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Development of Learning Tools With Flipped Classroom Models to Train Critical Thinking Skills for 4th Grade Elementary School Students

***A Z Darmawati[1], Raharjo[2], U Azizah[3]**
[1]Basic Education Study Program, Faculty of Education, Universitas Negeri Surabaya, Indonesia
[2]Department of Biology, Faculty of Mathematics and Natural Science, Universitas Negeri Surabaya, Indonesia
[3]Department of Chemistry, Faculty of Mathematics and Natural Science, Universitas Negeri Surabaya, Indonesia

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ABSTRACT

This development research aims to describe the validity, practicality, and effectiveness of Flipped Classroom Model Learning Devices to Train Critical Thinking Skills of Grade IV Elementary School Students. The learning tools developed are teaching modules, Student Worksheets (LKPD), Student Teaching Materials (BAPD), and Critical Thinking Tests. The method used is the Thiagarajan 4D Research and Development model: Define, Design, Develop, and Dessiminate. The same research was previously conducted using the 2013 curriculum, with research subjects ranging from high school to university students. In this research, the development of learning tools used an independent curriculum with the subject of fourth-grade elementary school students. Data collection techniques are carried out through validation, observation, and tests. The results showed that the Tools Validity Score (TVS)) for teaching modules had 3.64 very good criteria, student worksheet had 3.54 very good criteria, Student Teaching Materials had 3.73 very good criteria, and a critical thinking test had 3.66 very good criteria. The practicality of learning tools in terms of the implementation of learning by the teacher in the class obtained 97.25% very good criteria, and the activeness of students obtained 84.65% very good criteria. While the effectiveness of learning tools obtained from the N-Gain analysis of pretest and posttest results obtained 0.57 moderate criteria. The results obtained indicate that the learning tools developed are very feasible as learning media for fourth grade students.

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INTRODUCTION

Science and technology continue to develop. The quality of education must be improved. As a formal educational institution, schools must produce graduates who are able to compete in the 21st century (Mardhiyah et al., 2021). Students need to be equipped with 21st century skills, namely 4C (critical thinking, collaboration, communication, and creativity). Critical thinking is the basis of these four skills.

Critical thinking skills are high-level thinking skills that need to be trained in students during the learning process. According to Ati and Setiawan (2020), (1) high-level thinking skills are needed in solving complex problems in all aspects of modern life in the information age and global competition. (2) Critical thinking is needed to analyze, synthesize, and evaluate arguments to obtain a decision that makes sense and can be accounted for. (3) students will be trained to be able to solve problems both in the learning process in class and in dealing with everyday problems that occur around students.

According to Zakiyah and Lestari (2019), a person's success at work is strongly influenced by his critical thinking skills. Therefore, critical thinking skills are a necessity for everyone living

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in the 21st century and need to be taught in students at school. In line with what Norrizqa (2021) said, the most effective way to train critical thinking skills is to incorporate them into every learning process. So, the teachers must be good at choosing learning models that can hone and train critical thinking processes.

Critical thinking skills need to be trained in a series of learning processes for all subjects (Seftian et al., 2019). But in practice there are still many students who have low critical thinking skills. In fact, when the government implemented the Computer Based National Assessment (ANBK) with HOTS-based questions, students still had difficulty solving these questions. This is possibly caused by several things, such as the lack of optimal online learning during the covid-19 pandemic, lack of reading literacy, teachers prefer simpler assessments, multiple choice types via google form. This assessment is easier to apply during a pandemic because the method of correcting answers is faster. Therefore, efforts are needed to improve students' critical thinking skills.

To practice these critical thinking skills, researchers use the flipped classroom learning model. The flipped classroom learning model is an inverted class that represents a learning model by reversing the learning cycle. Students who previously participated in the learning process in class will study independently at home, and vice versa. Students who usually complete assignments at home must complete them in class (Indrajit & Patandean, 2021). Meanwhile, according to Nida et al. (2018), flipped classroom means students studying independently at home before face-to-face learning in class to discuss material that is not yet understood. Materials can be provided online or offline.

The researcher chose the flipped classroom model because 90% of students have their own cell phones. Learning during the pandemic has also provided students with a lot of experience using mobile phones. Researchers hope that students will use their cellphones more for learning than playing. With the flipped classroom learning model, students will read the material before learning it in class so that it stimulates them to actively ask questions and be more prepared to receive the material. The researcher hopes that with interesting Flipbook teaching materials, students will be more motivated to read, be more responsible in their learning, and be more active when learning in class. So that it can train students' critical thinking skills. According to Apriliana (2019), the interactive flipbook of excretion material developed is very feasible to apply with validation results obtained at 91.25% and is able to improve students' skills in critical thinking. Damayanti and Raharjo (2020) have also developed an interactive flipbook on breathing material to train the critical thinking skills of class XI high school students, with a very good validity score of 4.

The flipped classroom learning model is also supported by Piaget's constructivism learning theory. Students can interpret information in their minds if it starts with them learning independently and experiencing it directly in their lives. Students are given the freedom to think actively to assemble the information or material being studied. Learning that makes students more active will be more conducive, more enjoyable and more effective. The flipped classroom learning model will stimulate and encourage students' critical thinking skills. Meanwhile, according to Lev Vygotsky, there is social interaction between individuals and their environment. Vygotsky strongly emphasized the role of social interaction for one's learning development. Social interaction of students with teachers, students with students, students with parents or with the surrounding environment. Vygotsky also emphasized that the mind can develop to reflect social reality. The process of communicating with other people results in the development of the meaning of words then forms a structure of consciousness (Baharuddin, 2008).

Research with the same learning model has been done before with the title "Effectiveness of Implementing the Flipped Classroom Learning Model on Increasing Students' Critical Thinking" conducted by Maolidah et al. (2017) shows that critical thinking test scores show a significant increase before and after using the flipped classroom learning model. The same research was also carried out by Agung and Riyadi (2021) on history subjects in class XI high school, with an

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increase of only 16.6%. Nonetheless, this model provides a fairly good effect. They recommend using video as a learning medium to maximize results.

From several studies on the flipped classroom learning model, most were tested at the junior high school to university levels. Meanwhile, in elementary schools, this learning model is rarely used. So this research is development research that is still rarely done. This study also uses an independent curriculum which is classified as a new curriculum.

In this research, the subjects were fourth grade students because, according to Piaget, the cognitive development of fourth grade students was at the concrete operational level, which marked the beginning of logical thinking. So that the child is mature enough to use logical thinking. While the chosen subject is Natural and Social Sciences (IPAS), water cycle material is very important for students. Therefore, researchers hope that after studying the water cycle material, students will be more concerned about the problems that exist in the surrounding environment. Students are able to find solutions to environmental problems related to the water cycle. Based on this description, it is necessary to develop a flipped classroom model learning device to train the critical thinking skills of 4th grade students.

RESEARCH METHOD

This research is development research with 4D model. Thiagarajan (1974) states that there are four stages of the 4D model: Define, Design, Develop, and Disseminate (Sugiyono, 2019). However, this research was only carried out until the development stage. The research subjects were fourth grade students at SD Muhammadiyah 4 Surabaya.

Define Stage

At this stage, initial and final analysis, student analysis, concept analysis, task analysis, learning achievement analysis, and formulation of learning objectives are carried out before designing learning devices.

Design Stage

At this stage, the researcher designs learning tools, which include the preparation of teaching modules, Student Worksheets (LKPD), selection of media (flipbooks), and preparation of critical thinking tests. Critical thinking test indicators in this research are (1) identifying problems, (2) determining the causes of problems, (3) determining the effects of problems, and (4) determining solutions to problems.

Develop Stage

At this stage, the finished learning device draft is given to the validator (an expert team) for validation. After that, it continued with product trials or development results in two different experimental classes.

The implementation of a learning tool can be tested using the pretest-posttest technique. In this model, both groups are tested first to determine the initial abilities of students. After the pre-test, the two experimental groups received learning treatments through the flipped classroom model. At the end of the lesson, the two groups received the same test, namely, the final exam, which tested the development of students' critical thinking through the material "The Water Cycle".

Instrument

The instrument used is the learning device validation sheet. The validation sheet is filled in by two validators who are competent in their fields to test the validity and feasibility of the learning devices made. The validation sheets in this study included teaching module validation sheets, teaching material validation sheets, student worksheets validation sheets, and validation sheets for students' critical thinking skills tests.

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Data Analysis

The data obtained is in the form of scores for every criterion. The validator's assessment was analyzed descriptively and quantitatively by determining the average score of each component using the following formula:

$$\text{TVS} = \frac{\textit{The total score of each device validation component}}{\textit{Total components on device validation}}$$

TVS = Tools Validation Score

The score obtained is then devided by the average value of the two validators. The learning tools assessment criteria are shown in Table 1.

Table 1. Assessment criteria

Score Intervals	Assessment Criteria
3,51 ≤ TVS ≤ 4,00	Very Good
2,51 ≤ TVS ≤ 3,50	Good
1,51 ≤ TVS ≤ 2,50	Not Good
1,00 ≤ TVS ≤ 1,50	Very Not Good

(Ratumanan, 2006)

The practicality of learning tools is seen from the implementation of learning by the teacher and the activities of students. The formula for calculating the percentage of implementation of learning is as follows.

$$\text{P} = \frac{\sum K}{\sum N} \text{ x } 100\ \%$$

$\sum K$= total aspects implemented
$\sum N$ = sum of all aspects

The percentage of learning implementation can be seen in Table 2.

Table 2. Learning implementation

Score Intervals	Assessment Criteria
0 % - 24 %	Not implemented
25 % - 49 %	Not Implemented
50 % - 74 %	Moderately Implemented
75 % - 100 %	Well Done

(Ratumanan, 2006)

While the formula for calculating student activity is as follows.

$$\text{P} = \frac{\sum R}{\sum N} \text{ x } 100\ \%$$

$\sum R$= students who carry out activities
$\sum N$ = total students

The percentage of student activity can be seen in Table 3.

Table 3. Students activity

Percentage intervals	Assessment Criteria
76 % - 100 %	Veri good
51 % - 75 %	Good
26 % - 50 %	Not good
0 % - 25 %	Very not good

(Purwanto, 2009)

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Learning device are practical if the implementation of learning and student activity is at least good.

The effectiveness of learning tools can be seen from the pretest and posttest scores of students. The value of students' critical thinking is calculated using the following formula.

$$\text{Critical Thinking Skills} = \frac{Students\ score}{Total\ score} \text{ X } 100\ \%$$

To find out the increase in pretest and posttest scores, you can use n-gain value analysis.

$$g = \frac{posttest\ scores - pretest\ scores}{maximal\ scores - pretest\ scores}$$

The n-gain results obtained are then interpreted according to the n-gain criteria in the Table 4.

Table 4. N-Gain criteria

N-Gain	Criteria
-1,00 ≤ g ≤ 0.00	Decline
g = 0,00	Still
0,00 < g < 0, 30	Low
0,30 ≤ g < 0,70	Currently
0,70 ≤ g ≤ 1,00	High

(Sundayana, 2014)

Learning tools are called feasible, if (1) valid based on expert team validation, (2) practical, if the implementation of learning and student activity is good, and (3) effective, if classically tests students' critical thinking skills thoroughly and can respond well to learning.

RESULTS AND DISCUSSION

This development research aims to describe the validity, practicality, and effectiveness of flipped classroom model learning tools to train critical thinking skills in grade IV elementary school students. The learning tools developed are teaching modules, student worksheets, student teaching materials, and critical thinking skills tests. Learning tools that have been validated were tested on two experimental classes of fourth grade students at Muhammadiyah 4 Elementary School, Pucang, Surabaya.

At the define stage, the researcher identified the fundamental problems that occurred in Muhammadiyah 4 Elemantary School, Pucang, Surabaya. These problems include many parallel classes with different teachers. The learning model used is also different. Some teachers still use boring learning models and do not activate students. While the impact of online learning during the Covid-19 pandemic, 90% of students had their own devices and the rest used their parents' devices. After learning returns to normal, when at home students use devices more to play. So, it is necessary to find a solution to make the tool more useful for learning. The results of student analysis show that the cognitive development of fourth grade students, according to Piaget, is at the concrete operational level, which marks the beginning of logical thinking. So that the child is mature enough to use logical thinking. While, the results of the task analysis need Student Worksheets (LKPD) as a guide for students to study independently at home. Students are given the task of making infographics about the Water Cycle.

At the design stage, researchers designed learning devices to train critical thinking skills. The first is a teaching module or lesson plan that will be used as a guide for learning. Second, the selection of learning media that is suitable for learning the flipped classroom model. (1) The researcher took a video about how clouds form, which was taken from the Kok Bisa YouTube channel and (2) designing flipbook teaching materials so that students are motivated to learn because the learning media used is interesting. Third, student worksheets that can activate all students in groups. Fourth, the most important thing in this research is the pretest and posttest

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questions to train students' critical thinking skills. Researchers took four indicators of critical thinking because the subject in this study were fourth grade students. The four indicators of critical thinking are (1) identifying problems, (2) determining causes of problems, (3) determining the consequences of problems, and (4) determining solutions to problems. The researcher designed a question grid by referring to the four indicators and then made questions and answer keys along with scoring guidelines.

At the development stage, the results of the learning tool design were validated by two validators. The results of learning device validation can be seen in Tables 5-8.

Table 5. Teaching module validation results

No	Aspect	Validator		Average	Total Component	TVS	Criteria
		1	2				
1	General Information	20	22	21	6	3.50	Good
2	Core Component	18	16	17	5	3.40	Good
3	Content	18	18	18	5	3.60	Very Good
4	Language	11	11	11	3	3.70	Very Good
5	Time	8	8	8	2	4,00	Very Good
Average						3.64	Very Good

Table 6. Validation results of student worksheets

No	Aspect	Validator		Average	Total Component	TVS	Criteria
		1	2				
1	Content	21	22	21.5	6	3.58	Very Good
2	Language	18	17	17.5	5	3.50	Very Good
Average						3.54	Very Good

Table 7. Student teaching material validation results

No	Aspect	Validator		Average	Total Component	TVS	Criteria
		1	2				
1	View and layout	18	20	19.5	5	3.90	Very Good
2	Illustration	11	12	11.5	3	3.83	Very Good
3	Content	17	18	17.5	5	3.50	Good
4	Language	17	20	18.5	5	3.70	Very Good
Average						3.73	Very Good

Table 8. Results of test validation measurement of critical thinking skills

No	Aspect	Validator		Average	Total Component	TVS	Criteria
		1	2				
1	Content	15	15	15	4	3.75	Very Good
2	Understanding	6	7	6.5	2	3.25	Good
3	Construction	15	15	15	4	3.75	Very Good
4	Language	19	20	19.5	5	3.90	Very Good
Average						3.66	Very Good

The results of the validation of the four learning tools by two validators showed very good results so that the developed learning devices were suitable for use in learning.

After being validated, the developed learning tools were tested in two different experimental classes. In implementing the flipped classroom model, researchers use video media and flipbooks uploaded via Google Classroom for students to study at home and use the student worksheet (LKPD) as a study guide. Students are divided into five heterogeneous groups so that there is a process of interaction and discussion that allows students to exchange ideas, information, and arguments so as to hone their critical thinking skills. Prior to the implementation of the flipped classroom learning model, the teacher took a pretest to determine his critical thinking skills.

In the first stage, students watch videos on why clouds form and read flipbooks at home. Previously, the teacher ensured that all students had joined Google Classroom to watch uploaded

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videos and flipbooks. Students prepare for learning in class by studying independently at home. To ensure students watch videos and read flipbooks, the teacher assigns each student the task of making infographics about the water cycle. By making this infographic, the researchers hope that students will understand the water cycle. For students, infographics are useful to help them understand the material they are studying. Infographics are very useful for them, especially when they are given the task of making infographics to facilitate understanding and internalization of learning material within themselves. In this internalization process, students must first understand the message before they can convey it (Bobek & Tversky, 2016). Therein lies the advantage of the infographic task, because in the future they will not only have to understand but also use the information they already understand to share with others in the form of graphic communication. Meanwhile, according to Azizah and Febriani (2020), the application of blended learning assisted by Google Classroom is effective in increasing student learning independence. So that students are ready to take part in learning in class.

In the second stage, students take part in class learning to carry out group discussions working on the student worksheet (LKPD), discussing material that has not been understood. The teacher guides and trains students to find problems, find causes of problems, find consequences of problems, and find solutions to these problems. After discussing, each group was given the opportunity to present the results of the group discussion. This presentation activity trains students to communicate with others and convey their ideas well. If critical thinking skills can be mastered, then they will be able to communicate the knowledge they have acquired. Someone who can convey his ideas well to others also has good communication skills (Lenburg, 2010; Damayanti & Raharjo, 2020). Furthermore, to measure students' understanding of the material and critical thinking, a posttest was carried out.

The results of observations from observers in the two experimental classes are shown in Figure 1 and Figure 2.

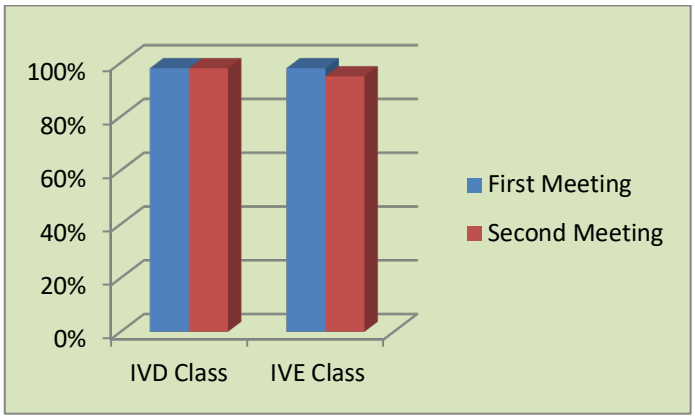

Figure 1. Learning implementation

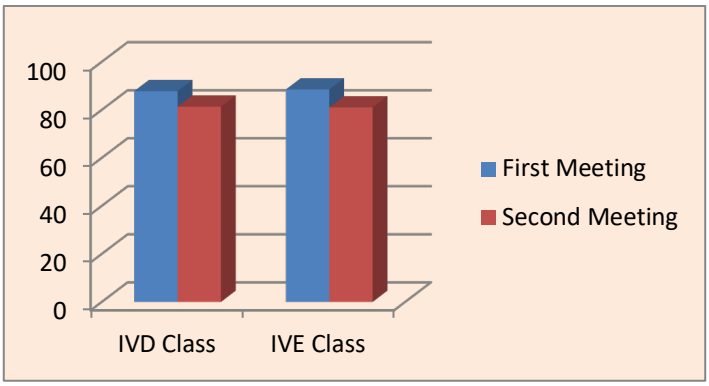

Figure 2. Students' activity

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In Figure 1, it can be seen that the implementation of learning in the first experimental class (IVD) in the first and second meetings showed very good criteria, each at 98%. Likewise, in the second experimental class (IVE), the learning implementation of the first and second meetings showed very good criteria (98% and 95%, respectively).

Figure 2 shows that the activity criteria of students in both classes are very good. Student activity in the first experimental class (IVD) at the first and second meetings was 87.8% and 81.3%, respectively. In the second experimental class, the activity of students with very good criteria, at 88.5% and 81%, respectively.

The results of the implementation of learning and the activeness of students in class show that the flipped classroom learning model is practically used in learning. Students do not come to school with an empty mind because they have previously studied independently at home. Flipped classroom learning is an embodiment of active learning and can be said to be constructivist learning (Santos & Serpa, 2020). So that students become more active in asking questions.

The effectiveness of the developed learning devices can be seen from the analysis of the pretest and posttest values tested in two different classes. The results of the pretest and posttest in both classes showed an increase. In the first class (IV D), the average pretest and posttest were 71.36 and 87.18, respectively. The result of the N-gain analysis is 0.55, with a moderate increase. While the average scores of the second pretest and posttest (IVE) were 70.73 and 88.23, respectively. The result of the N-gain analysis is 0.57, with a moderate increase.

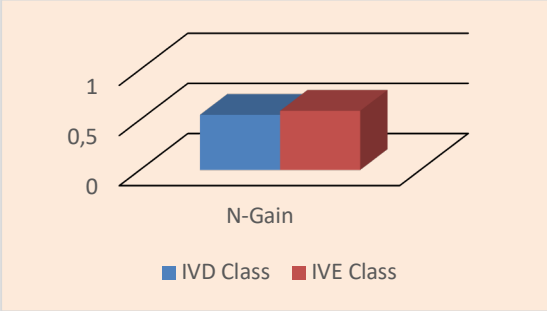

Figure 3. Comparison of N-gain of the two experimental classes

The increase in pretest and posttest scores is in the moderate category because critical thinking skills cannot be seen instantly, but it takes time to keep practicing. But at least students look more enthusiastic with their liveliness in asking and answering teacher questions and interacting actively with other students. This can be seen when students have group discussions. As stated by Potts (1994), the characteristics of learning to think critically are (1) increasing interaction between students (2) providing open-ended questions (3) providing sufficient time for students to reflect on questions posed or problems given (4) teaching for transfer (teaching to use newly acquired abilities in other situations or based on the experiences students have).

The flipped classroom learning model has proven to be effective in training students' critical thinking skills. According to the constructivist learning theory initiated by Piaget, students can interpret information in their minds if it starts with them learning independently and experiencing it directly in their lives. While the constructivism approach to learning, according to Lev Vygotsky, is the social interaction of individuals with their environment. Vygotsky emphasized the role of social interaction for the development of one's learning. Social interaction between students and teachers, fellow students, students and parents, or with the surrounding environment, Vygotsky also emphasized that the mind can develop to reflect social reality. The process of communicating with other people results in the development of word meanings, which then form the structure of consciousness (Baharuddin & Wahyuni, 2008). The flipped classroom learning model itself is an alternative to combining Piaget's and Vygotsky's constructivist learning theories.

CONCLUSION

Based on the results of the research, it can be concluded that the flipped classroom learning model is appropriate for use in learning to train the critical thinking skills of fourth grade elementary school students in terms of validity, practicality, and effectiveness. Valid, based on the assessment of two validators for all learning tools developed with very good criteria. Practical, based on the assessment of five observers who observed the implementation of learning by the teacher with very good criteria, and the activeness of the students was also very good. Effective, based on the N-gain analysis of the results of the pretest and posttest of the two classes tested, with an increase in critical thinking skills of an average of 0.56 with moderate criteria.

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Author (s):

*Aliyatuz Zakiyah Darmawati (Corresponding Author)
Basic Education Study Program, Faculty of Education,
Universitas Negeri Surabaya,
Jl. Ketintang, Surabaya 60213, Indonesia
Email: aliyatuz.19048@mhs.unesa.ac.id

Raharjo
Department of Biology, Faculty of Mathematics and Natural Science,
Universitas Negeri Surabaya,
Jl. Ketintang, Surabaya 60231, Indonesia
Email: raharjo@unesa.ac.id

Utiya Azizah
Department of Chemistry, Faculty of Mathematics and Natural Science,
Universitas Negeri Surabaya,
Jl. Ketintang, Surabaya 60231, Indonesia
Email: utiyaazizah@unesa.ac.id