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The Development of Crello-assisted E-Modules to Train Critical Thinking Skills on Elasticity and Hooke's Law Material

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Abstract: *The research sought to determine the appropriateness and learners' perceptions of the Crello-assisted E-Modules to Train Critical Thinking Skills on Elasticity and Hooke's Law Material. The research utilized the ADDIE (Analyse, Design, Development, Implementation, and Evaluation) development model. 1) The appropriateness results of the Crello-assisted E-Modules to Train Critical Thinking Skills on Elasticity and Hooke's Law Material had a mean percentage value of 87.67%; thus, it was in the Highly Appropriate category. 2) The findings of learners perceptions of e-modules were in the Excellent category, with a mean percentage value of 83.06%. Based on the validation and readability tests conducted on learners' in High School/Islamic High School, the generated e-modules were extremely suitable for future use. The advantages of e-modules were that lies in their attractiveness, including can even be used anywhere and anytime, moreover could further build up learners' critical thinking skills.*
***K*eywords**: *Elasticity and Hooke's Law; E-Module; Crello; Critical Thinking*

INTRODUCTION

The observations and interviews at Senior High School/Islamic High School in Bengkulu, specifically State Senior High School of 10 Bengkulu, State Islamic High School 1 Bengkulu, and State Islamic High School of 2 Bengkulu, demonstrate that many students still exist who require teaching resources other than printed books utilized by teachers. Most students reported that they required assist understanding physics lectures since the instructional materials used by teachers were still required to explain the content. The findings of the requirements analysis questionnaire distributed to Senior High Schools/Islamic High Schools students in Bengkulu demonstrated that 80.68 % of students still want electronic teaching resources on Elasticity and Hooke's Law. Overall, 84.45% of students receive instructional information primarily from teachers, 67.56% require continued active learning, and 82.25% need online and offline access to educational materials.

"Article 1, Clause 20 of Law No. 20 of 2003 on the National Education System defines learning as the interaction between students and teaching resources in a learning environment. Learning is any activity that contributes to acquiring a new skill or value. Thwas was directly related to learning physics and can be considered as an educational method studying natural phenomena." (F. Rohim, 2012). Typical learning resources are books, worksheets and other relevant learning resources. "The 21st century skills that students need to master are critical thinking, creativity, communication and teamwork, i.e. 4K skills." (Redhana 2019). quoted from (Paramitha and Sriyanti 2021): Due to the nature of physical education, memorization and understanding of the principles was insufficient; Critical thinking was required. Given some of these facts, there is a need to develop learning resources that convey essential considerations.

Relevant to the research "Development of Hots-Based E-Modules Assisted by Flipbook Marker as Alternative Teaching Materials for High School Students" was thwas study's findings, which indicated that thwas research was highly applicable and yielded results 89.6% in material aspects, 86.0% in medial aspects and 84.3% in linguistic aspects (Puspitasari, Hamdani and Risdianto 2020). It was also relevant to the study "Development of E-modules supported with Videoscribe simulation to train students' critical thinking skills on the topic of parabolic motion in high school", showing that this research was applicable and results of 82.14% for the material provided aspects, 77.33% with a good category (Natalia et al. 2021).

"The learning module was the smallest unit of the teaching and learning program that was studied individually or taught to students by students (self-instruction)." (Dirmansah and Sahono 2019); (Winkel, 2009). "Electronic modules are a method of presentation of autonomous learning materials systematically structured into minor learning units to meet particular learning objectives offered in electronic format." (Hammiyati, Maison, and Kurniawan 2019). "Innovation that contributed to the learning process was electronic modules. To encourage students' participation in the learning process, electronic modules may include voice, text, graphics, and video content." (Paramitha and Sriyanti, 2021). Hence, an e-module was the minor educational material in an electronic format that students possess to attain a learning objective.

"The advantages of electronic teaching materials or e-modules are (a) the content of electronic teaching materials, which includes material and practice questions, was presented varied not only text; however, some images and videos support learning material, (b) electronic teaching materials or e-modules can make it easier for students to learn in certain parts as desired. Thwas electronic teaching material or e-module has the disadvantage of requiring appropriate learning devices, such as computers or other electronic devices." (Puspitasari et

al. 2020); (Noviyanita W, 2018). "The advancement of technology, in thwas instance, increasingly quick and relatively simple-to-use software, enables modules to be built as electronic modules (e-modules) that can dynamically incorporate text, photos, videos, simulations, animations, quizzes, and evaluations. Through e-modules, the learning process can include audio-visual displays, sound, movies, and navigation, allowing students to interact more with the specified program." (Saprudin, Haerullah, and Hamid 2021) (Sugianto et al., 2013).

"Popular and free programs such as Canva are in high demand among reputable designers in the area. In addition, PicsArt, Adobe Photoshop Express, Desygner, Posters, Crello, and others. These applications range from free to paid; however, paying was relatively reasonable." (Hasan and Siregar 2021). "The types of platforms that can be used online range from free full-featured vector graphic design apps (such as Gravid Designer, Vecteezy, and Inkscape), cross-platform image editors (such as Gimp, Pixlr, and Crello), online design and publishing tools (such as Canva, Crello)." (Maselli and Panadisi 2022). According to researchers, Crello web editing has various e-book template capabilities, may be accessed for free, and, most crucially, the tools or equipment are user-friendly for novice users inexperienced with editing software.

"Critical thinking is the ability to think openly at the level of thinking that uses numerous processes with several concepts under existing facts. Someone with the requisite thinking abilities may identify problems, acquire relevant information, have multiple alternative problem-solving, reach a conclusion, dare to express viewpoints and assess arguments." (Latifah, Kurniawan, and Setyadi 2020). "Learning media, a supporting medium in the learning process must be established, and the instructor must create it." (Fitri, Nirwana, and Putri, 2022). "One strategy to increase critical thinking skills was employing innovative learning media to support teaching and learning. The growth of technology and the rising use of increasingly sophisticated electronic gadgets can serve as educational mediums. All disciplines must incorporate technology, information, and communication. Hence, using electronic teaching resources, such as practical and user-friendly electronic modules, tends to appeal more to students and teachers." (Hirzan and Yuhendri, 2020).

Based on the previous description, a study was conducted entitled Development of E-Modules Assisted by Crello to Train Critical Thinking Skills on Elasticity and Hooke's Law for thwas study, namely: 1) Determining the appropriateness of Crello-assisted e-modules to Train Critical Thinking Skills in Elasticity and Hooke's Law and 2) Determining learners' perceptions of Crello-

assisted e-modules to Train Critical Thinking Skills in Elasticity and Hooke's Law.

RESEARCH METHOD

"Thwas research employed the R&D (Research and Development) ADDIE model for its creation" (Vitrianingsih et al. 2021). "One of the instructional material development designs widely utilised was the ADDIE Model through 5 stages: Analyse, Design, Development, Implementation, and Evaluation. The development process requires several tests by a team of experts, individual research subjects, limited scale and wide scale (field), and revisions to improve the final product; however, the development procedure was shortened; it includes a testing and revision process to ensure that the developed product meets the empirically-tested criteria for a good product. There are no longer any errors (Cahyadi 2019). This research method is used to design and produce as well as test a product. To develop this product, data must be collected at the start of the research (needs analysis), and the product must be tested with the expert team's feedback so that it can be revised before being distributed. So that the research and development that researchers do is what produces products, the ADDIE Model R&D method is used. "According to the benefits of the ADDIE development model." (Srikandika et al., 2019). "the ADDIE development model offers simple and straightforward research stages and a systematic framework." (Silalahi and Chan 2022). For the reasons stated above, the researcher chose the ADDIE Model R&D method, and this development model has evaluation stages that coordinate with each other at each of the other stages like in the following picture:

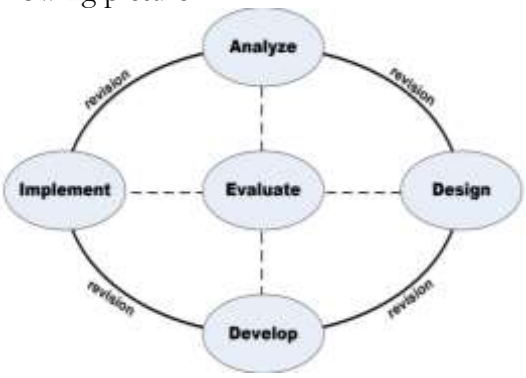

Figure 1. ADDIE model (Anggraeni, Elmunsyah, and Handayani 2019)

Thwas study surveyed 99 eleventh-grade students from State Senior High School 10 Bengkulu, State Islamic High School of 1 Bengkulu, and State Islamic High School of 2 Bengkulu. Thwas investigation was conducted from November to December 2022 in Bengkulu, Bengkulu Province. Purposive

sampling was employed as the sampling technique. Purposive sampling was a data source sampling strategy with unique considerations; for example, the person was regarded to determine best about what we expect (Chan et al. 2019). (Chan et al., 2019). Observation, interviews, and questionnaires were used to collect data for thwas study (Joko Raharjo, Suminar, and Mu'arifuddin, 2016).

The analyswas stage was conducted by processing data from the (quantitative) score results for each answer, which was calculated by percentage and interpreted. The assessment score used was a four-Likert scale. The four-Likert scale was designed to prevent neutral values, typically seen on a five-Likert scale; thus, score findings can be more precise.

Table 1. Likert Scale Scoring Criteria (Siburian, Putri, and Medriati 2022).

Interpretation	Score
Strongly Agree (SS)	4
Agree (S)	3
Disagree (TS)	2
Strongly Disagree (STS)	1

The collected data were analyzed by computing the assessment score of the possible responses of each component according to the criteria to interpret the score. Using the formula in an equation, the percentage computation of the obtained data was performed (1)

$$P = \frac{\Sigma x}{\Sigma xi} \times 100\%$$

Description:
P = Percentage
Σx = Total score of respondents' answers
Σxi = Total maximum score

(Anggraeni et al. 2019).

Table 2. Likert Scale Assessment Criteria

Interpretation	Percentage
Strongly Agree (SS)	80% - 100%
Agree (S)	66% - 79%
Disagree (TS)	56% - 65%
Strongly Disagree (STS)	0% - 55%

The existing data product validation phase employs quantitative and qualitative data analysis and qualitative data analyses to process data in response

to validators' feedback and suggestions. In contrast, quantitative data analysis was acquired from questionnaire findings. The appropriateness % was derived from equation (1) using table 3's eligibility conditions.

Table 3. Criteria for Appropriate Results (Marcelina et al. 2022)

Interpretation	Percentage
Highly appropriate	76% - 100%
Appropriate	51% - 75%
Inappropriate	26% - 50%
Highly inappropriate	0% - 25%

Using the equation, the criterion for students' perceptions was likewise the same (1). The interpretation of the perception criteria derived from the readability test results administered to students can be seen in the table below:

Table 4. Student Perception Criteria (Marcelina et al. 2022)

Interpretation	Percentage
Excellent	76% - 100%
Good	51% - 75%
Poor	26% - 50%
Very Bad	0% - 25%

RESULT AND DISCUSSION

The results and discussion section contains the research findings' results and analysis. Document the results of the conducted research, which must be supported by sufficient evidence. The outcomes and conclusions of the research must be able to respond to the research questions or hypotheses provided in the introduction.

Analyse Stage

The first stage was an analysis of the required needs derived through interviews and questionnaires; the questionnaire was a requirements analysis questionnaire for teachers and students. 1) No electronic-based learning media in the Elasticity and Hooke's Law material; 2) The school physics laboratory was not yet available; thus, the practicum process did not conduct properly; 3) Students required teaching materials other than printed books used by teachers, whether online or offline; and 4) Teachers required teaching materials that contain elements of critical thinking; thus, students' thinking skills can be trained with it. It can be concluded that electronic-based learning media that includes

elements of critical thinking, can assist practicum outside of the laboratory, and can be used face to face or online is required.

So the researchers chose Crello-assisted e-module development to train critical thinking skills on Elasticity and Hooke's Law material, which is relevant with the first opinion from (Paramitha and Sriyanti 2021) "Innovation that contributed to the learning process was electronic modules. To encourage students' participation in the learning process, electronic modules may include voice, text, graphics, and video content." As well as the second opinion from (Hirzan and Yuhendri 2020) "One strategy to increase critical thinking skills was employing innovative learning media to support teaching and learning. The growth of technology and the rising use of increasingly sophisticated electronic gadgets can serve as educational mediums." Using innovative teaching - learning activities media to achieve to is one way to improve critical thinking skills. This opinion's intended method is the use of learning media via e-modules that include a combination of media, which is also in line with the first opinion.The necessities assessment yielded three Senior High Schools/Islamic High Schools of Bengkulu received 87.5% from instructors and 84.1% from students; thus, they strongly agreed to develop e-modules assisted by Crello to train critical thinking skills on Elasticity and Hooke's Law content.

Design Stage

The second stage was the product's design. Thwas product employs the web-editing platform Crello, which focused on the performance and general layout desigh of the e-module. Researchers chose the Crello's web platform due to its exclusive access to templates and basic e-module designs, which could be downloaded in PDF format.

The design phase produced e-modules with a front cover, preface, concept map, table of contents, and introduction, which includes Basic Competencies, description, and usage instructions. There are learning objectives, material descriptions, assessment questions, learning videos, practicum, summary, evaluation questions, answer key, glossary, bibliography, and a back cover. The four preliminary designs researchers utilize are the front cover design, general design, material description chapter design, and back cover design. The available design was used to design the e-prologue, module's concept map, introduction, etc., in addition to the front cover, material description chapter, and back cover. The graphic below illustrates the four types of design.

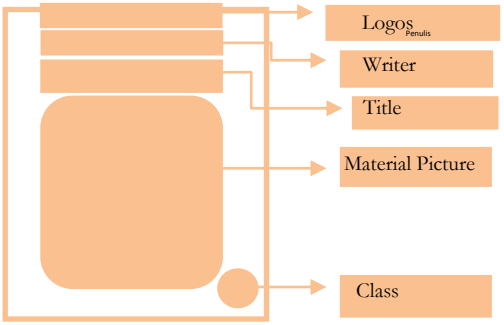

Figure 2. Front Cover Design

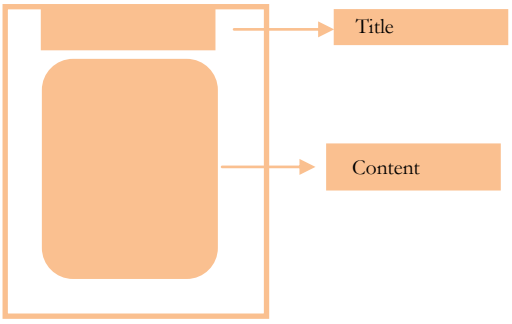

Figure 3. Main Design

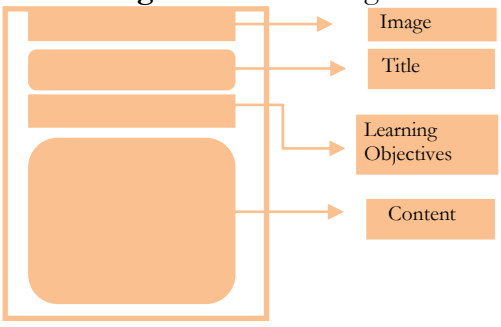

Figure 4. Material Description Chapter Design

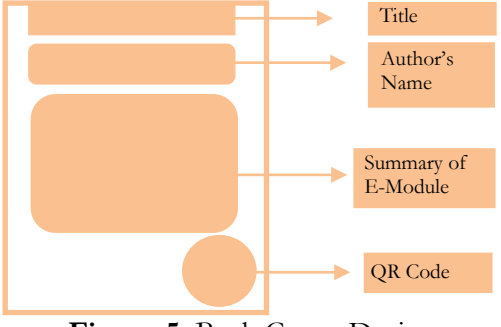

Figure 5. Back Cover Design

Development Stage

Researchers created the preliminary design, as depicted in the following images:

Figure 6. Front Cover Display

Figure 7. Foreword Display, Concept Map and Table of Contents Display, Introduction Display

Figure 8. Display of Material Descriptions, Learning Videos and Sample Questions, Display of Problem Exercises, Display of Practicum, Display of Summaries and Evaluation Questions, and Display of Problem Exercises. Presentation of Answer Keys, Exhibit of Glossary

Figure 9. Display of Bibliography and Back Cover

After e-module development had been completed, validation was performed. Five validators undertook validation to establish the practicability of its use in education. The outcomes of the material, language, and media validation are shown in Table 5 below.

Table 5. Appropriateness Results (Marcelina et al. 2022).

Aspect	Value Average	Category
Material	90,00%	Highly Appropriate
Critical Thinking	84,00%	Highly Appropriate
Language	88,83%	Highly Appropriate
Media	88,83%	Highly Appropriate
Average	87,67%	Highly Appropriate

The results were Highly Appropriate, with an average percentage of 87.67%, according to the appropriateness test's material, language, and media components.

Implementation Stage

Thwas stage continued with a readability test on sixty level High School/Islamic High Schools students in Bengkulu after expert validation. At thwas point, a small-scale readability test was conducted utilizing a perception questionnaire with three components: appearance, material presentation, and advantages (Marcelina et al., 2022). The outcomes of the test of student perception are presented in the table below:

Table 6. Learner Perception Test Results

Aspect	Average Value	Category
Display	85,90%	Excellent
Presentation of Material	82,74%	Excellent
Benefits	80,53%	Excellent
Average	83,06%	Excellent

With an average percentage value of 83.06%, the outcomes of the Crello-assisted E-Module Creation to Train Critical Thinking Skills on Elasticity and Hooke's Law Material for Senior High School/Islamic High Schools students in Bengkulu are highly realistic. This is also coherent with the opinion (Hirzan and Yuhendri, 2020) "… using electronic teaching resources, such as practical and user-friendly electronic modules, tends to appeal more to students and teachers."

Evaluation Stage

The final phase involved evaluation. The evaluation was summative, and summative assessment was conducted after the entire activity concludes (semester). The summative evaluation assesses the final competency or learning goals to be attained. The evaluation results serve as feedback for the development of instructional materials. Subsequently, modifications are created based on evaluation results or unsatisfied requirements that cannot be met by generating instructional materials (Cahyadi 2019).

CONCLUSION

Based on the results and discussion, can be concluded 1) The appropriateness results of the Crello-assisted E-Modules to Train Critical Thinking Skills on Elasticity and Hooke's Law Material had a mean percentage value of 87.67%; thus, it was in the Highly Appropriate category. 2) The findings of learner's perceptions of e-modules were in the Excellent category, with a mean percentage value of 83.06%.

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