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VALIDATION RESULT OF TEACHING MECHANICAL WAVES MATERIALS WITH ICT BASED MATERIAL INTEGRATED CTL FOR XI GRADE STUDENTS

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ABSTRACT

The 21st century skills integrate life career skills, learning and innovation-4C and information, media and technology skills. The components are needed in learning process to make learning process more effective and efficient. The 21st century learning is transforming from teacher center to student center. Student center learning can use ICT based learning material in learning process. Based on preliminary research that use of ICT based learning material were still low. Solution of this problem is to develop ICT based learning material integrated CTL to improve students thinking skills. The method that used in this research was research and development (R&D). The object of research was mechanical wave to increase students thinking skills. The data collection instrument used were validity questionnaire. The data analysis technique used was descriptive statistical analysis. The validity instrument for ICT based learning material integrated CTL to increase students thinking skills consists of five components, namely material substance, visual communication display, learning design, software utilization and CTL assessment. The validation results obtained were 87,37 which was in the very good category. From the research can be concluded that ICT based learning material integrated CTL to increase students thinking skills are valid for use in the learning process.

Keywords : *Learning material; ICT, Mechanical wave; CTL.*

I. INTRODUCTION

21st century learning combines literacy skills, knowledge, and mastery of technology. Contrary to the learning of the previous century, 21st century learning requires students to be active in the learning process. Students are asked to build their own abilities so that learning is not just a transfer of knowledge from teachers to students, but learning will be more meaningful if students are directly involved in finding a concept in the learning process. The teacher plays a role as a facilitator in the learning process. Teachers as facilitators must be able to package learning as attractive as possible so that it can arouse students' interest in learning. In addition, the teacher as a facilitator must facilitate students so that they can experience the learning experience. Students must be actively involved in the learning process to avoid mistakes in understanding the material [1]. In addition to demanding student activity in the learning process, 21st century learning also requires students to have 4C skills, namely critical thinking, creativity, communication and collaboration [2] .4C skills are needed by every student to compete with other students so that they can meet their daily needs. The development of Information and Communication Technology (ICT) has made significant changes in various fields of life, including education. Utilization of ICT in education can help the learning process such as presentations, independent learning media such as e-learning, e-teaching materials, and ICT based teaching materials. In addition, the use of ICT in the

learning process can also be used to visualize learning materials that students cannot encounter. One of the subjects that can use ICT is physics.

Physics is part of the Natural Sciences which studies about the phenomena that occur in everyday life. everyday life. Second, physics needs to be studied to develop students' abilities, understanding and skills to prepare students for the next level of education. Physics learning in schools can be supported by ICT based learning tools that make it easier for students to visualize physics learning materials that cannot be seen directly. One of the learning tools that can be used is ICT based teaching materials. ICT based teaching materials are teaching materials that utilize ICT tools to process, store and manipulate data so that the information produced is of high quality [4]. "ICT based teaching materials" can be used to assist teachers in carrying out the learning process. ICT based teaching materials can visualize learning materials that cannot be seen directly by students.

The real conditions found in the field are not in accordance with the expected ideal conditions. Based on the initial study conducted at SMAN 1 Lubuk Sikaping three preliminary study results were obtained. First, the use of CTL integrated ICT based teaching materials. The instrument used is a questionnaire on the use of ICT based integrated CTL teaching materials. The results of the questionnaire distribution obtained an average value of 54 which was in the low category. Second, students' creative thinking skills. The instrument for this second real condition was done by giving several questions to class XI Natural Science students at SMAN 1 Lubuk Sikaping which consisted of seven classes through google classroom. The average value obtained from giving questions for seven classes is 58 which is in the sufficient category. Third, student learning outcomes obtained from the student Mid-Semester Examination scores for class XI SMA students in the 2019/2020 academic year semester 1. The average value obtained for the seven classes is 60 which is in the sufficient category.

Based on the initial study conducted, there is a gap between the expected ideal conditions and the conditions in the field. This suggests that there is a problem in research that needs to be solved, one solution is to develop CTL integrated ICT based teaching materials to improve the thinking skills of class XI high school students. The teaching materials used are electronic teaching materials by integrating the CTL approach. The difference between this research and previous research is that the teaching materials used utilize technology in their use, so that they are in accordance with the needs of the 21st century. The teaching materials also integrate the CTL approach so that students can experience the learning experience directly through the presentation of material that is related to students' real lives. ICT based teaching materials can be used by teachers and students anytime and anywhere as long as they are connected to the internet network. The advantages of ICT based teaching materials include providing ease of use for students in the learning process, changing the role of students from being passive to being active, students can study or study teaching materials at any time. Teaching materials are supporting media in the implementation of learning activities to improve students' abilities [5]. Teaching materials are designed as tools that can help students and teachers in the learning process so that learning is more effective [6]. The use of ICT based teaching materials can be combined with contextual learning using the REACT learning strategy. Experimental activities are important so that students can see physical phenomena through visual aids [7]

CTL approach integrated learning using the REACT strategy can motivate students to learn because students are directly involved in learning activities. Students build their own knowledge by linking the problems given by the teacher with their knowledge and experience [8]. Learning activities are not dominated by teachers but students who are actively involved in finding new concepts in the learning process [9]. CTL integrated ICT based teaching materials have several advantages. First, the mechanical wave material presented in ICT based teaching materials is linked to students' real lives so that students find it easier to understand the learning material. Second, it can increase students' interest in learning physics because the teaching materials used are interactive so that they provide feedback for students. Third, it can optimize the assessment of students' creative thinking skills.

Contextual learning has seven components that must be applied in the learning process. The first component is constructivism, namely the ability of students to be able to build their own knowledge. The second component is finding, where students learn to use critical thinking skills based on the process of transferring from observation to understanding. The third component is asking questions, namely the application of asking questions can develop students' curiosity through a question-and-answer process between teachers and students so that learning will be more lively. The fourth component is a learning community, namely contextual learning carried out by forming groups whose members are heterogeneous, so that mutual assistance activities can occur between smart students and weak students in the learning process. The fifth component is modeling, where the teacher becomes a good model and example for students in the learning process. The component is reflection, which is the activity of repeating the material learned to remind students of the material they have learned. The seventh component is assessment, namely activities carried out to collect various data about knowledge and skills [10]

Based on the results of the initial study and the background that has been described, the title of this research is "Validation Result of Teaching Mechanical Wave Materials with ICT Based Material Integrated CTL for XI Grade Students". The approach used is the CTL approach using the REACT strategy, while thinking skills are limited to students' creative thinking skills. The purpose of this research is to determine the validity of ICT based teaching materials.

II. METHOD

The type of research used is research and development (R&D). The research method used is the scientific method for researching, designing, producing, and testing the validity, practicality, and effectiveness of the resulting product [11]. The model used in this research is the development model by Sugiyono. The development procedure in this model consists of ten steps but only six steps are carried out. This is because the research conducted is still on a limited scale and does not cover a wider study. The object of research is in the form of ICT based integrated physics CTL teaching materials to improve students' creative thinking skills carried out in class XI MIPA 2 physics learning on wave mechanics material competences 3.6 and 3.7.

The procedure in this study consists of six stages, namely potential and problems, data collection, product design, product validation, product revision and product testing [8]. One of the potentials possessed by SMA Negeri 1 Lubuk Sikaping is the advice and infrastructure at the school that supports the use of ICT based teaching materials while the problems encountered in the implementation of the practicum are still not running smoothly. The data collection stage was carried out by carrying out an initial study using a questionnaire on the use of CTL-integrated ICT based teaching materials, creative thinking ability tests and UTS scores of students in semester 1 of the 2019/2020 academic year. The product designed in this research is in the form of ICT-based teaching materials. The design of ICT-based teaching materials can be seen in Figure 1.

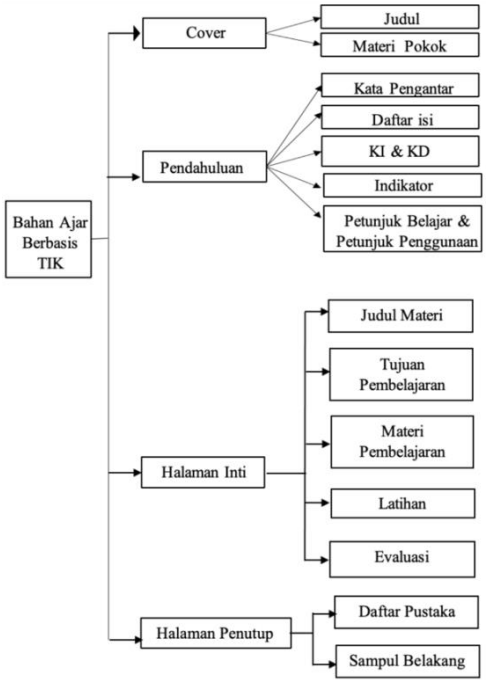


Fig 1. ICT Based Teaching Material Design

Before being used, the product is validated by experts, namely physics lecturers, FMIPA UNP. Validation is the extent to which the accuracy and accuracy of a product in carrying out its measuring function. After being validated, the product is revised according to the advice of experts so that the resulting product is even better so that it is suitable for use. After being revised, the ICT based teaching materials were tested in the field. The research instrument used consisted of a validity instrument. The instrument of validity is in the form of a questionnaire filled out by experts consisting of five components. Each component has an assessment indicator. Descriptive statistics is a data analysis technique used in this study by analyzing validation questionnaires. The weighting uses a Likert scale. The value obtained for each component is the total score for each component divided by the maximum score multiplied by 100.The instrument grid is derived from the components of developing ICT based teaching materials based on the Ministry of National Education 2010. The criteria for determining the validation of ICT based teaching materials can be seen in Table 1.

Table 1. Rating Category for Validity [12]

Interval	Category
80-100	Very Good
66-79	Good
56-65	Enaugh

40-55	Weak
30-39	Very Weak

(Source: Ref [12])

III. RESULTS AND DISCUSSION

The results of the study are the results of the validity of ICT based teaching materials which were validated by five experts, namely physics lecturers, FMIPA UNP. The validation results are used to determine the feasibility of using ICT based teaching materials using a validity instrument in the form of a questionnaire [13]. The mark's scheme rubric materials must be aligned with the taught materials. Validation instruments become the guidance for the validator to do marking scores. ICT- based materials are valid if only it is based on the national education department guidance 2010.

The validation questionnaire sheet consists of five components consisting of Material Substance (MS), Visual Communication Display (VD), Learning Design (LD), Software Utilization (SU) and CTl Assessment (CA). Each component has an assessment indicator. The score for each indicator has a range from 1 to 4. The average value for each component is obtained from the sum of the scores on each indicator divided by the total maximum score multiplied by 100. The results of the value data plot for each assessment component can be seen in Figure 2.

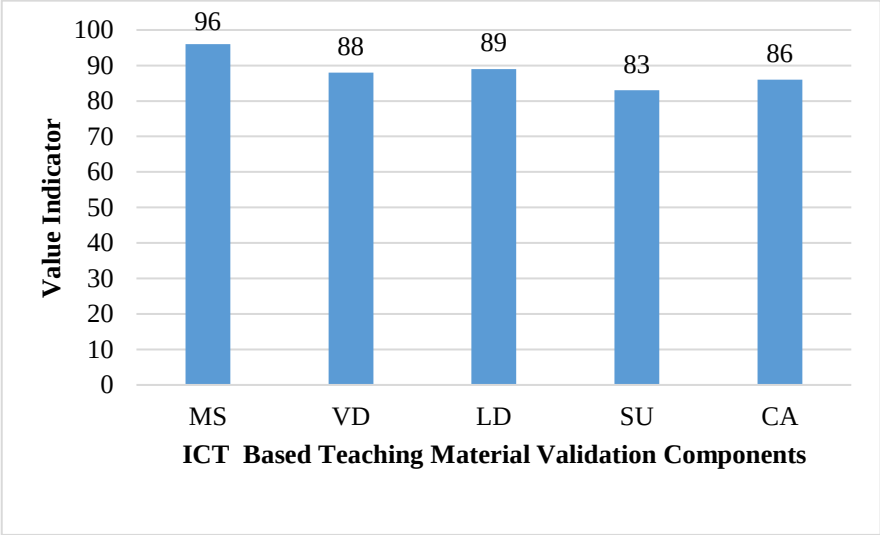


Fig 2. Value of Validation of ICT based Teaching Materials

Based on the data analysis in Figure 2, it can be explained that the value of each component varies with the lowest value of 83 and the highest value of 96. The first component of the validation assessment instrument is the substance of the material. The substance component of the material consists of four indicators, namely 1) truth, 2) material coverage, 3) current, 4) readability. The value given by experts for each indicator shows that the ICT based teaching materials presented do not deviate from the truth of science, the material presented is easy. understood and writing on ICT based teaching materials in accordance with the rules of the Indonesian language. The average value obtained from the four indicators on the substance component of the CTL integrated ICT based teaching materials is 91 which is in the very good category.

The second component is the visual communication display. The visual communication display component consists of 6 indicators, namely: 1) navigation, 2) letters, 3) media (film, sound, images, and animation), 4) color, 5) animation, 6) layout. The value given by experts for each indicator shows that ICT based teaching materials provide ease of use for users, the media presented is appropriate. with the material presented and the combination of colors and the use of fonts in ICT based teaching materials are proportional. The average value obtained from the six indicators on the visual communication display component of CTL-based integrated ICT based teaching materials is 88 which is in the very good category.

The third component is learning design. The learning design component consists of 8 indicators, namely 1) title, 2) KI and KD, 3) learning objectives, 4) material, 5) sample questions, 6) exercises, 7) compilers, 8) references. The value given by the experts for each indicator shows that the structure of the ICT based teaching materials is in accordance with the KI and KD on the mechanical wave material. The average value obtained from

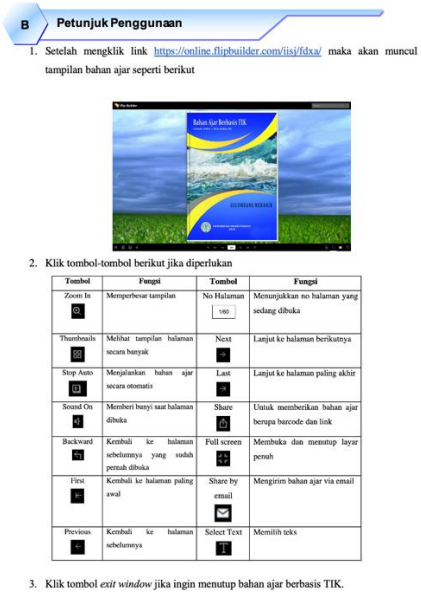
the eight indicators in the CTL-integrated ICT based learning design component is 88 which is in the very good category.

The fourth component is the use of software. The software utilization component consists of 3 indicators, namely: 1) interactivity (feedback from the system to users), 2) supporting software, 3) originality. The average score obtained from the three indicators on the components of the use of the CTL-based ICT integrated teaching material software is 86 which is in the very good category. The fifth component is the CTL assessment. The CTL assessment component consists of 3 indicators, namely: 1) the nature of the CTL, 2) the CTL component, and 3) the CTL strategy. The average value obtained from the three CTL assessment indicators for ICT based integrated CTL teaching materials is 88 which is in the very good category.

The value of the validation test results according to experts on ICT based teaching materials can be determined by finding the average value of all assessment components. The average value of the results of the validation of ICT based teaching materials according to experts is 87,37 which is in the very good category.

The next step is revising based on the validator's inputs which are (1) ICT based learning does not consist of technical guidance, (2) seventh video is better if it can also show minimum interference (destructive). (3) some university-level references have to added. It is done to achieve the proper ICT based learning and to eliminate some errors.

Fig 3. Guidance Before Revisited


B Petunjuk Penggunaan

1. Setelah mengklik link https://online.flipbuilder.com/iisj/fdxa/ maka akan muncul tampilan bahan ajar seperti berikut

2. Klik tombol-tombol berikut jika diperlukan

Tombol	Fungsi	Tombol	Fungsi
Zoom In	Memperbesar tampilan	No Halaman	Menunjukkan no halaman yang sedang dibuka
Thumbnails	Melihat tampilan halaman secara banyak	Next	Lanjut ke halaman berikutnya
Stop Auto	Menjalankan bahan ajar secara otomatis	Last	Lanjut ke halaman paling akhir
Sound On	Memberi bunyi saat halaman dibuka	Share	Untuk memberikan bahan ajar berupa barcode dan link
Backward	Kembali ke halaman sebelumnya yang sudah pernah dibuka	Full screen	Membuka dan menutup layar penuh
First	Kembali ke halaman paling awal	Share by email	Mengirim bahan ajar via email
Previous	Kembali ke halaman sebelumnya	Select Text	Memilih teks

3. Klik tombol *exit window* jika ingin menutup bahan ajar berbasis TIK.

Fig 4. Guidance After Revisited

Based on data analysis of Figure 3, before being revised, study guidance only consists of general steps which are used on teaching process. In Figure 4, some ICT based learning steps were added in the guidance for the user's convenient purposes thought Internet.

The next revision is on seventh video which is interference topic (figure 5). Based on the validator's input, minimum interference topic was added (figure 6) to boost students understanding to differ the maximum and minimum one.

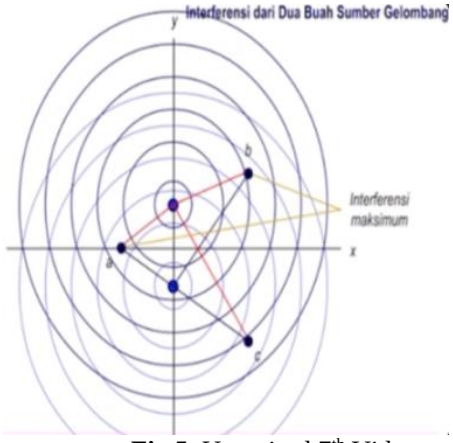


Fig 5. Unrevised 7th Video

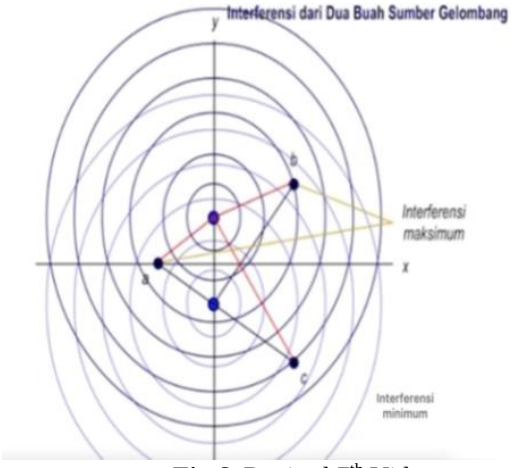


Fig 6. Revised 7th Video

Based on the analysis, on figure 5, video 7 only gives the maximum interference, on the other hand, as figure 6 shows, video 7 manages to distinct between the maximum and minimum interference The final revision is to add some references from university-level textbooks as shown on Figure 6.

Daftar Pustaka

Foster, Bob. 2017. *Akselerasi Fisika Jilid 2 Untuk SMA/MA Kelas XI*. Jakarta: Duta.

Hugh D. Young & Roger A. Freedman. 2003. *Fisika Universitas Edisi Kesepuluh Jilid 2*. Jakarta : Erlangga.

Kanginan, Marthen. 2015. *Fisika XII untuk SMA/MA Kelompok Peminatan Matematika dan Ilmu Alam*. Jakarta : Erlangga.

Suharyanto, dkk. 2009. *Fisika Untuk SMA Dan MA Kelas XII*. Jakarta: Pusat Perbukuan Departemen Pendidikan Nasional

Susilawati. 2008. *Penerapan Penjalaran Gelombang Seismik Gempa pada Penelaahan Struktur Bagian dalam Bumi*. Sumatra Utara: Universitas Sumatra Utara.

Fig 7. Unrevised Reference List

Daftar Pustaka

Foster, Bob. 2017. *Akselerasi Fisika Jilid 2 Untuk SMA/MA Kelas XI*. Jakarta: Duta.

Giancoli, Daugles C. 2001. *Fisika Jilid 1*. Jakarta: Erlangga.

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Tipler, P.A. 1998. *Fisika untuk Sains dan Teknik Jilid 2 Edisi Ketiga*. Jakarta: Erlangga.

Fig 8. Revised Reference List

ICT based learning had already revised based on the validator's inputs to maximize its potential to bolster in teaching activities and attaining learning objectives for teachers and/ or students.

The research show that validation of mechanical waves material ICT based integrated CTL for 11 grade students by experts. The results were satisfactory; however, the further validations are needed to point out some flaws in this product. This is a crucial step to verify its value. The results of the study obtained that the validity of CTL integrated ICT based teaching materials was in the very good category. Validation is needed in development research to find out the deficiencies contained in the product according to the indicators made [14]. Product validation is a process to test the validity of teaching materials carried out by several experts [15]. The mark's scheme rubric materials must be aligned with the taught materials. Validation instruments become the guidance for the validator to do marking scores. ICT- based materials are valid if only it is based on the national education department guidance 2010. The assessment component of the validation instrument in teaching materials must be in accordance with the theory used in the preparation of teaching materials [16]. The validation instrument is used as a guide for validators in making assessments [17]. ICT based teaching materials are said to be valid if they are guided by the 2010 Ministry of National Education guidelines [18]. The next step is revising based on the validator's inputs which are (1) ICT based learning does not consist of technical guidance, (2) seventh video is better if it can also show minimum interference (destructive), (3) some university-level references must added. It is done to achieve the proper ICT based learning and to eliminate some errors. On the field, some problems are encountered, first, ICT based learning which is made with two basic competences 3.6 and 3.7 for first term, eleventh grade. The topics are mechanical waves and travelling-stationary waves, respectively. To tackle this problem, some ICT based learning materials were added on first and second terms to improve the materials. Another limitation is the product test was only held to one class due to researcher's limited time. To address this, the research is held not only on one class to accomplish the better quality materials.

IV. CONCLUSION

Based on the results of the research, it can be concluded that the validity value of CTL based ICT teaching materials for class XI SMA students is 87,37 which is in the very good category. It is valid in terms of material substance, visual communication display, learning design and software utilization so it can be used in the learning process.

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