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Application of Snowball Throwing Model in Science Subjects on Student Learning Outcomes at Junior High School

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Abstract

This study aimed to describe the effectiveness of the snowball-throwing learning model in improving student learning outcomes in science subjects in junior high school. This quantitative descriptive research uses an experiment method and pretest-posttest one-group design. The research population was all VIII class students of Junior high school, 19 Palu in the 2022 / 2023 school year, totalling 107 people, with a research sample of VIII A class totalling 31 people. The sample was determined using a non-probability sampling technique, a simple random sampling method. The research instrument consisted of an evaluation test and a teaching observation sheet. Data analysis was carried out using non-parametric statistics and the Wilcoxon signed rank test to test the hypothesis of pretest and posttest data. At the same time, the data from the student activeness observation sheet was carried out descriptively per cent. As for determining the effectiveness of the learning carried out, using the N - Gain test. The pretest and posttest data analysis results obtained a significant probability value < α (0.05). Thus, it can be stated that the proposed research hypothesis is accepted, and it can be noted that the snowball-throwing learning model is efficacious in improving student learning outcomes. Gain test results show that the efficacy of snowball throwing learning is high with an N - -gain value of 0.8, with an N score of 80 % in the practical category. This achievement is supported by the observations of student activeness, with a percentage of 81.8 % in the outstanding category. It can be concluded that the snowball-throwing learning model effectively improves student learning outcomes in science subjects at Junior high school 19 Palu.

Keywords: Effectiveness, snowball throwing, learning outcomes

Introduction

Science subject is one of the lessons taught in educational units starting from elementary / MI, junior high / MTs and senior high / MA levels. In general, science learning is understood as an effort to find out about nature and all its contents that are carried out in a structured and systematic manner. Science contains a set of facts, concepts, principles, and a discovery process (Habibi et al., 2012). Science learning includes processes and products. Science as a process is seen as a way of obtaining information, processing and developing knowledge through scientific processes and attitudes. In contrast, as a product, science is seen as a collection of knowledge in the form of facts, concepts, principles, theories and laws (Zahro & Maulida, 2023). In science learning, one of the important aspects of concern is the process that students carry out in learning.

This educational theory is in line with the view of constructivism, which encourages the active role of students in learning to find and develop their concepts through direct interaction with the environment and various learning resources. To achieve science learning objectives as intended, efforts need to be made in teaching students. The diversity of student characteristics affects the effectiveness of learning techniques used to teach students (Dunlosky et al., 2013). In this case, there needs to be a change in the learning paradigm, namely student-centred learning.

So far, science learning is still complex for students; some even find science learning scary (Gumilar, 2023), boring and unpleasant. Learning that is carried out is still monotonous and does not pay attention to students' interests and learning needs. The learning paradigm still views students as learning objects. Meanwhile, the process still focuses on content-based instruction (CBI), namely learning that is fixated on completing topics/content of learning material, which does not pay attention to students' diversity and learning needs. Learning that is carried out ignores student learning activeness, ultimately affecting low student learning outcomes. Students tend only to receive learning materials delivered by the teacher. Students tend to be passive learners. In learning, the achievement of learning objectives cannot be maximized. This shows that the learning has not met the criteria of effectiveness.

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Junior High School 19 Palu is a highly diverse school with students. Students at the school come from a housing complex whose residents are pretty heterogeneous and also from local villages that are still homogeneous. This is undoubtedly a challenge for teachers when teaching students. Learning should be able to facilitate these differences and diversity, be fun, memorable, and meaningful for students, and make students the subject of learning. This is done to create effective learning.

The learning conducted at Junior High School 19 is still teacher-centred with CBI and conventional learning process patterns. This causes students to be uninterested in learning. The delivery of learning materials using the lecture method, followed by routine tasks in the form of a collection of questions that students must complete within a certain period, makes learning monotonous. Teachers see routine tasks as a way to complete the content of learning material quickly but ignore the quality of the tasks that students do. Students do not get assistance and guidance from teachers in completing these tasks. It is not uncommon for students to cheat or copy assignments from other students who are considered to have better academic achievement.

These learning conditions make students' participatory activities in learning very lacking. For example, when the teacher gives feedback on the tasks through discussion or question and answer, only a few students can respond and respond to the teacher's feedback. The answers given by students are also rote, which shows that students do not understand the material being studied. In general, students are more silent and passive in learning. Other student inactivity is shown in the collection of assignments that are not on time. There are even students who do not collect the assignments given. This influences students' low learning outcomes. Of the 65 students observed, about 50 % or 35 students scored less than 50, far from the minimum score set in science learning, which is 65.

As facilitators and organizers of learning in the classroom, teachers must conduct learning oriented towards achieving student competencies, which in turn can achieve the learning objectives set. Teachers are expected to design and conduct active, fun and memorable learning for students, which makes deep meaning for students in learning the material taught. This allows students to keep the material in their memory longer and better understand the material learned. Students no longer learn in monotonous conventional ways such as memorization and listening to teacher explanations. Through learning as described, it is hoped that classroom activities, including science learning, can create enjoyable learning, no longer boring learning, let alone frightening for students.

Junior high school students are individuals transitioning from children to early adolescence who, in their learning activities, tend to like game-oriented learning and require active movement. Game-based learning makes it easier for students to understand the material studied and science learning. Games can improve students' logic and understanding of studied subjects (Hidayatulloh et al., 2019). Teachers need to pay attention to student activeness because learning by doing or actively participating is expected to make it easier for students to learn the material. In addition, in the junior high school age phase, students learn to recognize their potential (character) through their learning activities, so learning that encourages student activeness in the classroom is very important. Students at junior high school can explore and elaborate on information to build concepts when the teacher designs learning that refers to the combination of student characteristics and the characteristics of the material being studied (Meriyati, 2015).

Student activeness in learning will create high interaction between students and teachers and between students and students. student activeness will positively impact students' ability to receive and understand learning materials. Students who are actively involved physically and mentally in the learning process will feel a more pleasant learning atmosphere, which will maximise learning outcomes (Novitasari & Pujiastuti, 2020). The learning process strongly influences student activeness, and activeness itself affects student learning achievement (Wibowo, 2016).

Activeness in learning is one of the determinants of student learning success, and these two things together are part of the effectiveness benchmark of the learning process. As explained by Antonijević (2018), effectiveness in education, or more interpreted explicitly as learning effectiveness, refers to the results obtained from the education/learning process, including representing the link between these results and all matters related to the education carried out.

In addition, learning management can also be another measure of the effectiveness of learning. As the leading figures in classroom learning, teachers must strive to implement a learning process that facilitates student learning needs. Students' physical and mental involvement needs to be a teacher's concern. In this case, learning through innovative learning models can be one of the solutions teachers can implement.

The explanation above is in line with Wardhiana et al (2013), who state that to achieve optimal learning, teachers should make learning innovations that attract students' attention so that students can focus on following the learning. Sardiman (2016) explains that the teacher's role in classroom activities is vital. As the person in charge of all forms of learning activities in the classroom, the teacher can compile and design learning scenarios that guide all learning activities to achieve the set goals. Therefore, teachers must create classroom learning activities that activate students (Kurniawati et al., 2017). Thus, it can be said that managing learning should be oriented and involve students mentally, physically, and psychologically,

which can make learning take place effectively and, in turn, produce students who can get maximum results.

One of the innovative learning models that is expected to create fun, enjoyable, memorable and even game-oriented learning in its implementation is snowball throwing. This learning model can train students to be more responsive to receiving messages from others through snowball replicas made of paper to convey messages to friends in one group and other groups (Putri et al., 2022). According to Zaqiyaturrahmah (2018), learning with the snowball-throwing model can increase student activity; students must be active and independent during learning. In addition, this model also requires students to be more creative in learning (Lindiani et al., 2020).

The results of the study by Sipayung et al. (2021) concluded that the snowball-throwing model affects student learning outcomes and can be explained by the activity of throwing snowball throwing students are more active. Another study conducted by Gumilar (2023) found that the snowball-throwing learning model positively affects the learning outcomes of grade IV students of MI Nurul Hidayah in science subjects. Masruroh et al. (2019) explained that students' learning outcomes with the snowball-throwing learning model were proven to increase compared to students taught with conventional learning. Meanwhile, Hujaemah et al. (2019) explained the results of their research where the snowball throwing learning model affected student learning outcomes on the material of the form of objects in class IV Koroncong Elementary School and the results of Indrayani & Surachman (2019), where the snowball throwing model affected student learning outcomes on the material of changes in the properties of objects in class V Prapag Kidul 01 Brebes elementary school.

The use of learning models is strongly influenced by the essential competencies (KD), learning objectives, material characteristics, student characteristics, and ability levels. For the learning to be directed, it must refer to the syntax to accommodate the things mentioned earlier. Chairunnisa & Lubis (2022) stated that the snowball throwing model consists of 8 stages, namely 1) the teacher explains the learning material, 2) organizes students into heterogeneous groups and explains the material to group leaders, 3) group leaders explain the material to their group members, 4) each student makes questions according to the material being studied, 5) students write the questions they have compiled on a piece of paper and make the paper resemble a ball which then students throw the paper ball to each other. 6) each student answers the questions in the paper ball that is obtained/thrown to him, 7) the teacher evaluates the students, and 8) the teacher closes the learning with the students. Each correct answer given by the student to the question from the group that threw the ball will be a point for the correct one. As one of the types of cooperative learning, the teacher will reward the group that gets the highest points at the end of the lesson.

Referring to the explanation and background of the problems described, this study aims to describe the effectiveness of the snowball-throwing learning model in improving student learning outcomes in terms of learning activeness in science subjects at junior high school 19 Palu. This study hypothesises that the snowball-throwing learning model effectively improves student learning outcomes in 19 Palu science subjects in junior high school.

Methods

This quantitative descriptive research uses a quick experiment method using a group pretest-posttest design. This research design is used to test the effectiveness of the learning model on student learning outcomes (Fitrianingsih & Musdalifah, 2015). According to a pre-experimental one—group pretest—a posttest design is a design in which a pretest is given before treatment so that the results can be known more accurately because they can be compared with the state before the treatment.

The study population was all VIII grade junior high school students, 19 Palu in the 2022 / 2023 school year, totalling 107 students. The research sample was class VIII A, with as many as 31 students determined by the non-probability sampling technique simple random sampling method. The research variables consisted of independent variables, namely the snowball-throwing learning model and the dependent variable of learning outcomes. The research instrument consisted of an evaluation test in the form of a multiple-choice test of 10 questions. In addition, as supporting data for student learning outcomes to determine the effectiveness of the learning process, observations were made of student activeness.

Pretest and post-test data were analyzed statistically using the non-parametric Wilcoxon signed rank test with the help of the SPSS for Windows version 25 application. This data analysis was carried out to test the proposed research hypothesis. The terms of hypothesis acceptance are:

1) If the significant probability value < α (0.05), then the proposed research hypothesis is rejected, and vice versa;
2) The proposed research hypothesis is accepted if the significant probability value> α (0.05).

To determine the level of learning effectiveness, the results of Hake's N-gain calculation (1998), as published in Febrinita (2022), were used with modified effectiveness criteria from Arikunto (2019), presented in **Table 1.**

Table 1. N-gain score criteria in percentage

N-gain percentage (%)	Criteria
> 76	High effective
56-75	Effective enough
40-55	Less effective
< 40	Ineffective

Results and Discussion

The effectiveness of learning implementation must concern teachers in the learning process. Effective learning is characterized by student involvement in learning. The involvement includes mental, physical and psychological involvement of students. Maximizing student activeness makes learning more meaningful and memorable for students so that students more easily accept learning materials, and learning outcomes will be better. This aligns with the opinion that the primary key to learning is actively involving students in learning (Baharun, 2015). This research was conducted at junior high school 20 Palu to describe the effectiveness of the snowball throwing learning model in improving learning outcomes regarding student activeness in science subjects. The effectiveness of implementing learning with snowball throwing in this study refers to 3 aspects, namely 1) student learning outcomes, 2) student activeness, and 3) the teacher's ability to manage learning.

Student learning outcomes

Student learning outcomes in this study are the first basis for determining the effectiveness of the learning carried out. The learning outcome test data consists of a pretest and a posttest. Noesgaard & Ørngreen (2015) explained that measuring learning effectiveness can be done by conducting a quantitative pretest and posttest.

This study begins with giving a pretest to students of class VIII A, the sample group, to get initial data about student scores before being treated. Furthermore, learning was carried out using the snowball-throwing model. The implementation of learning in two meetings follows the learning strategy design, which contains learning steps designed in such a way as to refer to the syntax of the snowball-throwing model. At the end of the second meeting learning activities, students were given a posttest to obtain student evaluation test data after receiving treatment. A description of the pretest and post-test data is presented in **Table 2.**

Table 2. Students' Pretest and Posttest Data

Component	Pretest	Posttest
N	31.0	31.0
Min	10.0	50.0
Max	65.0	100.0
Average	36.8	87.9

Pretest and posttest data were analyzed statistically to answer the proposed research hypothesis and test the effectiveness of the learning. Noesgaard & Ørngreen (2015) stated that one way to measure teaching effectiveness is to compare students' pretest and posttest scores by conducting an average difference test. Before testing the pretest and post-test data, a normality test was first carried out, with the results of both pretest and post-test data being abnormally distributed, as presented below.

1) Pretest data obtained a significant value of 0.042 < α (0.05), the data distribution is abnormal.
2) Posttest data obtained a significant value of 0.000 < α (0.05), data distribution is not normal.

Referring to the normality test results, the non-parametric statistical analysis of the Wilcoxon signed rank test presented in **Table 3** and **Table 4** is used to test the hypothesis.

Table 3. Output Wilcoxon signed rank test

		N	Mean Rank	Sum of Ranks
Posttest-pretest	Negative Ranks	0[a]	0.00	0.00
	Positif Ranks	31[b]	16.00	496.00
	Ties	0[c]		
	Total	31		

Table 3. shows that no students have decreased scores from the pretest to the posttest (negative rank), and all samples (31 students) get an increase in scores from the pretest to the posttest (positive rank), with an average increase in student scores of 16.00 (Mean rank). There is no similarity between pretest and posttest scores (Ties).

Table 4. Test statistics Wilcoxon signed rank test

Test Statistics		Summary
	Postest-Pretest	
Z	-4.866	
Asymp. Sig. (2-tailed)	0.000	Signifikan < α (0.05)

Table 4. shows that the proposed hypothesis is to reject H_0 and accept H_1, which means that the snowball-throwing learning model effectively improves student learning outcomes in science subjects at junior high school 19 Palu. This is indicated by the difference in the average scores of students' pretest and posttest, as shown in **Table 3.** where the posttest (87.9) > pretest (36.8). The results of this study are in line with and strengthen previous research conducted by (Kusumawati, 2017; Simarmata, 2018; Juliyanti, 2019; Mardiana & Syazali, 2020) that learning using snowball throwing both as a method and as a learning model can improve student learning outcomes in science subjects.

Through snowball throwing, students learn the subject matter more easily through group discussions and by making and answering questions. Students are trained to reason and build communication skills. Dewi et al. (2013) explained that snowball throwing helps students solve problems, reason, communicate, and develop self-confidence.

Students explore the material they learn according to their needs and reasoning abilities. With the snowball throwing model, the teacher can monitor the extent of students' knowledge and abilities in learning through group discussions and independently answer questions and learning activities, working on the LKPD provided in learning. These learning conditions make the material learned easier for students to understand.

Diyantari et al. (2020) revealed that in learning with the snowball-throwing model, material that is difficult for students to learn can be understood by students and can be used by teachers to determine the extent of students' understanding and knowledge of the material. Another explanation

was given by Makhfud & Imron (2020), that learning with the snowball throwing model students can train their thinking skills independently by answering questions from the teacher and the rolling ball and in groups through discussions to produce answers together. It is also reinforced by Yulita (2019), where students who learn with snowball throwing build their knowledge gradually. This knowledge is obtained through inquiry processes, which begin with questioning activities so that they can process information and clarify knowledge that has been understood and focus attention on knowledge that is not or still not understood.

Student learning activeness

One of the main principles in learning is student activeness because learning experiences as a form of learning outcomes are only obtained by students when actively interacting with their learning environment (Novitasari & Pujiastuti, 2020). According to Noesgaard & Ørngreen (2015), student activeness is also one of the benchmarks of learning effectiveness—data on the results of observations of learning activeness. Students are contained in **Table 5.**

Table 5. Data on student learning activity

Indicator of Activity	Meeting (%)		Average	Categori
	I	II		
Visual	80.2	85.1	82.6	Highly Active
Oral	80.8	83.3	82.0	Highly Active
Listening	80.6	83.9	82.2	Highly Active
Writing	81.8	81.4	81.6	Highly Active
Mental	79.7	83.7	81.7	Highly Active
Emotional	77.0	83.5	80.2	Highly Active
Average			81.8	Highly Active

Student activeness in this study was obtained from an activeness observation instrument modified from Diedrich's activeness indicators, which include visual activity, oral activity, listening activity, writing activity, mental activity, and emotional activity (Sardiman, 2016).

The data **Table 5.** shows that student activeness in this study is one of the primary keys to improving student learning outcomes through snowball-throwing learning models. The snowball-throwing learning model is designed so that the focus of learning is centred on students, placing students as learning subjects. In learning, students show positive behaviour and more respect for the class and learn by following the instructions and directions given by the teacher. Students look excited and enthusiastic in learning activities, not bored following the learning from beginning to end. This can be seen in the achievement of all activeness indicators in Table 5, with an average percentage score of 81.8 % in the outstanding category.

This aligns with the explanation (2016) that student activeness plays a vital role in the learning process because it affects student achievement, which is indicated by how active students are in learning the material. Student activeness is seen as one of the main principles in the learning process in the classroom because students gain learning experience through their interaction with the surrounding environment (Novitasari & Pujiastuti, 2020). Similarly, Kurniawati et al. (2017) explained that the active involvement of students in learning would improve learning outcomes, so learning outcomes are strongly influenced by student learning activeness.

The learning process in science subjects of Human Digestive System material using a snowball learning model with a snowball replica using a small plastic ball containing questions thrown/rolled from one student to another makes students feel the element of the game that makes learning fun. Students actively make questions and answer questions obtained from balls thrown by other friends. This is to the statement of Manalu et al. (2022) that learning with snowball throwing, students learn in a pleasant atmosphere, get the opportunity to ask questions and play a more active role in learning. Mursid et al. (2021), because in learning students seem to do learning activities while playing by throwing balls to other students, students develop their abilities in terms of thinking.

Learning with snowball throwing, students look active and excited and practice processing information by making questions to be filled in plastic balls, which are then wrapped in white paper to resemble snowballs. Similarly, in answering questions, students discuss in groups, looking for answers by confirming information from the material learned about the Human Digestive System. Students also get the opportunity to practice communication skills through activities to convey answers to questions through the results of discussions conducted. The snowball-throwing learning model is believed to train students' psychomotor and thinking skills to improve students' ability to answer questions (Manalu et al., 2022).

In addition, learning with the snowball throwing model that was carried out showed students who focused and concentrated on listening to explanations both from the teacher and fellow friends. When students explain material to each other, they seem more excited and enjoy it because they do not feel pressured, and explanations between friends make information easier to understand. Students more easily understand the instructions and directions given by the teacher to carry out learning activities due to the systematic delivery of the learning sequence. This statement is reinforced by the results obtained by Martiah. (2022), that learning with snowball throwing, students do not look indifferent but actively listen to the explanation of the material and follow the directions given.

Teacher's ability to manage learning

This study reviewed the effectiveness of learning with the snowball throwing model from the previous two aspects and also from the teacher's ability to manage learning. Roin and Mustaqim (2023) revealed that in addition to mastering

teaching materials, a teacher must design learning strategies to create an optimal and effective learning atmosphere by selecting appropriate learning models that activate students.

Teacher activities in this study were observed using an observation instrument sheet, which includes teacher activities in managing learning at stages including: pre-learning, opening learning, mastery of teaching materials, learning approaches/strategies, utilization of learning resources/media, learning that triggers student involvement, assessment of learning processes and outcomes and closing activities. The data analysis of teacher activities shows that the teacher's ability to manage learning is in the good category, with a percentage of 73.7 %. These results show that teachers can use the snowball-throwing model to learn well and create learning that makes students learn actively. This has implications for positive student activeness during the learning process, helping students understand the material/concept being studied and training students in reasoning, according to the views of (Fathurrahman et al., 2019).

The role of the teacher in learning with the snowball-throwing model is not limited to explaining learning material to students. The teacher has multiple roles as a facilitator, motivator, organizer, and evaluator of learning. These roles can make teachers place students as learning actors in the learning process.

Conclusions

Referring to the data analysis and discussion description, this study's conclusion is that the snowball-throwing learning model is efficacious in improving student learning outcomes. This is shown by the difference in pretest and posttest scores and evidenced by the results of statistical analysis.

Through the implementation and results of the research that has been carried out, several suggestions can be made, namely 1) snowball throwing model has effectiveness in improving student learning outcomes in science subjects, it is hoped that science teachers will teach students using this model, 2) for further research can be carried out by examining the use of snowball throwing learning models combined with methods or assisted by other interactive learning media, as a form of continuous learning innovation.

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