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The use of snowball throwing model assisted by Kahoot and e-poster to improve students' cognitive abilities in the excretory system material

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ABSTRACT

This research is motivated by the importance of learning innovation that is packaged according to the characteristics of generation Z. This research aims to analyze students' cognitive abilities using the Snowball Throwing, Kahoot, and E-Poster models and analyze how big their influence is. This research uses a quasi-experimental method with a quantitative approach. The analysis looks at how the students' cognitive improvement from before to after treatment, how the effect of the Snowball Throwing, Kahoot, and E-Poster models on students' cognitive, and how much influence the Snowball Throwing, Kahoot, and E-Poster models have on students' cognitive. Data collection techniques used pretest, posttest. The instrument used is multiple choice. Pretest, posttest were processed using the N-Gain test, t test, and effect size. Students' cognitive improvement using Snowball Throwing, Kahoot, and E-Poster models obtained an N-Gain of 0.62 (medium). The effect of Snowball Throwing, Kahoot, and E-Poster models on students' cognitive scores was $t_{count} (3.59) > t_{table} (1.99)$. The magnitude of the influence of the Snowball Throwing, Kahoot, and E-Poster models on students' cognitive scores $d = 0.87$ (big). There is a significant effect of Snowball Throwing, Kahoot, and E-Poster models on cognitive.

INTRODUCTION

Education in the 21st century requires students to have complex knowledge accompanied by various skills. Students are required to have HOTS (High Order Thinking Skills), skills in the world of work, skills in using information, media or technology in line with the innovative learning framework in the 21st century initiated by P21 (Partnership for 21st Century Learning) (Mishra & Mehta, 2017).



According to Uno & Mohamad (2012) innovative learning is a learning process that is packaged differently from learning in general that has been done by teachers in schools. In line with Hartono (2012) innovative learning can also be interpreted as learning that is packaged by teachers that is new in nature, carried out unusually, and aims to facilitate students in building their own knowledge in an effort to change behavior towards a better direction in line with their potential and differences.

Learning outcomes are the results obtained by students after following the learning process and very important for the students themselves (Rao et al., 2020). According to Purwanto (2018) learning outcomes are real changes in student behavior after the learning process is carried out in line with learning objectives. The existence of these learning outcomes allows students to grow and develop in a better direction. Cognitive is a domain that includes mental (brain) activities. According to Setiawati (2019) the learning and teaching level process in the knowledge domain (cognitive) in the revised version of Bloom's taxonomy is divided into three parts, namely LOTS (Lower Order Thinking Skill) including indicator C1 (Knowing), MOTS (Medium Order Thinking Skills) including indicators C2 (Understanding) and C3 (Applying), and HOTS (Higher Order Thinking Skills) including indicators C4 (Analyzing), C5 (Evaluating) and C6 (Creating).

In 2015, the results of the PISA of Indonesian students showed that they were below the average science score of OECD countries. The average science score of students' scientific literacy domain in OECD countries was 493, while Indonesia only achieved a score of 403. This indicates that there is a gap in treating Natural Science education (OECD, 2017).

Based on the results of observations with biology teachers at one of the Islamic Senior High Schools on December 10, 2021, it was stated that the cognitive learning outcomes of students in biology subjects, especially in the excretory system material for the 2016/2017 academic year, where learning evaluations were carried out face-to-face, the average overall cognitive learning outcomes of students had not reached the minimum completion criteria (KKM) of 72. The average score achieved by students was 51, which had not reached the specified KKM.

It is suspected that some of the causes are teachers being careless in analyzing the suitability between the characteristics of the model and media with the characteristics of the material to be studied, teachers are less integrating TPACK-based learning and have not been able to overcome some of the shortcomings of the model that have been explained by experts (Miguel-Revilla et al., 2020; Nelson & Voithofer, 2020). As a result, the average cognitive learning outcomes of students are low, especially the cognitive learning outcomes of HOTS indicators.

The solution offered related to the above problems is to combine a learning model with ICT-based learning media that is suitable for use in today's generation Z without eliminating the essence of the learning model or learning media, which means that the model and media have the same basis (matching). The combination of the model with ICT-based learning media certainly aims to integrate TPACK (Technological Pedagogic Content Knowledge) in learning with the hope of being able to improve students' cognitive learning outcomes for HOTS indicators. The Snowball Throwing type Cooperative Learning model (game-based) assisted by Kahoot (game-based) and E-Poster is the solution offered in this study.

The advantages of the Snowball Throwing type of Cooperative Learning model are that it can increase students' creativity and activity, develop students' thinking skills in discussion activities and completing learning tasks, develop skills in expressing opinions, improve skills in re-explaining material that has been obtained based on discussion activities, and improve learning outcomes in students (Rosidah, 2017). According to Darmawan (2020) Kahoot is one of the preferences of various interactive learning media that can create learning activities that are fun and not boring for both students and teachers. Kahoot emphasizes a learning style that can involve students with other colleagues to actively participate competitively in the learning process, both those that are being understood and those that have been understood. According to Aspahani et al. (2020) E-poster is an electronic poster with graphic design that is able to

communicate visual messages/information in a form that is difficult to damage and readers will be more interested in reading it.

The causes of misconceptions in the excretory system material by students include inappropriate initial preconceptions, originating from previous levels of education where students have understood the same material in Junior High School (SMP) so that there are several misconceptions experienced by students, until finally the knowledge obtained is carried over to the next level of education. Incomplete or incorrect reasoning is also a problem. Students say that the information obtained is incomplete, because when the teacher teaching, teacher almost always does not pay attention, finally when drawing conclusions there are conceptual errors. Student misconceptions can also be caused by a lack of interest in learning in the students themselves. This can happen because the excretory system material is less liked by students who for them are complicated and full of parts that need to be understood (Aprilanti et al., 2016).

Based on the problems above, it is necessary to conduct research on the use of the Snowball Throwing model assisted by Kahoot and E-Poster on students' cognitive on the excretory system material. The novelty in this study is combining the learning model with two practical digital media at once and only focusing on measuring HOTS in students and measuring the effect size, making this study different from previous studies. The purpose of this study is to analyze the improvement of students' cognitive learning outcomes using the Snowball Throwing learning model assisted by Kahoot and E-Poster and to analyze the effect of the Snowball Throwing learning model assisted by Kahoot and E-Poster on students' cognitive learning outcomes on the excretory system material.

METHODS

This study uses the Quasi Experiment method with a quantitative approach and Nonequivalent Control Group Design. Quantitative research emphasizes factual events that are processed by utilizing numbers, statistical processing, structures, and controlled testing. The population in this study were 164 students of grade XI MIPA 1 to 5 in the even semester of the 2021/2022 academic year at one of the Madrasah Aliyah. The sample used was purposive sampling by determining two classes as samples, namely class XI MIPA 4 with 35 students as an experimental class using the Snowball Throwing learning model assisted by Kahoot and E-Poster while class XI MIPA 2 with 35 students as a control class using the Discovery Learning model without the help of Kahoot and E-Poster. The data used in this study were primary data (field research results) and secondary data (literature theories). The data collection technique used was a pretest and post-test with a HOTS-based multiple-choice question instrument of 20 questions. The questions were created by the researcher himself and have been validated by the supervising lecturer and have been tested in schools equivalent to the experimental school and obtained a feasibility result of 0.33 with high criteria. In the revised version of Bloom's taxonomy, HOTS (Higher Order Thinking Skills) include indicators C4 (Analyzing), C5 (Evaluating), and C6 (Creating) (Setiawati, 2019). Data analysis was performed using SPSS version 26, using the N-Gain test, t-test, and effect size test.

RESULTS AND DISCUSSION

Based on the research results, the average pretest and post-test scores for students' cognitive learning outcomes were obtained, which are presented in Table 1 below.

Table 1. Results of N-Gain Test Calculation

Class	Pretest	Posttest	N-Gain	Criteria
ST model assisted by Kahoot and E-Poster	47,29	79,29	0,62	Medium
DL model without the help of Kahoot and E-Poster	47,14	70,57	0,45	Medium

Table 1 shows that the experimental class obtained an average pretest score of 47.29, an average post-test score of 79.29 with details of 24 students exceeding the KKM in biology subjects of 72 and 11 students did not achieve the KKM and an N-Gain score of 0.62 with moderate criteria. In the control class, the average pretest score was 47.14, the average post-test score was 70.57 with details of 14 students exceeding the KKM and 21 did not achieve the KKM and an N-Gain score of 0.45 with moderate criteria. When compared, the experimental class obtained an increase in students' cognitive learning outcomes that were superior to the control class.

The Snowball Throwing learning model assisted by Kahoot and E-Poster changes the learning pattern in the classroom from the beginning to the end of learning. Students are required to be able to understand and analyze the material presented, be able to compete with other students in answering quizzes presented on the Kahoot media, be able to discuss discussion materials together with other students using the help of E-Poster, be able to ask questions with different techniques, be able to express opinions on questions received, be able to respond to other people's opinions wisely, especially on the excretory system material whose discussion is difficult to understand and analyze. According to Shoimin (2017), the Snowball Throwing learning model has the following advantages: 1) Making students active in the learning process, 2) Learning activities are full of joy (joyfull) because students are like playing throwing snowballs, 3) Critical thinking skills in students are trained through activities to create and answer questions received, 4) Preparing students in various situations because students are unable to guess questions made by their peers, 5) Training students' self-confidence in efforts to express their opinions in public, 6) The teaching and learning process becomes effective and communicative so that it can achieve learning objectives optimally, and 7) The cognitive, affective, and psychomotor domains of students can be achieved.

According to Yapici & Karakoyun (2017) Kahoot is a website-based application that provides interactive services including quizzes, discussions or surveys that can be implemented as learning media to assist in teaching and learning activities. In line with Suja'i et al. (2019) Kahoot learning media makes learning more fun and not boring. The interaction between teachers and students in Kahoot and the concept of material with games can attract students' attention to be more active in learning.

The use of Kahoot greatly helps teachers in efforts to provide creativity and innovation in media and is able to introduce students to operating technology properly and correctly so that students are trained to follow the rapid development of technology. Teachers are able to make students comfortable and motivated to do quizzes on the media well (Christiani et al., 2019).

Poster learning media is included in the category of graphic media, namely visual learning media that provides facts, ideas or concepts through words, sentences, symbols and numbers or images (Intaha et al., 2020). Posters are usually used to attract attention and are easily remembered by others.

The calculation of N-Gain for the HOTS indicator of students' cognitive learning outcomes can be seen in Table 2 below.

Table 2. Results of N-Gain Calculation of Indicators

Question Number	Indicator	Pretest Score (%)	Posttest Score (%)	N-Gain	Criteria
1,2,3	Analyze the location and shape of the excretory organs in humans (C4)	57,14	88,57	0,73	High
4	Comparing the role of each excretory organ in humans (C4)	54,29	97,14	0,94	High
5,6,7,8,9,10,11	Analyzing the mechanism of the human excretory system organs in the process of eliminating metabolic waste substances (C4)	62,86	89,39	0,71	High
12,13,14	Evaluate disorders and diseases related to the human excretory system organs (C5)	46,67	75,24	0,54	Medium
15,16,17,18,19,20	Reconstructing technology related to the management of human excretory system organ diseases and psychological therapy to overcome mental disorders in kidney failure sufferers (C6)	23,33	61,9	0,50	Medium

Based on Table 2, the results of the N-Gain calculation for the experimental class indicators show that the indicator analyzing the location and shape of human excretory organs increased in percentage from 57.14 (pretest) to 88.57 (post-test), with an N-Gain score of 0.73, which is considered high. The indicator comparing the role of each excretory organ in humans increased in percentage from 54.29 (pretest) to 97.14 (post-test), with an N-Gain score of 0.94, which is considered the highest compared to other indicators. The indicator analyzing the mechanism of the human excretory system organs in the process of eliminating metabolic waste products increased in percentage from 62.86 (pretest) to 89.39 (post-test), with an N-Gain score of 0.71, which is considered high.

Based on Table 2, the indicator evaluating disorders and diseases related to the human excretory system organs increased from 46.67 (pretest) to 75.24 (post-test), with an N-Gain score of 0.54, classified as moderate. The indicator reorganizing technology related to the management of human excretory system organ diseases and psychological therapy to address mental disorders in kidney failure patients increased from 23.33 (pretest) to 61.9 (post-test), with an N-Gain score of 0.50, classified as moderate. This indicates improvement after treatment.

This can happen because the experimental class uses learning innovations that are in accordance with the characteristics of the current generation Z, namely combining the Snowball Throwing learning model with Kahoot and E-Poster media. According to Shoimin (2017) the Snowball Throwing model is a development of the discussion learning model and is part of the Cooperative Learning model. In line with Rosdiani (2014) and Abramczyk & Jurkowski (2020), cooperative learning or Cooperative Learning is a model that encourages cooperation and is characterized by a cooperative task structure, goals, and rewards.

Kahoot and E-Poster learning media are considered suitable for use today because they are in accordance with the characteristics of generation Z (Lashari et al., 2023; Özdemir, 2024; Wang & Tahir, 2020). According to Darmawan (2020) learning media that are suitable for the learning style of generation Z students in the Big Data era is by utilizing the development of internet technology. In line with Syahputra (2018) collaboration between learning models and the use of digital technology can foster creativity and innovation in students.

Based on the N-Gain value per indicator, the achievement of the creating indicator (C6) shows the lowest percentage. This is because creating (C6) holds the highest and most difficult level in Bloom's taxonomy. In line with the research of Anisha, et al., (2020) who obtained the percentage of HOTS ability indicators analyzing (C4) 55%, evaluating (C5) 47%, and creating (C6)

40%. Research by Sugino & Erman (2022) with indicators analyzing 85%, evaluating 75%, and creating 60%. The results of this study HOTS ability obtained are in the good criteria.

The analysis of the effect of the Snowball Throwing model, aided by Kahoot and Eposter, on students' cognitive learning outcomes in the excretory system topic can be determined based on the results of the hypothesis test. Table 3 below shows:

Table 3. Results of t Test Calculation

Data Analysis		Pretest		Posttest	
		ST Model, Kahoot, and E-Poster	DL Model Without Kahoot and E-Poster	ST Model, Kahoot, and E-Poster	DL Model Without Kahoot and E-Poster
Hypothesis	t _{count}	0,07		3,59	
	t _{table}	1,99		1,99	
	Conclusion	There is no significant difference		There are significant differences	

Based on Table 3 regarding the results of the hypothesis test calculation, the pretest t-count value is 0.07, which is less than the t-table value of 1.99, which means that there is no significant difference in students' initial abilities regarding the material to be taught. In addition, the posttest t-count value is 3.59, which is more than the t-table value of 1.99, thus there is a significant difference in students' cognitive learning outcomes between the experimental class and the control class.

Based on the description above, all can happen because of the learning innovation in the experimental class, namely combining the Snowball Throwing learning model (game-based) with Kahoot media (game-based) and E-Poster. The combination is considered suitable because it has the same basis so that in its implementation it does not eliminate the essence of either the model basis or the learning media because it is matching.

The Snowball Throwing learning model is relevant to the constructivism learning theory. According to Suzana & Jayanto (2021) constructivism theory is where someone is able to produce knowledge (cognitive) and form meaning based on their experiences. Two key concepts in constructivism theory that create new individual knowledge constructions (cognitive) are assimilation and accommodation. Assimilation causes individuals to incorporate new experiences into old experiences. This causes individuals to develop new perspectives, rethink what has been misunderstood, evaluate what is important and ultimately change their perspectives. Accommodation on the other hand, reframes the world and new experiences in existing mental (brain) capacities. Individuals create certain modes in which the world operates. When it does not operate in that context, they need to accommodate and reframe expectations with outcomes.

The Snowball Throwing learning model has a characteristic that is an advantage that is not possessed by other learning models. According to Shoimin (2017) the Snowball Throwing model has several advantages, namely the teaching and learning atmosphere becomes more exciting because students play by throwing question balls at other students, students get the opportunity to develop thinking skills because they are given the opportunity to create questions and give them to other students, and requires students to be ready with various possibilities because students do not know what questions their friends make.

Generation Z has the characteristic of being literate in technological developments. Learning media that is in accordance with the characteristics of the current generation is by integrating digital/electronic-based media. According to Rusliana et al. (2024), Kahoot is one of the applications that can be implemented as a game-based learning media which involves students in active competitions directly. The learning process using Kahoot can stimulate students' thinking power because this application provides interesting colour, animation, visual images and music features.

E-posters are practical learning media that can be accessed anytime and taken anywhere. According to Aspahani et al. (2020) E-posters are electronic posters with graphic designs that are able to communicate visual messages/information in a form that is difficult to damage and readers will be more interested in reading them. Electronic posters are said to be difficult to damage because they are not printed in the form of paper or banners, but electronic posters can be read on electronic media that can display electronic posters, for example, projectors, computers, and TVs. In line with Cecep et al. (2013) electronic media that can be accessed by students have different benefits and characteristics. When viewed from the side of its usefulness, electronic media itself is able to create a more interactive and interesting teaching and learning process, can be accessed anytime and anywhere and is able to improve the quality of the teaching and learning process.

Based on the results of the analysis of research data from Fitri et al. (2017) the Snowball Throwing model assisted by Word Square media is effective for students' cognitive learning outcomes in addictive and psychotropic materials. This is evidenced by the t-count value of 3.834 > t-table value of 1.677, it can be concluded that H1 is accepted, which means that the cognitive learning outcomes of students in the experimental class are significantly different from those in the control class.

Based on the research results of Latuperissa & Rumahlatu (2018) the Snowball Throwing type cooperative learning model can improve students' cognitive learning outcomes in the human respiratory system material. This is proven by the fact that 76.92% (20 students) got a score in the interval (81-90) with a good classification, 23.07% (6 students) got a score in the interval (70-80) with a sufficient classification, thus all students in the class using the Snowball Throwing model have mastered the learning indicators in the human respiratory system material.

As a form of renewal in this study, the researcher measured the extent of influence of variable x on variable y using effect size. Table 4 shows the results of the effect size calculation.

Table 4. Results of Effect Size Calculation

Effect size test data analysis				
\bar{X}_t	\bar{X}_c	S_{pooled}	d	Criteria
79,29	70,57	10,00	0,87	Big

Table 4 shows the results of the effect size calculation, the d value obtained is 0.87, where this value is quite large, meaning that there is a large influence of the use of the Snowball Throwing learning model assisted by Kahoot and E-Poster on students' cognitive learning outcomes in the excretory system material.

The use of Kahoot and e-Poster in the Snowball Throwing model provides a different color and implementation from previous learning. According to Afdilani et al. (2022) the Snowball Throwing strategy requires students to master the material, think creatively, and have a sense of responsibility for the tasks they undertake. This strategy divides several groups during its implementation and makes each student responsible for mastering the material well because in the process, students will be given the opportunity to answer questions from the material that has been provided.

Wulandari et al. (2023) stated that appropriate learning media is very important in supporting student learning. The selection of appropriate learning can help students to understand the learning material delivered by the teacher. Learning media can provide concrete experiences and also act as intermediaries that help student learning. This theory is in line with researches that said Kahoot! is an online game developed to answer challenges in the learning process that makes students more concentrated, more collaborative, comfortable in learning and increases learning motivation (Chaiyo & Nokham, 2017). In line with Diana & Winarsih (2023) that says e-poster learning media is designed with an attractive appearance and utilizes sophisticated

technology so that it makes students more motivated to learn. The appearance of learning media that is attractive, not boring, and easy to use makes students motivated to learn.

Overall, the implementation of the Snowball Throwing model assisted by Kahoot and e-Poster has a positive impact on students' cognitive abilities in the Excretory System material. This learning combination can be used in the classroom to experience a different, renewable learning experience, playing while learning but still achieving learning objectives. The needs of the 21st century generation for learning media are starting to be replaced by the old, widely used whiteboards, with smart boards, projection devices, and portable computers (Pujiastuti et al., 2020; Roemintoyo & Budiarto, 2021; Zulyetti, 2023). Currently, the new, digitally advanced generation spends their days with digital tools, such as: computers, smartphones, music players, video games and others.

CONCLUSION

Based on the research results and discussion, it can be concluded that the objectives of this study were achieved, as evidenced by credible data analysis that adhered to statistical theories. The improvement in students' cognitive learning outcomes on the excretory system using the Snowball Throwing learning model assisted by Kahoot and E-Poster fell within medium criteria, with an N-Gain value of 0.62. Furthermore, the effect of the Snowball Throwing learning model assisted by Kahoot and E-Poster on the excretory system on students' cognitive learning outcomes was found to be $t\text{-count} (3.59) > t\text{-table} (1.99)$, indicating a significant difference in students' cognitive learning outcomes between those who used and those who did not use the Snowball Throwing learning model assisted by Kahoot and E-Poster. The magnitude of the effect of the Snowball Throwing learning model assisted by Kahoot and E-Poster on the excretory system on students' cognitive learning outcomes was found to be $d = 0.87$, which falls within big criteria.

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