Mathematics Learning with The Teams Games Tournament (TGT) Model for Students at MAN 1 Banyumas

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Abstract

Student competence is measured based on certain indicators. One of the advantages that can be obtained from the implementation of the Computer-Based National Assessment (ANBK). About these aspects, identification of learning difficulties based on the results of ANBK needs to be carried out to improve the learning process on aspects of teaching methods, assessment methods, decisions on learning implementation, and assessment of learning implementation in schools. Several studies have shown that mathematics is widely experienced by students at various levels of education as a difficult subject. Awareness of the difficulties that students experience in their learning process is an important first step for teachers to design and manage mathematics lessons. This research uses a qualitative method with a descriptive approach. The process of collecting research data through observation, interviews, and documentation. The teacher performs various actions based on his findings in diagnosing students' difficulties in learning mathematics. The main activity performed by the teacher is to teach the Teams Games Tournament (TGT) method. The Team Games Tournament (TGT) applied at MAN 1 Banyumas is learning using academic tournaments, quizzes, and an individual progress score system, where each student competes as a representative of his team with other team members whose previous mathematics learning abilities are equivalent to theirs. Where the TGT applied at MAN 1 Banyumas encourages all students to have the same opportunity to represent their team in the assessment.

Keywords: Mathematics, Teams Games Tournament, Student

1. Introduction

In Indonesia, the results of the national exam can be used to map the ability and difficulty of learning. By understanding the mapping of learning capacity and difficulties, teachers can improve the learning process in the coming years. This study diagnosed the difficulty of MAN 1 Banyumas students in learning Mathematics. By identifying student difficulties in learning Mathematics, researchers can improve the learning process both to increase the capacity of individual students and to increase the grade level or school-level competence (Istiqlal, 2017).

At the elementary level, Wijaya, for example, revealed students' difficulties with fractions. Students in their research understand fractions as part of a whole, but more than 90% of these students cannot solve problems involving fractions as part of a collection of objects. Mathematics is also difficult for high school students (Yuwono, 2016). Retnawati, Kartowagiran, Arlinwibowo, and Sulistyaningsih revealed that only 5% of junior high school students can handle fractional exponents such as 4^(2/3). The concept of subsets and parallel lines is also difficult for this student which is indicated by the low percentage of correct answers of students, which is only about 30% (Yulianty, 2019).

In high school, Coşkun revealed that students have difficulty with: (1) the division algorithm on which modular arithmetic is based, (2) the symbolic representation of the division algorithm with modular arithmetic notation, and (3) the class equivalent to the concept of the mod. Mathematical difficulties are also experienced by students (Gazali, 2016) A study by Klymchuk, Zverkova, Gruenwald, and Sauerbier revealed that many college students cannot construct simple functions that represent familiar contexts. A general perspective on students' difficulties in mathematics was given by Russell, O'Dwyer, and Miranda who found that students' difficulties in mastering concepts occurred due to students' inability to

connect between the knowledge they learned and the knowledge they learned. the initial knowledge they have (Mashuri, 2019).

Awareness of the difficulties that students experience in their learning process is an important first step for teachers to design and manage mathematics lessons. In this regard, analyzing students' learning difficulties is often seen as an important step in accessing students' reasoning (Leonard, 2012). Analyzing student difficulties can be the first step in the process of improving student performance because it highlights the key aspects of the student learning process that need to be developed.

After diagnosing students' difficulties in learning mathematics, Tall and Razali recommend that underprivileged students cannot simply be helped by giving them specific strategies to overcome their specific mistakes (Cahirati et al., 2020). These students also need an overall strong math strategy. Furthermore, based on their analysis, Tall and Razali also highlighted that developing the self-confidence of underprivileged students is also an important step to help them obtain better math results (Cahirati et al., 2020).

Another example of instructional recommendations based on the analysis of student difficulties can be found in Wijaya's research, the results of the analysis of errors made by Wijaya, implying that improving the understanding of student tasks requires a focus not only on the student's language competence but also on the ability to select relevant information (Cahirati et al., 2020). Another example of instructional recommendations based on the analysis of student difficulties can be found in Wijaya's research, the results of the analysis of errors made by Wijaya, implying that improving the understanding of student tasks requires a focus not only on the student's language competence but also on the ability to select relevant information

It is following one of the principles of school mathematics put forward by the National Council of Mathematics Teachers that effective teaching of mathematics requires teachers to understand what students know and need to learn (Afsari et al., 2021). This understanding is the basis for teachers to support their students to learn mathematics well (Mashuri, 2019). Therefore, teachers need to be aware of the difficulties of their students in learning mathematics to develop and carry out learning activities effectively.

This expectation implies that the teacher needs to have the competence to identify the learning difficulties of students. With respect to the teaching of foreign languages, Edelenbos and Kubanek-German defined the so-called 'diagnostic competence of the teacher' as "the ability to interpret the development of the student's foreign language, to skillfully handle the assessment material and to provide the student with appropriate assistance in responding to this diagnosis".

By transforming this idea into the teaching of mathematics, the diagnostic competence of the teacher can be defined as the teacher's ability to interpret the thinking and reasoning processes of students, monitor the progress and difficulties of students, and give appropriate responses to the results of the diagnosis. With respect to diagnostic competencies, students have different prerequisites therefore the teacher needs to recognize each student and must be able to describe and interpret the abilities and difficulties of the students individually. This study aims to investigate diagnostic practices reported by teachers, especially mathematics teachers. This investigation includes not only how the teacher performs the diagnosis, but also the teacher's perspective on the student's learning difficulties.

Therefore, the teacher should be aware of this difficulty and give students the opportunity to recognize patterns in mathematics learning materials. Students learn new mathematical concepts and procedures by building on what they already know. In other words, learning by understanding can be viewed as making connections or building relationships either in existing knowledge or between existing knowledge and new information. When students attend school, they have an intuitive understanding of many concepts in mathematics including numbers, measurements, and probabilities. For example, kindergarten and first graders intuitively solve various problems that involve combining, separating, or comparing numbers by acting out problems with collections of objects.

The expansion of this strategy can be used as a basis for developing the concepts of addition, subtraction, multiplication and division. Although they master certain mathematical concepts, however, students have difficulty learning basic mathematics because students are often desperate to use their informal knowledge. The teaching of mathematics, which does not help students build their formal knowledge on their informal knowledge, can cause students to develop two separate systems of mathematical knowledge. It is interesting to note that students who obtain incorrect answers to their written calculations can often find the correct answers using concrete material.

However, when they are faced with their written work, about half of these students keep the wrong answer to written work. The difference between the results obtained from working in two different settings reveals that students are often unable to make connections between formal and informal mathematics.

In another study, fourth-graders who had linked decimal fractional numbers to physical representations of decimal magnitudes were more successful in dealing with problems they had never seen before—such as sorting (Mulyati & Evendi, 2020) decimals are based on size and change between decimal forms and regular fractions—rather than students who don't make the same connection. For this reason, teachers should provide context to help students realize their intuitive mathematical concepts and procedures, encourage them to argue whether they make sense, and guide them to make connections between their intuitive and formal mathematical concepts and procedures. Student errors are often systematic and rule-based rather than random.

In addition to student discovery, this error may be caused by rote-focused instruction. Students abstract or generalize procedures from following the steps in the example that have been worked on, but when their knowledge is memorized or insufficient, they may generalize or over-specialize rules and procedures.

For example, students may over-generalize the rule of subtracting the smaller from the larger on single-digit reductions to the problem of multidigit reduction if they are only taught to subtract the smaller from the larger amounts. Similarly, if students are only faced with borrowing double-digit deductions, they may be too devoted to borrowing from unit-digit to multi-digit reductions.

One way to reduce such difficulties is to help students make connections between conceptual and procedural knowledge. The construction of conceptual knowledge requires identifying the characteristics of concepts, recognizing the similarities and differences between concepts according to these characteristics, and establishing relationships between them.

On the other hand, procedural knowledge requires building skills, meaningful strategies, or algorithms to achieve goals. For example, students who do not align decimal points when adding up or subtracting decimal fractions may follow an algorithm without making a relationship between decimal position values and marching decimal points. More advanced connections, such as summing the same values, require generalizations and reflections on pieces of information such as lining up decimal points to add decimal fractions or looking for common denominators while adding regular fractions. While those connections may be obvious for adults, building them up can be difficult for students.

Therefore, teachers need to design instructions that help students build these big ideas. Concerning class instruction, the difficulty of students can also be attributed to using improper representations. For example, students who have difficulty in summing fractions can extrapolate incorrect algorithms from instructions on fractional representations. Students who have often presented fractions by using pie charts do "1/2 + 1/3 = 2/5" and justify the solution as "the addition of one piece of cake two pieces and one piece of cake three pieces will result in two pieces of five pieces at all". As discussed earlier, using the right representation will help students build different characteristics of the concept.

Furthermore, Rohmah, Majdi, & Utaminingsih stated that the factors that affect learning outcomes are factors from within the student and factors that come from outside the student or environmental factors. Factors that come from the student, especially his ability. The student's ability factor has a huge influence on the learning outcomes he has achieved. According to Razak, the factors that influence learning outcomes are 1) internal factors including intelligence, physiology, attitudes, interests, talents, and motivation; 2) External factors include the family environment, school environment, and community environment. Therefore, teachers must prepare an applied learning model that must be adapted to current conditions (Solihah, 2016).

A learning model that not only provides learning materials or videos and assignments but is an interesting learning and involves all students to help each other understand and master the material learned (Suherman, 2016). To make learning more engaging for students, teachers can take advantage of the app as a medium that is growing today.

One of the learning models that are in accordance with this is cooperative learning. Teams Games Tournament type cooperative learning. Team Games Tournament (TGT) is a learning using academic tournaments, quizzes, and an individual progress score system, where each student competes as a representative of his team with other team members whose previous academic abilities are equivalent to theirs (Hikmah et al., 2018). All students have an equal opportunity to represent their team in the assessment (Sukasih, 2018). The team with the highest points will get awards in the form of prizes and other awards. The above statement is reinforced by Rusman defining the Team Games Tournament (TGT) as a type of cooperative learning that places students in study groups of 5 to 6 students who have different abilities, genders, and ethnicities or races. Learning media or tools can be used to help make learning Teams Games Tournament more fun (Hakim & Syofyan, 2018).

Therefore, researchers use Teams Game Tournament (TGT) as a method in providing students with an understanding of mathematics. TGT is a type of learning that involves collaboration between students during class (Suherman, 2016). Teams Game Tournament is a method that involves students in a tournament formed in groups of students. Students will compete as representatives of their organization against other members of the group who have gathered for the tournament. The value of each group will be used to determine the value of the tournament.

Based on the background of the above problems, in this study want to know the practice of Teams Games Tournament (TGT) applied in MAN 1 Banyumas in learning Mathematics.

2. Research methods

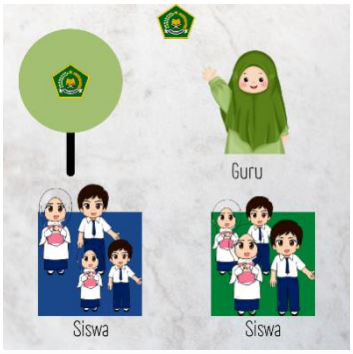
In this study, researchers used a qualitative type of research. Moleong defines this qualitative research as research that provides data results in the form of data in the form of words found in both written and oral data sourced from the subject and object under study (Zakariah et al., 2020).The qualitative approach used by researchers is descriptive. This descriptive approach is that this study describes various phenomena or events that occur in the environment, both natural and non-natural (Anggito & Setiawan, 2018).

The data collection process was carried out through observation at MAN 1 Banyumas and interviews with MAN 1 Banyumas Mathematics teachers, namely Heni Trisnawati, S.Pd.; Tuti Hariyani, S.Pd., Diah Eko Nuryenti, S.Pd., while the secondary data sources used in this study are literature materials such as books, theses and journals, and other literature related to mathematics learning and *Teams-Games-Tournament* (TGT).+

3. Results and discussion

3.1 Teams Games Tournament and mathematics learning

The method used in MAN 1 Banyumas in mathematics learning is through Teams-Games-Tournament (TGT), where this TGT is a generic teaching strategy developed by Purwandari and Wahyuningstyas, as one of the learning approaches in cooperative learning that is used to provide students with knowledge and understanding related to mathematics learning (Purwandari & Wahyuningtyas, 2017) .



Picture 1. Teams Games Tournament Method at MAN 1 Banyumas

Heri Trisnawati, S.Pd mentioned that this method suggests the formation of student study groups consisting of four to five students who are heterogeneous in terms of ability, gender & race. Hakim and Syofyan mentioned that student 1 mentioned that a model like this made himself blend in with the others without seeing the difference. Each competing group will have a representative of students of the same level of ability (Hakim & Syofyan, 2018).

Teams Game Tournament is a type of learning that involves collaboration between students during class (Sukasih, 2018). Teams Game Tournament is a method that involves students in a tournament formed in groups of students. Students will compete as representatives of their organization against other members of the group who have gathered for the tournament. The value of each group will be used to determine the value of the tournament (Rosady et al., 2017).

In Teams Games Tournament, an important component in a learning process through this method is the interaction between students and educators. One of the characteristics of a student who has good behavior is none other than having skills and some achievements, or it can be seen through his tasks that are immediately completed. By providing a comfortable learning environment, things related to achievement can be overcome, especially if they are supported by adequate facilities. The usefulness in the readiness of something related to the teaching and learning process can be felt none other than if the educator plays an active role during the teaching process. Tuti Hariyanti, S.Pd said that the interaction that occurs during the learning process is very important to accumulate students' understanding. Diah Eko Nuryanti, S.Pd added that with the diverse characteristics of students, the interactions provided also need variations. Student 1 mentioned that TGT offers various concepts through learning mathematics, in addition, student 2 added that with various responses and characters, TGT plays a role in the practice of TGT taking place in the classroom.

Thus, efforts to build an attitude of mathematical symbols through the Teams Games Tournament focus on learning efforts and ways and techniques so that students have high concern and mutual respect, as well as the development of skills, and do not rule out the possibility of this being influenced by interactions that occur during the learning process.

Practice Teams Game Tournamet on Mathematics learning at MAN 1 Banyumas. In practice, MAN 1 Banyumas applies the learning process of Teams Game Turnament. Teams Game Turnament can be realized with intensive deepening and communication activities between teachers and students. Thus, during the learning process it is very necessary to create a conducive atmosphere in order to create its own motivation during the learning process. Student 2 mentioned that TGT makes students more motivated to get to know more deeply about learning mathematics.

Tuti Hariyanti, S.Pd mentioned that the main teaching materials used in TGT are worksheets and math wheels. TGT has three basic elements, namely: (1) a team of students is randomly placed into a team regardless of ethnicity, culture, race between students. (2) games – students engage in exercises designed by the teacher, and (3) tournaments – students represent their teams and compete individually against students from other teams and individual scores contribute to team scores (Salam et al., 2015).

The Teams Game Tournamet method held at MAN 1 Banyumas is carried out through several stages, namely:

1. The teacher introduces learning-related topics or mathematics materials to be discussed. This introduction lays the foundation for the partial or full achievement of learning outcomes.
2. The teacher uses the math wheel to determine the topic that will be used as the theme in this game.
3. Students work in small teams to prepare their questions and answers related to the topic and in accordance with the specific guidelines given by the teacher.
4. Students answer questions asked by other teams.
5. Students are scored according to their individual performance (the quality of the questions asked and the accuracy of the answers) and the performance of their team (based on how their answers are compared with the answers by other teams).

The context of the above random formation of teams regardless of ethnicity, race, and culture intends to develop a sense of social cohesion and social responsibility to build an attitude of mathematical symbols. The TGT rules are described in class before the first session and are written through the board. These regulations are summarized in the following sections. *First*, students form a small team of about 4-5 students. Therefore, six teams of 4 or 5 students were formed: These four teams are heterogeneous from different backgrounds in terms of ethnicity, language, and origin. *Secondly*, Each team nominates a captain who is responsible for collecting and delivering questions and answers from the team at the end of each hour. Other captain responsibilities include ensuring the information provided by team members is complete and talking to the teacher in case of conflict with questions (i.e., incomplete or inappropriate) or match results.

The duration of each match is 2 hours. The pairs for the first match are taken randomly. Ideally, all teams would face each other once, but due to time constraints (more teams than the time slots available for the match), the rest of the matches were set according to the Swiss pairing system. In the Swiss system, the winner is pitted against the winner, the losing team is pitted by losing, and so on.

In the following games, each team faces an opponent with the same points or almost the same. No team is paired with the same opponent twice. Victory is counted as 3 points, draw as 1 point and no points are awarded for defeat against the general classification. In the final classification, teams are ranked based on the points accumulated in all their matches.

For 1 hour, each team member must prepare his question and the answer to that question. Different pages should be submitted for questions and answers, labeled with the names of students and teams at the top of each first page. The number of questions generated by each team is equal to the number of team members. In this way, it is ensured that everyone participates and the question can be solved within the allotted time.

Students are allowed to take examples of references available in learning but they will be penalized if they use too similar parameters or ask something trivial. Heri Trisnawati, S.Pd mentioned that the more creative and original the questions, the higher the value they will get. The use of external sources such as books or web-based resources during the game is strictly prohibited to ensure fair competition (that is, all students must use the same basic means: book notes and available subject matter). Although teammates should give priority to their questions, they can help each other with this task.

At the end of the first session, the team captain collects questions and answers from all the students to pass on to the teacher. After a short break (during which the teacher separates and saves the answers in the first hour), the questions asked are distributed to the members of the opposing team (according to the draw of the math wheel). Each team is then given an hour to answer (as many as team members). At the end of the second session, the teacher collected all the questions and answers. That process lasts until one of the teams gets the most value and it's that team that wins the learning model *Teams Games Tournament* (TGT).

In this case, the MAN 1 Banyumas Teacher has a role in the Teams Games Tournament method, namely: 1) Providing initial knowledge in mathematics learning which is the basis of the topics to be discussed in each match 2) The teacher also acts as a referee during the game, so that in practice TGT can be implemented properly in the class.

4. Conclusion

The teacher performs various actions based on his findings in diagnosing students' difficulties in learning mathematics. The main activity performed by the teacher is to teach the Teams Games Tournament (TGT) method. The Team Games Tournament (TGT) applied at MAN 1 Banyumas is learning using academic tournaments, quizzes, and an individual progress score system, where each student competes as a representative of his team with other team members whose previous mathematics learning abilities are equivalent to theirs. Where the TGT applied at MAN 1 Banyumas encourages all students to have the same opportunity to represent their team in the assessment.

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