



Mathematics Learning Media with a Sports Context: Effects on Mathematical Connection Ability

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Abstract. The research was initiated due to the low ability to make mathematical connections, the suboptimal implementation of the independent curriculum, and the limited use of mathematics learning media. The independent climate policy has brought changes that influenced school learning activities, particularly in mathematics. A crucial supporting aspect in the learning process is the use of learning media, which can significantly help develop students' mathematical abilities. Students who frequently use real-life contexts in their learning can better solve mathematical connection problems. This research explores the use of sports as a context for mathematics learning. The objective is to assess the potential impact of using sports-contextual learning media on students' mathematical connection abilities. The study employs a mixed-method approach involving one seventh-grade class in a junior high school in Karawang Regency. Research instruments include a mathematical connection ability test, a questionnaire to gauge student responses to using sports-contextual learning media on integer material, and an observation sheet to monitor student engagement in the learning process. The findings indicate that students are enthusiastic about learning mathematics when using sports-contextual learning media, which captures their attention and moderately enhances their mathematical connection abilities.

Keywords: Learning Media, Sports, Mathematical Connection Ability.

1 Introduction

Education occupies a strategic position in preparing human resources who are empowered and have character that is rooted in the nation's cultural values and Pancasila [1]. By providing quality educational activities, it is hoped that young generation individuals can compete in the era of globalization and survive in the face of very rapid world changes. This is because individual thinking power is the result of various knowledge obtained during the educational process as a provision for facing the challenges of globalization [2]. Curriculum development in Indonesia aims to improve the quality of education, because the heart of education is the curriculum [3]. The changes that occur from the existence of an independent curriculum policy affect the role of teachers and educational challenges that require teachers to develop personal competencies and learning competencies [4]. This has a big influence on learning activities at school, especially on learning mathematics. In this case, one of the

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supporting aspects that is very necessary in the learning process is learning media. The use of mathematics learning media is useful to help develop students' mathematical abilities in the learning process.

Learning media plays a role in stimulating students' positive responses to learning because the material presented through images, sound and movement will attract students' attention to learning, so that it can help them understand the material in depth [5]. This has the implication that the success of the learning process is greatly influenced by the availability of appropriate learning media to support the learning process [6]. Learning media that presents real problem situations by utilizing collaboration between worksheets and video illustrations can foster students' curiosity and motivation to take part in a series of learning activities in class, so that students' positive attitudes towards learning mathematics will be built. The attraction of using video media is that students can watch and study learning videos repeatedly in direct (face-to-face) and distance learning [7]. Students can be guided to construct new concepts and rediscover the connection between concepts that have been studied through worksheets [8].

Mathematics learning that utilizes worksheet media combined with video illustrations will present new experiences for students in absorbing new knowledge, thus making students more motivated and increasing students' curiosity. Mathematics learning media will be more meaningful, interesting and enjoyable by using sports contexts in the mathematics learning process [9]. One of the sports is futsal, this sport can be used as a starting point for learning about rectangles, circles, lines, triangles, quadrilaterals, statistics, distance, speed, angles, probability, addition and subtraction of integers, and sets. The use of context in learning mathematics is not only interesting for students, but can help students improve their mathematical connection abilities because the context in everyday life is relevant to mathematics learning material. Mathematical connection ability is an ability that students must have as an ability to connect mathematics to experiences in everyday life, other materials, and other scientific disciplines [10]. Learning that emphasizes knowledge and understanding of the relationship between mathematical concepts and concepts in other fields or with everyday life will help students solve the problems they face in real life [11]. By being able to relate material to other concepts, students are considered to have good mathematical connection skills and can solve problems with logical thinking.

Several research results show a lack of students' mathematical connection abilities, even though students in Indonesia should have these abilities. The mathematical connection abilities of students in one of the high schools in Bandung Regency, West Java are still relatively low [12]. The mathematical ability of students in one of the secondary schools in Banjarmasin City, West Kalimantan shows that students in the low and medium categories do not meet the three indicators of mathematical connection, while the high category only meets one of the three indicators of mathematical connection ability [13]. The lack of mathematical connection abilities of students at one of the secondary schools in Tinambung sub-district, West Sulawesi. Teachers think that mathematics learning is difficult to connect with other mathematics material or other subject material because they are not used to it, even though the connection between one subject and another or one material with other material is a demand for the current curriculum [14]. This research needs to be carried out to find out how this learning media helps students improve their mathematical connection

abilities. The media used uses a different context from previous research. This research uses the context of futsal, badminton and basketball. It is hoped that this problem can be resolved with learning that involves context in everyday life, namely the sports context as outlined in learning media in the form of print and audio-visual media. It is hoped that the choice of media and sports context will have a positive influence on students' mathematical connection abilities.

2 Methods

The method used in this research is a mix method. This mix method research was carried out simultaneously with the aim of complementing the picture of the study results regarding the learning conditions being researched with and to strengthen the results of the research analysis [15]. The pretest was carried out before implementing learning media in a sports context and then carried out a posttest in one class in mathematics learning. The research subjects involved were students one class VII in a junior high school in Karawang Regency. The instruments used were a mathematical connection ability test, a questionnaire to determine students' responses to the use of learning media with a sports context on integer material and an observation sheet to observe students in participating in the learning process. All test instruments have been tested for validity and reliability with the results showing they are valid and reliable. Next, data analysis using statistical descriptive calculations from pre-test and post-test data as well as N-Gain to determine the average increase in the use of learning media with a sports context on mathematical connection abilities. Calculation of students' pretest and posttest results will be calculated by the average score and improvement using the Hake formula [16].

$$N - Gain = \frac{\text{Posttest Score} - \text{Pretest Score}}{\text{Maximum Score} - \text{Pretest Score}}$$

The results obtained show an increase in students' mathematical connection abilities and the magnitude of this increase will be interpreted based on the criteria for the N-Gain calculation results in Table 1 [17].

Table 1. N-Gain Criteria

N-Gain Score	Criteria
$N - Gain > 0.70$	High
$0.3 \leq N - Gain \leq 0.7$	Middle
$N - Gain < 0.3$	Low

After carrying out the post-test, students fill out a response questionnaire regarding mathematics learning using learning media with a sports context. The percentage results of student responses in each aspect of the assessment are interpreted according to the student response categories in Table 2 [18].

Table 2. Response percentage criteria

Percentage	Criteria
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81%-100%	Very Good
61%-80%	Good
41%-60%	Passable
21%-40%	Not Good
0%-20%	Very Not Good

3 Result and Discussion

Students' initial mathematical connection abilities are shown by students' pre-test scores which tend to be small and there are several students who get a final score of zero. The average value obtained was 22.51. This indicates that students have not been able to integrate the understanding of the basic concepts they have learned with the concept of integer material. Students find it difficult to understand the meaning of questions in story form and are unable to translate the questions into mathematical form, so that the calculation results obtained do not match the meaning of the questions given. Students' inability to convert story problems into mathematical form results in students not being able to get important information from the questions presented and being confused about completing mathematical calculation [19]. Apart from that, students are also unable to determine the order of values of several integers due to a lack of understanding regarding integer material.

Students have not been able to link the connection between the concept of integers and the concept of distance, so students have difficulty applying these two concepts correctly and get wrong calculation results. Students' mistakes in absorbing the information presented also cause students to write inappropriate whole number notation, so that when applying whole number calculation operations, students cannot determine the number notation correctly in the results of their calculations. Students who are still less able to understand the relationships of mathematical concepts and their use in accordance with the questions given [20]. Therefore, students' ability to connect each mathematical concept with material in other fields of science is very important so that students can apply the knowledge they learn in everyday life.

The learning process using learning media with a sports context begins with providing stimulus regarding the previous material and students are directed to listen carefully to the video shown on the projector by the research team while guiding students to directly work on the activities contained in the worksheet, and the research team provided the opportunity to ask students about what they saw in the illustrative video or how to fill in the students' worksheets. Furthermore, at the end of the meeting students are given the opportunity to practice their understanding better through the activity sheet on the worksheet. The final implementation at each meeting is carried out by the research team by guiding students to explain the conclusions about what they have learned at the meeting.

Learning activities carried out using work sheets accompanied by illustrative videos make students very interested and enthusiastic about learning. This is because the illustration video displays sound and animated images related to integer material, thereby increasing student interaction with the material and providing motivation for students to take part in learning activities. The use of videos in learning activities will

make the learning situation more enjoyable than just using audio media or visual media, because students actively use two sensory systems, namely the senses of sight and hearing, which makes students' motivation and interest in learning increase more [21].

Learning using media in the form of worksheets accompanied by illustrative videos can also facilitate students' understanding of mathematical concepts, such as whole numbers. Presenting illustrative videos related to integer material helps students grasp the material visually, making it easier for them to connect the concept of integers with real-world applications. Interactive videos can help students understand mathematical concepts in an integrated manner and demonstrate the connections between the concepts they are studying. This approach enables students to better comprehend how these concepts are related and how they can be applied in various situations [22].

The media is designed to be engaging and includes several learning activities that guide students in constructing knowledge related to integer concepts following specific processing steps. Practice questions on the worksheet aim to enhance students' problem-solving skills during learning activities. Additionally, the learning media is based on everyday contexts related to various sports games, making it easier for students to understand integer material through relevant examples. Understanding built through contexts familiar to students' daily lives and related to the material will enhance their comprehension and retention of the concepts [23]. The developed learning media includes worksheets accompanied by animated video illustrations of sports games such as badminton, futsal, and basketball.

Based on the posttest results, it shows an average value of 50.43 with the lowest value being 11.11 and the highest value being 100. Furthermore, the N-Gain calculation result is 0.36 with a moderate interpretation. Judging from the results, the average value of the pretest was 22.51 and the posttest was 50.43, indicating that there was an increase in the average value of 27.92. Several students who previously got a score of 0 during the pretest also showed an increase in their score during the posttest, although it was not significant. In this regard, the results above show that mathematics learning which has been implemented using learning media with a sports context in collaboration with illustrative videos is able to increase students' mathematical connection abilities in the moderate improvement category. The use of contextual-based worksheets in mathematics learning can help improve student learning outcomes [24].

After carrying out the post-test, students fill out a response questionnaire regarding mathematics learning using learning media with a sports context. Student responses to the aspect of assessing interest in learning media with a sports context are in the very good category as shown by the percentage of each statement at 81% -100%. The use of learning media in a sports context can encourage students' willingness to study mathematics material, especially on the subject of integers. In terms of usability, it is in the very good category, shown by the percentages for each statement at 81%-100%. The use of learning media in a sports context has helped students understand how to master the concept of integers and how far students are able to relate this material to problems in everyday life. Video illustrations can make it easier for students to connect mathematical concepts to everyday life situations [25]. The use of learning videos based on a contextual approach to mathematics content can make the learning process more effective, because it can overcome time and space limitations and help students understand and relate learning material to real situations [26].

In terms of media appearance, it is in the very good category, shown by the percentage of each statement at 81%-100%. The sports context learning media used has been able to present mathematical concepts in integer material in an interesting way and makes it easy for students to understand and through the use of this media students can relate the mathematical material they study to the context of everyday life. The use of learning media which includes animated videos will improve the quality of learning because the presentation of abstract material can be delivered interactively to stimulate students' willingness to learn and improve the learning experience [27]. Furthermore, in terms of media readability, it is in the good category, shown by the percentage of each statement at 61% -80%. Thus, it can be interpreted that the choice of language and writing in learning media with a sports context uses sentence structures that are easy to understand and do not give rise to multiple interpretations.

4 Conclusion

The learning media helps students learn integer material so that there is an increase in mathematical connection abilities in the medium category based on the results of the mathematical connection ability test. Learning integer material using learning media with a sports context makes students more enthusiastic in participating in learning.. Furthermore, there was a positive response from students towards the use of learning media in a sports context. Thus, this learning media can be used by teachers to help students understand integer material.

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