



E-Book Development of Static Fluid Contents to Improve Students' Numeracy Literacy Competence

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ABSTRACT

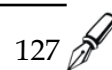
This research aims to develop an E-Book on Static Fluid Materials in Tutoring as an educational partner, with a focus on improving students' numeracy literacy competencies. E-book development was conducted using the 4-D development model, which includes the defining, designing, developing, and disseminating stages. The research instruments consisted of e-book validation sheets and questions that were tested on material expert lecturers and media expert lecturers from Surabaya State University. The validity of the e-book and questions was measured using a validity interpretation table for aspects of presentation feasibility, content feasibility, and linguistic feasibility. In addition, the validity of the pre-test and post-test questions on the e-book was also calculated. The validation results showed that the developed e-book had a very valid quality, with a validity percentage of 97%. Aspects of presentation feasibility, content feasibility, and linguistic feasibility in the E-Book as a whole meet the criteria of "Very Valid" (85-100%) based on the validity interpretation table. The validity of the pre-test and post-test questions on the e-book was also proven to be high, with a validity percentage of 89%. The questions measured students' ability to identify facts, formulate mathematical problems, use mathematical concepts, facts, procedures, and reasoning in the context of static fluids, perform calculations based on certain rules or formulas, and interpret reasoning to solve problems.



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INTRODUCTION

Education is an important aspect of life, acting as a foundation for the basic abilities that every individual must have to improve their potential and compete in the ever-evolving world of education (Geiger et al., 2015). In the context of global development, literacy is a crucial element, and in 2016, the Ministry of Education and Culture defined literacy as "the ability to access, understand and use information intelligently." The concept of literacy encompasses understanding in science, technology, finance, culture, and citizenship, all of which play an important role in shaping an individual's capacity to utilize resources and achieve quality life. In the 21st century, literacy encompasses more than just the ability to read, write, and count. It also includes an understanding of science and technology (digital literacy), finance, culture and citizenship. These six aspects are the basic literacies identified in the "Roadmap for the National Literacy Movement" published by MoEC in 2017. Mastery of these aspects is key to improving the competence and character of each individual (Kemendikbud, 2020; Kemendikbud, 2017).



However, despite the importance of literacy, Indonesia faces challenges in improving its quality of education. Since joining PISA in 2000, Indonesia has consistently scored below average in the PISA index (Pratiwi, 2019). PISA survey results showed that Indonesian students have low levels of competence in math and science (OECD, 2018; OECD, 2019). This indicates the need for changes in the education system to prepare a skilled workforce that is in line with the demands of various industries.

Therefore, the PISA encourages changes in the education curriculum in Indonesia, including the transformation of the education evaluation system into a National Assessment (Direktorat Jenderal Pendidikan Tinggi, 2022). The National Assessment is an evaluation program that aims to evaluate the quality of schools and equivalency programs at primary and secondary education levels. The assessment aims to assist educational institutions in directing their primary focus to developing students' competencies and character (Dewi, 2020).

In an effort to improve the quality of education and students' literacy competencies, recent studies have focused on the development of e-books. Research conducted by Retno Setya Pratiwi and Fida Rachmadiarti on the development of STEM-based e-books on plant growth and development, as well as research by Ayu Febriana and her team on the development of Digital Books based on Minimum Competency Assessment (AKM) to improve students' reading literacy, have shown positive results in improving students' literacy skills (Pratiwi & Rachmadiarti, 2022; Febriana & Nugroho., 2023). Likewise, Febrianti's research on the development of Digital Book based on Flip PDF Professional to improve students' science literacy skills (Febrianti, 2021) also provides results in line with previous research.

In an effort to support this research, several relevant theories will be used, including Multiliteracy Literacy Theory, Constructivism Learning Theory, Problem-Based Learning (PBL) Theory, Cognitive Theory, and ADDIE Instructional Development Model Theory (analysis, design, development, implementation, and evaluation). These theories will be the basis for designing an effective and innovative Static Fluid E-book so that it can improve students' numeracy literacy competence and improve the quality of education in Indonesia (Susanto et al., 2016; Wahyuni & Rahayu., 2021).

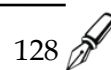
These studies found that the use of e-books as a learning medium can improve students' literacy skills in various fields, including science, reading, and numeracy skills. This is in line with previous discussions on the importance of testing the effectiveness and continuing the development of e-books in a learning context (Sartianis et al., 2022).

In the context of this study, we also developed the Static Fluid E-book in Tutoring as an educational partner to improve students' numeracy literacy competence. This study is expected to provide insights into the effectiveness of e-books in improving students' numeracy literacy skills in the context of fluid physics learning. Thus, this study is expected to contribute positively to improving the quality of education and numeracy literacy skills of students in Indonesia. The results of this study are also expected to provide guidelines and references for tutoring institutions and related parties in developing and implementing e-books as innovative and efficient learning media in line with the latest research findings.

RESEARCH METHOD

This research is a developmental research on E-book learning media for fluid material using the 4D development model with the stages of defining (define), designing (design), developing (develop), and disseminating (disseminate). The subject of this research is E-book learning media on fluid material that has been developed and tested on Edulab Tutoring class XI students. This E-book development research began in the even semester of the new academic year 2022/2023. The development stage was carried out at Surabaya State University, while the limited trial stage was carried out at Edulab Surabaya.

The variables that are the focus of this research are: (1) E-Book Validity: E-book validity (feasibility of presentation, content, language, and achievement of independent curriculum aspects) assessed by fluid material expert lecturers and media expert lecturers using validation



sheets.(2) Validity of Pretest Questions: This variable includes the questions tested on the pretest to measure students' numeracy skills before they get the treatment (learning using E-Book). The validity of the pretest questions will determine whether the questions are in line with the research objectives and whether they can accurately measure students' numeracy skills before they take part in the learning. (3) Posttest Question Validity: This variable includes the questions tested on the posttest to measure students' numeracy skills after they have received the treatment (learning using E-Books). The validity of the posttest questions will determine whether the questions are in line with the research objectives and whether they can accurately measure the improvement of students' numeracy skills after the learning.

The validity of the feasibility of presentation, content, language, and achievement of independent curriculum aspects is measured using a validation sheet involving a fluid material expert lecturer and a media expert lecturer. The scores obtained will be calculated to determine the percentage of feasibility based on the interpretation criteria.

This research uses the 4D development model which consists of defining, designing, developing, and disseminating stages. This research design aims to develop fluid material E-Books that are in accordance with the independent curriculum and test their feasibility and effectiveness in improving the numeracy skills of science class XI students at Edulab Surabaya. The development method uses the 4-D model which consists of defining, designing, developing, and disseminating stages.

The defining stage begins with curriculum analysis to determine the learning outcomes relevant to the fluid material. Furthermore, student analysis is carried out to understand the characteristics of learners as the object of the trial. Concept analysis is used to identify the main concepts in static fluid material. The E-Book design stage involves designing an attractive appearance using the Corel Draw application and Flip PDF Pro software. The E-Book will be in the form of digital media with interesting features, such as videos, concept maps, web links, and practice questions (Alwan, 2018).

The development stage includes revisions based on input from supervisors and seminar examiners. After that, validation was carried out by material expert lecturers and media expert lecturers. The readability test stage used the Fry formula to ensure students' ease of understanding of the E-Book content. Limited trials were conducted with 20 students using a pre-experimental research design with pretest and posttest. The results of the trial will be disseminated to evaluate the feasibility and effectiveness of the E-Book that has been developed.

Validation was carried out by giving validation sheets to material expert lecturers, and media expert lecturers by giving scores to the draft E-Book and questions that have been developed according to the rubric provided. This validation was carried out before the E-Book and questions were tested on students. This method is used to determine the feasibility of the E-Book developed including the feasibility of content, presentation, and language. While the feasibility of the questions given includes the feasibility of material, questions and language used to measure students' numeracy literacy competencies.

Analysis of E-Book validation results uses data from expert lecturers or validators. The analysis of these results is done by calculating the score according to the score criteria on the validation sheet, then proceed with the interpretation into the feasibility value according to Table 1.

Table 1. Likert Scale Scoring Criteria

Score	Category
1	Less Valid
2	Quite Valid
3	Valid
4	Very Valid

(Nizar, 2018)

From the scores obtained, an analysis was carried out to determine the feasibility of the E-Book using the following formula:

$$\text{Percentage Validity} = \frac{\sum \text{Score Obtained}}{\sum \text{Maximum Score}} \times 100\%$$

The percentage results obtained from the above calculations are then interpreted according to the criteria in Table 2.

Table 2. Likert Scale Interpretation Criteria	
Feasibility Percentage (%)	Interpretation Criteria
25-39,9	Not Valid
40-54,9	Less Valid
55-69,9	Quite Valid
70-84,5	Valid
85-100	Very Valid

(Riduwan, 2015)

Based on the interpretation table, the E-Book will be declared valid when it gets a feasibility presentation of $\geq 70\%$. Analysis of question validation is done by calculating the score according to the score criteria on the validation sheet, then proceed with interpretation into the feasibility value according to Table 3.

Table 3. Criteria for Question Validation	
Criteria for Question Validation	Score
81 – 100%	Very High
61 – 80%	High
41 – 60%	Fair
21 – 40%	Low
0 – 20%	Very Low

(Arikunto, 2010:75)

In the question validity test, the questions tested were pre-test and post-test questions. The results of the assessment are calculated in per cent (%) using the formula.

$$V = \frac{\text{Number of assessor scores}}{\text{Number of maximum score}} \times 100\%$$

Description:

V = validity

% = constant

RESULTS AND DISCUSSION

The developed e-book has a structure consisting of a title, preface, table of contents, introduction, teaching materials, evaluation, summary, glossary, and bibliography. This e-book has various interesting features that aim to provide an interactive learning experience and facilitate the development of students' numeracy literacy competencies. Figure 1 shows a snapshot of some of the features included in the E-Book. These features include "Go Watch" which allows students to access videos relevant to the fluid material, "Mind Map" which provides a concept map of the fluid material, "Go Information" which provides web links to search for information related to the material, "Go Concept" which provides explanations of important concepts, "Drilling Problems" which provides various questions to practice numeracy literacy competencies, and "Reflection" which provides opportunities for students to reflect on their understanding after learning.

The "Go Watch" feature allows students to access videos relevant to fluid material. It aims to train students' ability to use digital tools and facilities as well as process facts and opinion information found online. This feature also helps students to gain a better understanding of the material and develop their digital literacy.

The "Mind Map" feature provides a concept map of fluid material. The concept map helps students to visualize the relationship between different concepts in the material, which can deepen their understanding of important concepts in fluids and improve their concept literacy. The "Go Information" feature provides web links that facilitate students in finding and managing information related to the material. Students can access external sources of information that help

broaden their understanding of facts and opinions related to fluid material. This encourages students to conduct independent information searches, which is an important skill in information literacy. The "Go Concept" feature provides explanations of important concepts in fluid materials. Through the explanations in this feature, students can improve their understanding of the concepts underlying fluid material and improve their concept literacy. The "Drilling Problems" feature provides various problems designed to train students' numeracy literacy competencies. By working on these problems, students can familiarize themselves with the types of problems related to numeracy literacy in the context of fluid materials. This feature assists students in developing numerical problem-solving skills and in improving their literacy. The "Reflection" feature provides a means for students to reflect on their understanding after undergoing the learning process. Students were given reflection questions that allowed them to rethink the concepts they had learned and apply them in the context of everyday life. This feature encourages students to develop their critical thinking skills. Table 4 shows the results of the validation of the developed e-book (Haque et al., 2021). The validation was conducted by three validators and involved several aspects, including presentation, content, and linguistic feasibility. The validity percentage for each aspect is also shown in this table.



Figure 1. Snapshot of E-Book Features of Static Fluid material: (a) Go Watch; (b) Mind Map; (c) Go Information; (d) Go Concept; (e) Drilling; (f) Reflection.

Table 4. E-Book Validation Data

No	Aspects assessed	V1	V2	V3	Modus
Presentation Feasibility					
1	Display Quality	3	4	4	4
2	Layout Quality	4	4	4	4
3	Text Quality	4	4	4	4
4	Image Quality	4	4	4	4
5	Video Quality	3	4	4	4
6	E-book Quality	4	4	4	4
Total		22	24	24	24
Content Feasibility					
7	Quality of Material Concept	4	4	3	4
8	Foreword	4	4	4	4
9	Instructions for Using the E-book	3	4	4	4

No	Aspects assessed	V1	V2	V3	Modus
Presentation Feasibility					
10	E-book Characteristics	4	4	4	4
11	Material Content	3	4	4	4
12	Glossary	4	4	4	4
13	Bibliography	4	4	4	4
14	Completeness of Material	4	4	4	4
15	Numeracy Literacy Aspects in Each Chapter	4	4	4	4
16	Numeracy Literacy Supporting Features	3	4	3	3
Total		37	40	38	39
Linguistic Feasibility					
17	Language Use	4	4	4	4
18	Language Structure	4	4	4	4
19	Use of Terms	3	3	4	3
Total		11	11	12	11
Total		70	75	74	74
Percentage Validity		92%	99%	97%	97%

Description: V1=Validator 1; V2=Validator 2; V3=Validator 3

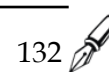
Table 5 contains the results of the validation of the pre-test and post-test questions in the e-book. The validation was conducted by three validators and involved several aspects such as suitability to the material, clarity of sentences in the questions, and suitability to numeracy literacy indicators. The validity percentage of each aspect is also shown in this table.

Table 5. Question Validation Data

No	Assessment Item	V1	V2	V3	Modus
Material					
1	The suitability of the organization of the questions with the material	5	5	4	5
2	The suitability of the concept in each question	4	4	5	4
3	The suitability of the content of the material on each item	4	4	5	4
4	The references used are appropriate and adequate	5	5	5	5
5	Excerpts really work	4	4	5	4
Total		22	22	24	22
Question					
6	Understanding of the instructions for doing the questions	4	4	5	4
7	Clarity of sentences in the question	5	5	4	5
8	Clarity of image presentation	5	5	5	5
9	Conformity with numeracy literacy indicators	4	4	4	4
Total		18	18	18	18
Language					
10	The sentences in the questions do not cause multiple interpretations	5	5	5	5
11	The language used is communicative	4	4	5	4
12	The language used is easy to understand	5	5	5	5
13	Language is in accordance with PUEBI	4	4	5	4
Total		18	18	20	18
Total		58	58	62	58
Validity Percentage		89%	89%	95%	89%

Description: V1=Validator 1; V2=Validator 2; V3=Validator 3

Table 6 presents an analysis of the overall E-book validation results. This table shows the percentage of validity from three aspects of the assessment: presentation feasibility, content



feasibility, and linguistic feasibility. The analysis results show that E-Book has a very high validity.

Table 6. Analysis of E-Book Validation Results

No	Aspect Assessment	Percentage Validity	Criteria
1	Feasibility of Presentation	91,67 %	Very Valid
2	Feasibility of Content	92,5 %	Very Valid
3	Language Feasibility	91,67 %	Very Valid
	Total	97 %	Very Valid

The results of the E-Book validation analysis in Table 6 show that the feasibility of e-book presentation reached 91.67% of the total possible score, within the "Very Valid" criteria (85-100%). The feasibility of e-book content reaches 92.5% and is also within the criteria of "Very Valid" (85-100%). Meanwhile, the linguistic feasibility of the e-book reached 91.67% and was also within the criteria of "Very Valid" (85-100%). Overall, this e-book has very high validity, with a total validity percentage of 97%. Table 7 contains the analysis of the validation results of the pre-test and post-test questions in the e-book. This table shows the percentage validity of each assessment aspect, such as suitability to the material, clarity of sentences in the questions, and suitability to numeracy literacy indicators. The analysis results show that the questions in the e-book have a high level of validity.

Table 7. Analysis of Question Validation Results

No	Aspect Assessment	Percentage Validity	Score
1	Content	88 %	Very High
2	Problem	100 %	Very High
3	Language	90 %	Very High
	Total	89 %	Very High

The validity of the questions was analyzed by calculating the percentage of validity based on data from three validators. The analysis results showed that the validity of the question material reached 88% and was in the "Very High" criteria (81-100%). The validity of the questions reached 100% and was also within the "Very High" criteria (81-100%). The validity of the question language reached 90% and was within the "High" criteria (61-80%). Overall, the questions in this e-book had a high level of validity, with a total validity percentage of 89%.

This e-book has high validity, indicating that it is reliable and feasible for use as a teaching material to improve students' numeracy literacy competence. The high validity of the pre- and post-test questions also indicates that these questions have an excellent level of validity and can be used to measure students' numeracy literacy competence (Damayanti & Raharjo., 2020).

The results showed that the developed e-book has a complete structure with interactive features that aim to improve students' numeracy literacy competence in Static Fluid material. The integration of these interactive features is based on several relevant theories, such as the Multiliteracy Literacy Theory, Constructivism Learning Theory, Problem-Based Learning (PBL) Theory, Cognitive Theory, and ADDIE Instructional Development Model Theory (Analysis, Design, Development, Implementation, Evaluation).

The use of the "Go Watch" feature allows students to access videos relevant to fluid material. This is in accordance with the Multiliteracy Literacy Theory, which emphasizes the importance of students' ability to use digital tools and facilities, as well as process facts and opinion information found online. In addition, this feature supports the development of students' digital literacy. The "Mind Map" feature is based on Constructivism Learning Theory, which emphasizes the importance of visualizing the relationships between different concepts to deepen students' understanding (Damayanti & Raharjo., 2020). Concept maps help students visualize and connect important concepts in fluid materials, thereby improving their concept literacy. The "Go Information" and "Go Concept" features are based on Problem-Based Learning (PBL) theory and multiliteracy literacy theory. Both features encourage students to search for information related to the material and deepen their understanding of the underlying concepts. Students' ability to

search for information independently is an important skill in their information literacy. The "Problem Drilling" feature is based on Cognitive Theory and Problem-Based Learning (PBL) theory. This feature is designed to train students in numeracy literacy competencies and help them develop numerical problem-solving skills in the context of fluid materials. The "Reflection" feature reflects the application of constructivist learning theory and multiliteracy literacy theory. This provides an opportunity for students to reflect on their understanding after learning (Febriana & Nugroho., (2023). Through reflection questions, students were invited to relate the concepts they had learned to everyday life situations, thus developing their critical thinking skills.

CONCLUSION

E-books with interactive features have high validity and are suitable as learning media. These features help improve students' numeracy literacy competence in static fluid materials through interesting learning experiences and active student involvement. The pretest and posttest questions have a very high level of validity and can be relied upon to measure students' numeracy literacy competencies. Although the developed e-book has shown high validity, further development is needed to increase the diversity of interactive features and content offered. The development of this e-book can include the addition of new features such as interactive simulations or more varied practice questions to enrich students' learning experiences.

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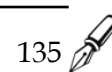
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