

Development of an Integrated Discovery Learning E-Book on *Tabuik* to Improve Students' Critical Thinking Abilities and Collaborative Attitudes

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ABSTRACT

This study aims to evaluate the validity, readability, practicality, and effectiveness of an Integrated Discovery Learning E-Book based on the Tabuik cultural tradition to enhance students' critical thinking skills and collaborative attitudes. The research followed the 4D development model (Define, Design, Develop, Disseminate) and was implemented at SMP Negeri 25 Padang. The validity of the e-book was assessed by three expert lecturers. Readability and practicality were evaluated by 31 students and 3 teachers. To test effectiveness, 93 students participated. Data from the validity, readability, and practicality tests were analyzed using standard rating scales. Effectiveness data were analyzed using the General Linear Model (GLM), specifically MANOVA. The e-book received a validity score of 76 (very high), a readability score of 63.35 (good), and a practicality score of 19.33 (very good). The GLM test showed a significance value < 0.05 , indicating a statistically significant improvement. Students' critical thinking and collaborative attitudes improved, with N-gain scores of 0.73 and 0.71, respectively—both categorized as high. The findings confirm that the developed e-book is not only educationally sound but also culturally relevant and engaging, promoting higher-order thinking and social skills among students. The Tabuik-based e-book is valid, readable, practical, and effective in enhancing critical thinking and collaboration. Future studies should explore incorporating a broader range of cultural elements for more generalized outcomes.

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1. INTRODUCTION

Advanced countries must be supported by resilient and adaptable human resources, who are intelligent, creative, and possess good moral standards. Investment in education guarantees a country's productivity, as the accumulation of knowledge, skills, attitudes, and good morals will ultimately enhance the welfare of its people (Suryadi et al., 2020). Education is a primary concern in the Fourth Industrial Revolution of the 21st century. The global attention on education in the 21st century demands

that learners possess abilities in learning and innovation (Asrizal et al., 2018). The learning abilities required in 21st-century education include metacognitive skills, communication, critical and creative thinking, problem-solving, collaboration, innovation, and innovative literacy (Mardhiyah et al., 2021).

21st-century educators are expected to leverage technology and information to help students reach their maximum potential. Concrete actions that teachers can take to meet the demands of 21st-century education include using innovative teaching resources with diverse features to facilitate activities that can be accessed anytime and anywhere, adjusting the forms of learning materials to suit current student learning conditions. One such resource is electronic books (e-books), which offer physical displays and additional capabilities such as animations, music, and videos that help explain their content (Suyatna et al., 2018). Students' learning interest can be enhanced by using e-books (Ma'ula et al., 2017).

One of the essential abilities to develop in 21st-century education is critical thinking (Kemendikbud, 2017). Thinking ability can change students' attitudes and understanding of their learning sources and nature (Wartono et al., 2018). Enabling students with critical thinking abilities to better comprehend the lessons taught by teachers and assist them in managing their thoughts, understanding the core of their learning, and grasping the meaning of the knowledge acquired (Damayanti & Kuswanto, 2021).

However, the current issue is that students' critical thinking ability remains low. The 2022 PISA result shows that Indonesia scored 383, indicating a decline in science comprehension compared to 396 in 2018. This result reveals that, generally, Indonesian students can only recognize scientific phenomena and direct examples using basic knowledge (OECD, 2023). The fact that Indonesia ranked poorly in science on the 2022 PISA assessment further indicates that students' critical thinking ability still insufficient. Furthermore, a meta-analysis conducted by Putri et al. (2020) on 12 articles related to junior high school students' critical thinking ability during science learning revealed that Indonesian students' critical thinking abilities range from low to moderate. Half of the reviewed articles indicated that students' critical thinking abilities were below average, while the other half also showed poor levels of thinking.

Another issue found is students' collaborative attitudes. Based on observations and interviews with science teachers, it was noted that student's collaborative attitudes are also classified in low category. Some students are still individualistic and are less actively involved in group activities.

The problems of low student's critical thinking and collaborative attitudes can be dealt with by innovating learning through models that support student engagement and activity during the learning process. One model that can be used to enhance students' critical thinking ability and collaborative attitudes is the discovery learning model. In this model, students are taught to observe, question, experiment, reason, and communicate through syntax (Pratiwi & Rasmawan, 2014). Students who engage in discovery learning must actively seek and articulate concepts from prior information obtained through experience. By integrating the discovery learning model and the ethnoscience in the eBook, students not only receive information passively but also build their knowledge through cultural exploration and concept discovery, thus enhancing their understanding and critical thinking abilities. Meanwhile, the discovery learning model emphasizes the active involvement of students in interacting with their peers to discover concepts. This also encourages the development of collaborative attitudes among students.

Not only from the standpoint of thinking ability, but the benefits of the discovery learning syntax can also increase students' active participation in group discussions by demonstrating their direct involvement in the learning process (Ekaputra, 2022). Working on projects together can help foster a more collaborative attitude (Septikasari & Frasandy, 2018). Evayani (2020) emphasizes that the discovery learning model can improve student participation in the learning process and learning outcomes.

In addition to providing innovations in the forms of teaching materials and instructional models involved in the teaching materials, teachers need to introduce further innovations. One innovation that

can be integrated into the teaching materials is incorporating local wisdom, known as ethnoscience, into the learning content (Virijai et al., 2024). One local wisdom integrated into the material on vibrations, waves, and sound is the *Tabuik* tradition that developed in Pariaman, West Sumatera. Within the *Tabuik* celebration, there is a musical instrument called the *Gandang Tasa*, which is played during the *Tabuik* performance. This instrument used in the *Tabuik* tradition, can be further studied in line with the concepts in science education. The integration of this material is predominantly physics-based but remains connected to biological content.

Several previous studies have explored the development of teaching materials focused on individual learning models or isolated variables. For instance, Nurlaili (2021) developed a Discovery Learning-based e-module aimed at enhancing critical thinking skills, and the results confirmed its positive impact. Rosita (2024) designed learning modules incorporating an ethnoscience-based, project-based learning model to strengthen students' collaboration and critical reasoning, showing improved outcomes in both areas. Similarly, Rachman and Sunardi (2022) created an inquiry-based digital textbook for social science subjects, which demonstrated the need for continued innovation in improving critical thinking among vocational students.

However, there is a lack of research integrating the Discovery Learning model with elements of local wisdom, particularly the *Tabuik* tradition, to improve both critical thinking skills and collaborative attitudes. No existing study has yet explored how local cultural content can be effectively embedded within Discovery Learning frameworks to support these dual competencies.

Therefore, it is essential to develop instructional materials in the form of an Integrated Discovery Learning E-Book based on *Tabuik*, specifically for Grade VIII students studying the topic of Waves, Vibrations, and Sound. This research aims to examine the validity, readability, practicality, and effectiveness of this e-book in enhancing students' critical thinking abilities and collaborative attitudes.

2. METHODS

This study employed a Research and Development (R&D) approach to develop an Integrated Discovery Learning E-Book based on *Tabuik*. The development process followed the 4D model—Define, Design, Develop, and Disseminate—aimed at producing a learning resource that is valid, readable, practical, and effective in enhancing students' critical thinking abilities and collaborative attitudes.

In the define stage, researchers identified instructional needs and gathered relevant information to support the product's development. This process involved conducting initial analysis, student analysis, task analysis, and concept analysis, while also determining learning objectives relevant to the topic of Waves, Vibrations, and Sound for eighth-grade students.

The design stage involved developing a criterion-referenced assessment, selecting culturally relevant teaching materials, deciding on the e-book's format, and creating an initial design aligned with the principles of Discovery Learning and the local cultural context of *Tabuik*. The next stage, develop, included drafting the product, validating it with experts, revising based on feedback, and conducting both limited and extensive testing. Product validation was carried out by two lecturers from Universitas Negeri Yogyakarta (UNY), who served as expert validators. The limited test, adapted from Ofianto et al. (2023), was used to assess readability and practicality using a standard scale. This phase involved 31 ninth-grade students and 3 science teachers from SMP Negeri 25 Padang.

To evaluate the product's effectiveness, an extensive test was conducted involving 93 eighth-grade students from three different classes, selected using a cluster random sampling technique. These students were divided into one experimental group and two control groups. The effectiveness of the e-book in improving critical thinking and collaborative attitudes was measured using pretest-posttest instruments, and the results were analyzed using gain scores and the General Linear Model (GLM) through MANOVA analysis.

Participant selection considered several criteria: students had not yet learned the topic of vibrations and waves, demonstrated basic digital literacy (such as operating smartphones), and represented varied

academic performance levels. The sample size in this study aligns with Sugiyono's (2017) recommendation of 30–500 participants, with 31 students involved in the limited test and 93 in the extensive test. The design for the effectiveness test referred to Creswell's (2014) non-randomized pretest-posttest control group design.

In the final stage of the research, dissemination was carried out by sharing the study's findings with science teachers and submitting the results for publication in academic journals to encourage broader implementation and scholarly contribution.

a. Calculate the average total score for each component using the Formula 1:

$$\bar{X} = \frac{\sum x}{n} \quad (1)$$

Description:

$\bar{X}$ = average score

$\sum x$ = total score of each validator for a component

n = number of validator

b. Calculate the ideal average score ($\bar{X}_i$) which is $\frac{1}{2}$ (Ideal maximum score + Ideal minimum score).

c. Calculating the standard deviation (SB_i) which is $\frac{1}{6}$ (Ideal maximum score - Ideal minimum score).

Table 1. Category for Validity, Readability and Practicality Questionnaires (Mardapi, 2012)

Score Intervals	Category
$\bar{X} > (\bar{X}_i + 1,50 SB_i)$	Very high
$(\bar{X}_i + 1,50 SB_i) > \bar{X} \geq \bar{X}_i$	High
$\bar{X}_i > \bar{X} \geq (\bar{X}_i - 1,50 SB_i)$	Low
$(\bar{X}_i - 1,50 SB_i) > \bar{X}$	Very low

The data from the effectiveness test were analyzed using statistical procedures in SPSS 21 software, specifically employing the General Linear Model (GLM), which includes Multivariate Analysis of Variance (MANOVA). This analysis was conducted to determine whether there were statistically significant differences in critical thinking ability and collaborative attitudes between the experimental and control groups. The GLM was applied using input data from students' pretest and posttest scores for each measured variable, in accordance with Ho (2014).

In addition to significance testing, the degree of improvement in students' critical thinking and collaborative attitudes was evaluated by calculating the Normalized Gain (N-Gain) based on their pretest and posttest scores, using the formula presented in Formula 2.

$$N - \text{Gain score} = \frac{\text{Posttest score} - \text{Pretest score}}{\text{Maximum score} - \text{Pretest score}} \quad (2)$$

Table 2. Category of N-Gain (Hake, 1999)

Gain Score (g)	Category
$g > 0.7$	High
$0.7 \geq g \geq 0.3$	Medium
$g < 0.3$	Low

The N-Gain values were further analyzed statistically using Microsoft Excel 2010 to determine whether the observed improvements were significant. Students' critical thinking abilities were assessed through a set of essay questions developed based on established critical thinking indicators. These questions reflected five key indicators: elementary clarification, analysis, evaluation, explanation, and inference.

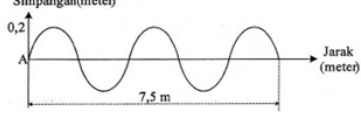
To ensure the reliability of the assessment instrument, a reliability test was conducted using IBM SPSS 26. The results of this analysis are presented in the following table and serve to confirm the consistency of the instrument in measuring the intended critical thinking components.

Table 3. Instrument Reliability Test Results

Cronbach's Alpha	N of Items
.836	10

The instrument's reliability is above the 0.05 level, as indicated by the Cronbach's Alpha score of 0.803. This indicates that the instrument is reliable for measuring students' critical thinking abilities. Here is an excerpt of the essay questions to measure students' critical thinking abilities.

2. Perhatikan gambar dan pernyataan berikut.



Pernyataan:

- Gelombang di atas memiliki panjang gelombang 3 m.
- Bila frekuensi gelombang adalah 25 Hz maka cepat rambat gelombang adalah 75 m/s.
- Jumlah gelombang sebanyak 5.
- Periode gelombang berbanding terbalik dengan frekuensi

Diantara pernyataan tersebut, manakah pernyataan yang tepat sesuai dengan gambar yang disajikan! Jelaskan alasan Anda!

Jawab:.....

4. Perhatikan beberapa peristiwa berikut:

- Ketika berteriak di dekat tebing suara kita akan mengalami gaung.
- Astronot tidak dapat mendengar bunyi di luar angkasa.
- Frekuensi bunyi yang didengar di air berbeda dengan frekuensi bunyi di udara.

Diantara peristiwa di atas, manakah yang merupakan karakteristik gelombang bunyi. Mengapa demikian?

Jawab:.....

Figure 1. Instrument of Critical Thinking Abilities

3. FINDINGS AND DISCUSSION

3.1. Define

In the define stage, several analyses are conducted to determine the needs for product development. (a) Preliminary analysis to identify students' initial critical thinking abilities and collaborative attitudes. According to the findings from observations and interviews conducted with teachers, students' critical thinking abilities and collaborative attitudes in class still need to be improved. Students often to focus on memorizing facts and concepts without understanding them in depth, which is why giving high-level thinking questions is rarely done, considering the ability of students who often have difficulty analyzing these high-level thinking questions. Next for the collaborative attitudes, even though some students are able to work together in groups, the majority still show an attitude of individualism and are less actively involved in group activities. Students who have higher abilities tend to dominate and provide fewer opportunities for other students to contribute. The problems that have occurred are due to the teaching materials used, which have not effectively

developed students' critical thinking abilities and collaborative attitudes. The teaching materials have not been combined with learning models that improve student contributions in the learning process, both in terms of thinking and collaboration. (b) Students are able to use technology well and familiar with the term Tabuik Tradition which originates from West Sumatra. (c) Based on the analysis at this stage, the identified development need is to create an integrated discovery learning e-book on Tabuik to improve students' critical thinking ability and collaborative attitude.

3.2. Design

The design stage involves selecting teaching materials that align with students' characteristics and learning needs. Given that students possess both the ability and familiarity with digital technology, the development of electronic-based teaching materials, such as e-books, is appropriate and effective. Once the material is selected, the next step is determining the format of the e-book. The structure of the e-book includes several key components: a cover, foreword, table of contents, list of images, tables, videos, pretest, learning objectives, indicators, Tabuik cultural content, instructional materials, embedded videos, posttest, bibliography, glossary, and author information.

As a form of electronic teaching material, the e-book is enhanced with multimedia elements such as text, images, audio, animations, videos, and hyperlinks, which together support an interactive and engaging learning experience.

3.3. Develop

In the design stage involves creating draft an integrated discovery learning e-book on Tabuik using Canva. Canva is a graphic design tool that helps its users easily create various types of creative designs (Alfian et al., 2022). Canva serves as an alternative for designing electronic products as learning media, allowing for more flexible learning since the materials can be modified with videos, images, audio, and animations, thereby assisting students in understanding the lessons (Tambunan & Tambunan, 2023). And then the product will be exported as an e-book via the corporate Flip PDF Corporate application.

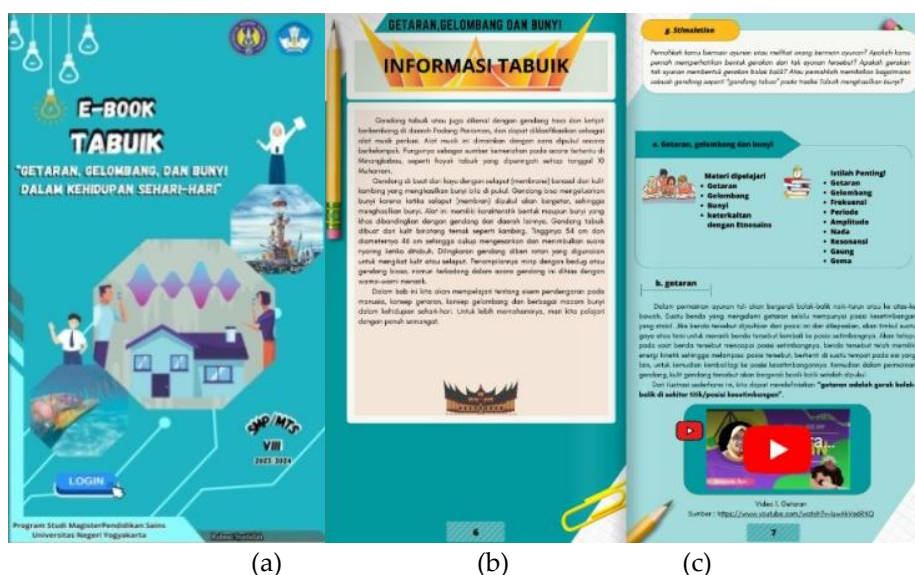


Figure 2. Cover (a), Tabuik information (b), materials (c), of the e-book

After the product development, product will be tested in validity, readability, practicality, and effectiveness.

3.3.1. Validity Test

The developed e-book draft was evaluated for its validity in terms of content and construct validity by two validator to obtain expert opinions about products made based on certain aspects (Anggreni et al., 2020). The validator, namely lecturers in science education from Universitas Negeri Yogyakarta. The assessment results of the Integrated Science e-book based on Discovery Learning yielded two types of data: qualitative and quantitative data. The qualitative data were collected through product feasibility assessments, which included suggestions from experts to improve the product. Quantitative data were obtained through scores from the product validity assessment, which were then analyzed to determine the quality level of the product. The criteria for the assessment results were established by comparing the evaluation results against the criteria in Table 1 (Mardapi, 2012). The validity results of e-book are shown in Table 3 below.

Table 4. Result of Validity Analysis

Construction	Average Score (X)	Quality
<i>Cover</i>	8	Very high
Foreword	7	Very high
Table of Contents	1	Very high
Image List	1	Very high
Table List	1	Very high
Videos List	1	Very high
<i>Pretest</i>	5	Very high
Content Material	39	Very high
Learning activities based on discovery learning	1	Very high
Video	1	Very high
<i>Posttest</i>	5	Very high
Glossary	1	Very high
Bibliography	1	Very high
Author Information	4	Very high
Overall Score	76	Very High

According to the table above, the overall average validity score is 76 was categorized as very high. This means that the e-book being developed is valid, according to experts. During the product development process, revisions are made based on feedback and suggestions from validators.

3.3.2. Readability Test

The readability test aims to evaluate the extent to which the e-book content can be understood by readers, ensuring that the language, structure, and presentation of information are appropriate for the target audience's level of comprehension. The readability test was conducted using a questionnaire with 31 students as respondents. The number of respondents used refers to the opinion of Singarimbun & Efendi (1995), who state that the minimum number for a questionnaire trial is at least 30 individuals. The small number of respondents allows this research to be conducted in greater depth and enables the collection of more detailed data and focused analysis. In terms of limitations, the study is constrained by the time allocated by the school, considering that teachers must quickly complete the material in preparation for the final summative assessment. The results of readability are shown in Table 5.

Table 5. Result of Readability Analysis

Aspect	Average Score (X)	Quality
Convenience	23.23	Very good
Attractiveness	21.42	Good
Comprehensibility	18.71	Good
Overall Score	63.35	Good

According to the table above, the e-books scored an average of 23.33 in the convenience aspect, placing it in the very good quality category. The attractiveness aspect received an average score of 21.42, categorizing it as good quality. Finally, the comprehensibility aspect received an average score of 18.71, which is also classified as good quality. The overall average score for the readability aspect was 63.35, were categorized as good. The result interpreted that the e-book has a readability level in the good category. The readability level of teaching materials will influence readers in increasing their interest in learning, memory and speed of reading efficiency (Zidatunnur & Rusilowati, 2021). An e-book that is easily comprehensible for students stimulate interactive learning in the classroom. Selamat (2023) explains that an e-book can be considered an interactive teaching material if its usage includes interactive sentences that can be interpreted in a two-way manner.

3.3.3. Practicality Test

The practicality test evaluated the product practically used in the learning process. Practicality needs a response from student to improve the product. Data were obtained through scores from the product practicality assessment, which were then analyzed to determine the quality level of the product. The criteria for the assessment results were established by comparing the evaluation results against the criteria in Table 1 (Mardapi, 2012). The results of practicality which are shown in Table 6.

Table 6. Result of Practicality Analysis

Aspect	Average Score	Quality
Ease of Use	7	Very good
Attractiveness	7	Very good
Efficiency	5.33	Very good
Overall Score	19.33	Very good

According to the table above, the e-books in the ease of use aspect received an average score of 7, placing it in the very good category. The attractiveness aspect also received an average score of 7, placing it in the very good category. Lastly, the efficiency aspect earned an average score of 5.33, placing it in the very good category. The overall average value for the practicality aspect shows a value of 19.33, indicating that it falls within the very good category since $X > 14.9$. Thus, it can be interpreted that the integrated discovery learning e-book on Tabuik has a level of practicality classified as a very good category.

The result indicate that e-books help teachers in explaining material, save time, can be used anytime and anywhere. This is as stated by Akmal & Saputra (2020), where through the existence of electronic teaching materials, students can learn independently wherever and whenever, adjusting to each child's learning speed, and can determine the learning sequence.

3.3.4. Effectiveness Test

The effectiveness test was conducted by collecting the students' pretest and posttest results. The result was analyze using a statistical test on the general linear model (GLM), which in this study uses MANOVA. The results of the effectiveness are presented in Table 7.

Table 7. Result of Effectiveness Analysis Using MANOVA

	Sig.	Partial Eta Squared
Pillai's trace	,000	,544
Wilks' lambda	,000	,733
Hotelling's trace	,000	,844
Roy's largest root	,000	,914

Based on the table above, the significance value for Hotelling's Trace is less than 0.05, indicating that the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted. This result suggests a statistically significant difference in the pretest and posttest scores for critical thinking ability and collaborative attitudes. The observed differences demonstrate that there is a simultaneous improvement in these two variables across the Experiment, Control 1, and Control 2 classes.

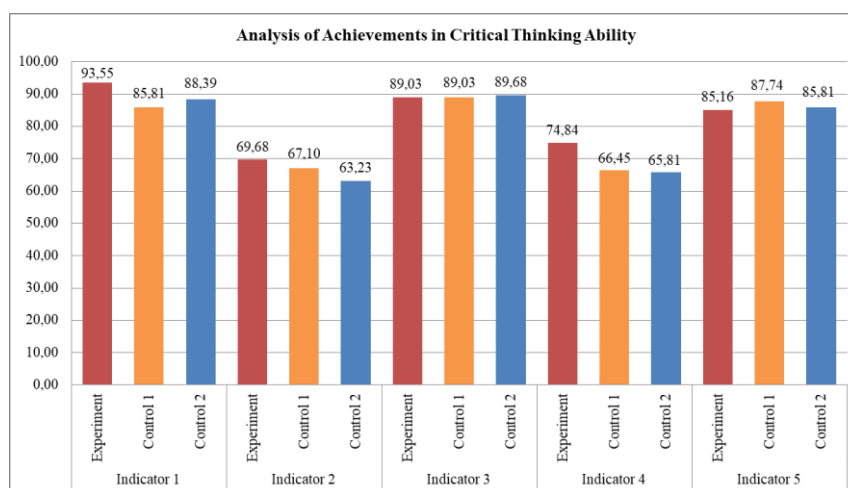
To further examine the extent of improvement, the N-Gain test was used to analyze changes in critical thinking and collaborative attitude scores between the pretest and posttest. The N-Gain results for students in both the experimental and control groups are presented in Table 8, providing a more detailed view of the learning gains achieved in each class.

Table 8. Result of N-Gain Critical Thinking Ability and Collaborative Attitude

Group	Variable	N-Gain	Category
Experiment	Critical Thinking Ability	0.73	High
	Collaborative Attitude	0.71	High
Control 1	Critical Thinking Ability	0.67	Medium
	Collaborative Attitude	0.59	Medium
Control 2	Critical Thinking Ability	0.66	Medium
	Collaborative Attitude	0.49	Medium

Based on Table 7, the average N-Gain value for the experiment class is higher than that of both control classes. This data indicates that the critical thinking ability and collaborative attitudes of students in the experiment class improved more than those of students in the control class after using an integrated discovery learning e-book on Tabuik. The gain results strengthen the MANOVA test, which shows that there are differences in increasing critical thinking abilities and collaborative attitudes in the experimental class and both control classes.

The difference in the improvement of critical thinking skills and collaborative attitudes between the experimental class and the control class can also be seen from the analysis of the achievements of each indicator. The achievements can be seen in the following Figures 3 and 4.

**Figure 3.** Analysis of Achievements in Critical Thinking Abilities

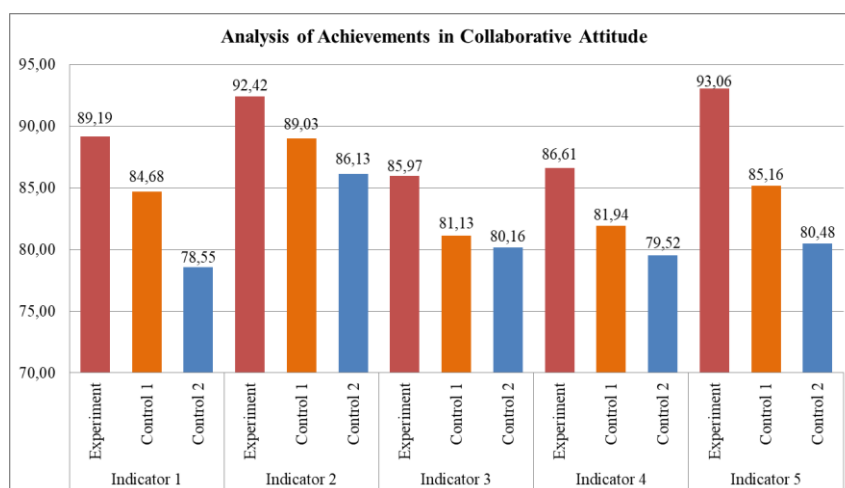


Figure 4. Analysis of Achievements in Collaborative Attitudes

Supporting factors that lead to a higher improvement in the experimental class after using e-books are the implementation of the discovery learning model in the learning activities. Discovery learning is a model that effectively engages students in the learning process, as learners are directly invited to discover concepts. This learning model can enhance students' critical thinking abilities. Thus, combining e-books with the discovery learning model can be a solution to support the improvement of students' critical thinking abilities (Hagi et al., 2019). The optimal development of students' critical thinking abilities must involve interactive learning, where students are viewed as thinkers rather than mere recipients of information (Rosida et al., 2017).

In addition to implementing a model that supports active student involvement in concept discovery, the e-book is also enhanced with the integration of local wisdom. This integration of local wisdom (ethnoscience) can strengthen students' understanding of concepts. The ethnoscience approach in science learning allows students to develop a deeper understanding of scientific concepts while preserving and respecting their cultural heritage (Virijai et al., 2024). The e-book includes local wisdom related to *Tabuik*, which is iconic of Pariaman, West Sumatra, and lessons can be drawn from its scientific aspects (Emelina & Zubaidah, 2022). Scientific concepts found in the *Tabuik* tradition, such as the *Gandang Tabuik*, apply principles of vibration, waves, and sound. This combination of the discovery learning and integration of ethnoscience further strengthens the support to improve critical thinking's students.

Another benefit of discovery learning is that it supports the enhancement of students' collaborative attitudes. This is due to the fact that the syntax of discovery learning requires a collaborative approach in students' concept discovery. Students are trained to identify problems, collect data, process data, verify, and make a conclusion collaboratively (Balqist et al., 2019). Thus, the implementation of the discovery learning model not only improves critical thinking abilities but also improves the collaborative attitudes of students.

3.4. Disseminate

The last stage is to distribute the integrated discovery learning e-book on *Tabuik* to science teachers at the school and publish the research results in journals.

Discussion

In the industrial revolution 4.0, we are increasingly familiar with 21st-century education. This era is characterized by the integration of technology in education, both in the implementation of learning and learning media. In 21st-century learning, digital learning media serve as resources that

educators can use to impart knowledge in an engaging manner that is meaningful for students. One example of such media is an electronic book (e-book). An e-book is an excellent format for digital media because it provides an interactive and multimedia experience for students to learn (Mavropoulou, 2023).

The developed e-book aims to equip students with 21st-century skills, enabling them to adapt to global challenges amidst the increasingly advanced developments in science and information. This e-book will focus on two 21st-century skills, namely critical thinking and collaboration (Andrian & Rusman, 2019). Critical thinking ability is one of the crucial aspects in student development that can affect their ability to understand, analyze, and evaluate information (Sutoyo, 2023). Collaboration is an element of cooperation, representing a characteristic of future intelligence, the attitude required to confront the challenges of the industrial era 4.0 (Ramuni, 2022).

The e-book is designed based on the discovery learning model and integrates local wisdom, specifically "*Tabuik*." Discovery learning can be implemented by integrating of local culture. Initiatives to preserve culture in education align with Government Regulation Number 19 of 2005 on National Standards of Education, particularly Article 14, Paragraph (1), and are further developed in the 2013 curriculum, which encourages the integration of culture into learning. The curriculum needs to be adaptable to changes in science, culture, technology, and the arts. Therefore, it is crucial for schools to teach students about local cultural wisdom (Utaminingsih, 2021). The e-book is designed in accordance with a discovery learning framework and integrates ethnoscience with the local wisdom of the *Tabuik* tradition. During the implementation, students are guided to uncover material concepts by following the structured steps of the Discovery Learning syntax, which is informed by cultural stimuli derived from local wisdom.

This local wisdom is integrated into the e-book through the presentation of stimuli in the form of brief narratives and traditional images. The aim is to remind students of their culture while exploring the scientific concepts contained within it. In the development of this e-book, the highlighted local wisdom focuses on the *Tabuik* tradition, particularly emphasizing the characteristic musical instrument from this tradition, namely the *Gendang Tasa/Gendang Tabuik*. Through engaging narratives and attractive illustrations, students are encouraged to understand the meaning and function of the *Gendang Tasa/Gendang Tabuik* in cultural tradition, while also exploring the scientific aspects behind it. This situation is in line with the concept of ethnoscience. Learning in a system of knowledge from local cultures knowledge and related to certain natural phenomena is called *Ethnosains* (Dewi et al., 2019). The concept of playing the *Gendang Tasa/Gendang Tabuik* can be explained using the principles of wave vibrations and sound in science, providing students with the opportunity to see the direct relationship between tradition and science. Thus, the integration of local wisdom not only serves as a stimulus that enriches the learning experience but also encourages students to appreciate their cultural heritage while developing a deeper scientific understanding. Learning that incorporates elements of local cultural wisdom can enhance students' skills to face the challenges of the Industrial Revolution 4.0 era (Utaminingsih, 2021).

The advantages of the integrated discovery learning e-book on *tabuik* are that it can enhance critical thinking abilities and collaborative attitudes. Research results have shown that the experimental class received an n-gain score of 0.73 for critical thinking ability and 0.71 for collaborative attitude, with both aspects in the high improvement category. More specifically, as seen in Figure 2 and Figure 3, the analysis of achievements in critical thinking ability and collaborative attitudes is more dominated by the experimental class compared to the control class. In the critical thinking ability indicators, the experimental class achieved the highest scores in 4 out of 5 indicators, next, in collaborative attitudes, the experimental class scored the highest in all indicators. -centered and support the improvement of students' critical thinking abilities by engaging them actively at every stage of the learning process. By integrating the discovery learning model and the ethnoscience of *tabuik* in the e-book, students not only receive information passively but also build their knowledge through cultural exploration and concept discovery, thus enhancing their understanding and critical thinking abilities. Meanwhile, the

discovery learning model emphasizes the active involvement of students in interacting with their peers to discover concepts. This also encourages the development of collaborative attitudes among students.

The effectiveness of the developed e-book can be attributed to its innovative integration of the Discovery Learning model with elements of local wisdom, which collectively enhance students' critical thinking abilities and collaborative attitudes. By incorporating the Discovery Learning approach, the e-book becomes student-centered, actively involving learners in each stage of the learning process, thereby fostering higher-order thinking skills (Hagi et al., 2019). As noted by Nursakinah (2023), Discovery Learning emphasizes the active participation of students, encouraging them to construct their own understanding through exploration and investigation (Shu & Ye, 2023).

This model not only deepens conceptual understanding but also strengthens students' capacity for critical thinking (Hakim et al., 2018). According to Tosuncuoglu (2018), critical thinkers are those who can investigate, analyze, accept or reject information, evaluate arguments, and draw conclusions. These skills are cultivated through the structured stages—or syntax—of the Discovery Learning model.

The integration of local culture into the e-book further supports the development of critical thinking by making the content more relevant and meaningful. Cultural context enables students to connect learning materials to their lived experiences, enhancing engagement and comprehension (Lubis et al., 2022). Supporting this, Uge et al. (2019) found that Discovery Learning models enriched with local wisdom have a significant impact on students' critical thinking development.

In Discovery Learning, teachers serve as facilitators or mentors, creating opportunities for students to independently or collaboratively in groups to explore the subject matter (Shu & Ye, 2023). In practice, learning using e-books is conducted in groups, allowing students to engage in problem identification, data collection, data processing, and drawing conclusions collaboratively. Collaborative attitudes can be supported through projects carried out together (Septikasari & Frasandy, 2018). Discovery Learning encourages students to actively collaborate with their friends in learning (Ramuni, 2022). The syntax of discovery learning presented in the e-book will keep students engaged, and they will help each other when group members do not understand. Thus, e-books based on discovery learning can improve students' collaborative attitudes.

Previous studies have explored the use of Discovery Learning combined with digital teaching materials to enhance students' critical thinking skills. For example, research by Rizka Nurlaili et al. (2021) focused on the development of a Discovery Learning-based e-module, with findings indicating that it effectively improved students' critical thinking abilities. Similarly, Kurniasih et al. (2021) developed an e-book on ecosystem material using the Discovery Learning model, and their results also showed a positive impact on students' critical thinking.

These studies demonstrate the effectiveness of integrating Discovery Learning with digital materials; however, they primarily concentrate on cognitive outcomes, particularly critical thinking. In contrast, the present study introduces an innovative approach by combining Discovery Learning, digital learning materials, and local wisdom, specifically the Tabuik tradition, to improve not only critical thinking abilities but also collaborative attitudes. The findings reveal that this integrated e-book model is effective in enhancing both competencies, offering a more holistic approach to student learning.

Future research is encouraged to involve a broader range of local schools in testing the e-book to validate its effectiveness across diverse educational contexts. It is also recommended that subsequent studies explore the integration of various technologies, instructional models, and cultural content. Expanding the variety of learning topics and local wisdom incorporated into digital resources can further enrich active, participatory learning while preserving and promoting cultural values within the educational experience.

4. CONCLUSION

Based on the findings and analysis, it can be concluded that the Integrated Discovery Learning E-Book based on Tabuik is a valid, readable, practical, and effective teaching tool. Expert validation placed the e-book in the very high category with a score of 76, while readability and practicality were rated good (63.35) and very good (19.33), respectively. The General Linear Model (GLM) analysis showed a significant effect ($p < 0.05$), with N-gain scores of 0.73 and 0.71 for critical thinking ability and collaborative attitude, both falling into the high category. These results demonstrate the e-book's effectiveness in enhancing higher-order thinking and student collaboration through a culturally integrated learning model. However, the research is limited in scope as it focuses on only one subject topic. To improve the generalizability and impact of the findings, future studies are encouraged to incorporate a broader range of local cultures, learning topics, and technological approaches into similar digital learning tools. Furthermore, expanding the application of e-books to other content areas may reveal additional benefits and challenges. Teachers are recommended to adopt culturally integrated e-books as alternative learning resources to promote student engagement, cultural awareness, and conceptual understanding in science education.

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