Contextual teaching and learning of physics at elementary school

Y Hendawati\(^*\), S Pratomo\(^1\), S Suhaedah\(^1\), N A Lestari\(^2\), T Ridwan\(^3\) and N W A Majid\(^3\)

\(^1\)Study program of Elementary School Teacher Training, Bandung, Universitas Pendidikan Indonesia, Indonesia
\(^2\)Teacher, Elementary School
\(^3\)Study Program of System and Information Technology Education, Universitas Pendidikan Indonesia, Bandung, Indonesia

\(^*\)yuyuhendawati@upi.edu

Abstract. The student should be a master for science comprehension concepts, especially in material styles found in everyday life. The research aims to know influence approaching Contextual Teaching and Learning on the improve ability to comprehend the science concept. The experiment was carried out for 3 weeks involving 50 grade V elementary school students based on equal ability levels. Pre-test and post-test refers to the falling motion material of an object due to gravitational force, how to enlarge and minimize friction force, as well as factors that influence the magnetic breakthrough force. As for each meeting an observation was carried out on 50 elementary school students conducted by the observer. The results of this test are processed and analyzed further using a t-test. The result showed that there is a significant difference between the ability of understanding concept students of experimental class using Contextual Teaching and Learning with control class students using direct learning method with pre-test post-test \(\leq 0.05\). Other than that the T test and N-gain of both classes showed the result of 0.000. That is approach Contextual Teaching and Learning influencing to improve understanding ability students’ concept science learning method in elementary school.

1. Introduction

One of the goals of science learning is that developing knowledge and understanding of scientific concepts that are useful and applicable in everyday life [1]. Referring to these objectives students are required to understand the concept of science, including the material of gravity, friction and magnetic force. Through experiments, students will more easily understand it because they can see and experience the phenomenon itself.

Understanding the concept of students in science subjects tends to be low. Teachers tend to use conventional learning (teacher-centered learning), namely learning that is done by the lecture method and assignment of assignments [2]. Students only succeed in solving known problems, with available supporting information [3]. Although, the abilities and attitudes needed to adapt to the ever changing landscape of scientific ideas are myriad and varied [4].

True learning expects a change in students both in terms of mastery of concepts, understanding concepts, and students' thinking abilities. There has been a lot of research about improving the understanding of the science concept by using various models, methods or approaches. There are 10
kinds of integrated learning models, namely: fragmented, connected, nested, sequenced, shared, webbed, threaded, integrated, immersed, and networked [5].

The ability to understand the concept of elementary school students, especially in science learning is very closely related to the activities that exist in the environment [6]. Therefore, in this study learning was carried out using the Contextual Teaching and Learning approach. The application of material is carried out through various kinds of experiments such as comparing the falling motion of a piece of paper with coagulated paper, comparing the speed of the slow pace of a car on a smooth and rough surface, and placing paper clips with a distance of a few cm until they are no longer attracted by the magnet. This paper is designed to study the impact of the Contextual Teaching and Learning approach on the ability to understand the science concept in the matter of the influence of gravitational force on falling objects, how to increase and minimize friction based on its surface, and the factors that affect the magnetism force such as the thin thickness of the barrier and the magnetic distance to magnetic object.

At the end of this writing, students' abilities are measured based on indicators of understanding including interpreting, exemplifying, summarizing, inferring, comparing, and explaining using the Contextual Teaching and Learning approach that connects academic content with real life, and the stages of application, constructivism, inquiry, questioning, learning community modeling, reflection, and authentic assessment [7, 8].

2. Methods
This study involved 50 elementary school students with parental permission first, which consisted of 2 classes namely the experimental class 25 students with the number 14 men and 11 women and the control class 25 students with the number 12 male and female 13. The average age of both classes is 11 or 12 years. The experimental class and the control class have the ability that is equivalent to the average grade of report cards 70. In addition, both of them have the same family background, most of them come from middle to lower class families. In this study the experimental class used the Contextual Teaching and Learning approach and the control class used the direct learning model. Details of the research are explained in the subsection below.

3. Contextual teaching and learning
A Contextual Teaching and Learning approach is applied to be able to help students understand the concept of science in a timely and precise manner based on the surrounding environment. Contextual Teaching and Learning is a constructivism approach focusing on knowledge that is very contextual and relevant to the lives of students from diverse backgrounds [9, 10]. The learning process refers to the 7 principles of CTL, as follows [11]:

- Constructivism, which is to build knowledge in their own minds.
- Inquiry, namely knowledge and skills obtained based on finding yourself.
- Questioning, namely activities for students to dig up information, confirming what is already known.
- Learning Community, namely learning obtained from cooperation with other people.
- Modelling, which is as an example of the material being taught.
- Reflection, which is a way of thinking about what has just been learned then how that knowledge settles in the minds of students.
- Authentic Assessment, namely the process of collecting data that can provide an overview of student learning progress.

3.1. Application of the contextual teaching and learning approach in learning
The concept developed and implemented in the learning Contextual Teaching and Learning as follows [12]:
Table 1. The concept developed and implemented in the learning CTL.

| No | Stages of Contextual Teaching and Learning | Understanding Indicators |
|----|------------------------------------------|--------------------------|
| 1  | Constructivism. The teacher directs all students to build their initial knowledge about the material style by giving a few questions. | Explain the definition of gravity, friction and magnetic force. |
| 2  | Inquiry. The teacher encourages all students to discover each new knowledge independently. | Interpreting the influence of gravitational forces on the motion of falling objects. |
| 3  | Questioning. The teacher encourages all students to ask questions based on the information they want to know. | Students work together to conduct experiments on gravity, friction and magnetic forces. - Compare the speed of falling of two objects based on different weights, shapes and sizes. - Compare the motion of objects on different surfaces. - Classifying objects that are magnetic and non-magnetic - Describes factors that affect the magnetic translucency style |
| 4  | Learning Community. The teacher encourages all students to ask questions based on the information they want to know. Interpret the benefits and disadvantages of friction in everyday life. | - Compare the speed of falling of two objects based on different weights, shapes and sizes. - Compare the motion of objects on different surfaces. - Classifying objects that are magnetic and non-magnetic - Describes factors that affect the magnetic translucency style |
| 5  | Modelling. The teacher gives a direct example to all students related to teaching material namely style. | |
| 6  | Reflection. Students reiterate the material styles that have been learned. | |
| 7  | Authentic Assessment. Teachers conduct assessments based on competencies that have been achieved by paying attention to aspects of knowledge and skills from the beginning of learning to the end of learning. | |

At the first meeting after being given the pretest, the two classes studied gravity-style material by conducting experiments comparing the motion of falling objects. In the experiment, students dropped 2 objects simultaneously. First drop the pen and close the pen, then observe which one comes down first. Both drop gravel and marbles. Third, dropping a sheet of HVS paper and HVS paper that has been kneaded. After that, students conclude the results of the experiment. And the conclusion is that the motion of falling objects is not influenced by weight, but is influenced by air. The second meeting discussed friction by conducting experiments comparing the motion of objects on different surfaces. In the experiment, students drove the car on the floor and above the ground. The conclusion of this experiment is that the car that runs on the floor accelerates faster than the car that runs on the ground, meaning the slippery surface can reduce friction while the rough surface can increase friction. The third meeting discussed the magnetic force by experimenting with factors that affect the magnetism force. In this experiment, students put a paper clip with the distance as far as possible as measured by a ruler until the magnet cannot pull the clip. The conclusion of this experiment is that at a distance of 7 cm the clip loses the magnetic attraction (note: the magnet used in this study is a small magnet). Before learning ends, then both classes are given posttest to measure students' abilities after being given treatment. And each meeting was observed by observers.
4. Results and discussion

Based on the results of the research that was carried out before being given treatment, it showed that the average pretest data did not differ in the two classes. While the posttest data have a significant difference in both classes. This is evidenced by the average yield of a different test of 0.945. In addition, the different test of pretest data per indicator also shows a significant result of $\geq 0.05$. This means that before being given a treatment there is no difference or can be said to be equivalent to the ability of students to understand concepts in the experimental and control classes. Whereas after getting the treatment it has a significant difference with a difference that tends to be high at 2.84. This was also proven based on the average test results of 0.002 differences. In addition, different tests of posted data on indicators interpreting, exemplifying, comparing, concluding and explaining indicate that there are differences with the significance of 0.05, meaning that on these 5 indicators the two classes have different abilities. While the indicator classifies there is no difference to the processing significant value 0.135, then the ability of students to understand the concept of classifying concepts have the same or equal ability in both classes. However, overall it can be concluded that the ability to understand the concept of students after being given treatment is a significant difference.

There were significant differences in science learning outcomes between experimental class students using contextual learning models and control class students using conventional learning [13]. There are significant differences in achievement motivation and science learning outcomes between students who learn with visual media assisted contextual learning and students who learn with conventional learning [14]. The results of their research stated that there were significant differences in science learning outcomes between students who took learning using a contextual approach with students who followed conventional learning models, besides the results of the study also stated that there was a significant interaction effect between learning uses a contextual approach and students' critical thinking skills towards science learning outcomes [15]. The findings of the results of this previous study indicate that contextual approaches do not only affect the ability to understand concepts, but also affect learning outcomes, achievement motivation and critical thinking. So that in this study, which caused the difference in posttest scores between the experimental class and the control class was the application of the Contextual Teaching and Learning approach in the experimental class.

Then find out, whether there are differences in the ability to understand concepts before and after being given treatment, then the testing is done by calculating the pretest posttest data in both classes. The posttest pretest score in the experimental class has an increase with a large enough difference of 5.68 with a different test result of 0.000 while in the pretest posttest score control class has an increase with a difference of 2.92 and a significance value of 0.002. This means that before and after giving treatment in the experimental group and the control group has increased, but with the ability to understand different concepts.

Then find out the significant difference between the ability of students to understand the concept of experimental class and control class. This test uses the calculation of the average N-gain value. The results of the analysis of the experimental class showed an increase by obtaining an average value of N-gain of 0.5305 included in the medium category. While the control class obtained an N-gain value of 0.2734 with interpretation in the low category. That is, between the experimental class and the control class has a different increase in the ability to understand the concept. This was also strengthened through different tests using inferential statistics with the acquisition of a significance value of 0.001. In addition, the results of the acquisition of N-gain per indicator data indicate that there are 5 indicators of understanding concepts that have different improvements, namely indicators interpreting, exemplifying, comparing, concluding and explaining with the acquisition of different tests. 0.05. This is also supported by student activities in constructivism activities by a percentage of 96.7% and found 95%. While the indicators classify there are no differences, meaning that the ability to understand the concept of the experimental group and the control group on this indicator has an equivalent increase. But overall because there are differences in the increase in understanding of concepts in both groups, and the experimental group has increased tend to be high, it can be said that there is an effect of contextual
approach to students' conceptual understanding ability in the science learning experimental class with style material.

Furthermore, the success of learning in addition to being supported by a suitable approach is also supported by student activities during learning. In the experimental class student activity reached a score of 89.3%, which was interpreted in the very good category, while in the control class the activity of students reached a score of 74.2% which was interpreted in good categories. As for each stage in the experimental class that gets the highest percentage of student activity, namely on the stage of constructivism, because at this stage almost all students are active in building their initial knowledge by answering the questions given by the teacher. While the lowest student activity on the questioning stage, because there are still students who do not dare to ask questions or answer questions given by the teacher. While in the control class the lowest student activity is in the phase of demonstrating knowledge and skills, because in this phase there are still many students who do not listen to and pay attention to the explanations presented by the teacher, this is evident because students often make noise in the classroom during learning. While the activity of students who get the highest score is in the phase of providing guided training. Although students are often noisy when the teacher explains, but during guided training students do not make noise and almost all students do the exercises properly and correctly.

As for more clearly the recapitulation of student observations in the experimental class can be seen in table 2.

Table 2. Recapitulation of activities for experimental class students.

| No. | Stages          | Meeting 1 | Meeting 2 | Meeting 3 | Score | Percentage | Information |
|-----|-----------------|-----------|-----------|-----------|-------|------------|-------------|
| 1.  | Constructivism  | 95        | 96        | 99        | 290   | 96.7%      | Very good   |
| 2.  | Find            | 90        | 97        | 98        | 285   | 95%        | Very good   |
| 3.  | Asking          | 152       | 160       | 182       | 494   | 82.3%      | Very good   |
| 4.  | Learning Society| 87        | 90        | 95        | 272   | 90.7%      | Very good   |
| 5.  | Modelling       | 88        | 89        | 98        | 275   | 91.7%      | Very good   |
| 6.  | Reflection      | 77        | 84        | 99        | 260   | 86.7%      | Very good   |
| 7.  | Actual Assessment| 86    | 95        | 99        | 280   | 93.3%      | Very good   |
|     | **Total Meeting** | **675**   | **711**   | **770**   |       | **89.8%**  |             |
|     | **Percentage**  | 84.4%     | 88.9%     | 96.3%     |       |            |             |

Learning science in the experimental class using the CTL approach is more effective and good in helping to improve students' conceptual understanding of style, material because learning is related to students' real life, compared to the control class that uses Direct Instruction models. This is in line with what was stated that various competencies will be built steadily and maximally when learning is done contextually namely learning that is supported by situations in real life. The learning process is said to be effective if all students can be actively involved both mentally, physically, and socially. Because in the process of learning activities that stand out there are students [16].

There was an increase in understanding of concepts in science learning after the CTL learning model was applied [17]. There were differences in the achievement of science learning outcomes between students who were taught using a contextual approach and students who were taught with conventional learning [18]. Contextual learning is an approach that is very suitable to be applied in science learning, and contextual approaches also have a positive impact on student learning achievement.

The findings above illustrate that learning using the CTL approach is very effective to be used to improve students' understanding of concepts in learning science. It is said to be effective because this approach has the characteristic of linking subject matter with students' real life. At the time of learning students will easily accept the material provided by the teacher well, as well as in their learning students
are required to be active both in building initial knowledge possessed with new knowledge, find out for themselves the problems that the teacher gives or work with the group to conduct experiments and discussions. Contextual learning is a way of learning that connects the mind (knowledge and experience) to the actual circumstances in life [19].

Overall based on the findings and discussion, it is seen that the students' ability to understand concepts in the experimental class using the CTL approach has increased compared to the control class using Direct Instruction. This means that there is an effect of the Contextual Teaching and Learning approach on improving students' ability to understand concepts in class V science learning style material.

5. Conclusion

Based on the results of the study, the conclusions of this study are: 1) Ability to understand students' concepts before being given treatment, in the experimental group or in the control group in equal abilities. Evidenced by the results of testing the pretest value data both showed that between the experimental group and the control group there was no difference. In addition, the average difference test per-indicator overall concept comprehension ability did not find significant differences between the two classes. 2) The ability to understand students' concepts after being given treatment, both in the experimental group and in the control group there were differences. This is evidenced by the results of testing the posttest value data both showed that between the experimental group and the control group there were significant differences. In addition, the average difference test per-indicator concept comprehension ability shows that there are 5 indicators that have differences, namely indicators interpreting, exemplifying, comparing, concluding and explaining. While the indicator classifies no difference. But overall the ability of students to understand concepts after being given treatment in both classes is different. 3) The ability to understand the concepts of students in the experimental group and the control group is significant. Analysis of different test pretest posttest scores showed between the two groups there are significant differences. This is reinforced by the N-gain score in the experimental group which increases in the medium category, while the control group increases in the low category. Then, the different N-Gain tests on each indicator of the ability to understand concepts show that there are significant differences between the two classes. That is, increasing the ability to understand the concept of students is higher in the experimental group than in the control group. Because there is a greater increase, the contextual approach has an effect on increasing students' conceptual understanding.

Researchers try to recommend the following: 1) For teachers who want to apply the Contextual Teaching and Learning approach, it would be good before applying must prepare the media and teaching materials; 2) For readers if they want to do research related to contextual approaches and concept comprehension skills, it is expected to conduct research based on more sample sizes and can overcome deficiencies in this study.

References

[1] Mulyasa M 2011 Competency and Contextual Learning Based KTSP (Bandung: PT Remaja Rosdakarya)
[2] Setianingsih D, Ramadhan A and Gagaramusu Y 2014 Meningkatkan Pemahaman Konsep Bagian-Bagian Tumbuhan Melalui Pembelajaran Kooperatif Model Stad pada Siswa Kelas IV SDN 02 Laantula Jayakarta Wita Ponda Kab. Morowali J. Kreat. Tadulako Online 3 2
[3] Sadiqin I K, Santoso U T and Sholahuddin A 2017 Pemahaman Konsep IPA Siswa SMP Melalui Pembelajaran Problem Solving pada Topik Perubahan Benda-Benda di Sekitar Kita J. Inov. Pendidik. IPA 3 1 pp 52–62
[4] Anderman E M, Sinatra G M and Gray D L 2012 The challenges of teaching and learning about science in the twenty-first century: Exploring the abilities and constraints of adolescent learners Studies in Science Education 48 1 pp 89-117
[5] Toharudin U 2016 Meningkatkan Pemahaman Konsep IPA dan Keterampilan Berinkuiri Siswa Sekolah Dasar Melalui Pemanfaatan Bahan Ajar Bernuansa Literasi Sains dalam Model Pembelajaran IPA Terpadu Biosf. J.Bio. Pend.Bio. 1 4
[6] Samatowa U 2011 *Science Learning at Elementary School* (Jakarta Barat: Indeks)
[7] Anderson L W and Krathwohl D R 2015 *Framework for Learning, Teaching and Assessment* (Yogyakarta: Pustaka Pelajar)
[8] Driver R, Asoko H, Leach J, Scott P and Mortimer E 1994 Constructing scientific knowledge in the classroom *Educational researcher* **23** 7 pp 5-12
[9] Morrel P 2003 Cognitive Impact of a Grade School Field Trip *J. Elem. Sci. Educ.*
[10] Sears S J and Hersh S 2002 *Best Practices in Contextual Teaching and Learning: Program Profiles and Cross-Profile analysis* (Columbus: The Ohio State University)
[11] Johnson E B 2002 *Contextual Teaching and Learning* (Thousand Oaks, CA: Corwin Press)
[12] Yamin M *Constructivistic Education Paradigm* (Jakarta: Gaung Persada Press)
[13] Sugiantari N M, Suarmi N K and Margunayasa I G 2013 The Influence of Contextual Learning Models on Learning Outcomes of Science Class V SDN in Kaliuntu Village *e-Journal PGSD University of Education Ganesha*
[14] Merta K, Wayan L and Suastra I W 2015 Pengaruh Pendekatan Pembelajaran Kontekstual Berbantuan Media Visual terhadap Motivasi Berprestasi dan Hasil Belajar IPA pada Siswa Kelas IV Gugus II Kecamatan Abang Kabupaten Karangasem *E-Journal Progr. Pascasarj. Univ. Pendidik. Ganesha* *Progr. Stud. Pendidik. Dasar* **5**
[15] Khotijah S, Dantes N and Tika I N 2015 The Influence of Contextual Learning Approach to Science Learning Outcomes in terms of Critical Thinking Ability in Grade IV Students of MI Tawakkal Denpasar *e-Journal Univ. Ganesha Edu. Postgrad. Progr. Dep. Basic Educ.*
[16] Susanto A 2016 *Learning and Learning Theory in Primary Schools* (Jakarta: Kencana)
[17] Sholichah R I and Sugiaryo 2017 *Improving the Understanding of the Concept of the Characteristics of Light through the Contextual Teaching and Learning Model (CTL) in Class V Students of SD Negeri 02 Kedungjeruk Mojogedang Karanganyar 2016/2017 Academic Year*
[18] Sucitawati M R, Yahruddin and Sumantri M 2013 The Influence of Contextual Learning Approach to Grade IV Students' Science Learning Achievement in Academic Year 2012/2013 in Elementary School 3 in Banjar District *e-Journal PGSD University of Ganesha Education PGSD Department*
[19] Kosasih E 2012 *Learning and Learning Theory* (Bandung: UPI Press)