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Effectiveness of the CinQASE Web Integrated Learning Model to Train Higher Order Thinking Skills

Rahmat Saifuddin Anwar1,*, Abdul Salam[1], Surya Haryandi[1], and Nur Farahwahidah Abdul Rahman[2]

[1]Pysics Education Study Program, Universitas Lambung Mangkurat Banjarmasin, Indonesia

[2]School of Education, Faculty of Social Sciences and Humanities Universiti Teknologi Malaysia, Malaysia

*saifuddinanwar@outlook.com

Abstract

The lack of training in higher-order cognitive thinking skills in physics makes most students of class XI MIPA in a high school in Marabahan unable to solve problems that require the ability to analyze (C4) and evaluate (C5) well. This study was intended to describe the effectiveness of using the web-integrated CinQASE learning model to train higher-order thinking skills in the C4 and C5 domains. This study used the pre-experimental one-group pretest-posttest design. The efficacy of the web-integrated CinQASE learning model to train higher-order thinking skills is calculated with the eta-squared effect size for a paired sample t-test. In contrast, the description of students' achievement in higher-order thinking is viewed from the percentage of the average score of the student learning outcomes test on items that have C4 and C5 domains. The results showed that using the model had moderate effectiveness (η^2 = 0.94) and helped train students' ability to think at a higher level, as shown by an increase in students' achievement in higher-level thinking in the good category. Thereby, the use of the web-integrated CinQASE learning model can supply considerable benefits in training students' higher-order thinking skills. These results also write down a practical need for teachers and schools to implement learning approaches that use the potential of technology to enhance learners' higher-order thinking skills in the 21st century.

Keywords: CinQASE Learning Model; Higher-Order Thinking Skills; Web-Integrated Learning

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INTRODUCTION

The evolution of times has altered the field of education in the twenty-first century. The purpose of learning in the framework of 21st-century learning is to enable schools to score students with

high cognitive abilities (Ariyana et al., 2019; Miterianifa et al., 2021). Students are encouraged to have creativity and the ability to think critically in a better direction (Hartini et al., 2020; Jailani et al., 2018; Suyidno et al., 2019; Turidho et al., 2019). Furthermore, the student's ability to think at a higher level benefits the student as a supplier in the modern industrial era (Ansari & Taufiq, 2020). One area of study that can be used to train students' ability to think at a high level is physics.

Physics learning that trains the student's ability to think at a high level will help the student solve problems of the 21st century, including those involving critical thinking (Milia et al., 2022). Through physics, students are not only taught about knowledge of the laws of nature but also equipped with materials relevant to the complex and rapidly evolving modern industrial era as it is in the 21st century. Thus, the learners can be trained to be active members of society and make good decisions in solving real-life problems (Hartini et al., 2022).

Results of the previous studies showed contradictory findings, where students generally tend to be unable to evaluate, present ideas, solve analytical problems, and create ideas (Fikri et al., 2022; Sukma & Kholiq, 2021). This may be due to a lack of training in high-level thinking skills at school, including in physics studies (Apino & Retnawati, 2017; Maratin & Shodikin, 2022). Corresponding facts were also found at one of the high schools in Marabahan. A preliminary observation of this study of 98 pupils in the MIPA XI class in August 2022 showed that student's access through the percentage ratio of scores in high-level thinking areas was 3.31% in the very poor category. This result is detailed for high-level thinking skills in C4 (evaluating) with a score of 6.62% (very bad) and in C5 (evaluating with a rating of 0.00%) (extremely not good).

The results from an interview with a physics teacher at the high school also revealed that students could apply similarities in simple cases but had difficulty implementing them on issues requiring high-level reasoning. In addition, students tend to show proactive attitudes when learning is done in groups and by using electronic devices because they can provide a representation of the learning material that is relatively more interesting and interactive.

The characteristics of high school students make web-integrated learning suitable for use in training high-level thinking skills (Ganapathy et al., 2017). Web-integrated learning can help improve the cognitive abilities of students (Hariadi et al., 2021; Rizki et al., 2022). This allows the student to repeat it independently (Pradewi & Wijayanti, 2019; Shabrina & Diani, 2019). The results of interviews are also considered when creating a group learning format through a collaborative learning model (Arends, 2012). One of the many collaborative models that can be chosen as an approach to learning is the Collaborative in Questioning, Analyzing, Synthesizing, and Evaluating (CinQASE) model (Hunaidah et al., 2022).

Based on this thought, this research was conducted to reveal the effectiveness of web-integrated learning (CinQASE) in training high-level thinking skills in students. The indicators of such high-level thinking are based on Bloom's revised taxonomy and are limited to the C4 (analyze) and C5 realms (evaluate). As for the topic chosen, it is elasticity, given the wide application of this topic in everyday life and the material context that requires a strong understanding of mathematical and physics concepts (Bakri et al., 2021; Batlolona et al., 2019; Kharida et al., 2009).

CinQASE's web-integrated learning combination training high-level

thinking skills on elasticity topics aims for more effective learning using unprecedented approaches. By integrating the CinQASE learning model, which has proven to be effective in developing high-level thinking capabilities and using rich web resources of content and interaction, students are expected to experience a more exciting and in-depth learning experience in learning the concept of elasticity.

METHOD

The study design is pre-experimental in the form of a one-group pretest-posttest. The study involved a population of XI MIPA students at one of the high schools in Marabahan. The sample consisted of 30 students selected with purposive sampling techniques. The research was conducted in November 2022 and continued to January 2023.

The data analysis technique was performed with Minitab software and used the Ryan-Joiner formula to test the normality of the data with the following hypothesis:

Ho: The data is normally distributed.

Ha: The data is not normally distributed.

The effectiveness test was performed by the technique of testing the hypothesis with a paired sample t-test on the values of the pretest and posttest with the following hypotheses:

Ho: There is no significant difference between average student abilities before and after the treatment in this study.

Ha: There is a significant difference between average student abilities before and after the treatment in this study.

The extent to which the effectiveness of the research treatment on the ability of the student was calculated by calculating the effect size eta squared as follows:

$$\eta^2 = \frac{t^2}{t^2 + (n-1)} \quad (1)$$

where n is the number of students (Cohen et al., 2018; Huck, 2012). Efficiency score η2 with a minimum score of 0.01 is in small categories, 0.06 is in medium categories, and 0.14 is in large categories (Cohen et al., 2018).

The description of the participants' access to high-level thinking was reviewed from the average percentage of scores (x) obtained when answering the analytical questions (C4) and evaluating (C5) on the learning test and is expressed by categorization in Table 1 (Adapted from Nurhayati & Angraeni, 2017).

Table 1 Category of higher-order thinking skills achievement

Interval of the Score (%)	Category
$P > 80$	Very Good (VG)
$60 < P \leq 80$	Good (G)
$40 < P \leq 60$	Fair (F)
$20 < P \leq 40$	Poor (P)
$P \leq 20$	Very Poor (VP)

RESULTS AND DISCUSSION

The CinQASE learning model is implemented in four phases: problem presentation, individual work, team or group work, class discussion, and evaluation and feedback. CinQASE's web-integrated learning in this study carried out as many as four meetings with the following material details: the properties of material elasticity, the law of Hooke (two meetings), and the string of speeds.

The CinQASE learning model begins with presenting the problem and encourages students to share their experiences related to the learning to be done. Next, the students are instructed to reduce the problem to one that can be solved through learning.

Students find more information about the tasks requested using integrated web learning resources in the individual work phase. The information obtained later is used as a supply for more complex tasks in the teamwork phase. These tasks may involve conceptual and/or procedural knowledge, such as practical or high-level thinking skills.

In the discussion phase of the class, the entire team members exchange views based on information obtained in the earlier learning phases for confirmation. The CinQASE learning process is closed with evaluation, feedback, and reflection. The proportion of students' achievement scores is listed in Table 2.

Table 2 Proportion of students' achievement scores

Question number	Indicator of Competence Achievement	Proportion of Students Achievement Scores	
		Pretest	Posttest
1	Counting the Young's Modulus, tensile stress, and/or modulus elasticity.	0.41	0.96
2	Connecting the concepts of Young's Modulus, tensile stress, and elasticity modulus to the principle of equilibrium.	0.11	0.52
3	Organizing the correlation between the potential energy of elasticity and Hooke's law, the rapid constant, and Young's modulus.	0.06	0.86
4	Assessing the best solution to a problem involving a series or parallel string according to specified criteria.	0.02	0.56

Table 3 Descriptive statistics of students' learning outcomes

Aspect	Pretest	Posttest
Maximum	25.50	96.00
Minimum	0.00	31.00
Average	12.13	68.12
Standard Deviation	6.47	16.83

Based on the study results, when the pretest was carried out, no student could reach the specified standard of achievement score, which is 75. However, the learning outcomes on elasticity from the posttest value data vary considerably. About 40% of pupils have reached the standard of the achievement score. The proportion of achievement of posttest scores of students according to indicators of achieving learning competence can be reviewed in Table 2. In addition, descriptive statistical tables can be summarized by processing pretest and posttest results, as shown in Table 3.

Furthermore, to draw the correct conclusions based on statistical theory, a normality test was carried out to check whether the data used has a distribution that is close to normal. Based on Figure 1, the p-value is > 0.100, so the zero hypothesis is accepted. In other words, the gain data of the pretest and posttest participants is distributed normally.

Next, a paired sample t-test was performed to see if there was any difference between the pretest and the posttest values. Test results show a t-count of 21.50 with a p-value of 0.000. Thus, the zero hypothesis was statistically rejected so that it could be concluded that there was a difference in the average ability of the students before and after the treatment of the research.

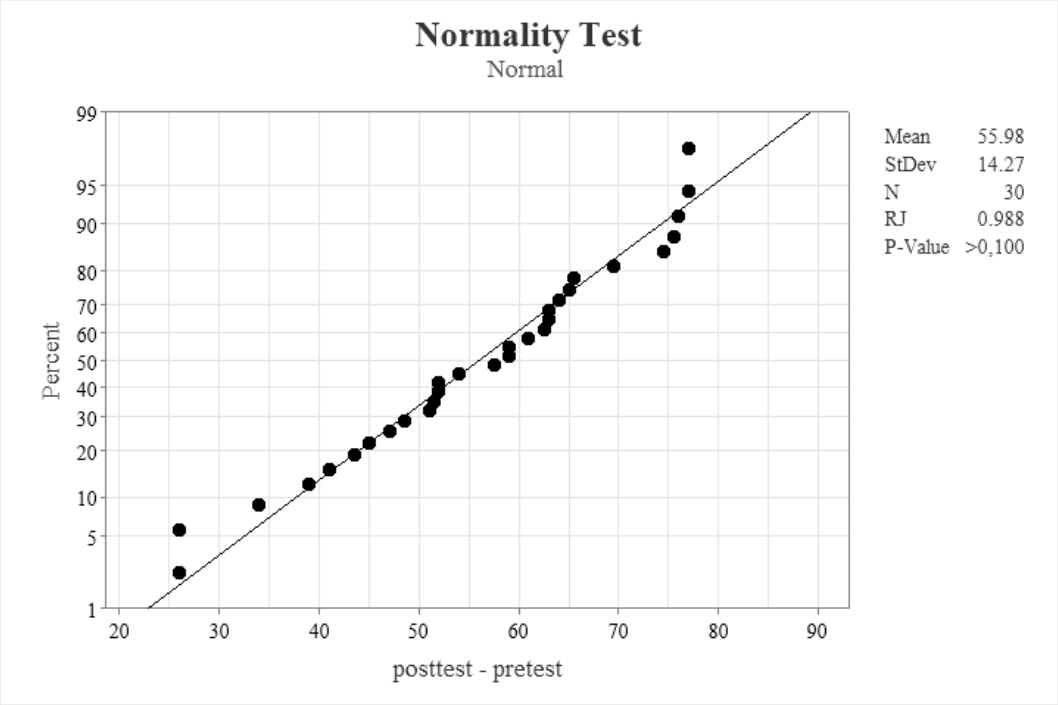

Figure 1 Results of normality test

Numerically, the size of the effectiveness of the research treatment, i.e., the use of a web-integrated learning model of CinQASE to train high-level thinking skills, was calculated using the eta-squared for paired sample t-test (η^2). The result of the calculation of the η^2 score is as follows:

$$\eta^2 = \frac{21.50^2}{21.50^2 + (30-1)} = 0.94$$

The results show that the effectiveness of categorized research treatments is moderate. The achievement of this score indicates that using CinQASE's web-integrated learning model is quite significant in training high-level thinking skills in students (Kolopita et al., 2022).

According to the data obtained in Table 4, the students' access to higher-order thinking skills (HOTS) at the time of the pretest category was very poor. It shows that there is a tendency for students to lack understanding of C4 and C5 skills prior to research treatment. Factors influencing this include not being trained in high-level thinking skills at school (Suarmawan et al., 2019; Utami et al., 2021).

Table 4 Achievement of students' higher-order thinking skills

Cognitive Domain	Proportion of Score	
	Pretest	***Posttest***
C4	0.0912	0.672
C5	0.0242	0.588
Average	0.0577	0.612
Percentage of Score Average	5.77% (VP)	61.2% (G)

Nevertheless, based on Table 2, the pretest scores of students in C3 are relatively higher than in other domains, which indicates that the initial ability of the students within C3 is relatively good (Amto et al., 2019; Mafudiansyah et al., 2020). The results showed consistency with the record of interviews with physics teachers at the study site, saying that the students could apply the equations to simple questions.

Further, after the treatment of the research, through a posttest (Table 2), it was obtained that the learning ability of the participants in the C3 region has been categorized very well (P = 96%).

The ability to think in the C4 and C5 realms has also been well-trained. The high level of thinking achieved by many of the students in the access category can be seen in Figure 2.

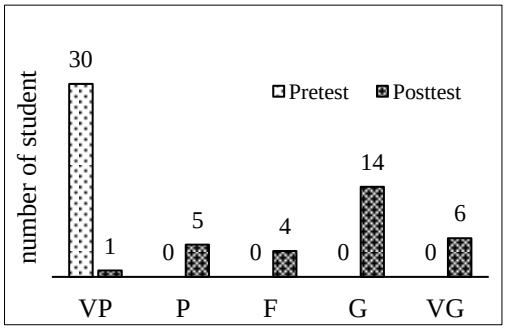

Figure 2 Diagram of the number of students based on high-order thinking skills achievement.

Improving the student's HOTS is supported using CinQASE's web-integrated learning model, which is structured to consider the elements that help the student train his analytical and evaluative skills. The students, as participants, were trained to analyze causality relationships through StoryLine features, find errors with Find and Fix features, deduce equations collaboratively (Derive Together), and apply the concepts taught through competence tests (Training Center).

These features are based on several suitable methods to train students' C4 and C5 skills (Muhsin et al., 2022; Tang, 2017). Moreover, enhanced learning integration with web technology also plays a significant role in influencing the learning outcomes of students (Hariadi et al., 2021; Shabrina & Diani, 2019; Umam & Azhar, 2021).

The selection of the CinQASE learning model as a collaborative model can help improve students' learning outcomes (Dewi et al., 2016; Hunaidah et al., 2022; Ningrum, 2016). The collaborative learning model is used to enable students to build knowledge with the help of peers (Syarifuddin & Atweh, 2021). In addition, the CinQASE learning phases strongly support the existence of positive interdependence between the student and his or her team or group and between the team and the entire class (Arends, 2012). It makes the discovery of concepts and facts about the subject being studied more meaningful (Backfisch et al., 2020; Buckley et al., 2015; He et al., 2022).

Nevertheless, although the general use of CinQASE's web-integrated learning model is effective in well-training students, through information from Table 2, C4 and C5 competencies can still be improved. It's because some students get poor scores. These competencies have key indicators: attribute (attributing, C4) and criticize (critiquing, C5).

Based on experience during the study, students who obtained poor scores are likely to have lacked motivation to attend lessons, enthusiasm, and ability to perform their duties properly (Ormrod et al., 2019). This is in line with other studies with similar findings (Di et al., 2019; Gonget al., 2020; Hafizah et al., 2020; Omar & Awang, 2021). In addition, it does not exclude the possibility that the quality of learning done in the classroom affects the results obtained by the students (Lu et al., 2021).

Thus, it is necessary to make structured and intensive efforts to organize classroom learning. In addition, training in other important skills also needs to be done to ensure that the CCT students can be equal in various aspects. By training incrementally, the ability to think in the high-level cognitive realm of the student will be enhanced much better (Gupta & Mishra, 2021).

CONCLUSION

CinQASE's web-integrated learning model on the elasticity topic has proven effective and can train thinking skills in high-level cognitive fields (C4 and C5). Besides, students with higher-order thinking skills (HOTS) have been well-

trained. This is shown by the increased access of the CCTT from the very poor category to being categorized as good after the implementation of CinQASE-integrated web learning.

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