



Augmenting Knowledge: Measuring the Cognitive Impact of Pop-Up Book Integration

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Abstract. The purpose of this study was to find out how the influence of the use of Pop Up Book media on the cognitive learning outcomes of fifth grade students at SDN Celep Sidoarjo. This type of research is a quantitative pre-experiment with a one-group Pretest-Posttest design using written test sheets in the form of multiple choice questions with indicators of cognitive learning outcomes. The sample in this study were 25 fifth grade students at SDN Celep Sidoarjo. Overall the use of Pop Up Book media in the learning process analyzed with N Gain obtained results of 0.72 which can be interpreted that there is a high influence on students' cognitive learning outcomes. The implication of this study is that the use of Pop Up Book media can improve students' cognitive learning outcomes, and for further researchers it is hoped that they will vary the Pop Up Book media using different materials, as well as be more creative in making Pop Up Book media.

Keywords: learning outcomes, pop up book, heat change

1 Introduction

Learning outcomes are skills that students acquire or develop themselves from the skills that students already have [1]. Learning outcomes can be a measuring tool for student achievement of the ability to understand learning material which is shown in the form of grades obtained from student test results on a material [2]. Learning outcomes become an important element in the learning process, because learning outcomes are used as a measurement of the learning process shown in the form of symbols, letters and sentences that explain the results of student achievement within a specified time [3]. In the national education system, there are three aspects in learning outcomes, namely cognitive, affective, and psychomotor [4]. Among these three aspects, the most dominant in assessing learning outcomes is the cognitive domain, because this domain is an instant appearance to show student success in understanding learning material [5]. Cognitive learning outcomes are one of the tools to determine the level of student learning outcomes in achieving educational goals. Cognitive learning outcomes as a description of student achievement in mastering a learning material obtained from assessment results after learning activities [6]. Cognitive learning outcomes are related to aspects of remembering, understanding, applying, analyzing, assessing, and creating [7]. Cognitive learning outcomes

receive a lot of public attention because cognitive includes actions that prioritize the intellectual field, namely aspects of knowledge and aspects of thinking skills [8]. The science subject is a field that needs to be mastered by all elementary school students in order to improve students' cognitive abilities so that the expected learning objectives can be achieved optimally [9]. Science learning in elementary schools is related to basic concepts related to natural events and phenomena in the surrounding environment [10].

Based on the data obtained from research by the 2019 Program For International Student Assessment (PISA) on learning outcomes, Indonesia has low learning outcomes, especially the cognitive domain ranks last out of 69 countries assessed, namely the 62nd, 61st, and 63rd so that it is said that the cognitive abilities of Indonesian students are low and need to be improved [11]. In line with research conducted by Prasetyo on learning outcomes in one of the Gondolusi State Elementary Schools that the learning outcomes of fourth grade students in the field of science are very low, the event is evidenced by the learning outcomes achieved by students below the KKM which is 75 [12]. The same research was also conducted by Yuliana where student learning outcomes at one of the Bendungan Elementary Schools on thematic learning need to be remedial, the problem can be seen from the values of students who are still below the KKM [13].

From several explanations of the problem of low learning outcomes, this also happened at SDN Celep Sidoarjo. This is evidenced by the results of the daily tests of 5th grade students in science lessons, the average scores obtained by students include aspect C1 which is 53%, aspect C2 which is 43%, aspect C3 which is 56%, aspect C4 which is 47%, aspect C5 which is 37%, and aspect C6 which is 45%. Based on the average score achieved by students from the daily test, it proves that student learning outcomes are below the KKM, which is KKM 75, therefore it can be stated that the results obtained by grade V students in cognitive abilities are still low. Through observation activities carried out by researchers, researchers found the cause of the low cognitive learning outcomes of 5th grade students of SDN Celep Sidoarjo in science learning, namely because it is caused by monotonous teaching and learning activities for students and lack of applying media in the learning process that can increase student interest in learning. This makes students feel bored during the learning process and has an influence on the learning outcomes achieved by students.

Based on these problems, the learning process requires a medium that can attract students' interest during the learning process. Learning media holds an important position in improving learning outcomes, because learning media greatly supports the development of students' knowledge in the learning process [14]. Learning media is very important, namely as a support for the quality of the teaching process, learning media as a supporting aspect in delivering learning material to students, and concretizing learning that is still abstract, and can increase student interest in learning something new in learning so that it is easy to understand and has an effect on student learning outcomes [15]. As for one of the various media used in the learning process that can help in improving student learning outcomes is Pop Up Book [16]. Bluemel and Taylor revealed that Pop Up Book is a book that is able to show the ability to move and the interaction of the book is done by utilizing paper to make rolls, folds, shapes, and turns [17]. Muktiono also stated that Pop Up Book is a book that can present a variety of beautiful and interesting images and can be upheld, the image can also move when the book page is opened and provide an amazing effect [18]. It is also stated by Sholeh that Pop Up Book media is a book that shows a three-dimensional shape and moves when the book page is opened and the book is displayed according to student characteristics, so that it attracts students' attention and can make it easier for teachers to achieve learning goals [19].

The studies related to the use of Pop Up Book media as a support for changes in learning outcomes are better, namely research conducted by Eliyanti, the results of her research prove that applying Pop Up Book learning media has an impact on improving student learning outcomes and becoming an alternative learning media for teachers in the learning process [20]. The same research was conducted by Winda, the results of the study prove that the use of Pop Up Book can support teachers in teaching material to students, and is able to attract student interest in learning, thus having a good impact on student learning outcomes [21]. Fitriana & Zuanita in their research also revealed that Pop Up Book media had a good effect on the learning outcomes obtained by students, and was very efficient in trying to improve student understanding compared to using textbooks [22]. Based on some of these studies, it can be concluded that Pop Up Book media in the learning process has an effect on efforts to improve learning outcomes, but in some of these research results the intended learning outcomes are still general in nature and have not been centered on one aspect, as for the aspects assessed by the teacher and become a benchmark for student success in mastering a material is the cognitive aspect, so that researchers focus on cognitive learning outcomes, using different materials and research objects from previous studies. Based on this background, the formulation of the problem in this study, namely How does the use of Pop Up Book media affect the cognitive learning outcomes of fifth grade students at SDN Celep Sidoarjo. The purpose of this study is to determine how much influence the use of Pop Up Book media has on cognitive learning outcomes obtained by fifth grade students of SDN Celep Sidoarjo.

2 Research Methods

The type of research in this study is quantitative pre-experiment. The design in this study is One group pretest-posttest, where the experimental group is carried out a teaching (Use of Pop Up Book media). The type of One group pretest-posttest design was chosen because there is one group and there is no comparison group with the control group, in this form of design a pretest is given before teaching and a posttest after teaching. The research description is as follows:

$$O_1 X O_2 \quad (1)$$

Description:

O_1 : Test results before treatment (Pretest)

O_2 : Test results after being treated (Posttest)

X : Teaching treatment using Pop Up Book media (Treatment)

The population in this study were fifth grade students of SDN Celep Sidoarjo, totaling 25 students. In this study using saturated samples, as for those sampled in this study, namely all 5th grade students of SDN Celep Sidoarjo, totaling 25 students. Saturated sample is a sample with a sampling technique using all members of the population because the population is small, which is less than 30 members. The source of data in this study was obtained from the pretest and posttest scores of students on the use of Pop Up Book media on heat change material in grade 5 SDN Celep Sidoarjo. The research instrument used in the form of cognitive questions with written test categories in the form of multiple choice questions with indicators of the cognitive domain from C1 to C4 which have been tested for construct validity obtained results of 3.74 which means very good, and the content validity test obtained results with the highest value of 0.885 which means valid for use, and tested for reliability with results of 0.753 classified as reliable or high criteria. Data collection techniques with the application of Pop Up Book media on heat change material, then using written test techniques before and after learning

by applying Pop Up Book media on heat change material. Before Pop Up Book heat change material is applied, it is called pretest and after Pop Up Book heat change material is applied, it is called posttest. The written test technique is used in order to see the learning outcomes achieved by students related to cognitive aspects. Based on the student score data on the pretest and posttest that has been carried out, the technique for analyzing the data from the pretest and posttest results uses the N-Gain formula which is described as follows:

$$\langle g \rangle = \frac{\langle S_{post} \rangle - \langle S_{pre} \rangle}{100\% - \langle S_{pre} \rangle} \quad (2)$$

Description :

$\langle g \rangle$ = normalized gain score

S_{post} = Post test score

S_{pre} = Pre test score

The scores obtained can be categorized using the score interpretation criteria found in the following table:

Table 1. Normal gain criteria [23]

N-Gain	Criteria
$g > 0,7$	High
$0,3 \leq g \leq 0,7$	Medium
$0 < g < 0,3$	Low

Based on the criteria for interpreting the N-Gain score according to Hake, the application of Pop Up Book media is said to have an influence if the cognitive learning outcomes of students obtain an N-Gain score > 0.3 with moderate criteria [24].

3 Results and Discussion

Implementation of research at SD Negeri Celep Sidoarjo class V on science learning by using Pop Up Book media on Caloric Change material. Research data obtained from Pretest and Posttest scores of students on the use of Pop Up Book media in learning. The results of the scores obtained by students were analyzed using the N-Gain formula obtained the following data.

Table 2. Results of improvement in students' cognitive learning outcomes

Sample	Pretest	Posttest	N-Gain	Category
Average	61,92	89,12	0,72	High

Based on the results of student achievement in the table, the value of learning outcomes before being given treatment using Pop Up Book learning media, the initial learning results of the Pretest were classified as low with an average value of 61.92, while for the Posttest data on learning outcomes using Pop Up Book media, the average value of 89.12 was classified as very good criteria, and it can be concluded that the value obtained by students has increased. The results of the N-Gain calculations that have been carried out obtained an overall result of 0.72 including in the high category.

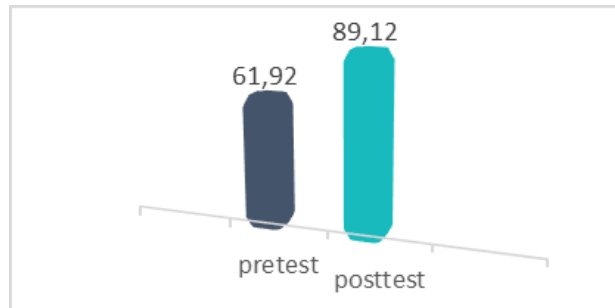


Fig. 1. Diagram of student pretest and posttest achievement

Based on the achievement of learning outcomes in the diagram obtained from 25 students, the value of students' cognitive learning outcomes before being given treatment using Pop Up Book learning media or called Pretest has increased significantly after being given treatment using Pop Up Book media or called Posttest. This shows that the use of Pop Up Book media in learning has a good effect and can help improve student learning outcomes with an attractive Pop Up Book media design that displays beautiful and moving images, and provides interesting effects on each page, so that students are very happy, enthusiastic, active, and excited during the learning process. According to Megawati, students who have a sense of pleasure, interest, and enthusiasm in learning mean that students have a high interest in learning, and if students have a high interest in learning, students become more active in learning so that they get good learning outcomes [25]. The results of this study are supported by previous research conducted by Adinda in 2019 which concluded that the implementation of learning using Pop Up Book media is very enjoyable because Pop Up Book media can increase students' attention and interest in understanding learning material, so that it affects student learning outcomes for the better [26]. The achievement of 4 indicators of students' cognitive learning outcomes calculated using the N-Gain formula according to Hake obtained the following results.

Table 3. Results of the achievement of indicators of students' cognitive learning outcomes

No.	Learning outcome indicators	<i>Pretest</i>	<i>Posttest</i>	N-Gain	Category
		Average	Average		
1.	Remembering	15,2	29,12	0,91	High

2.	Understand	8	20,76	0,80	High
3.	Apply	11,62	20,77	0,74	High
4.	Analyzing	11,76	16,76	0,62	Medium
Total		46,58	87,41	3,07	
Average		11,64	21,85	0,72	High

Based on the results of the achievement of cognitive learning outcomes for each indicator in the table, the recall indicator obtained an N-Gain value of 0.91 classified as high, the understanding indicator obtained an N-Gain value of 0.80 classified as high, the application indicator obtained an N-Gain value of 0.74 classified as high, and the analysis indicator obtained an N-Gain value of 0.62 classified as medium.

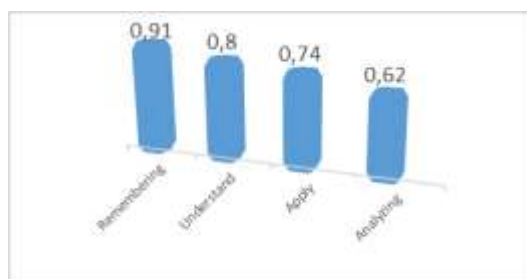


Fig. 2. Diagram of Achievement of Indicators of student cognitive learning outcomes

Based on the results of the achievement of indicators of cognitive learning outcomes in the figure above, the recall indicator has the highest increase, namely the obtained N gain result of 0.91 including in the very high category, this can occur because in the learning process all students are very enthusiastic to observe and study the heat change materials contained in the Pop Up Book media, so that students can remember and describe the definition of heat, temperature, and the form of objects. The aspect of remembering is a cognitive domain or low-level thinking process, where this ability includes the ability to know and remember things that have been learned before [27]. In the question of remembering indicators, students are given several choices and students can show one of the notions of heat, temperature and the form of objects, and students show the forms of objects that are in accordance with their properties. The results of student answers on the recall indicator are on average all correct and have a high achievement score compared to other indicators, because the recall aspect is a fundamental aspect where students are required to recognize or understand without having to understand. In line with research conducted by Sholihah, in the aspect of remembering student achievement is very high, so it can be said that students have developed skills to determine their learning goals which is the definition of thinking, namely remembering [28].

In the understanding indicator, the N gain result is 0.80 in the high category. This shows that students understand and understand the heat change material. The ability to understand is the second level cognitive aspect of Bloom's cognitive domain which is defined as the ability to

absorb the meaning of the material learned [29]. The high achievement on the understanding indicator is because the level of thinking of students on this indicator is still at a low level, namely with the activity of understanding or knowing by looking at the pictures and explanations about the heat change material in the Pop Up Book media. In the recall indicator question, students must be able to determine the type of change in the form of objects that occurs in a picture, and determine the type of change in the form of objects that is in accordance with the event of a change in the form of objects presented in the problem. The results of student answers on this indicator are on average correct, so it can be stated that students are able to understand, and understand about heat change material including temperature and changes in the form of objects. In line with research conducted by Lathifah, the achievement of cognitive abilities in the aspect of understanding is on average high, which indicates that the cognitive abilities of students have reached the stage of understanding, understanding and restating the material that has been obtained in the learning process [30].

In the applying indicator, the N gain result is 0.74 in the high category, indicating that students are able to apply or apply their learning outcomes in everyday life. The indicator of remembering students' thinking ability is one level higher than understanding which only requires knowing and understanding. In the applying indicator, student activities only connect the material in everyday life, namely mentioning examples of events of changes in the form of objects that occur in everyday life. High achievement in the applying indicator occurs because in the learning process students are very enthusiastic and interested in the pictures of events changing the form of objects contained in the Pop Up Book, so that students easily understand and can provide examples of events changing the form of objects that occur in their daily lives. In line with research conducted by Harsyah, in the aspect of applying the average student achievement is quite high where students seem to be able to feel and see the real application of the material from what is being learned in class so that it can encourage them to apply it in their daily lives [31]. In the question of applying indicators, students must be able to show examples of changes in the form of objects that are in accordance with the provisions, and determine the right pair between activities and changes in the form of objects that are appropriate in a table. The results of the answers of most students are correct, which means that students have been able to apply the material in everyday life, but a small number of students are still unable to distinguish the kinds of events that change the form of objects in everyday life.

On the indicator of analyzing the results of N gain 0.64 in the medium category, indicating that students have not been able to analyze changes in heat to the temperature and form of objects. The level of thinking on the analyzing indicator is at a high level compared to the indicators of remembering, understanding, and applying. The ability to analyze is the ability to express thoughts, so learning must be in accordance with the character of science and contain scientific attitudes [32]. Student activities on the indicator of analyzing in the learning process are analyzing the images of the heat process that can change the temperature and form of objects contained in the Pop Up Book media. In the question of analyzing indicators, students must be able to analyze events that occur in everyday life and conclude changes in temperature and form of objects due to heat at the event. The results of the average student answer are less than optimal, this happens because of the lack of student interest in reading questions about analysis, so students cannot provide conclusions on the question. In addition, in the learning process students lack understanding in the analyzing part, so that in these indicators students cannot analyze the heat change material correctly and these indicators have not been achieved optimally. In line with research conducted by Fitriani, in the aspect of analyzing students have not been able to analyze and provide conclusions on the material that has been studied so that the achievement of the cognitive domain in the aspect of analyzing is in the low category [33].

Based on the research conducted, students' cognitive learning outcomes in science learning have been adjusted to the cognitive development of students, the preparation of indicators is carried out from low to higher levels of thinking in accordance with Bloom's cognitive, namely remembering, understanding, applying, and analyzing, so that students can achieve maximum learning outcomes. Based on the results of the N-Gain test, there is a significant difference in science learning outcomes between pretest and posttest. In addition, the data obtained that the average Posttest is greater than the average Preetest, it can be concluded that the use of Pop Up Book media has a significant effect and can improve the cognitive learning outcomes of fifth grade students of SD Negeri Celep Sidoarjo.

4 Conclusions

Based on the results of research data analysis and discussion related to the use of Pop Up Book media in grade V students of SDN Celep Sidoarjo, as well as the results of N-Gain calculations that have been carried out, the overall result of 0.72 is classified as high. Thus it can be concluded that Pop Up Book media has a high effect on the cognitive learning outcomes of fifth grade students of SDN Celep Sidoarjo.

Based on the results of research on the use of Pop Up Book media, the implication of this study is that the use of Pop Up Book media can improve students' cognitive learning outcomes, and it is hoped that future researchers will further vary Pop Up Book media using different materials, and be more creative in making Pop Up Book media tailored to the ability level of students.

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