

THE EFFECTIVENESS OF THE KAHOOT-ASSISTED TEAMS GAMES TOURNAMENT (TGT) MODEL ON STUDENTS' ENGAGEMENT AND MATHEMATICAL COMMUNICATION SKILLS

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Abstract

Mathematics learning at SMP Negeri 15 Tegal, Indonesia, is still dominated by teacher-centered lecture methods, resulting in relatively low levels of learning engagement and mathematical communication skill among eighth-grade students. This study examined the effectiveness of the Kahoot-assisted Teams Games Tournament (TGT) model on students' engagement and mathematical communication skill on the topic of measures of central tendency. A quantitative approach with a quasi-experimental, pretest-posttest control group design was used. The population consisted of 254 eighth-grade students across eight classes; using purposive sampling, class VIII C (32 students) served as the experimental group taught with Kahoot-assisted TGT and class VIII B (32 students) as the control group taught with teacher-centered learning. Data were collected through interviews, a 15-item essay test, documentation, and a Likert-scale engagement questionnaire, then analyzed using normality, homogeneity, Independent Sample t-test, and Normalized Gain (N-Gain) procedures. The results show a significant difference in learning engagement (Sig. 2-tailed = $0.029 < 0.05$) and in mathematical communication skill (Sig. 2-tailed = $0.000 < 0.05$) between the experimental and control groups, with the experimental class scoring higher on both measures. N-Gain analysis further confirmed that mathematical communication skill improved in the "high" category for both classes, with a slightly larger average gain for the experimental class (0.78 versus 0.74). These findings indicate that the Kahoot-assisted TGT model is effective in improving both students' learning engagement and mathematical communication skill in mathematics instruction.

Keywords: Teams Games Tournament, Kahoot, Student Engagement, Mathematical Communication Skill, Measures of Central Tendency.

1 INTRODUCTION

In the current era, education faces rapid and often unpredictable changes that demand a continuous improvement in teaching and learning quality. Mathematics instruction at the junior secondary level, however, remains dominated by teacher-centered lecture methods that position the teacher as the primary source of information while students remain passive recipients of content, so that interaction, participation, and active engagement have not developed optimally. Under this pattern, students have limited opportunity to ask questions, engage in discussion, or express mathematical ideas during the learning process; engagement is difficult to develop when instruction is not designed to be interactive, varied, and participatory.

Beyond the issue of instructional method, mathematics is still widely perceived as difficult, abstract, and intimidating. Instruction that emphasizes symbols, formulas, and procedural steps without meaningful activity makes it difficult for students to grasp concepts deeply, and consequently to communicate their reasoning and present solutions in a clear, systematic manner. Mathematical communication skill the ability to convey mathematical ideas, reasoning, and solutions, whether orally or in writing, through symbols, tables, graphs, and other mathematical representations is an essential competency that conventional instruction has struggled to develop. Prior studies report that junior secondary students often struggle to explain solution steps, provide mathematical justification, and present answers in a coherent and logical sequence, a condition attributable in part to the limited variation in instructional methods used, which leaves students receiving information passively without adequate opportunity to discuss, collaborate, and voice their opinions.

One instructional alternative that emphasizes cooperation, healthy competition, and active student involvement through structured academic games is the Teams Games Tournament (TGT) cooperative learning model, through which students are encouraged to help one another, discuss, and communicate while solving mathematical problems. Group discussion and academic tournaments within TGT have been reported to encourage students to voice opinions, ask questions, and discuss more actively with peers, indirectly training and improving their mathematical communication skill. The effectiveness of TGT can further be enhanced through digital, game-based learning media such as Kahoot, an interactive and competitive quiz platform shown to increase students' motivation, attention, and participation in mathematics classrooms.

Several prior studies support the relevance of combining TGT and Kahoot. Umami & Saraswati found that Kahoot-assisted TGT significantly increased student engagement and learning outcomes on algebraic-operations material at the junior secondary level. Wulandari, Hendrastuti, & Krisma reported that students taught with Kahoot-assisted TGT achieved better mathematical communication skill than those taught with conventional instruction, particularly in expressing mathematical ideas orally and in writing, explaining solution steps, and discussing with peers. Devi, Mayasari, & Indriani similarly found a positive effect of the Kahoot-assisted TGT model on students' mathematics learning outcomes. These studies are relevant to the present research in their shared use of the Kahoot-assisted TGT model and their emphasis on student engagement, yet research examining both engagement and mathematical communication skill together, on measures-of-central-tendency material at the junior secondary level, remains limited.

Based on this gap, and on the condition observed at SMP Negeri 15 Tegal, the present study investigates the effectiveness of the Kahoot-assisted Teams Games Tournament (TGT) model on students' engagement and mathematical communication skill. Specifically, the study addresses four research questions: (1) is there a difference in learning engagement between students taught with Kahoot-assisted TGT and those taught with teacher-centered learning; (2) is there a difference in mathematical communication skill between the two groups; (3) is Kahoot-assisted TGT effective in improving students' learning engagement in mathematics instruction; and (4) is Kahoot-assisted TGT effective in improving students' mathematical communication skill.

2 METHODOLOGY

This study employed a quantitative approach, a systematic design intended to measure variables numerically and test hypotheses. The research type was quasi-experimental, i.e., a design that includes a control group but cannot fully control external variables that may influence the outcome of the experiment. A pretest-posttest control group design was used, consisting of two non-randomly assigned comparison classes: a pretest administered before treatment and a posttest administered after the treatment the Kahoot-assisted Teams Games Tournament (TGT) model had been applied.

The population comprised all eighth-grade students of SMP Negeri 15 Tegal, Central Java, Indonesia, totaling 254 students distributed across eight classes (VIII A–VIII H). Using purposive sampling, class VIII C (32 students) was assigned as the experimental group taught with Kahoot-assisted TGT, class VIII B (32 students) as the control group taught with teacher-centered learning, and class VIII A (32 students) served as the try-out class for instrument testing. The learning material was measures of central tendency (mean, median, and mode), and instruction in both classes was delivered over four meetings.

The TGT model was implemented following its five systematic cooperative stages: class presentation, teamwork, academic games, tournament, and team recognition. Student engagement was assessed using indicators covering participation in question-and-answer activities, involvement in discussion, responsiveness to teacher questions, teamwork, and persistence in completing tasks. Mathematical communication skill was assessed using indicators covering presenting data in tables or diagrams accurately, explaining the steps for computing mean, median, and mode in writing, using statistical symbols and terms correctly, and interpreting the results of data-centralization measures logically in real contexts.

Data were collected through interviews for the preliminary study, a 15-item essay test measuring mathematical communication skill, documentation of attendance records and instructional materials, and a Likert-scale questionnaire measuring engagement. Prior to hypothesis testing, prerequisite tests of normality and homogeneity were conducted on the pretest and posttest data of both classes. The hypotheses were then tested using an Independent Sample t-test at a significance level of $\alpha = 0.05$, with the decision rule that a two-tailed significance value below 0.05 indicates a significant difference between the experimental and control group means. The effectiveness of the treatment in improving mathematical

communication skill was further examined through Normalized Gain (N-Gain) analysis, comparing each class's pretest and posttest scores.

3 RESULTS AND DISCUSSION

SMP Negeri 15 Tegal is a state junior secondary school located in Tegal City, Central Java, Indonesia, accredited "A" and designated as a Sekolah Penggerak (Mobilizing School) under the national curriculum reform. The study was conducted during the even semester of the 2025/2026 academic year, from 19 to 26 May 2026.

Prerequisite analyses (normality and homogeneity tests) confirmed that the pretest and posttest data of both the experimental and control classes met the assumptions required for parametric hypothesis testing.

Table 1 presents the results of the Independent Sample t-test comparing students' learning engagement between the experimental class (Kahoot-assisted TGT) and the control class (teacher-centered learning).

Tabel 1. Independent Sample t-test Results - Student Engagement

T	Df	Sig. (2-tailed)	Mean Difference
-2.243	60	0.029	-2.581

As the significance value (0.029) is below 0.05, H_0 is rejected: students' learning engagement differed significantly between the two groups, with the experimental class showing higher engagement, reflected in more active discussion, teamwork, participation in the academic games, and involvement in the tournament activities.

Table 2 presents the Independent Sample t-test results for students' mathematical communication skill, based on posttest scores, since the posttest reflects students' ability after the learning process.

Tabel 2. Independent Sample t-test Results - Mathematical Communication Skill

T	Df	Sig. (2-tailed)	Mean Difference
-7.977	60	0.000	-18.194

The significance value (0.000) is likewise below 0.05, indicating a significant difference in mathematical communication skill between the experimental and control groups, in favor of the experimental class.

To examine the magnitude of improvement, Normalized Gain (N-Gain) scores were computed from each class's pretest and posttest results (Table 3).

Tabel 3. N-Gain Results - Mathematical Communication Skill

Class	Mean Pretest	Mean Posttest	Mean N-Gain	Category
Control	24.06	80.48	0.74	High
Experimental	24.32	84.06	0.78	High

Both classes recorded N-Gain scores in the "high" category, indicating that mathematical communication skill improved substantially in both groups following instruction; the experimental class, however, achieved a somewhat larger average gain than the control class.

Taken together, these findings indicate that the Kahoot-assisted TGT model is effective in improving both students' learning engagement and their mathematical communication skill, compared with teacher-centered instruction. The cooperative structure of TGT group discussion, peer teaching, academic games, and tournament competition created more opportunities for students to ask questions, exchange ideas, and justify their reasoning, while Kahoot's game-based quizzes provided immediate feedback that sustained motivation and attention throughout the lessons. During TGT sessions, students were also required to explain their problem-solving steps to teammates, giving them repeated practice in expressing mathematical ideas verbally and in writing using appropriate symbols and representations, practice that is largely absent from a lecture-based classroom. These results are consistent with prior studies reporting that Kahoot-assisted TGT increases student engagement and strengthens mathematical communication skill.

4 CONCLUSIONS

This study demonstrates that: (1) there is a significant difference in learning engagement between students taught with the Kahoot-assisted Teams Games Tournament (TGT) model and those taught with teacher-centered learning; (2) there is a significant difference in mathematical communication skill between the two groups; (3) the Kahoot-assisted TGT model is effective in improving students' learning engagement in mathematics instruction, through group discussion, academic games, and tournament activities; and (4) the model is likewise effective in improving students' mathematical communication skill on the topic of measures of central tendency.

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