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Validity of Integrated e-Modules Contextual Teaching and Learning Approaches Subject Matter Elasticity to Improve Critical Thinking Ability of Students Senior High School

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ABSTRACT

Students need to develop their critical thinking skills, which include the 4Cs of the 21st century: creativity, collaboration, communication, and critical thinking. These 4Cs are qualities that are essential for success in the modern world. So it's important to acquire knowledge that can sharpen critical thinking abilities. In three high schools in Sungai Punuh City, the pupils' critical thinking abilities were not as good as anticipated. The first research revealed that the lack of connections between the teaching materials and the usage of physics in daily life was the root of the students' poor critical thinking skills. 77% of students said that the professors' teaching resources did not incorporate real-world applications of physics.Textbooks predominate in the instructional resorcesutilized, however they do not promote critical thinking or self-learning. Therefore, in order to develop students' critical thinking abilities, autonomous learning tools are required that meet their demands. In order to enhance critical thinking abilities, research was done on the construction of integrated e-modules using the CTL technique on material elasticity. The findings of expert validity tests are especially communicated in this study. Three experts from the Faculty of mathematics and natural sciences. Padang State Univercity Physics Department conducted the validity test, which had an average validity score of 85.7% in the extremely valid category. According to the validity test results, the e-module is combined with the CTL method to resources elasticity to improve critical thinking abilities that are prepared to be evaluated for applicability and efficacy in the actual world.

Keywords: Validity; e-Module with CTL Approach; Critical Thinking; Elasticity

I. INTRODUCTION

Science and technology (IPTEK) are developing at a breakneck pace in the twenty-first century, having a significant impact on Indonesia's current educational structure. The goal of education in the twenty-first century is to develop students' knowledge, abilities, attitudes, and command of information and communication technology (ICT), in which education in the 21st century uses more technology in learning. 21st century education requires students to have knowledge skills in the field of technology[1].

Everyone must have 21st century skills to face global competition[2]. The "The 4C Skills"—Critical Thinking, Creativity, Collaboration, and Communication—are referred to as 21st century skills [3]. The capacity for critical thought is one of the abilities that pupils need to possess. The ability to reason, communicate, analyze, and solve issues is known as critical thinking. Another definition of critical thinking is rational, analytical thinking with an emphasis on choosing what to believe or do[4]. Students who are adept at critical thinking will find it simpler to approach problems methodically, deal with countless difficulties in an orderly manner, develop creative questions, and provide answers that are seen to be somewhat novel. Because critical thinking abilities are so helpful and necessary for navigating life now and in the future, someone must possess them or learn how to do so[5].

Because learning physics involves more than just memorizing facts, concepts, principles, and laws, 21st century skills play a crucial role in the process [6]. These skills include the capacity to find information, use technology, apply the scientific method, and engage in critical thought. As a discipline that investigates everyday natural phenomena, physics is often studied through witnessing actual natural occurrences. A division of natural

science (IPA) that plays a significant part in daily life is physics. To be able to address issues that arise in daily life, one must master physics[7].

Students need to learn these 21st century skills in order to compete in the globalization period and meet the advancement of science and technology (IPTEK)[8]. Thus teaching materials in printed form used by teachers must also be modified into non-printed teaching materials or electronic teaching materials by utilizing digital media and packaged in an attractive manner so that they are easier to understand and can be accessed anywhere.

Any type of material used to conduct teaching and learning activities is a teaching resource[9]. In this age of globalization, E-Module is one of the educational resources that teachers may create. Due to the fact that the E-Module is a stand-alone teaching resource that is organized methodically to meet certain learning objectives, it is provided in an electronic format and includes animation, voice, video, and navigation, increasing user interaction with the program[10]. The study instructions, competencies to be met, topic matter, supplementary materials, practice questions, work instructions, evaluations, and comments on evaluations are all included in the E-Module. Students can study independently with the help of E-Modules. and students can access E-Modules anywhere using smartphones or laptops.

To develop the Physics E-Module, it is necessary to have a method or model approach so that it is more directed and structured. One approach that is suitable to be applied to learning physics is the Contextual Teaching And Learning (CTL) approach, because by using a contextual approach it involves students directly in learning, if students feel directly involved in learning it will certainly evoke emotions and feelings so that students will pay more attention to learning. and better able to understand the concept of physics. This is supported by Johnson's research which states that to be able to develop students' potential, CTL provides opportunities to use thinking skills at a higher level in the real world [11]. The same thing was stated by Monica in her research that the use of CTL-based E-Modules shapes the attitudes and behavior of students who can find and build their own concepts that they learn by looking at the environment around or experienced by these students and linking them to learning material [12].

Contextual approach-based learning is desperately needed in the present day because it allows students to better connect what they are learning to their everyday lives. The usage of CTL-based physics modules can communicate ideas to students in a way that stimulates their interests, feelings, and thinking processes, making physics learning more enjoyable and engaging. By using natural occurrences in daily life, instructors can inspire students to study and comprehend physics principles [13].

The facts discovered in the field demonstrate that physics learning does not go as predicted. Initial observations at three Sungai Punuh City schoolsSMAN 3 Sungai Penuh, SMAN 4 Kota Sungai Penuh, and SMAN 5 Sungai Penuhshow that this is the case. 80 students at SMAN Kota Sungai Penuh and three physics professors each received a questionnaire as part of this observation.

The availability of teaching resources, particularly in physics subjects, was found to be still in the form of printed teaching materials, which were insufficient to enable students to learn on their own. The only teaching resources used by students were LKS, though printed books were also available, according to the results of the questionnaire given to physics teachers. With limited learning resources, students will lack information about learning because they only get information from educators and additional information from LKS, where the LKS used also contains little learning material and presents more questions, so that student participation in learning physics is low and causes lack of understanding of students' concepts of the material they are studying.

Based on the results of the student survey, it was discovered that 75% of students more easily understood the material if using book media in electronic form along with video, animation, and virtual labs, and 77% of students are more interested if learning physics is related to everyday life. 85% of students who responded to the survey stated that physics learning was classified as difficult learning and required a long time to understand physics material.

To overcome this problem, it is necessary to carry out learning innovations that can be used by students to study independently. One of them is by developing teaching materials in the form of contextual-based E-modules that can motivate students to be more active and creative. This teaching material is packaged in a practical and attractive manner so that it fosters students' interest in learning physics and is able to increase students' conceptual understanding of learning physics and is able to improve students' critical thinking e-module with a CTL (Contextual Teaching And Learning) to improve critical thinking skills on elasticity material the material produced by the validity of the team of experts is valid and has a teacher's response and students towards products that are developed are very practical.

II. METHOD

Research and development, sometimes known as R&D, is the term used to describe this kind of study. A specific product is made using the research and development approach, which is also used to assess the product's usefulness and efficacy [14].A Physics E-module based on the Contextual Teaching and Learning (CTL) approach to material elasticity is what this study's creators came up with. The definition, design, development, and dissemination phases make up the four stages of the 4D model, which is the development model employed in this study. The research findings from the define stage through the develop stage are presented in this paper. A validation instrument was employed in this investigation, and it was completed by three specialists from FMIPA UNP's physics department.A Likert scale is used to fill out the validation tool. as seen in the table

Table 1. Likert Scale

Likert scale	Assessment
1	Strongly Disagree
2	Disagree
3	Undecided
4	Agree
5	Strongly Agree

(Source: [14])

After the respondent fills out the product validity questionnaire, it is then calculated using the formula:

$$Final\ score\ = \frac{Total\ score}{maximum\ score} \quad \text{.....(1)}$$

After the results of the validity are processed using this formula, the determination of the validity of the product is valid or not is determined by the score interpretation criteria obtained can be seen in table 2.

Table2. Product Validity Criteria

Interval	Category
0 – 20	Invalid
21 – 40	less valid
41 – 60	Valid Enough
61 – 80	Valid
81 – 100	Verry Valid

The criteria used in determining e-module validation based on the CTL approach to material elasticity. (source: [15])

III. RESULTS AND DISCUSSION

1. RESULT

Based on the created E-module, it contains six components for the development of ICT-based teaching materials including (1) material substance; (2) display of visual communication; (3) learning design; (4) use of software; (5) assessment of the CTL (Contextual Teaching and Learning) approach; and (6) critical thinking assessment, with an instrument component that contains several indicators. Figure 1 displays the results of the validity value data plot

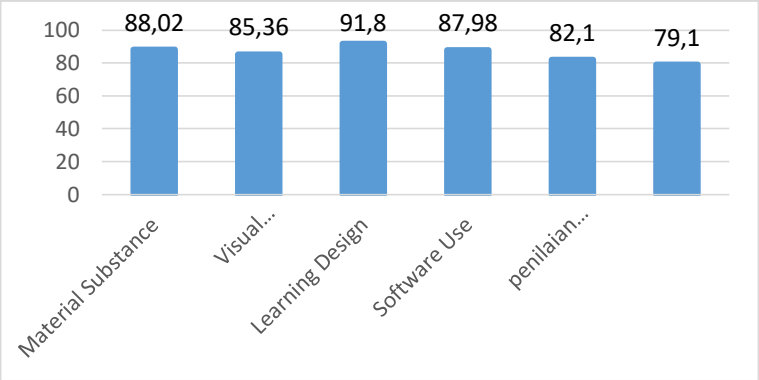

Figure 1. Results of the validity of the E-Module with an approach to improve critical thinking skills.

Based on Figure 1 it can be seen that the value of the validity component includes 88.02%; 85.36%; 91.8%; 87.98%; 82.1% and 79.1%. The average validation value of the e-module model is 0.84 with a valid category so that a valid e-module is produced.

he material presented in the CTL Approach-Based Physics E-Module is accurate and in line with facts found in daily life, according to the first two components of the feasibility of the content: 1) Explanation of the description of the material is correct, and 2) 3) The CTL Approach-Based Physics E-Module's content, activities, and experiments' correctness. 4) A photograph or video corresponds to the information in the CTL Approach-Based Physics E-Module. 5) the principles stated in the Physics-Based E-Module CTL Approach are accurate; 6) Reliability of the examples and problems in the CTL Approach-Based Physics E-Module, 7) The information offered is pertinent to daily living.8) The CTL Approach-Based Physics E-Module's presentation of visuals and videos with accuracy, 9) KD is followed by the learning content offered in the CTL Approach-Based Physics E-Module. 10) The CTL Approach-Based Physics E-Module's lesson content is in line with the course's learning objectives. 11) Current or current applications are used in the CTL Approach-Based Physics E-Module, which has been constructed in digital form. Figure 2 displays the findings of the value data plot for each indicator.

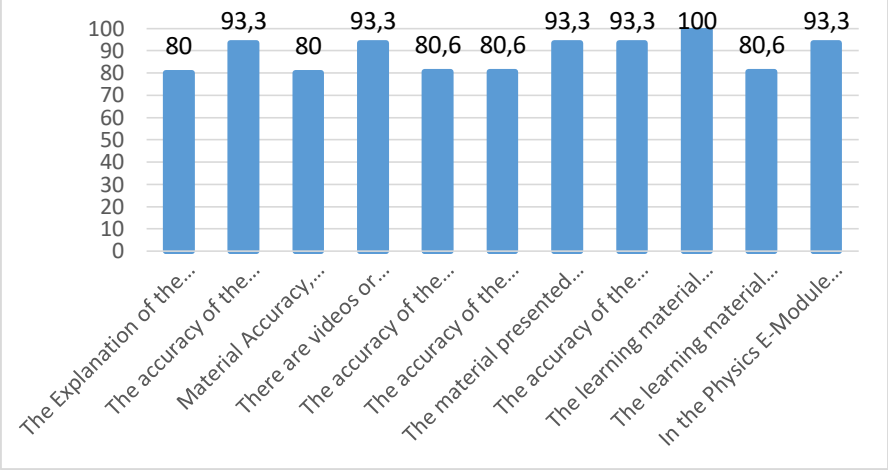

Figure 2. Material Substance validation results

The indication values for material substances vary from 80% to 100%, as shown in Figure 2. Five of the eleven indicators are deemed legitimate, falling between the ranges of 80% and 80.6%, while six are deemed highly valid, falling between the ranges of 93.3% and 100%. With a very valid category, the material substance indicator's average validation value is 88.02%.

Components of a visual communication display include of 1) There are buttons that work properly, are clear to see, and are simple to use in the Physics E-Module Based on the CTL Approach. 2) Instructions for utilizing the e-module are included in the Physics E-Module Based on the CTL Approach. 3) There are learning guidelines in the Physics E-Module Based on the CTL Approach. 4) The font's size and form are appropriate for the paper size and the spacing, 5) There are examples in the form of images, animations, and videos, together with references to their sources, in the Physics E-Module Based on the CTL Approach. 6) The Physics E-Module Based on the CTL Approach has several learning resources.There are fascinating color combinations in the Physics E-Module Based on the CTL Approach, appropriate animations and movies, and a well-designed layout.

Students learn more easily thanks to the Physics Module Based on the CTL Approach. Figure 3 displays the findings of the value data plot for each indicator.

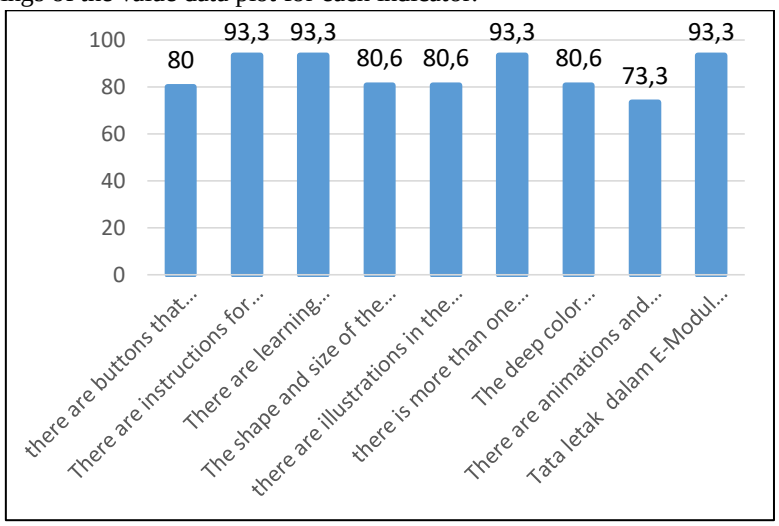

Figure 3. The results of the validity of the Visual Communication Display.

Figure 3 shows that the visual communication display's indication value varies from 73.3% to 93.3%. There are 4 indications out of the 9 indicators that are rated as extremely valid (93.3%), and 5 indicators that are rated as valid (73.3% -80%). As a consequence, 85.36% of the visual communication display component's validation results fell into the Very valid category.

components of the design of learning, including 1) The CTL Approach-Based Physics E-Module has a title that describes what is contained inside it. 2) There is general material, including KI, KD, Indicators, and Learning Objectives, in the CTL Approach-Based Physics E-Module. 3) The CTL Approach-Based Physics E-Module's learning materials complement the course's learning goals, 4) There are activities pertinent to the learning goals in the CTL Approach-Based Physics E-Module. 5) The CTL Approach-Based Physics E-Module contains guidelines and exercises, 6) The cover section of the Physics E-Module Based on the CTL Approach contains the author's identity (name and institution), 7) In the reference section there are 5 or more references, 8) In the reference section there are references according to the title 9) There are updated references or recent. The results of the data plot for the validity value of the learning design components can be seen in Figure 4.

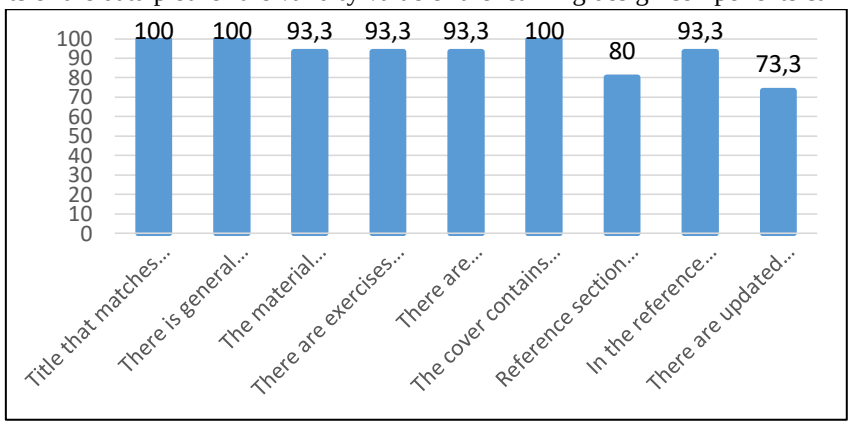

Figure 4. The results of the validity of the Learning Design

Based on Figure 4 it can be seen that the value of the indicators in the learning design ranges from 73.3% - 100%. Of the 9 indicators, 7 indicators are classified as very valid, namely 93.3%-100% and 2 indicators are classified as valid, namely 73.3% and 80%. The average validation value of the learning design is 91.8 with a very valid category.

The components of using the software consist of 1) In the CTL Approach-Based Physics E-Module students can write answers via google form, 2) In the CTL Approach-Based Physics E-Module students can enter experimental results via google form, 3) In E- The CTL Approach-Based Physics Module (students can answer formative tests on the e-module, 4) The software used is in accordance with the needs of writing in the CTL Approach-Based Physics E-Module (, 5) In the CTL Approach-Based Physics E-Module contains pictures,

videos , and animation and supported by sources as originality material. Figure 5 displays the findings of the validity value data plot for the software usage component.

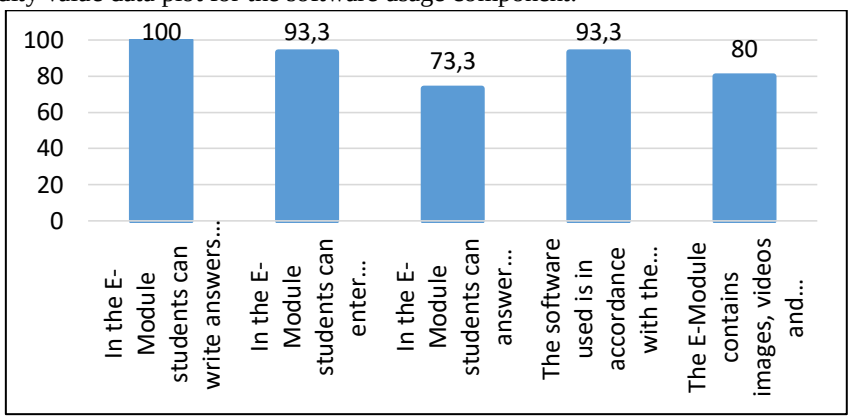

Figure 5. The results of the validity of using the software

Figure 5 shows that the validity value spans from 73.3% – 100%, with 3 of the 5 indications being categorized as extremely valid (93.3% – 100%), and the other 2 being rated as valid (73.3% and 80%). As a consequence, the software's validation findings have an average value of 87.98% and fall into the category of being extremely valid.

The contextual teaching and learning (CTL) approach's assessment component includes seven indicators: constructivism, inquiry, asking questions, learning communities, modeling, genuine assessment, and reflection. Figure 6 displays the outcomes of the data plot for each indicator component of the online module evaluation utilizing the CTL (Contextual Teaching and Learning) methodology.

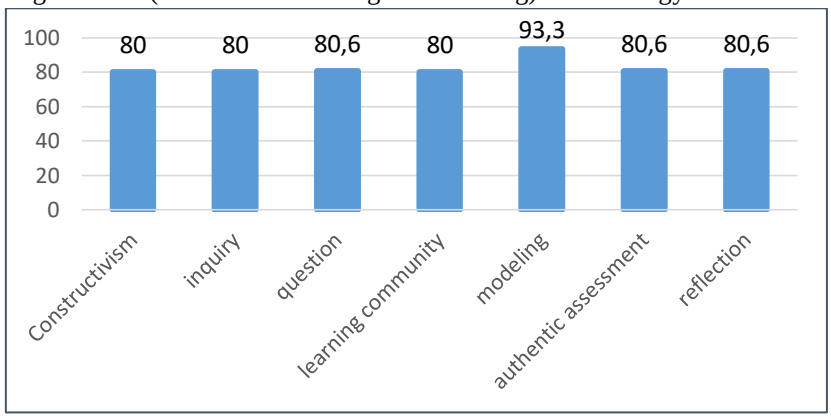

Figure 6. Component Validity Results of the CTL approach

Based on Figure 6 it can be seen that the CTL (Contextual Teaching And Learning) approach ranges from 80% -93.3%. Of the seven indicators there is 1 indicator with a very valid category that is worth 93.3% and 6 indicators with a valid category with a validation value of 80% -80.6%. The average validation value of the CTL (Contextual Teaching And Learning) approach component is 80.1% with a very valid category.

The critical thinking assessment component consists of 6 indicators, namely (1) assessing students' critical thinking skills; (2) assist students in analyzing a problem; (3) assist students in solving a problem; (4) assist students in concluding solutions to the problems presented; (5) assist students in evaluating a problem; and (6) the formative test contained in the CTL-based E-module is able to measure students' critical thinking abilities. The results of the data plot for each indicator component of the e-module assessment using the CTL (Contextual Teaching and Learning) approach can be seen in Figure 7.

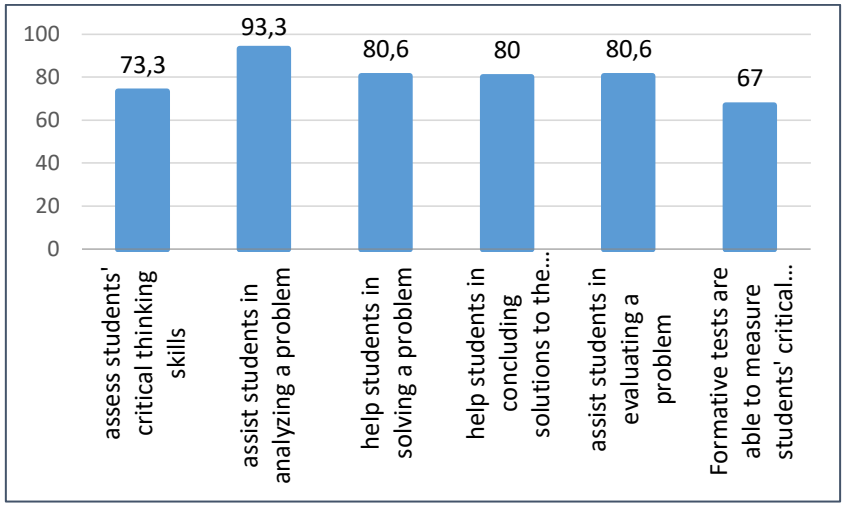

Figure 7. Results of the validity of critical thinking assessment

Based on figure 7 it can be seen that the character assessment ranges from 67% -93.3%. Of the six indicators there is 1 indicator with a very valid category that is worth 93.3% and 5 indicators with a valid category with a validation value of 67% -80.6%. The average validation value of the critical thinking assessment component is 79.1% with a valid category.

2. DISCUSSION

Learning approach to enhance critical thinking abilities confirmed by three physics instructors at FMIPA UNP. Six factors were validated: the material substance, the visual communication display, the learning design, the usage of software, the comparison of the e-module method to the CTL (Contextual Teaching and Learning) approach, and the critical thinking abilities. The constructed e-module has an average score of 85.7 and is classified as having a very valid category, according to the validity analysis results.

The created e-module received a validity rating of 88.02 with a very valid category for the material's substance, indicating that it meets the standards[16].This mandates that all educational materials created must adhere to the relevant curriculum. In terms of visual communication display, the developed e-module has a score of 85.36 and is classified as very valid. In the display of visual communication already using good navigation. The e-module also uses appropriate, proportional and attractive fonts and uses both images and videos. The e-module also contains clear and precise instructions for using the e-module. In accordance with research that has been done before, it states that the appearance of teaching materials will make users interested in using them [17]. The content of the material contained in existing textbooks is general or not in accordance with environmental conditions and does not provide examples (pictures/explanations) that are in accordance with the environment around students [18].

Contextual learning can encourage students to have a more positive attitude in studying Physics. When students can connect concepts they have learned with real life situations, it means they have put the context learned into actual situations and turn them into life experiences [19]. In terms of learning design, the developed e-module obtained a validity value of 91.8 with a very valid category. The e-module is said to be valid in the learning design component because in the e-module it has fulfilled the learning outcomes that will be achieved both the titles presented in the e-module are in accordance with the material contained therein. The e-module has also included a flow of learning objectives regarding measurement material and there are learning objectives that are made in accordance with the learning objectives of measurement material. The e-module also contains the author's name and clear source of the images and videos contained in the e-module. In terms of software utilization, the developed e-module obtained a validity value of 87.98 in the very valid category. The developed e-module is interactive in nature which can provide feedback to users, and the developed e-module is the original work of the researcher. In terms of evaluating e-modules using the CTL (Contextual Teaching and Learning) approach, the developed e-modules scored 82.1 in the very valid category. The e-module already meets the CTL approach indicators such as (1) Constructivism; (2) inquiries; (3) ask; and (4) learning communities; (5) modeling; (6) authentic assessment; (7) reflection.

IV. CONCLUSION

Based on the research, e-module products are created that incorporate the CTL (Contextual Teaching and Learning) strategy to promote critical thinking abilities on the material elasticity for high school physics learning. The created e-module has a very high level of validity in terms of the criteria used for approach assessment CTL (Contextual Teaching And Learning), as well as evaluations of critical thinking and material substance, visual presentation, learning design, and software use. The next research is at the stage of disseminating and carrying out large-scale trials, and the availability of e-modules with a CTL (Contextual Teaching And Learning) to increase critical thinking abilities on content 100 are some suggestions made by the authors based on the research completed. It is anticipated that educators will use the material's elasticity as one example of how to vary their teaching materials in a lesson.

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