



DEVELOPMENT OF ALGEBRA CARD MATERIALS BASED ON TEAMS GAMES TOURNAMENT (TGT) TO ENHANCE JUNIOR HIGH SCHOOL STUDENTS' UNDERSTANDING OF MATHEMATICAL CONCEPTS

Vira Alfioni Babang Amah^{1*}, Rio Febrianto Arifendi², Elita Mega Selvia Wijaya³

Prodi Pendidikan Matematika, Universitas Tribhuwana Tungadewi, Malang, Indonesia¹⁻³

Email : viraalfionibabangamah4@gmail.com^{1*}, rioarifendi@gmail.com², elita.selvia@gmail.com³

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Abstract

a Teams Games Tournament (TGT)-based approach that meets the criteria of being valid, practical, and effective in improving students' understanding of mathematical concepts in algebraic expressions. This study employed the Research and Development (R&D) method using the ADDIE model, which comprises the stages of Analysis, Design, Development, Implementation, and Evaluation. The research subjects consisted of 12 eighth-grade students at Sunan Giri Junior High School in Malang. Research data were collected through interviews, expert validation, teacher and student response questionnaires, as well as pretest and posttest assessments. The results indicated that the developed instructional material achieved a very high level of validity, with a media validation rate of 90.18% and a test item validation rate of 89.16%. The practicality of the media is demonstrated by a student response rate of 91.37% and a teacher response rate of 96.43%, both of which fall into the "very practical" category. In terms of effectiveness, the average student score increased from 60.75 on the pretest to 87.50 on the posttest. Furthermore, the N-Gain analysis result of 0.66 indicates a moderate category. Thus, the Teams Games Tournament (TGT)-based Algebra Cards learning medium is deemed suitable for use as an alternative learning method to improve students' understanding of mathematical concepts in algebraic expressions.

Keywords: Algebra Cards, Teams Games Tournament, Mathematical Concept Understanding, Algebraic Expressions.

(*) Corresponding Author:

Vira Alfioni Babang Amah, Alama,
viraalfionibabangamah4@gmail.com, 081246533713

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INTRODUCTION

Education plays a crucial role in developing students' thinking skills, including through mathematics instruction. One topic that students often find difficult is algebraic expressions, as it involves the use of abstract symbols and variables. Difficulty in understanding basic algebraic concepts can lead to students developing misconceptions about algebraic expressions (Utami, 2017).

Based on interviews with mathematics teachers at Sunan Giri Junior High School in Malang on October 14, 2025, eighth-grade students still struggle to understand the concepts of variables, coefficients, and constants, as well as the application of algebraic expressions in contextual problems. Daily test results show that only 4 out of 12 students achieved a score above the minimum passing grade of 75, indicating that students'

understanding of algebraic concepts remains relatively low. One alternative that can be used to address this issue is algebra-based manipulative media. This media helps students understand algebraic concepts more concretely through manipulative activities involving visual and physical representations. The use of algebra-based manipulatives has been proven to be valid and can facilitate improvements in students' understanding of mathematical concepts (Maulida et al., 2022).

To make learning more active and engaging, algebra cards can be integrated with the Teams Games Tournament (TGT) learning model. This model combines group collaboration and academic games, thereby enhancing student engagement and learning outcomes in the learning process (Syafii & Yulianti, 2019). Therefore, the development of TGT-based algebra cards is expected to help improve junior high school students' understanding of algebraic expressions.

METHODS

The data obtained in this study were analyzed to determine the quality of the Teams Games Tournament (TGT)-based algebra card teaching material that was developed. The analysis focused on three main aspects: validity, practicality, and effectiveness. Data processing was conducted quantitatively using percentage analysis, mean values, and N-Gain scores.

Validity data was obtained from evaluations conducted by subject matter experts and media experts. All validation scores were converted into percentages and then compared against established validity criteria. The results of this analysis were used to determine the media's suitability before it was implemented in instructional activities. The media was deemed suitable for use if it received a rating of "valid" or "highly valid."

Practicality data was obtained through questionnaires completed by teachers and students after the media was used in the learning process. The collected data was analyzed in the form of percentages to determine the ease of use, visual appeal, and usefulness of the media in supporting learning activities. The media's practicality was assessed based on predetermined categories, thereby determining whether the media was easy to use for both teachers and students.

Data on effectiveness were obtained from the results of pre-tests and post-tests administered to students before and after instruction using TGT-based algebra cards. The analysis involved comparing the mean scores of the pre-tests and post-tests, calculating the percentage of learning achievement based on the Minimum Passing Criteria (KKM), and determining the N-Gain scores to assess the extent of improvement in students' understanding of mathematical concepts. The N-Gain scores obtained were then classified into high, moderate, or low categories to describe the level of effectiveness of the developed media.

In addition to test results, data on group scores and tournament points collected during the Teams Games Tournament (TGT)-based learning process were also used as supporting information to assess student engagement in learning activities. The overall results of this analysis were used as the basis for evaluating the quality of the educational materials developed in terms of validity, practicality, and effectiveness.

RESULTS & DISCUSSION

Results

The product developed in this study is an algebra card game based on the Teams Games Tournament (TGT) method, designed to support the teaching of algebraic expressions. This educational tool was designed as an alternative learning method that combines game elements and group collaboration, enabling students to participate more actively in the learning process.

Algebra cards are used as a tool to help students understand algebraic concepts through guided play activities. In practice, students work in groups, follow predetermined game rules, and participate in academic tournaments. Each success achieved during the game is awarded points, which are then accumulated to determine the group with the highest score. The developed media is shown in Figure 1, and the game rules are shown in Figure 2.



Source: research findings (2026)

Figure 1.
Algebra Card Media Display



Source: research findings (2026)

Figure 2.
Rules of the Game

Media Validation Results

The validation phase was conducted to assess the suitability of the Teams Games Tournament (TGT)-based algebra card media before its implementation in learning activities. The assessment process involved two validators who evaluated the media and test instruments based on aspects that had been established in accordance with the development objectives.

Table 1.
Results of the Validation of Test Materials and Questions

No.	Component Evaluated	Percentage (%)	Category
1.	Algebra Card Materials	90,18	Highly Valid
2.	Test Questions	89,16	Highly Valid
3.	Average	89, 67	Highly Valid

Source: Research data sources (2026)

Based on Table 1, the results of the validation of the Teams Games Tournament (TGT)-based algebra card teaching material by subject matter experts and media experts show that the teaching material achieved a validity rate of 90.18%, while the test items achieved a validity rate of 89.16%. The average validation result of 89.67% falls into the “highly valid” category. This indicates that the media and test instruments developed have met the criteria for validity in terms of content, construct, and readability, making them suitable for use in mathematics instruction on algebraic expressions.

Results of the Usability Test

The usability of the Teams Games Tournament (TGT)-based algebra card teaching aid was assessed through questionnaires completed by students and teachers after the aid was used in teaching algebraic expressions. The evaluation was conducted to

determine the ease of use, the appeal of the teaching aid, and the feasibility of implementing instruction using the developed teaching aid.

Table 2.
Results of the Media Usability Test

No.	Respondent	Percentage (%)	Category
1.	Students	91,37	Very Practical
2.	Teachers	96,43	Very Practical
3.	Average	93,90	Very Practical

Source: Research data sources (2026)

According to Table 2, the Teams Games Tournament (TGT)-based algebra card teaching aid achieved a practicality percentage of 91.37% based on student responses and 96.43% based on teacher responses. The average practicality percentage obtained was 93.90%, falling into the “very practical” category. These results indicate that the developed teaching aid is easy to use in the learning process.

Results of the Effectiveness Test

The effectiveness of the instructional material was determined based on the improvement in student learning outcomes after using the TGT-based algebra card material. The analysis was conducted by comparing pre-test and post-test scores, followed by the calculation of N-Gain scores.

Table 3.
Pre-test, Post-test, and N-Gain Results

No.	Indicator	Score
1.	Pre-test average	66,25
2.	Post-test average	87,50
3.	N- Gain	0,66
4.	Category	Moderate

Source: Research data sources (2026)

Based on Table 3, there was an improvement in student learning outcomes following the use of TGT-based algebra cards. The N-Gain score of 0.66 falls into the moderate category, indicating an improvement in the understanding of mathematical concepts.

Discussion

This study presents an analysis of the results of the development of Teams Games Tournament (TGT)-based Algebra Cards, examined in terms of validity, practicality, and effectiveness. The results of this study are interpreted by referring to learning theories and relevant previous research to strengthen the findings obtained. In terms of validity, the instructional material scored 90.18% and the test instrument scored 89.16%, both falling into the “highly valid” category. These results indicate that the instructional material meets the criteria for content, construct, and language validity. This high level of validity suggests that the material aligns with the learning objectives and the characteristics of algebraic expressions. This aligns with the principle that good learning tools must meet validity standards before being used in the learning process. Furthermore, the use of card-

based manipulative media has proven effective in helping students understand abstract mathematical concepts through concrete representations, as demonstrated by Ummah & Azmi (2020), who state that manipulative media that adhere to the principles of mathematical concept construction can foster student independence and active engagement in building their understanding.

In terms of practicality, the survey results showed that 96.43% of teachers and 91.37% of students rated the method as “very practical.” This indicates that the medium is easy to use, engaging, and can be applied in the classroom without significant obstacles. This aligns with the characteristics of the Teams Games Tournament model, which emphasizes group cooperation, individual responsibility, and structured academic competition. Furthermore, TGT-based learning has proven effective in increasing student engagement and fostering a more enjoyable learning environment. This is supported by the findings of Yulianti et al. (2019), which demonstrate that consistent implementation of the TGT model effectively promotes active student participation while simultaneously improving mathematics learning outcomes.

In terms of effectiveness, the research results indicate an improvement in student learning outcomes based on a comparison of pretest and posttest scores. Before the use of the media, students still struggled to understand basic algebraic concepts such as variables, coefficients, constants, and algebraic operations. This suggests that abstract mathematical concepts were not fully grasped through conventional instruction. After the implementation of the TGT-based Algebra Cards, there was an improvement in students' ability to understand and solve problems more systematically. This finding aligns with Maulida et al. (2022), who demonstrated that the use of card-based media in mathematics instruction significantly enhances student learning outcomes compared to conventional instruction, particularly in mastering abstract concepts.

The N-Gain analysis result of 0.66 falls into the moderate category. In addition, all students achieved learning mastery at a 100% rate based on the minimum passing score of 75. These results indicate that the TGT-based Algebra Cards are effective in improving students' understanding of mathematical concepts in algebraic expressions. This finding is supported by Syafii & Yulianti (2019), who state that TGT-based learning in algebra can significantly improve learning outcomes through active student interaction during the learning process.

Theoretically, the results of this study support constructivist theory, which posits that knowledge is constructed through active learning experiences, social interaction, and the use of learning media that facilitate the understanding of abstract concepts. In this context, TGT-based Algebra Cards provide learning experiences through discussion, cooperation, and competition, thereby making students more active in constructing their own understanding. Thus, Teams Games Tournament (TGT)-based Algebra Cards can be said to meet the criteria of validity, practicality, and effectiveness, making them suitable for use as a mathematics learning medium for algebraic expressions.

CONCLUSION

Based on the results of the research and development of the Teams Games Tournament (TGT)-based Algebra Cards learning media for the algebraic expressions unit in the 8th grade at Sunan Giri Junior High School in Malang developed using the ADDIE model through the stages of analysis, design, development, implementation, and evaluation it can be concluded that the resulting media, when evaluated in terms of validity, practicality, and effectiveness, has met the established criteria. The validation results show that the media received an average score of 90.18% and the test questions

received a score of 89.16%, both falling into the “highly valid” category, making them suitable for use in instruction. Regarding practicality, based on a questionnaire completed by 12 respondents comprising students and teachers the average student response was 91.36% and the average teacher response was 96.43%, both falling into the “highly practical” category. In terms of effectiveness, there was an improvement in student learning outcomes, as evidenced by an increase in the average pretest score from 66.25 to 87.50 on the posttest a difference of 21.25 points and an N-Gain score of 0.66, which falls into the moderate category, indicating that the instructional medium was effective in enhancing students’ conceptual understanding. The analysis results also showed that all students experienced moderate to high improvements in learning outcomes, with no students falling into the low category. Nevertheless, this study still has limitations, including time constraints in implementing the TGT model, classroom management during game activities, and the pilot test being conducted at only one school. Therefore, it is recommended that future research develop the media for other mathematics topics, expand the pilot test locations to more than one school, and refine the design, question variations, and game mechanics so that the media becomes more innovative and optimal in supporting learning.

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