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Research Article

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Effectiveness of STAD with Digital Bingo Media on High-Order Thinking Skills and Learning Motivation in Middle School Biology

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ABSTRACT

The aims of this research are to determine the effectiveness of the STAD learning model assisted by digital bingo media on human excretory system topic of the high-order thinking skills of middle school student and to determine students' learning motivation when using the STAD model assisted by digital bingo media. This research uses quantitative research with true experimental methods. Pretest-Posttest Control Group Design is the design in this research.The results of the research show: (1) Teacher activities in implementing the STAD model are appropriate to syntax, with a 92% accurancy; (2) The results of high-order thinking skills show that posttest scores in the experimental class are higher than those in the control class, namely 74.81 > 67.97. Independent sample T-test results obtained t count > t table, namely 2,220 > 2,000 with a significance of 0.03 < 0.05; (3) Students' learning motivation, as seen from the test percentage, shows 72%, which is included in the high category, so it can be concluded that the use of the Student Teams Achievement Division (STAD) model assisted by digital bingo media is effective for high-order thinking skills and has a positive impact on the learning motivation of second year middle school students in the learning excretory system in humans at MTs Negeri Salatiga in 2023/2024 academic year.

Key words: *STAD, digital bingo media, HOTS, learning motivation*

ABSTRAK

Tujuan penelitian ini adalah untuk mengetahui keefektifan model pembelajaran STAD berbantuan media bingo digital pada materi sistem ekskresi manusia terhadap keterampilan berpikir tingkat tinggi siswa sekolah menengah dan untuk mengetahui motivasi belajar siswa pada saat menggunakan model STAD berbantuan media bingo digital. Penelitian ini menggunakan penelitian kuantitatif dengan metode eksperimen sejati. Pretest-Posttest Control Group Design merupakan desain dalam penelitian ini. Hasil penelitian menunjukkan: (1) Aktivitas guru dalam menerapkan model STAD sudah sesuai sintak, dengan akurasi 92%; (2) Hasil keterampilan berpikir tingkat tinggi menunjukkan skor pada kelas eksperimen lebih tinggi dibandingkan dengan kelas kontrol yaitu 74,81 > 67,97. Hasil Uji Independent Sample T-test diperoleh t hitung > t tabel yaitu 2,220 > 2,000 dengan signifikansi 0,03 < 0,05; (3) Motivasi belajar siswa dilihat dari persentase tes menunjukkan 72% termasuk dalam kategori tinggi, sehingga dapat disimpulkan bahwa penggunaan model Student Teams Achievement Division (STAD) berbantuan media bingo digital efektif untuk keterampilan berpikir tingkat tinggi dan berdampak positif terhadap motivasi belajar siswa sekolah menengah tahun kedua pada pembelajaran sistem ekskresi pada manusia di MTs Negeri Salatiga tahun pelajaran 2023/2024.

Kata kunci: STAD, Media bingo digital, HOTS, Motivasi Belajar

INTRODUCTION

Now days, 21st century skills are really important to be learned. 21st century skills are the skills that somebody needs, to face everyday problems that are becoming more complex day by day and to be successful in a career in the world of work (Wrahatnolo & Munoto, 2018). The 21st-century skills are developed through practice, study, and experience (Redhana, 2019). 21st century skills are divided into four, the first one is thinking skills, communication skills, technology literacy, and technology productivity. These skills are related to learning that focuses on high-order thinking skills. The use of HOTS-based learning and 21st century skills is very important for students to get used to (Ilmi & Puspita, 2023).

High-order thinking skills are complex thinking processes in describing material, making conclusions, building representations, analyzing, and building relationships by involving the most basic mental activities. In Bloom's taxonomy, high-order thinking skills are at levels C4 to C6 (Ariyana, Pudjiastuti, Bestary, & Zamroni, 2018). HOTS-based learning is used in schools with the purpose to improving students' thinking abilities which are currently still at a low level to a higher level, especially with regard to the ability to think critically and creatively in receiving various types of information and knowledge and being able to create decisions in complex situations (Septianingsih et al., 2022).

As 21st century skills, high oder thingking skills are important to every student because it is a skill that is often used and important in the modern world like today (Widana, 2017). Higher order thinking skills include the ability to think logically, critically, and creatively and to solve problems independently. Logical thinking is the result of thinking that can be proven and meets the rules of scientific thinking so that it can be accepted by common sense. Critical thinking is a form of thinking that involves reflection and evaluation activities. Students who are critical in analyzing new things will use the knowledge and experience they already have. Meanwhile, creative thinking is the ability to produce new or unique ideas or thoughts. All the abilities that can be developed if students have high order thinking skills, are useful in students's daily lives. (Setiawati et al., 2019).

Academic achievement has a close relationship with high-order thinking skills. Students who have high-level thinking skills will find it easier to remember, understand and apply them in the learning process. Aspects of high-order thinking skills that require the ability to solve problems will be useful for students, both now and in the future when students are adults (Ongardwanich et al., 2015). One way for participants to become accustomed to using high-order thinking skills is through the use of HOTS-based teaching materials in their learning. Apart from that, the use of HOTS-based worksheets for students will have a positive effect on motivation to learn science (Beddu Sultan, 2019).

Based on the interview with the science teacher, science learning at MTs Negeri Salatiga has started to use HOTS questions to measure students' competence. However, there are significant differences in study results between students, there are students who get satisfactory results while other students get results that are far below. In the learning method that is usually used, the teacher explains to the students, then writes the main points of discussion on the board. Not only that, but the teacher also draws pictures of organs that they learn about.

Based on the problems above, the solution is needed to overcome the problem of high-order thinking skills. The solution that can be given to this problem is that teachers need to use models, methods or approaches in learning that are more enjoyable, both in terms of material, learning models and helpful media (Panggabean, 2021). The learning model that is considered capable of helping improve students' high-order thinking skills is Students Teams Achievement Division (STAD). STAD is a type of cooperative

learning model, where in the lesson the teacher provides material and then gives students the opportunity to express and communicate with each other. By using the STAD learning method, students are actively involved in discussing problems together, sharing difficulties in understanding the material and equipping their knowledge (Rahmatika, 2019).

Beside learning models, the media of study also need to be used to solve existing learning outcomes problems. The bingo board is a game that contains numbered tables, when students can complete questions in four rows horizontally, vertically or diagonally, the group will get points which affect the overall score of the group. By using the bingo board learning media, students become more motivated in participating in learning because study using games, increase students' abilities in analyzing problems in a creative way (Oktaviani, 2019).

Students learning motivation is one of the important factors in science learning. The success of the learning process is influenced by students' learning motivation. Therefore, indicators of learning quality can be seen from students' motivation. According to Kompri (2016), learning motivation is a psychological aspect that is experiencing development inside their self, it means that it is influenced by the physiological conditions and psychological maturity of students. Learning motivation comes up because of internal factors, such as desire to succeed, encouragement of the need to learn, and hopes for goals. Meanwhile, external factors include appreciation, a conducive learning environment, and interesting learning activities (Nasrah & Muafiah, 2020).

By using the STAD learning model assisted by digital bingo media, Hopelly can increase students' high-order thinking skills and learning motivation. The result of another study by Radoti (2023) shows that the application of the Student Teams Achievement Division (STAD) cooperative learning model is effective in improving students' understanding of hiragana and katakana letters. In Ramo (2021) research result shows that there is a significant difference between students' pretest and posttest scores on biology subjects when learning using bingo games and direct instruction. The research shows that the use of bingo games can improve student performance in biology learning. In other research, such as that of Israil (2019) which uses the STAD type cooperative learning model to increase students' learning motivation in science learning in junior high schools, the results show that the use of the STAD type cooperative learning model in science learning can increase students' learning motivation, as indicated by an increase in the percentage of learning completion. So it can be seen that previous research has similarities with research conducted by current researcher, in this research, the researcher assumes that the Student Teams Achievement Division (STAD) learning model and media bingo are learning model and media that can be used for more effective learning. There are also differences between previous research and this research, such as subjects, place, time of implementation. There are also two dependent variables in this research, namely high-level thinking skills and students' learning motivation, that have never been studied by other researchers. The research results were done differently too.

The purpose of this research are to determine the effectiveness of the STAD learning model assisted by digital bingo media on human excretory system topic of the high order thinking skills of middle school students and to determine students' learning motivation when using the STAD model assisted by digital bingo media.

RESEARCH METHOD

This research uses the quantitative research method, which is a systematic investigation of problems around us, then collects data that can be measured using statistical, mathematical, or computational techniques until the conclusions are reached (Karimuddin, 2022). Researcher use true experiment type of research, because researcher manage all the eksternal variable that can affect research proses. The pretest-posttest control group design is used in this reasearch, that two groups selected randomly, then given a pretest to determine the initial conditions between the experimental group and the control group. Then they were given different treatments and the posttest results of the two groups were seen to know whether there are differences between the two groups (Sugiyono, 2016). The research stages can be seen in this Figure 1.

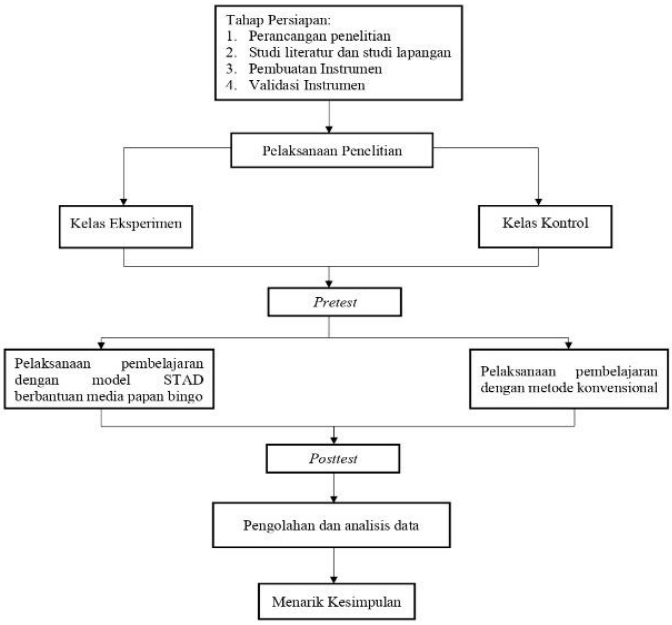

Figure. 1 Research Flow

The population of this research is all eighth grade students in the MTs Negeri Salatiga 2023/2024 academic year. The sampling technique that be used in this research is cluster random sampling, which class VIII E and VIII F are picked as the control class and the experimental class. There are 31 students in each class, so the total sample in this study is 61 students.

The data in this study is collected using research instruments, which are tests and questionaires. Researcher use test to evaluate students' high-order thinking skill and questionare to assess students' learning motivation. The test contains 15 multiple choice questions for each pretest and posttest. The test questions have been validated and tested for reliability before being used. The quistionare contain 20 statement about learning motivation. Test instrument and quistionare is validated by science learning expert and using software SPSS 29.0.2.0 version. Validation test in SPSS using correlation two pearson test and reliability test is tested using cronbach alpha test.

In this study, data analysis is done using both descriptive and inferential parametric statistics. Descriptive statistics show the scores of both the experiment and the control class, while inferential parametric statistics verify the hypothesis with normality, homogenity, and independent sample t-test.

Researcher using Independent sample T to test the hypothesis because can compare the average results of two unrelated groups (Ghozali, 2016).

RESULT AND DISCUSSION

According to the data analysis findings, the study's results will be discussed in three main sections: the implementation of the STAD learning model, students' high-order thinking skills outcomes, and the results of students' learning motivation.

1. Implementation of STAD Learning Model

The Student Teams Achievement Division (STAD) model is implemented in the experimental class, VIIIF. The learning proses is going good as planned and has been proven by the results of the model implementation observation sheet which has been adapted to the STAD syntax by Afandi & Irawan (2013). The implementation of STAD learning model can be see in Figure 2 – 7 bellow.

Figure. 2 Syntax 1 convey learning goals and motivate students

Figure. 3 Syntax 2 Deliver Information

The experiment class begins with a prayer and taking attendance. The teacher then introduces the lesson by outlining learning objectives and motivating students with the practical benefits of mastering the topic for their everyday lives. Motivating students is crucial as it serves as a accelerator that inspires them to participate actively. Research indicates that motivation plays a significant role in academic performance across various educational levels, influencing study efforts as an factor from inside themself (Filgona et al., 2020). In the second syntax, teacher delivers information about the human excretory system through power point. Students will pay attention to teacher' explanations and ask a question about the topic that is being discussed.

Figure. 4 Syntax 3 Organizing student

Figure. 5 Syntax 4 Guiding the group

After discussing the topic, teacher will split the class into 6 small groups. Then students will gather with their group members and play the digital bingo. Teacher choose group activity with playing games because supportive group activities like quizzes and exercises aid students in comprehending and reaching their learning goals effectively. Collaborative efforts, such as peer support and group discussions, motivate students to strive for better results. Weaker students benefit from continuous training and guidance to improve their understanding and readiness to tackle high-order thinking skills (HOTS) questions (Takko et al., 2020). In the fourth syntax, students solve the question that is written in the bingo with their group members, and teacher guiding the group discussion.

Figure. 6 Syntax 5 Evaluation

Figure. 7 Syntax 6 Give reward

Both students and teacher discuss the answers of questions that were shown in bingo before and draw conclusions about today's topic. In the syntax 4 and 5 students are answering the question in the bingo which contain indicator of high-order thinking skill. The indicators of high-order thinking skills include analysis, evaluation, and creation, which are closely associated with the Student Teams Achievement Division syntax. This method indirectly fosters students' development of high-order thinking skills (Kurniawan, 2021).

In the last syntax give reward, teacher will give a reward to a group that gets the highest score while plays digital bingo before. Giving reward to students can hopefully increase students' learning motivation. Whit that, all the syntax in the STAD learning model has been accomplished. The implementation of STAD learning model is also proven by implementation observation sheet, that directly observed by the science teacher. The result of implementation observation sheet shows that 92% of syntax are accomplished.

2. Effectiveness of the STAD Learning Model assisted by Digital Bingo Media on Students' High-order Thinking Skill

The data in this research was obtained through a learning process in the experimental class and control class. Students' high-order thinking skill and students' learning motivation, are control variables in this study. Research data was gathered using pretest and posttest multiple-choice questions to evaluate the high-order thinking skills of students in the control class (VIII E) and experimental class (VIII F). Additionally, a questionnaire on students' learning motivation was administered to the experimental class, VIII F.

The STAD learning model emphasizes comprehension of concepts and encourages collaboration among students in problem-solving. Meanwhile, in direct instruction learning for the

control class, students tend to be more passive because they only listen to the teacher's explanation, so they are not optimal at solving problems The difference in learning implementation between using the STAD model and the direct instruction model has a different impact on students' high-order thinking skills in terms of the pretest and posttest scores. Learning in the experimental class is able to encourage students to work together with their friends to solve problems. In line with Kemuning Sari & Agung (2023) research results, the use of the STAD learning model in science learning has a significant influence on science knowledge competency for class V in elementary school.

Based on the results of the hypothesis test using the independent sample t-test, there are significant differences in students' high-order thinking skill between classes that use the Student Team Achievement Division (STAD) model with direct instruction. The difference in results is shown by the average posttest scores for the experimental class and control class, as shown in Table 1. The posttest results of the experimental class which used the STAD learning model, obtained an average posttest score of 74.81. Meanwhile, the average posttest score in the control class which used the direct instruction model was 67.97. Based on the results of the average posttest scores, it can be concluded that the average score of the experimental class is higher than the average score of the control class.

Table. 1 average score pretest and posttest each class

Class	Pretest	Posttest
Experiment	54,13	74,81
Control	62.81	67,97

The frequency of posttest and pretest scores in each class can be seen in the graph in Figure 8 until Figure 11.

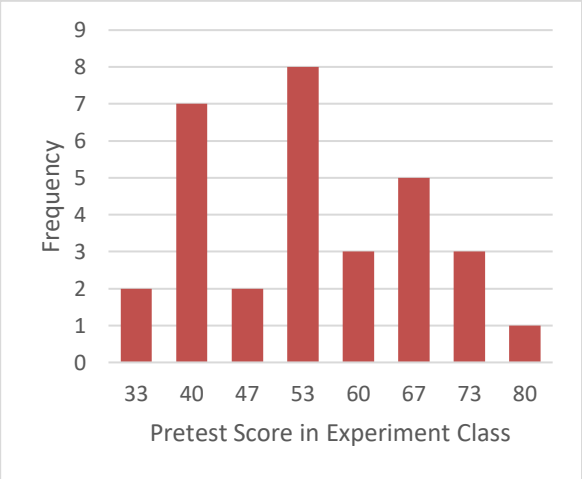

Figure. 8 Pretest score experiment class

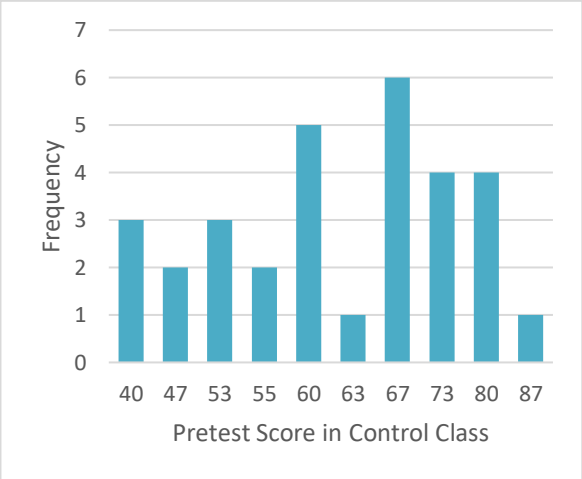

Figure. 9 Posttest score control class

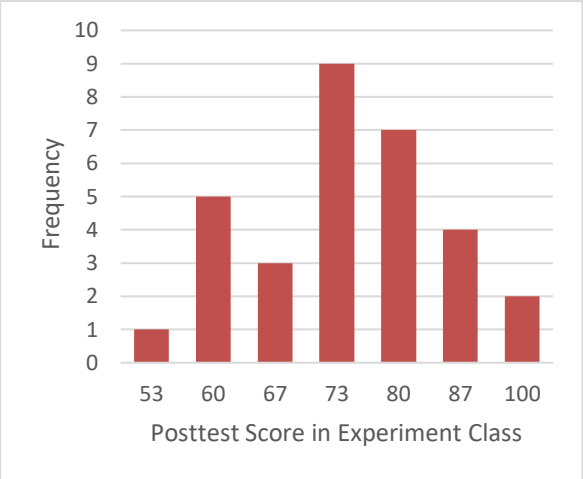

Figure. 10 Posttest score experiment class

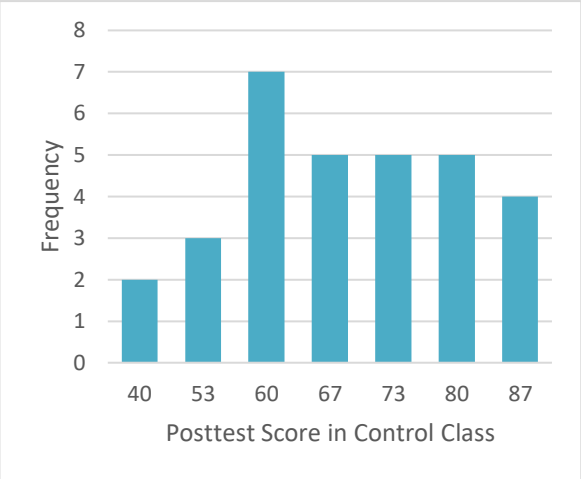

Figure. 11 Posttest score control class

This study using the independent sample t-test to analyze the hypothesis. The results of the independent sample t-test show that t count = 2,220 and t table = 2,000, which means, t count > t table, with signification 0,03 < 0,05 so it can be concluded that the use of the student teams achievement division model assisted by digital bingo media is effective to increase high-order thinking skill of students in VIII grade at MTs Negeri Salatiga 2023/2024 academic year.

Table. 2 The result of hypothesis testing

Test Result	df	t count	t table	Sig (2- tailed)
Eksperimen	60	2.220	2.000	0,03
Kontrol	60			0,03

This research shows the results that the Student Team Achievement Division (STAD) model is effective for students' high-order thinking skills. Which is also in line with the research results of Ariani & Agustini (2018), from the data collected it can be concluded that the use of the Student Team Achievement Division (STAD) learning model and the Teams Games Tournament (TGT) learning model for VIII grade middle school students shows that there is an increase in physics learning outcomes. The result of another study by Radoti (2023) shows that the application of the Student Teams Achievement Division (STAD) cooperative learning model is effective in improving students' understanding of hiragana and katakana letters. In Ramo (2021) research result shows that there is a significant difference between students' pretest and posttest scores on biology subjects when learning using bingo games and direct instruction. The result study by Awaliah, Wahyudin, & Caturiasari (2023) shows here is an influence of the Student Team Achievement Division (STAD) learning model assisted by bingo media that the results of Civics learning at elementary school.

Previous research shows that the use of STAD and bingo media is effective for learning. not only in science learning but in other subjects such as language lessons and civics. The use of STAD is effective in learning because students are actively involved in discussing problems together, sharing difficulties in understanding the material, and equipping their knowledge, which makes learning more enjoyable and can increase students' learning motivation.

3. STAD Learning Model Assisted by Digital Bingo Media on Students' Learning Motivation

The results of using the STAD model in the experimental class show several differences in student activities, that students are more communicative in asking questions and expressing opinions, students also become more motivated to carry out investigations regarding a problem, students also become more skilled when discuss with friends to create an active and fun learning environment. When students are able to answer the questions, it will encourage students to improve their high-order thinking skills. According to Nasrah & Muafiah (2020) there is 6 indicator of student learning motivation. Researcher use questionnaires to determine students' learning motivation. The results of the questionnaires can be seen in Table 3 below.

Table. 3 questionnaire percentage for each indicator

Indicator	Frequency	total	Precentase	category
Desire to succeed	468	620	75%	High
Encouragement to learn	264	372	71%	High
Diligently do the task	262	372	70%	High
tenacious in facing difficulties	279	372	75%	High
interesting activities in learning	299	372	80%	Very high
Enjoys finding and solving problems	208	372	56%	Good

After the learning process, experimental class students were better trained to solve problems and persevere in doing tasks. Students are encouraged to actively interact with their friends, so they can motivate each other and help each other in the process of mastering the topic. Apart from that, it can increase students' learning motivation, according to the opinion of Israil (2019) who stated that the STAD learning model can increase students' learning motivation. In this study, learning motivation in the experimental class obtained a percentage of 72%, which is in the high category, meaning that the use of the Student Teams Achievement Division (STAD) model has a positive impact on students' learning motivation.

CONCLUSION

Based on test results and analysis of research data on the effectiveness of the STAD learning model assisted by digital bingo media on the human excretory system topic of high-order thinking skills and students learning motivation show results of hypothesis testing with the independent sample T-test, it was obtained that t count > t table, namely 2,220 > 2,000 with a significance of 0.03 < 0.05. Therefore, the use of the Student Teams Achievement Division (STAD) learning model is effective for students' high-order thinking skills in VIII grade on science learning. Students' learning motivation result can be seen from the test percentage of 72%, which based on the criteria scale is included in the high category, so it can be concluded that the use of the STAD model has a positive impact on the learning motivation of class VIII students. The results of this research can be used as a reference for teachers' teaching as a

solution to learning problems. The use of the STAD model with bingo media can also be used not only in science learning but in other subjects such as mathematics, language learning, and civics.

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