posttest mean difference of the control group is 6.37. The gain of the experimental group after 4 weeks of application is significantly higher than that of the control group. This result shows that the study of improving mathematics achievement through creative mathematics games and activities with the flipped classroom model is very effective on the mathematics achievement levels of fourth-grade primary school students.

Discussion

Many studies conducted with the flipped classroom model have achieved fruitful results. Chen et al. (2015) stated that the flipped classroom model supports the development of basic education goals such as problem-solving, critical thinking, and social interaction. It has been shown that the flipped classroom model, which has recently emerged as a new approach to teaching and learning, differs from traditional classrooms and offers interactive teaching.

The primary purpose of the flipped classroom model is to reverse or invert the

traditional learning process. In other words, activities usually carried out in the classroom, such as taking instructional content, are carried out individually outside the classroom. In contrast, activities such as exercises and homework, which are usually carried out outside school hours, are implemented in the classroom under the teacher's guidance. The biggest aim of this study is to ensure that effective individual homework and games are combined with creativity skills.

Creative mathematics games with the flipped classroom model enable students to develop positive attitudes towards mathematics. In this way, children do not see math class as boring and enjoy exploring with fun. The studies (Ariyanti, Azizah & Amir, 2022; Balaaldia, 2022; Usluoğlu & Toptaş, 2023) have revealed that teaching mathematics with creative activities and games is very effective in improving mathematics attitude and academic success in mathematics.

The sub-problem of this study was to examine the effects of creative mathematics games made with the flipped classroom model on children's academic success. Therefore, experimental and control groups were created from two identical 4th-grade classes. An achievement test was prepared and administered to both groups without disrupting the dates and plans of their curriculum. After the preliminary tests of the experimental and control groups were taken, studies were started with the experimental group for 4 weeks.

The researchers shot creative math game videos for the experimental group that were compatible with the achievement test. These game videos were shared with the experimental group. Each game was at a level that students could easily try at home and school. Thus, each student in the experimental group could learn according to his or her learning speed and level. The primary basis of the study is the flipped classroom model, where students learn core content on their own, at their own pace, through instructional videos or other resources, such as recorded lectures or readings, before relevant class meetings. The students in the experimental group both had fun and learned. Meanwhile, no intervention was made in the control group. The 4th-grade students in the control group continued their mathematics lessons with traditional instruction.

At the end of 4 weeks, the achievement test was applied again to the experimental and control groups. Posttest results from both groups were compared. The average difference between the pre- and posttests for the experimental group is 16,68. This result is relatively high and significant for four weeks of application. This means that creative mathematics games made with the four-week flipped classroom model positively impacted the mathematical success of the experimental group. On the other hand, the average difference between the pre- and posttests for the control group is 6,37. This means that traditionally taught mathematics courses do not have much effect on mathematics achievement.

IV. Conclusion

Based on the findings of this study, it was concluded that the flipped classroom model and creative mathematics activities and games significantly impact pupils' mathematics achievement. As a result, it was observed that the aim of this study was achieved in mathematics. Trying different methods and models to achieve mathematical success causes children to encounter the fun side of mathematics rather than the serious side. Especially for children in primary school, mathematics lessons can be perceived as quite abstract. To prevent this, teachers can explore mathematics through concrete and creative games. Creative mathematics games created with the flipped classroom model have saved teachers' time and facilitated individual learning. Thus, students could do mathematics at their own pace and readiness level. It is recommended that the study be applied to other mathematics subjects. In addition, applying creative games with the flipped classroom model with other disciplines will benefit teaching.

Based on the findings of the study, the

following recommendations are made:

1. Teachers should design creative activities using the flipped classroom model to enhance pupil engagement and achievement in mathematics.
2. Seminars and conferences should be organized to train teachers on effectively integrating creative activities using the flipped classroom model.

Acknowledgement

Special thanks to the school's administration, teachers, and pupils who participated in this study and approved the research.

References

Almulla, M. A. (2020). The effectiveness of the project-based learning (PBL) approach as a way to engage students in learning. *Sage Open*, *10*(3), 2158244020938702.

Al-Samarraie, H., Shamsuddin, A., & Alzahrani, A. I. (2020). A flipped classroom model in higher education: a review of the evidence across disciplines. *Educational Technology Research and Development*, *68*(3), 1017-1051.

Arnab, S., Clarke, S., & Morini, L. (2019). Co-creativity through play and game design thinking. *Electronic Journal of E-Learning*, *17*(3), 184-198. https://doi.org/10.34190/JEL.17.3.002.

Ariyanti, N., Azizah, N. L., & Amir, M. F. (2022). Math village: Creative games as an effort to improve children's counting ability post covid 19 pandemic. *Procedia of Social Sciences and Humanities*, *3*, 1252-1258.

Bahiyah, N. (2023). Revolutionizing education: unlocking the potential of asynchronous video for interactive online learning. *International Journal of Education and Humanities*, *3*(2), 187-196.

Balaaldia, M. C. T. (2022). Math creative games: An intervention material in teaching basic mathematics. *IJRP: International Journal of Reseach Publication*, *103*(1), 856-870.

Cabı, E. (2018). The impact of the flipped classroom model on students' academic achievement. *International review of research in open and distributed learning*, *19*(3).

Chatain, J., Bitter, O., Fayolle, V., Sumner, R. W., & Magnenat, S. (2019, October). A creative game design and programming app. In *Proceedings of the 12th ACM SIGGRAPH Conference on Motion, Interaction and Games* (pp.1-6). https://doi.org/10.1145/3359566.3360056.

Chen, L., Chen, T. L., & Chen, N. S. (2015). Students' perspectives of using cooperative learning in a flipped statistics classroom. *Australasian Journal of Educational Technology*, *31*(6).

Husna, N. A. U., Febrian, F., Risky, M., Arifin, Y. S., Hamudin, I. A., Sarah, S., ... & Wardina, F. (2023). Ethnomathematics on traditional games: Porok from Penaga Village. *Jurnal Gantang*, *8*(2), 133-143. https://doi.org/10.31629/jg.v8i2.6653

Lazic, B., Knežević, J., & Maričić, S. (2021). The influence of project-based learning on student achievement in elementary mathematics education. *South African Journal of Education*, *41*(3).

Lin, X., & Gao, L. (2020). Students' sense of community and perspectives of taking synchronous and asynchronous online courses. *Asian Journal of Distance Education*, *15*(1), 169-179.

Luo, X., Wang, F., & Luo, Z. (2009). Investigation and analysis of mathematics anxiety in middle school students. *Journal of mathematics Education*, *2*(2), 12-19.

Meeter, M. (2021). Primary school mathematics during the COVID-19 pandemic: No evidence of learning gaps in adaptive practicing results. *Trends in neuroscience and education*, *25*, 100163.

Mulyono, B., Kurniadi, E., Araiku, J., Otniel, O., & Ratnanenci, C. (2023). Development of Android-based statistics learning simulation

media to support student achievement. *Jurnal Gantang*, *8*(2), 145-154. https://doi.org/10.31629/jg.v8i2.6465

Mun, J. (2022). The Effect of Game Playing and Goal Orientation on Creativity. *Frontiers in Psychology*, *13*, 899694. https://doi.org/10.3389/fpsyg.2022.899694.

Oni, L. (2018). Effect of cooperative learning strategy on students' achievement in and attitude to Mathematics. In *Harvard Conference on Preparing Students for an Uncertain Future, Boston, USA* (Vol. 16, No. 1, pp. 55-66).

Petrillo, J. (2016). On flipping first-semester calculus: A case study. *International Journal of Mathematical Education in Science and Technology*, *47*(4), 573-582.

Price, P. C., Jhangiani, R. S., & Chiang, I. C. A. (2015). Quasi–experimental research. *Research methods in psychology*.

Toptaş, V., Usluoğlu, B., & Şengün, G. (2021). Opinions and suggestions of classroom teachers in online mathematics education during the Covid-19 pandemic. *Journal of Educational Technology and Online Learning*, *4*(4), 880-895.

Sulaimon, J. T., & Manditereza, B. (2024). Investigating the Effect of the Traditional Flipped Classroom in Teaching Primary 3 Class Mathematics. *Journal of Education and Practice*, *8*(1), 1-12.

Sulaimon, J. T., Yusuf, M. O., Yakub, K. I., & Syarif, M. I. (2023). Effect of probem-solving method on pupils'academic achievement in mathematics. *el-Ibtidaiy: Journal of Primary Education*, *6*(2), 165-175.

Ugwuanyi, C. S., Okeke, C. I., & Asomugha, C. G. (2020). Prediction of Learners' Mathematics Performance by Their Emotional Intelligence, Self-Esteem and Self-Efficacy. *Cypriot Journal of Educational Sciences*, *15*(3), 492-501.

Unal, E., & Cakir, H. (2021). The effect of technology-supported collaborative problem-solving method on students' achievement and engagement. *Education and Information Technologies*, *26*(4), 4127-4150.

Usluoğlu, B., & Toptaş, V. (2023). Investigation of the effects of creative games and activities on mathematics attitudes and achievements in primary school. *Elementary Mathematics Education Journal*, *5*(1), 65-73.