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Development of CTIL Model Textbooks Based on H5P Application to Improve Students' Critical Thinking Skills

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Abstract

21st Century Skills are key competencies crucial for students to thrive and succeed in the future. Critical thinking skills are one of the urgent 21st-century skills. Students' critical thinking skills must be trained with the right learning models and textbooks. This study aims to develop a valid and practical H5P-based Critical Thinking-Independent Learning (CTIL) textbook to improve students' critical thinking skills. The research instruments were textbook validation sheets and textbook readability questionnaires. The data analysis used quantitative descriptive techniques. Quantitative descriptive analysis was carried out on the results of experts' validation and the textbook readability questionnaire. Based on the results of the research conducted, it was found that the validation result from the material expert was 3.81 in the very valid category, from the language expert was 3.80 in the very valid category, and from the media expert was 3.23 in the valid category. The results of the textbook readability questionnaire stated that the textbook was easy to understand, easy to use, and interesting, and students enjoyed using the H5P-based CTIL textbook with an average percentage of 82% in the very high category. Based on the results of the analysis, it can be concluded that the developed H5P-based CTIL textbook is valid and practical. Further research can be conducted by empirically testing the H5P-based CTIL textbook to determine its practicality in science learning broadly.

Keywords: Critical thinking-independent learning model; critical thinking skills; H5P application

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INTRODUCTION

One of the excellent skills needed to face challenges in the VUCA era: Volatility, Uncertainty, Complexity, and Ambiguity in the 21st century is critical thinking skills (Guo et al., 2023; Hasyim et al., 2024c; Raghuramapatruni & Kosuri, 2017; Saputro et al., 2022). In the VUCA era, a person is required to be able to make decisions quickly based on facts (Xiaohong & Ling, 2019). The decision-making process requires critical reasoning (Ennis, 2011). Therefore, one of the ways to prepare the quality of

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human resources for 2025 is to equip students with critical reasoning (World Economic Forum, 2020). High critical thinking skills are very important for students to have because high critical thinking skills can help students solve problems effectively (Akhdinirwanto et al., 2020; Fadilah et al., 2020; Hariadi et al., 2021; Prahani et al., 2020).

Critical thinking skills are one of the 21st-century skills that are urgent for students to develop and succeed in the future (Hasyim et al., 2020, 2024b, 2024a; Misbah et al., 2022). Critical thinking skills require students to think logically and reflectively to decide what to do through observation, analysis, synthesis and conclusion according to the facts (Facione, 2015). In addition, students with good critical thinking skills can develop the ability to solve problems, complete complex tasks, think reflectively and focus on decisions.

Critical thinking involves one logical and reflective process that allows a person to observe, analyze, synthesize, and draw conclusions based on facts (Facione, 2015). This confirms that critical thinking is vital for students as prospective superior human resources. Therefore, students who have high critical reasoning will be able to use their minds to think abstractly, have an open attitude towards everything, and build effective communication with others (Wahyuni et al., 2020; Yani et al., 2021). The results of an initial study related to critical reasoning were conducted on 27 students of grade VIII in Surabaya, Indonesia. The average score of the initial test (pre-test) of critical reasoning was still low, 4.39 from a score range of 1-10 (Hasyim et al., 2020). This is supported by the results of recent research, which showed that the results of improving critical reasoning in junior high school/Islamic junior high school students were in the low category (Arini & Juliadi, 2018; Fitriani et al., 2019; Kamsinah et al., 2020; Purwanto, 2019; Ratnasari & Prayitno, 2020).

The importance of students mastering critical thinking skills needs to be balanced with appropriate learning models and supporting textbooks. Therefore, the facts in the field show that the results of students' mastery of critical thinking skills could have been better. This is supported by the results of observations of one of the public junior high schools in Surabaya City, which show that one of the low critical thinking skills of students is caused by the learning model and textbooks used that do not support the improvement of critical thinking skills. Therefore, it is necessary to develop textbooks that can improve the critical thinking skills of junior high school students.

The critical thinking-independent learning (CTIL) model, which is the basis for creating textbooks, has been proven to improve the critical thinking skills of junior high school students. In addition, the CTIL model is also designed to train students' independence because it is supported by five syntaxes, namely: 1) motivation, 2) phenomenon identification and analysis, 3) self-investigation, 4) interpreting data and communicating results, and 5) reflection (Hasyim et al., 2024c). All the syntaxes of the CTIL model have sub-syntaxes proven to support improving students' critical thinking skills, including indicators of interpretation, analysis, evaluation, inference, explanation, and self-regulation (Hasyim et al., 2024b). Critical thinking and independence are very important parts of the Pancasila Student Profile, which has six key competencies: devotion to God Almighty, noble character, global diversity, cooperation, independence, critical reasoning, and creativity.

Based on the latest research, the development of CTIL textbooks based on H5P can be used to strengthen the profile of Pancasila students. The textbook has

the advantage of using the CTIL model, which has been proven to improve students' critical reasoning (Hasyim et al., 2024a). In addition, the textbook also uses the H5P platform, which stimulates students to be more interactive. It helps students understand learning materials and improves critical reasoning and independent learning (Bakri, 2021; Utari et al., 2022). The H5P platform is very supportive of quizzes, interactive videos, and various types of content that require active participation from students. This is important because active engagement in learning has been shown to improve students' critical thinking skills (Fauziah et al., 2024).

This study focuses on determining the validity and practicality of the H5P-based CTIL textbook. This study was conducted to find the answer to the question: How is the validity and practicality of the H5P-based CTIL textbook to improve the critical thinking skills of junior high school students?

METHOD

This type of research was Research and Development (R&D), which was done by adapting the 4D development model (Wibowo et al., 2022; Wilujeng, 2022). This study aims to produce a valid and practical H5P-based CTIL textbook. This development model consisted of four steps: define, design, develop, and disseminate, as shown in Figure 1 (Thiagarajan et al., 1974; Wibowo et al., 2022; Wilujeng, 2022).

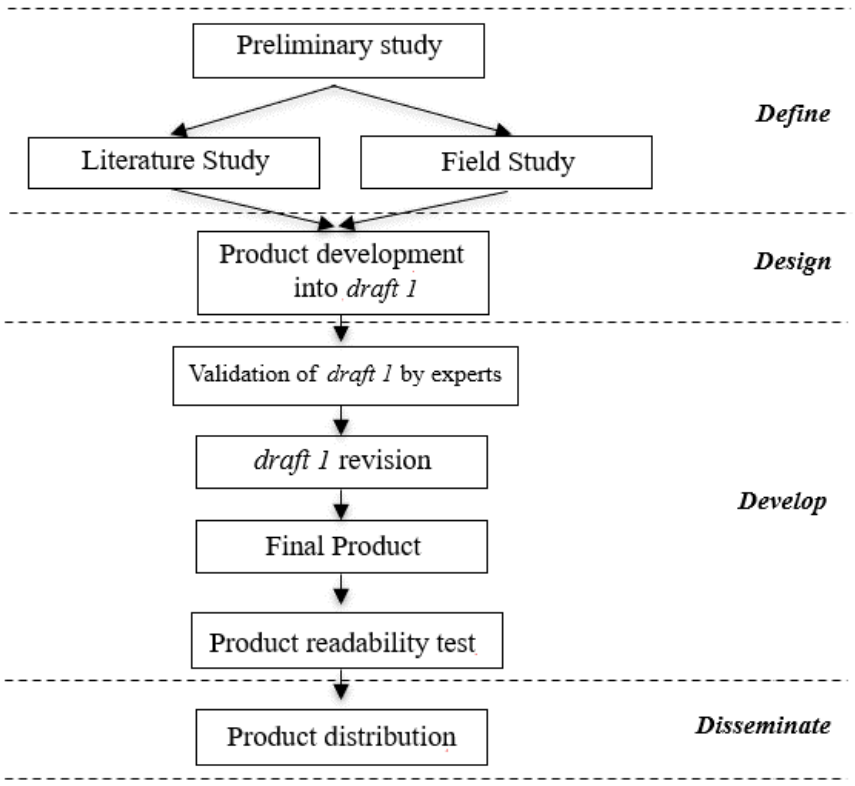

Figure 1 Product development design

The research procedure is shown in Figure 1. The data obtained included experts' validation, as well as the results of the textbook readability questionnaire. The instruments used included experts' validation sheets and textbook readability questionnaires. All instruments were constructed and validated before being used in the study. Construct validation of the instruments

was carried out by two validators. Each validator validated each research instrument.

The explanation of the research procedure is presented in Figure 1; the complete explanation is as follows.

Define

At this stage, materials and learning objectives were analyzed (Winarni et al., 2020). Thus, the textbooks developed are in accordance with students' needs and the demands of the latest curriculum.

Design

At this stage, the textbook's design, such as the book cover, layout design, material to be presented, and H5P based on the material, was selected.

Develop

At this stage, product validation was carried out by the experts, namely material expert, media expert and language expert. Input from the experts was used to improve the product, and then a product readability test was carried out on 150 respondents.

Disseminate

At this stage, the textbook products that had been developed were disseminated. However, the distribution chosen at this stage was only up to the final packaging stage (Wilujeng, 2022).

Based on the three experts' validation results, the development stage was then analyzed descriptively and quantitatively. Quantitative analysis was carried out using a Likert scale presented in Table 1.

Table 1. Experts' Validation Assessment Criteria

Validation Result Criteria	Score
Very good	4
Good	3
Less	2
Very Less	1

(Wilujeng, 2022)

The assessment results obtained from the three validators were averaged and then compared with the validity category criteria in Table 2.

Table 2 Experts' validation assessment criteria

Score Interval	Assessment Category	Information
$3.30 \leq P \leq 4.00$	Very Valid	Can be used without revision
$2.30 \leq P < 3.30$	Valid	Can be used with slight revision
$1.80 \leq P < 2.30$	Invalid	Can be used with a lot of revision
$1.00 \leq P < 1.80$	Very Invalid	It cannot be used yet and still requires consultation

(Hasyim et al., 2024b)

Data related to student readability were obtained from the scale of students' responses to the product. The data were then analyzed using a quantitative description. The students' response scale data analysis used a Likert scale in the form of positive questions. The percentage of students' responses was converted according to the criteria in Table 3.

Table 3 Readability percentage category product

Percentage (%)	Assessment Category
$80 \leq P \leq 100$	Very good
$60 \leq P < 80$	Good
$40 \leq P < 60$	Good enough
$20 \leq P < 40$	Not good
$0 \leq P < 20$	Bad

(Hasyim et al., 2024a)

RESULTS AND DISCUSSION

To produce a valid and practical H5P-based CTIL textbook, several stages of the 4D development model are required, including define, design, develop, and disseminate. The following is an explanation of the results obtained at each stage.

Define

Based on the study of material analysis, the material of temperature and heat has been chosen. This is based on several previous studies that stated that junior high school students still experience difficulties in terms of temperature and heat (Cahyaningtyas et al., 2023). The difficulties experienced are caused by the lack of learning media for temperature and heat that are more interactive with students. In other studies, it turns out that students were also declared weak in solving temperature and heat problems at the junior high school level (Djamilah et al., 2023). Based on the description, it is necessary to develop a textbook on temperature and heat material based on interactive H5P videos with the following details of the material and learning objectives.

Table 4 Results of the analysis of the material and its competency achievement indicators

Material	Competency Achievement Indicators
Temperature and Its Changes	1. Explaining the concept of temperature 2. Analyzing various types and functions of thermometers. 3. Taking temperature measurement data using a non-scaled thermometer by comparing it with a scaled thermometer independently. 4. Explaining the concept of expansion. 5. Giving examples of the expansion of solids, liquids and gases. 6. Describing the difference between temperature and heat. 7. Analyzing the relationship between heat and changes in the temperature of an object and the relationship between heat and changes in the substance of an object. 8. Distinguishing the phenomenon of heat transfer by conduction, convection, and radiation. 9. Mentioning examples of heat transfer events by conduction, convection and radiation.
Heat and Its Transfer	1. Conducting experiments on the effect of heat on the temperature and form of objects independently 2. Analyzing the results of observations related to the effect of heat on temperature and form. 3. Summarizing the investigation results regarding the effect of heat on temperature and form. 4. Conducting heat transfer experiments independently. 5. Analyzing the results of observations related to heat transfer. 6. Concluding the results of the investigation related to heat transfer.

Design

The book cover design, layout, material selection, and H5P interactive video integration had been designed at this stage.

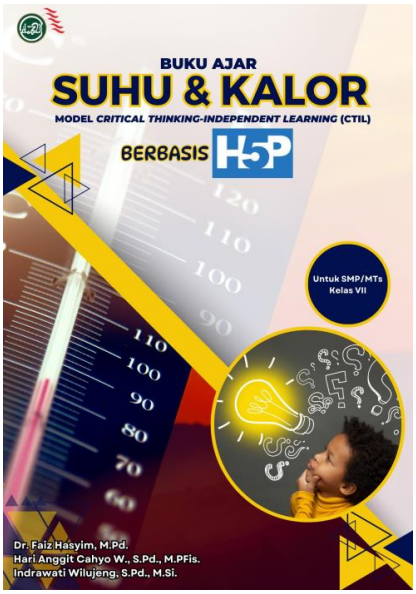

Figure 2 Cover of H5P-based CTIL textbook

Figure 2 shows the result of the cover design of the H5P-based CTIL textbook. This book presents a Concept Map page, as shown in Figure 3, to help students fully understand the material on temperature and heat.

Figure 3 Cover of H5P-based CTIL textbook

At this stage, the layout of each phase was also determined, consisting of Phase 1: Motivation, Phase 2: Identification and Analysis of Phenomena, Phase 3: Independent Investigation, and Phase 4: Data Interpretation and Communicating Results. Figure 4 shows an example of the layout of one of the phases.

Figure 4 Phase 1 placement layout that is motivation

Phase 1 was developed to build students' motivation. Before deeper learning about temperature and its changes, students were stimulated by events related to the material close to their daily lives.

After going through Phase 1, students were invited to identify and analyze phenomena related to temperature and its changes. At this stage, students did not only listen passively; they were expected to actively identify through the notes or worksheets provided.

In Phase 3, students independently conducted investigations. In this phase, the worksheets provided can be accessed via smartphone by scanning the barcode provided. It is hoped that students can conduct investigations independently and enjoyably. An example of the display in Phase 3 can be seen in Figure 5 below.

In the next phase, Phase 5, students were asked to interpret data and communicate the practicum results. The activity was closed with Phase 5, namely reflection activities. Students were asked to independently conduct an evaluation

to review their understanding of the material that had been studied with guidance from the teacher.

Figure 5 Phase 3, independent investigation and worksheets access using barcode

The H5P integration in this textbook was located at the end of the chapter, where the H5P interactive video content can be accessed through the barcode provided. The H5P interactive video access barcode display can be seen in Figure 6.

The H5P interactive video integrated into this book briefly explains the material. At certain times, students are asked questions. Figure 7 shows the display of the H5P interactive video.

Figure 6 Barcode display for H5P interactive video access

Figure 7 Barcode display for H5P interactive video access

Develop

Based on the validation from the three experts, the results are shown in Figure 8.

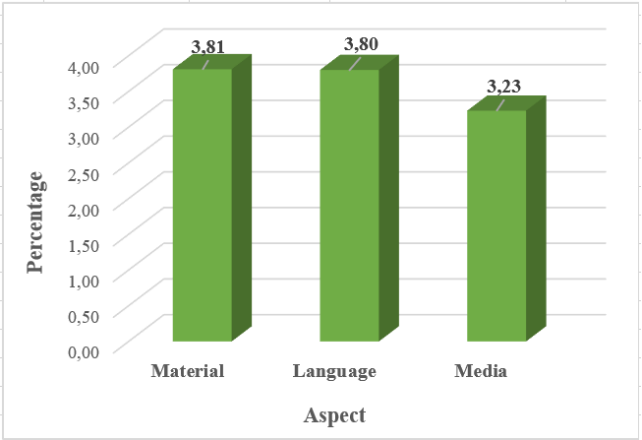

Figure 8 Experts' validation assessment results

The validation result of the material expert was 3,81 with a very valid category, the validation result of the language expert was 3,80 with a very valid category, and the validation result of the media expert was 3,23 with a valid category. The average validation result was 3,61, with a very valid category.

Based on the results of the experts' validation, according to the criteria that had been determined in Table 2, the H5P-based CTIL textbook is stated as "can be used without revision". However, in this study we made improvements based on the suggestions and input given by each validator. The improvements made in the media expert validation were in writing the image reference links. In addition, the suggestion from the media expert was to re-ensure that the QR code and Barcode can work properly when scanned.

Linguists validated the H5P-based CTIL textbook as quite good overall. One suggestion was to ensure consistency in greeting use. We conducted a review to ensure this.

The last expert validation was the material expert. From the material side, there were no direct suggestions or improvements. Suggestions from the material expert was that it is needed to add some sample questions to add to the students' experience. We facilitated this by adding the number of questions to the H5P interactive video.

The next stage was the product readability test. This test was carried out to ensure that students can use this product. This activity was carried out by involving 150 respondents of junior high school students with the criteria that the students had received temperature and heat material. The 150 respondents were divided into 5 classes, namely class A, class B, class C, class D, and class E.

The results of the readability percentage analysis for each class are presented in Table 5.

Table 5 Results of product readability test analysis

Class	Percentage (%)	Category
A	80 %	Very Good
B	78 %	Good
C	83 %	Very Good
D	80 %	Very Good
E	87 %	Very Good
Average	82 %	Very Good

Based on Table 5, the H5P-based CTIL textbook was included in the "Very Good" category. This readability criterion is important because textbooks with a high readability level can increase students' learning motivation (Pratiwi et al., 2023).

Researchers made several innovations in testing the textbook's readability. This was because there was an evaluation after each data collection activity. The findings found that the use of smartphones as a means of accessing H5P content significantly influenced the classroom atmosphere during the test.

In several classes at the beginning of the week of data collection, students were directed to access textbooks and H5P content using laptops. The atmosphere in the classroom seemed quite noisy. This was very different from the next day when H5P access was provided using smartphones, students seemed very focused, the classroom atmosphere was very conducive. This is in line with previous research, namely that smartphones significantly influence students' learning processes, especially since the COVID-19 pandemic era (Maknuni, 2020).

Disseminate

At this stage, the textbook finalization process was carried out. The revised textbooks were then printed practically and completely ready to be used or used as material for further research studies. After the final printing process of the

textbook sample was complete, we conducted a review again, especially those related to the QR code or Barcode, to carry out another scanning test. This was done to ensure that the QR and Barcode can really be accessed easily.

Another finding that we got in this process is that there was a difference in access when students used the default smartphone browser and used Google Chrome. Users with the Google Chrome browser did not find any obstacles at all.

The H5P interactive video integrated into this book contains a brief explanation of the material. At certain times, students are asked questions. Figure 6 shows the display of the H5P interactive video.

CONCLUSION

Based on the research conducted, it can be concluded that the H5P-based CTIL textbook is valid and practical for use in improving the critical thinking skills of junior high school students. This can be seen based on the validation results from the material expert of 3,81 in the very valid category, the language expert of 3,80 in the very valid category, and the media expert of 3,23 in the valid category. The results of the textbook readability questionnaire stated that the textbook is easy to understand, easy to use, and interesting, and students enjoyed using the H5P-based CTIL textbook with an average percentage of 82% in the very high category. The limitation of this study is the empirical test of the product only in one of the public junior high schools in Surabaya City. Further research is an empirical test of the H5P-based CTIL textbook to broadly determine its practicality in science learning.

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