



# Development of Science Learning Modules with Computer-Based Test (CBT) Assessments to Train Critical Thinking Skills of Students at SMP Negeri 7 Bontang

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**Abstract:** This study aims to improve Modules for science subject with the Computer-Based Test Assessment in order to train students' critical thinking on one of science topics which is human's respiratory system using ADDIE model. This model of research is the development research level 3. The data were collected by involving expert's validation, observation, test, and questionnaire. The results showed that: the module validity result in terms of module itself was 93.75% with a very valid category. The validity in terms of language and material were 88.77% and 99.54% respectively, while the results by the Computer-Based Test application were 97%. The module's practical results assessed by questionnaires were 89.41% and it means this module is highly practical to be used. The results of the module's efficacy in terms of normality, the n-gain of all classes in pre-test and post-test's sig value > 0.05, therefore the data was distributed normally. The results of paired sample t-test indicate that there is a noticeable difference on the average of pre-test and post-test results in the experimental group. Hence, the science module with Computer-Based Test is effective to be utilized as learning materials that can increase students' critical thinking skills at schools.

**Keywords:** ADDIE model; Assessment; Computer-based test; Science module

## Introduction

The era of industrial revolution 4.0, where the development of science and technology greatly influences all aspects of life, especially education (Yahaya et al., 2021), the use of information and communication technology (ICT) in Indonesia has also experienced rapid development in the last five years (Hairida et al., 2023; Metre, 2013; Zhang et al., 2022). This is proven by the percentage data on the use of information and communication technology based on data from BPS from the 2022 Susenas Survey, there were

66.48% Indonesian used the internet in 2022, and it was an increase from 62.10% in 2021 (Herdiansyah et al., 2023). This high internet use reflects massive accessible information and public acceptance of technological developments and changes towards information among the society (Achmad, 2021). The increasing number of internet users in Indonesia is also influenced by the rapid development of cellular phones (Prayitno et al., 2020). In 2022, 67.88% of Indonesians had had cell phones, rising from 65.87% in 2021. This makes Generation Z students who live in an era of rapid

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technology prefer to involve technology, including in learning activities at school (Szymkowiak et al., 2021).

Education in Indonesia is required to be able to adapt to various changing times. Several changes have occurred including to the curriculum, which has become the Independent Learning Curriculum (Istaryaningtyas et al., 2021). This curriculum is the result of an evaluation of the 2013 Curriculum. According to the Ministry of Education and Culture (Kemdikbud) website, the Independent Learning Curriculum aims to improve the teaching and learning process which was disrupted due to the pandemic. The Independent Curriculum encourages schools to adapt the curriculum according to the existing potential (Yunaini et al., 2022). The implementation of the Independent Curriculum certainly has an impact and transformation for teachers and all educational components and stakeholders. Learning administration, including learning tools, teaching strategies, and assessments carried out by teachers, will also undergo a transformation.

Education at junior high school level is a transitional level from elementary school level, and for this reason, it is highly necessary to understand learning material and solve problems related to factual problems around them. Based on the observations in 6 junior high schools in Bontang conducted by researchers, the problem that often occurs is that students' activities in class are only done by listening to the teacher's explanations, taking notes and answering questions by the students. Opportunities for students to develop independently in acquiring knowledge have not been provided by this learning method. Critical thinking, apart from the lack of teacher skills to implement learning that trains critical thinking skills, this results in a lack of student understanding regarding learning material and in solving problems in real life.

Science learning activities can train students to think critically, critical thinking is an intellectual thinking process using independent, clear and rational reflective thinking (Ahmatika, 2017). According to (Fisher, 2011), critical thinking involves an active process in interpreting and evaluating the results of observations, communication, information and arguments. Duron et al. (2006) also suggests that critical thinking requires the ability to analyze and evaluate the information received. Meanwhile, Ennis (2011) explains that critical thinking is a reflective process that focuses on making decisions about the truth and the right steps to take.

Critical thinking skills are considered crucial in facing the challenges of the 21st century educational era. This process involves steps such as observation, analysis and drawing conclusions regarding the various problems faced. Critical thinking is not just about looking for answers, but also challenging the truth, facts,

or available information, thus allowing individuals to question and evaluate information in more depth (Haber, 2020).

Critical thinking abilities do not grow naturally in line with human physical development. As educational institutions, schools have an important responsibility in helping students develop these abilities. In the 21st century education era which is dominated by information and technology, students are expected to have critical thinking skills. They need to be able to respond to change quickly and effectively, which requires flexible intellectual skills, the ability to analyze information, and integrate multiple sources of knowledge to solve problems.

Based on this description, the role of teachers is to face the challenges of their time and be able to create innovations and create teaching materials so that learning activities in the classroom run optimally. Careful planning is needed to ensure that the learning process runs actively, effectively, and can develop students' critical thinking abilities. Learning planning in the context of the Independent Curriculum is realized in carefully arranged teaching materials. Choosing the right teaching materials can train critical thinking skills (Wahyuni, 2015).

Teaching materials refer to all materials used in the teaching and learning process (Tomlinson, 2023). This includes explanations of material knowledge, experience, and theory that are tailored to help teachers and students understand certain topics or materials that have been established in the curriculum (Ridha et al., 2020). Teaching materials can be in the form of modules, Student Worksheets (LKPD), or slide presentations (Kosasih, 2021), which aim to simplify the learning process. With the existence of these teaching materials, students can increase their knowledge and experience. Students learn at their own individual pace, with the opportunity to repeat or review the material, which can increase their understanding significantly (Marshman et al., 2020). It is also associated with improved memory and longer retention, because learning experiences involve more than just listening, involving reading and reasoning skills.

Learning modules are part of the teaching materials whose presence can stimulate students' needs for critical thinking (Puig et al., 2020). The learning process that occurs in Indonesia generally focuses on cognitive abilities only, students are still required to be able to memorize information but not understand it. The implementation of the teaching and learning process in the classroom does not encourage the achievement of critical thinking (Anwari et al., 2021). The lack of students' critical thinking abilities greatly influences the students' very shallow understanding of problems, this is due to the lack of practicing questions that stimulate

critical thinking abilities. Critical thinking skills are still low, this could be because students are not used to solving evaluation questions that refer to critical thinking indicators.

An effective class does not only depend on careful learning planning, but also on the teacher's ability to assess student competency achievement (de Vries et al., 2023). In assessment activities, the role of a teacher is not only limited to finding answers to questions about what students have learned, but more about how or how well students understand or master the results or processes obtained during the learning process at school for the assessment process to measure understanding, the ability to solve problems and student achievement of learning goals is very necessary. The purpose of assessment is to provide feedback to students and teachers regarding the extent to which learning objectives have been achieved (Morris et al., 2021). It also helps assess student needs, measure achievement and provide a basis for improving future teaching strategies (Ibarra-Sáiz et al., 2020; Schildkamp et al., 2020; Winstone et al., 2022).

Assessment is also called assessment (Purnomo et al., 2018). Assessment is an instrument that measures an individual's level of achievement objectively (Ma et al., 2020). As a process of collecting information about student performance to be used as a basis for making joint decisions. The Yukon Department of Education believes that "Assessment is a systematic process of gathering information from a variety of sources to make accurate decisions. Knowledge assessment is carried out by educators through written tests, oral exams and assignments, while skills competency assessment is carried out through performance assessments. This performance assessment requires students to demonstrate their ability in a particular competency through practical tests, projects and portfolio assessments.

Initial observation results in 6 schools in Bontang, namely SMP N 1, SMP 2, SMP N 4, SMP 7, SMP 8 and SMPIT DHBS. The current situation in schools is that students and teachers have difficulty using the student handbook in the independent curriculum developed by the Ministry of Culture and Research. , and RI Technology 2021 because it is incomplete in terms of explanation and lack of practice questions and Student Worksheets (LKPD). The observation results show that in the 6 schools that carry out assessments, there are still those that carry out assessments using the paper-pencil method, the rest of the assessments are carried out using G-form and Quiziz. The paper-pencil method itself has several disadvantages, including: The format of the questions displayed is very limited because they are printed and displayed on paper, so the form and format of the questions on the PBT only consist of text or image-

based questions. PBT cannot display video phenomena more clearly other than the black ink displayed is monotonous, printing in various colors over a wide range of test levels requires more expensive printing costs and paper quality, poor ink will hinder students' understanding of the questions presented (Ardiansyah, 2020).

The shortcomings of using evaluations using paper pencils can be overcome by using CBT, namely tests that can be used on Android and PC computers, also called Computer-Based Tests (CBT), CBT is a daily test system that is almost the same as online exams but uses an Android smartphone or computer as a medium for implementation. The advantages of Android-based daily tests are efficiency for educators in processing student scores, an automatic assessment system, and an online system that allows storing student answers and more structured data (Ardiansyah, 2020). However, not all schools use CBT for formative and summative exams. The use of CBT is more common in schools that have supporting facilities, in line with the rapid development of technology in the world of education.

Computer-Based Tests are the solution to reduce the use of paper so as to reduce costs, according to Ardiansyah (2020) the use of CBT also has many advantages including to ease teachers to carry out assessment management, utilizing technology so that teachers' skills in innovation and creativity increase, facilitating advanced data processing in value processing. Of course, for students who have grown up in the digital era, namely the net generation, information on the results of formative and summative assessments can be received quickly and in a planned manner, making students better able to prepare themselves to achieve maximum grades (Daka et al., 2021; Ismail et al., 2022; Mannion, 2022).

This research answers the problems of educators in the process of facing challenges in innovating in preparing special teaching materials in the form of learning modules and the process of assessing knowledge in summative tests which can train students' critical thinking skills. Schools still carry out assessments using conventional methods, namely the paper-based test (PBT) system. Therefore, researchers are trying to develop it in a contemporary way, namely switching from assessments using paper-based tests to computer-based tests. The solution offered by researchers is by developing an online application which includes a respiratory system learning module which is equipped with a guide, students can repeat the material and can carry out modified assessments with critical thinking skills. Teachers can also save time because they don't need to assess manually, it can save paper because we don't incur costs in duplicating questions and the questions collection is safely stored.

Based on this description, the author intends to carry out research to develop learning modules with Computer Based Test (CBT) assessments to train critical thinking ability of students at SMP Negeri 7 Bontang. The specific objectives of this research are to create a design for developing learning and assessment modules to improve junior high school students' critical thinking skills in class VIII science. To find out the validity of developing learning modules and Computer Based Test assessments to improve junior high school students' critical thinking skills in class VIII science. To find out the effectiveness of developing learning modules and Computer Based Test assessments to improve junior high school students' critical thinking skills in class VIII science and also to find out the practicality of developing modules and assessments to improve junior high school students' critical thinking skills in class VIII science.

**Method**

This research used the research and development (RnD) method. RnD is a process to develop new products or improve existing products, which can be accounted for. This research refers to the ADDIE development design which includes 5 stages, namely: Analysis, Design, Development, Implementation and Evaluation. The research was carried out at SMP Negeri 7 Bontang at Jl KS. Tubun Gang Koi, Tanjung Laut Indah Village, South Bontang District, Bontang City, East Kalimantan. This research was carried out in the 2023/2024 academic year, taking place in the even semester in March – May 2024.

The researcher carries out an analysis of various things that are used as a basis for designing and developing products including needs analysis and curriculum analysis. In needs analysis, the researcher analyzes field needs related to problems in science learning in Biology Material in class VIII by making observations. This needs analysis is the initial stage in development research. At this stage, it is known that the problems that exist in schools are related to the low achievement of science scores in biology material, the topic of discussion of the respiratory system that needs to be developed from independent curriculum books and the types of assessments that exist in schools.

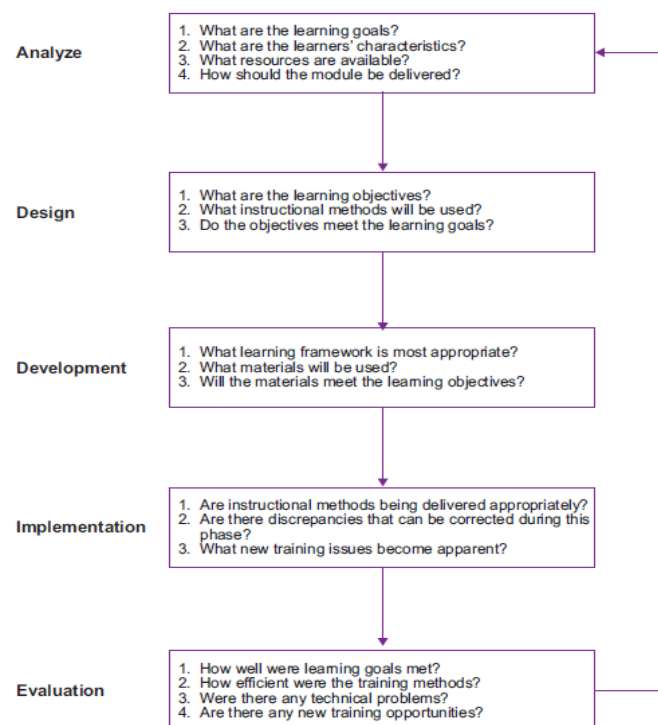
Curriculum analysis aims to examine the science curriculum and material in junior high schools. The curriculum analysis process begins with selecting Biology material that is in accordance with the independent curriculum used in schools, then analyzing appropriate learning outcomes in order to design learning tools.

In addition, the researcher conducts the second stage where the researcher creates a plan or design from the results of the analysis in the previous stage. The

product created is a Computer Based Test-based learning and assessment module. Then, the researcher conducts the development stage. At this stage the researcher developed a science learning module with computer assessment based on storyboards and flowcharts, creating modules, create and develop a module by developing a paragraph framework based on learning objectives.

At the implementation stage, the learning and assessment modules that have been developed and declared valid and suitable for use are then carried out. Before using the Respiratory System module, students first undergo a pre-test using the CBT application, the results of which will be compared after studying the module.

In the Evaluation stage. The researcher find out the impact of learning using the Computer Based Test module. Measure and look for any information that can make students achieve good results.



**Figure 1.** ADDIE method chart (Mayfield, 2011)

The data required in this research was collected in five ways, namely conduct observations on science teachers in several schools and a sample of students for the start of the research as well as researcher observations while teaching in class which are assessed by observers (teachers). Validation of research instruments and learning tools by validators. Giving tests to students (posttest pretest). Request written answers or fill out questionnaires from students.

## Result and Discussion

### *Validation Results by Module Experts*

The validation sheet instrument is adjusted based on the provisions on the feasibility of the learning instrument which refers to the book assessment according to BNSP and is prepared based on the description of the indicators that have been developed. The finished Module Product is validated in stage one by experts.

Based on the analysis carried out on the module validation instrument in the presentation aspect, the Technical indicators obtained a percentage of 93.75% which was categorized as very valid. So the module has been arranged sequentially and systematically. There are instructions for use as signs for learning activities for each component in the module as a whole. Study instructions are a component that must be present in teaching materials (Miranda et al., 2021)

The material indicator obtaining a percentage of 100% is categorized as very valid. So the module illustrations can be clearly understood and are in accordance with the respiratory system material.

The learning indicator obtained a percentage of 100% which is categorized as very valid. So the module has been able to accommodate students' needs to be actively involved. Apart from that, the module has prepared LKPD activities to stimulate students' critical thinking skills in the classroom. The module is also equipped with an understanding test along with an answer key to make it easier for students to correct the results of the exercises carried out. Evaluation activities in the form of practice questions are equipped with supporting information such as discussion of practice questions which is also an important component that must be present in teaching materials (Miranda et al., 2021).

In the graphic aspect, the module size indicator obtained a percentage of 100% which was categorized as very valid. The modules as teaching materials used in class measure 210x297 mm (Ministry of National Education 2008). The skin design indicator getting a percentage of 100% is categorized as very valid. Meanwhile, the design of the content section received a percentage of 100%. Module content is good if it is supported by a content layout that is consistent with one another (Mamun et al., 2020; Rajabalee et al., 2021; Yani et al., 2020).

In terms of paper quality and print quality, both obtained a percentage of 100% which is categorized as very valid. So the module as print media can be used for school needs. Overall, the average module validation assessment in the material aspect obtained an average percentage of 100%, including very valid criteria.

### *Material Validation Results*

Based on the analysis carried out on the module validation instrument in the technical aspect with indicators of conformity to the truth of facts and concepts and clearly not referring to concept refraction, deviations and misconceptions, a percentage of 99.54% was categorized as very valid. So the module is in accordance with the competency formulation on the topic of biodiversity. The modules developed are structured systematically and coherently with the acquisition of factual concepts obtained empirically. The module can provide understanding to students without refraction of the concept.

The indicator of suitability of media content for children's development obtained a percentage of 100% which was categorized as very valid. So the module as a teaching material is easy for students to understand when used in learning. Teaching materials in the form of modules are very helpful in the learning process so that they can replace the teacher's role in supporting individual learning (Eviyanti et al., 2022).

The modules are packaged lightly so that they can be easily accessed by students according to their thinking abilities. The scientific substance indicator obtained a percentage of 100% which is categorized as very valid. So the module has the novelty of highlighting the respiratory system material in biology learning material.

The insight indicator for progress and development obtained a percentage of 100% which was categorized as very valid. So the module is in accordance with the curriculum used. The curriculum set by the government runs in harmony with the learning activities delivered by teachers (Septiani et al., 2020). Overall, the average module validation assessment in the content aspect is 100%, including very valid criteria.

### *Results of module validation by language experts*

Based on the analysis carried out on the module validation instrument on the linguistic aspect, the readability indicator obtained a percentage of 85% which was categorized as valid. So the module can be accessed and the information absorbed by readers, including the research targets, are class VIII junior high school students.

The indicator of conformity with good and correct Indonesian language rules obtained a percentage of 75% which was categorized as valid. So the module is in accordance with PUEBI so that the language structure used by the module is good, correct and appropriate for its use.

The language logic indicator obtained a percentage of 75% which was categorized as valid. So the sentence structure used in the module is not biased or does not refer to double meanings.

This shows that the module can be interpreted easily when students are learning. The preparation of language in teaching materials is an important component for describing instructions for use, explaining theory, and providing practice questions (Syamsi et al., 2017). Overall, the average module validation assessment in the language aspect was 86.77%, including very valid criteria.

Based on the results of a review of the interpretation of the questionnaire that has been filled out by the expert team, it can be concluded that the module has met the eligibility requirements in terms of module (content), material (presentation and graphics), and language. Therefore, the module is suitable for field testing, and it is ready to be used as a learning resource for respiratory system. (Ministry of National Education 2008) explains that development products or learning tools must meet the eligibility criteria by experts in terms of content, presentation, graphics and language before being tested in the field.

*Media Expert Validation Results (Application)*

Based on the analysis carried out for the Computer-Based Test application validation instrument, the linguistic aspect of the application display aspect indicator was 96.6% categorized as very valid. In the special display the percentage was 97.5%, in the application presentation indicator the percentage was 96.6%.

This assessment application with a computer-based test from the initial validation with a validator generally obtained a total score of 97%, this means that the application is very valid to use and suitable for use for field testing purposes.

*Results of the Implementation Phase*

At the implementation stage of the design that had been developed, limited and extensive trials were carried out at SMP N 7 Bontang class VIII. The trial subjects were limited to 15 students. The broad trial subjects consisted of two classes, namely the experimental class and the control class. As an experimental class, class VIII.A has 28 students and the control class is class VIII.D with 28 students.

Class VIII.A learning activities use the respiratory system module with CBT assessment and Problem Based Learning and Project Based Learning models. For class VIII. D uses modules from the Ministry of Education and Culture using PPT media, additional LKPD using Problem Based Learning and Project Based Learning models. Learning activities were carried out over 5 meetings. At the Implementation stage, limited and extensive product trials are carried out.

The results of the limited test stage are that students use the module product with a Computer Based Test

assessment which after the download process the students are given a questionnaire. Limited product trials by filling out questionnaires from students through practicality tests, application tests (Functionality Test) and (Usability Test).

**Table 1.** Results of Analysis of Functionality Aspect Testing

| Expert                 | Total Function | Success | Fail |
|------------------------|----------------|---------|------|
| 1 <sup>st</sup> Expert | 27             | 27      | 0    |
| 2 <sup>nd</sup> Expert | 27             | 27      | 0    |
| Total                  | 54             | 54      | 0    |

Based on the data in Table 1, the level of system functionality can be determined using data analysis in accordance with ISO/IEC. Based on the results of these calculations, a functionality (x) value of 1 is obtained. In accordance with the interpretation of ISO 9126, it is said to have good functionality if the x value is close to 1 ( $0 \leq x \leq 1$ ), then the Pintar Science application system has met the standards or has functionality which is good because it has an x value close to 1. Based on the calculation results above, the success rate of the system implemented by the CBT application is 100%, the failure rate is 0%, and the value is 1. This is based on ISO 9126, where the good value is close to 1, the development of the CBT application is in the "GOOD" category. So it can be said that this CBT application system is suitable for use for learning evaluation activities, especially daily tests at school.

The results of testing the usability aspect using a questionnaire in the form of a checklist containing questions for each indicator that the percentage for each assessment is shown in table 2.

**Table 2.** Percentage of Each Assessment of Usability

| Criteria          | Percentage (%) |
|-------------------|----------------|
| Strongly disagree | 1.7            |
| Disagree          | 1.9            |
| Neutral           | 5.1            |
| Agree             | 20.0           |
| Strongly Agree    | 71.3           |

From the calculation results of each assessment indicator shown in table 2, it can be seen that respondents generally stated that they strongly agreed with the usability aspect of the CBT Pintar Science application. Testing the usability aspect is seen from 3 parts, namely: usefulness; ease of learning, and satisfaction. This testing process is carried out after the posttest using the Pintar Science application has been completed. All participants have had experience using the Pintar Science application starting from the installation process, logging in, to the process of taking the exam by answering several questions provided,

confirming the end of the test, and getting a report on the test results.

#### *Results of the Evaluation Stage*

At the evaluation stage, evaluation is carried out starting from the analysis, design, development, implementation, evaluation stages. Details of the evaluation stage: This stage evaluates the module product with a CBT assessment. In Addie's model there are 2 types of evaluation (formative evaluation) and (summative evaluation). Firstly, formative evaluation can be carried out after completing each stage. The second is a summative evaluation which actually assesses the overall learning design at the end of the program (Broadbent et al., 2018).

This development research was carried out from 20 March 2024 to 2 June 2024 at SMP Negeri 7 Bontang. Before carrying out the research, the researcher carried out a needs analysis first by giving observation questionnaires to science teachers in class VIII in 6 different schools to find out the problems that occurred in the field.

From the results of these observations, the obstacles experienced by teachers in learning are: the contents of the independent curriculum books on the respiratory system are incomplete and assessments in schools are still carried out using conventional methods so that they require time for proofreading, they are wasteful in using paper and students' answers are prone to being lost.

Teachers at SMPN 7 Bontang also felt the low critical thinking abilities of students during learning due to the decline in cognitive scores in science subjects for class VIII students. This is because the questions given do not stimulate students' critical thinking abilities. This observation was carried out to avoid gaps, the development of learning media must be based on the needs and characteristics of students (Ma et al., 2020).

The results of the observations also obtained information regarding the good internet connection at school and that all students have smartphones that they can use when learning. Because students have smartphones, the use of smartphones with an Android system is an ideal platform for distributing learning materials to students (Muchson, 2019). The potential that can be developed from this problem is by developing learning modules with CBT assessments to improve the critical thinking skills of class VIII SMP students in science subjects regarding the respiratory system.

Before designing the product, researchers consulted with class VIII teachers regarding teaching materials, especially modules that would be developed as alternatives or potential problems in the needs analysis. Next, the researcher created development objectives, teaching modules with Problem Based Learning (PBL) and Project Based Learning (PJBL),

designed learning modules with CBT assessments, made storyboards, flowcharts.

The flowchart in this CBT assessment design contains a menu summary flow which was developed in the form of a concept map. Flowcharts are the basic structure of application design and function to illustrate the flow of each work. Storyboards are used to explain or guide the flow of virtual lab media which is developed briefly in table form (Chen et al., 2023). Providing an overview of the application that will be produced is the function of the storyboard. After being validated by a team of experts, the media can be tested in limited trials. At this stage the teacher is the respondent for a small class trial through a functionality test. The data obtained at this stage is the response to the review of ICT teachers and science teachers, in the form of test results on the functionality aspect using a checklist questionnaire which contains a list of system functions that have been created. Based on the test results on the functionality aspect, it can be seen that there are 27 functions that have been created. Being in the Smart Science application system has a success value of 100% and a failure value of 0%. Based on the results of these calculations, a functionality (x) value of 1 is obtained. In accordance with the interpretation of ISO 9126, it is said to have good functionality if the x value is close to 1 ( $0 \leq x \leq 1$ ), then the Pintar Science application system has met the standards or has functionality which is good because it has an x value close to 1.

Practicality testing in a limited trial was carried out randomly in class VIII involving 16 respondents by asking students to first download the assessment application on the Play Store, then asking students to fill out a response questionnaire. The results showed that the attractiveness indicator for the product was 91%, the time efficiency obtained a percentage of 90%, flexibility in use 89%, and ease of interpretation 87.27%. Extensive product practicality testing was carried out with a usability test in the control class of CBT application users (classes 8A and 8C with a total of 58 people) and 2 teachers teaching science subjects. There were 3 indicators measured in the usability test, namely usefulness (usability of the application), ease of learning (ease of learning), and satisfaction (satisfaction) in total there are 28 questions. Based on the test results on the usability aspect in table 4.18, it can be seen that the percentage of each questionnaire answer in a row is that users strongly agree 71.3%, users agree 20%, users are neutral 5.1%, users disagree 1.9%, and users strongly disagree 1.7%. Based on table 4.19 above, it can be seen that the Smart Science CBT application system meets the usability aspect with a score of 92.3% (Very High). In the usefulness aspect (usability of the application), the largest percentage of respondents chose the module with CBT assessment which saves time in carrying out

exams, is very easy and practical to use and has an attractive appearance and is easy to remember how to use the CBT application.

Testing the effectiveness of the module teaching materials with CBT assessment of improving critical thinking skills was obtained by pre-test and post-test scores by conducting extensive trials in class 8A, experimental class and 8D, control class. The effectiveness of the module in improving students' critical thinking skills with paired sample t test and N-Gain.

The questions used for the pre-test and post-test are based on critical thinking indicators. For each item, the pretest and posttest questions use 10 Ennis indicators. These indicators consist of: Defining terms and assessing definitions, Observing and assessing a report, Thinking conjecturally, Understanding and using graphs in mathematics, Using background knowledge about situations and conclusions that have been previously determined, Concluding and assessing a relationship, Asking questions and answering clarifying questions, Assessing the credibility of a source, Analyzing arguments, Focusing on questions. From the analysis of the increase in students' critical thinking skills, on average, the indicators in the control and experimental classes experienced an increase. In the experimental and control classes, the first indicator of critical thinking, namely defining terms and assessing definitions, has received a very good classification category, meaning that students have been able to master the questions. In the experimental class the third and tenth indicators, namely thinking conjecturally and focusing on questions, have received a very good classification, while the other indicators in the experimental class have received a category with a good classification.

## Conclusion

The validity of the science module with the Computer-Based Test CBT assessment developed on the respiratory system material was declared very valid by material experts with a score of 99.45%, valid by language experts with a score of 86.77%, very valid by module experts with a score of 93.75 % and very valid according to media (application) experts with a score of 97% in improving critical thinking skills. Hence, the science modules with Computer-Based Test assessments can be implemented as teaching materials in schools, especially in VIII grade. The effectiveness of using the Computer-Based Test Module on the respiratory system material was reviewed based on the results of the independent and paired sample t-test which was declared effective in improving students' critical thinking skills. Based on the independent sample t-test, there is a significant difference in critical thinking skills

(Sig. (2-tailed) of  $0.003 < 0.050$ ) between the experimental class and the control class. The results of the paired sample t-test show that there is a significant difference in the average pretest and posttest scores in the experimental class (Sig. (2-tailed) =  $<.001$ ) and the control class (Sig. (2-tailed) =  $<.001$ ). Modules with Computer Based Tests are effectively used as teaching materials that can improve students' critical thinking skills at school. The practicality of using modules with CBT assessments on respiratory system material was stated to be very practical by 89.41% of students, including very practical criteria in improving critical thinking skills, so that modules with practical CBT assessments are used as teaching materials in schools. The practicality of the CBT Smart Science application through a Functionality test carried out by the teacher found that all the features functioned well so that it was obtained at 100% based on ISO 9126 in the "GOOD" category. Based on the analysis of USE questionnaires for teachers and students, in using the CBT Pintar Science application respondents felt they could save more time in carrying out formative summative tests, this application is very easy and practical to use, and has an attractive appearance.

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## Conflicts of Interest

The authors declare no conflict of interest.

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