The use of Talking Toys in reducing the cognitive loads of elementary school students in science learning

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Abstract. This research aimed to reduce the intrinsic cognitive load of student in learning science subject by implementing Talking Toys media. The research conducted in one of the elementary school in Garut by using post-test only control group design. 60 student of class X become the sample of the research that divided into two Classes namely experimental and control class. Students intrinsic load was measured from students capacity in processing information. Data was obtained through essay test which compiled in the form of task complexity worksheet. Students learning result was measured by written test of their reasoning ability. The result shows that students who got treatment by talking toys media has higher ability in processing information compare to students who did not receive it. Research result illustrate that elementary school students intrinsic load while learning science subject in experimental class is lower than in control class. The low level of students intrinsic load has correlation with the high level of students learning result.

1. Introduction

The Learning is an activity carried out by a person to achieve the desired competence. Through the learning process, a person can acquire better knowledge, skills, and attitudes. The learning process is carried out to improve personal abilities or competencies [1].

In practice, this activity requires interaction to achieve this competence. As stated in the Law No. 20 of 2003 concerning National Education System Article 1 Paragraph 20, learning is the process of interaction between students and educators and learning resources in a learning environment. In other words, a teacher must create a condition or environment that supports students’ learning process. Active engagement in the learning process has been found to positively impact student outcomes, including test performance, course grades, and persistence [2,3].

One of the concepts or subjects that students must master is science. Science education is a very strategic education to improve human resources. Experts also agree that the purpose of introducing science is to direct students to a positive attitude according to Dalgety, Coll and Jones [4]. This reasoning is based on the Theory of Reasoned Action, which stated that attitude is behavior combined with normative beliefs and control beliefs according to Ajzen [5].

However, the process of learning science is not as easy as imagined. Not all students can achieve the expected goals. The level of understanding, motor skills, or student attitudes can be seen from the learning outcomes or student achievement. If student learning outcomes are high, it means their understanding is high and vice versa. This demands high cognitive loads of students in learning science.
Therefore, teachers must provide opportunities for students to be active in learning [6]. Teachers must also act as motivators by facilitating the learning process, providing stimulus, and creating a positive learning environment for students according to Subanji [7].

Cognitive load is a mental effort that must be made in working memory to process information received at certain intervals [8,9]. Information processing in human cognitive is called information processing theory. Understanding the subject matter's content is closely related to the cognitive processing system, which consists of working memory and long-term memory [10]. Working memory has a limited capacity system that stores and manipulates temporary information, and plays a crucial role in the learning process of elementary school-age children, such as thinking, reasoning, remembering, and solving problems in arithmetic, language, and reading comprehension [10-12].

According to the cognitive load theory by Moreno [13], the load contained in working memory can be reduced by increasing its capacity. Working memory has two components; the visuospatial sketchpad, which controls visual performance, and the spatial and phonological loops containing phonological storage and articulatory processes that facilitate children to remember information. Cognitive load theory states that human cognitive architecture's strengths and limitations come from instructional design [13]. Cognitive load theory divides cognitive load into three; intrinsic cognitive load, extraneous cognitive load, and germane cognitive load [8,9].

An exciting learning media is expected to reduce the cognitive load experienced by students. This is in line with what was said by Lautfer, that learning media is one of the teaching aids for teachers to deliver teaching material, increase student creativity, and increase student attention in the learning process [14]. With the media's existence, teachers are assisted in conveying information so that it becomes easier for students to understand. It is in accordance with what was conveyed by Sadiman that the media is a messenger in the form of all information from the sender to the receiver so that it can stimulate thoughts, feelings, attention, and interests so that the learning process occurs [15].

Talking Toys is a medium that is projected to become a solution to students' cognitive load problems. Talking Toys is a doll commonly used by children in general, but they are optimized to be used in the learning activity. This doll can say the parts of its body according to touch commands.

### 2. Research methods

The research design used was a post-test only control group design. In this design, neither the experimental nor the control groups were chosen randomly, and these two groups would be compared. The experimental class got treatment while the control class did get any treatment.

The students' intrinsic load data were measured from the student's ability to analyze the captured information by elaborating questions in the form of task complexity worksheets. Learning outcomes were measured using written tests on the aspects of reasoning abilities based on the complex thinking framework of Marzano, on the dimensions of expanding and refining knowledge [16].

### 3. Results and discussion

The Talking Toys learning media used in the core learning activities is a teaching media helping teachers explain animal body parts and their functions to students, so that information is easier to understand.

Talking Toys can make the sounds of animal body parts and their functions according to what students are pressing, such as the head, feet, eyes, shell (in turtles), tail, and wings. The use of visual media is expected to facilitate students' absorption of information and increase motivation in students' learning process. This is in line with Hamalik statement, which stated that the use of teaching media in the teaching and learning process could generate new desires and interests, generate motivation and stimulation of learning activities, and even bring psychological influences on students [17].

The research analysis results showed that the use of Talking Toys as a teaching aid during learning resulted in a learning process that was more interesting, interactive, and could help students in the process of analyzing information that had an impact on optimal learning outcomes. Table 1 describes the results of the comparison of the information analysis abilities of the experimental class and the control class.
Table 1. Students' information analysis ability.

| Component          | Analysis Information Ability |
|--------------------|------------------------------|
|                    | Experimen | Control |
| Number of Sample   | 30        | 30      |
| Average (x)        | 66.5      | 54.7    |
| SD                 | 5.9       | 7.8     |
| Max Value          | 85        | 77      |
| Min Value          | 57        | 38      |

Data Normaility test (Saphiro Wilk)

| Sig         | Conclusion       |
|-------------|------------------|
| 0.166>0.05 | Normal           |
| 0.009<0.05 | not Normal       |

Homogeneity Test (Lavene Test)

| Sig         | Conclusion       |
|-------------|------------------|
| 0.569 > 0.05| Homogen          |
| Sig         | Conclusion       |

T Test (U Mann Whitney)

| Sig         | Conclusion       |
|-------------|------------------|
| 0.000 < 0.05| Significant      |

Table 1 presents that the average students' information analysis ability in the experimental class was 66.5, which was higher than the average students' information analysis ability in the control class of 54.7. Furthermore, the data normality test using the Shapiro-Wilk test showed that the data were normally distributed for the students’ information analysis skills in the experimental class (α > 0.05) and not normally distributed in the control class (α < 0.05). The homogeneity test using the Lavene Test showed that the data was homogeneous (α > 0.05). Because the data were not normally distributed, the next test was carried out with non-parametric statistics, namely the Mann-Whitney U test with p-value or sig. equal to 0.000 (α <0.05). The results of this test illustrated that the students' information analysis abilities in the experimental class and the control class differ significantly.

In a learning process, there was a process of receiving and processing information by students, and learning outcomes can be interpreted as the end of the process. In receiving and processing information, internal and external conditions will react to each other. According to Susanto, internal factors come from inside of students that affect their learning abilities, while external factors come from outside of students that affect learning outcomes [18].

A learning activity aims at facilitating the flow of information from teachers to students who will later become knowledge for students. The learning theory developed by Gagne is also called the Information Processing Learning Theory, which is a description or model of activities in the human brain when processing information [19].

Based on the cognitive load theory, when the learning process occurs, the information will enter into two main functional components of the student's cognitive scheme, which are long-term memory and working memory [20]. According to Gagne in Rusman, comprehension is an individual's way of receiving and understanding information obtained from learning [21]. When individuals understand information after learning activities, she/he will produce good learning outcomes. Student learning outcomes data in this research were obtained from the results of a reasoning test given in the form of an essay based on the learning taxonomy developed by Marzano [16]. The processing levels measured for conceptual mastery are comparing, classifying, inducing, deducing, analyzing errors, constructing support, abstracting, and analyzing a perspective.
Table 2. Students' information analysis ability.

| Component       | Analysis Information Ability |
|-----------------|-------------------------------|
|                 | Experimen | Control |
| Number of Sample| 30         | 30      |
| Average (x)     | 71.5       | 67.7    |
| SD              | 10.5       | 10.9    |
| Max Value       | 96         | 82      |
| Min Value       | 60         | 45      |

Data Normality test (Saphiro Wilk)

| Sig          | Conclusion |
|--------------|------------|
| 0.963>0.05   | Normal     |
| 0.973>0.05   | Normal     |

Homogeneity Test (Lavene Test)

| Sig          | Conclusion |
|--------------|------------|
| 1.000 > 0.05 | Sig        |
|              | Homogen    |

T Test (t-Test)

| Sig          | Conclusion |
|--------------|------------|
| 0.000 < 0.05 | Significant|

Based on the data in table 2 above, students' average learning outcome or processing ability in the experimental class was 71.5, which was higher than the average processing ability of students in the control class, which was 67.7. The normality test, which was carried out using the Shapiro-Wilk test showed that the data were normally distributed for the processing ability of students in the experimental class ($\alpha > 0.05$) and normally distributed in the control class ($\alpha > 0.05$). Furthermore, the homogeneity test using the Lavene Test showed that the data was homogeneous ($\alpha > 0.05$). Testing was continued by using the independent t-test (t-test) with p-value or sig. equal to 0.000 ($\alpha < 0.05$). Thus, the processing abilities of students in the experimental class and the control class differed significantly.

The experimental class's higher processing ability showed that Talking Toys media could improve information analysis skills, which impact high reasoning abilities resulting from students' learning process. These results illustrated that the Talking Toys media could help students analyze information during the learning process.

4. Conclusion

Learning activity using Talking Toys media is considered effective because it resulted in optimal student understanding marked by better student learning outcomes. High learning outcomes has indicated a decrease in student's cognitive load after using the Talking Toys media.

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