

# Development of CBT Integrated E-Module to Improve Student Literacy HOTS

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**Abstract:** Generations in the 21st century must be prepared to have **24** 21st literacy competencies and skills. The application of HOTS literacy **in the learning process** makes students more resilient and able to solve their own problems. This study aims to develop an integrated CBT e-module to improve student literacy HOTS. The resulting e-module has met the valid criteria and has proven to be effective in increasing student literacy HOTS. Student responses to the resulting e-modules are also very positive because the e-modules are designed using the Kvisof Flipbook Maker application which can be opened on laptops, computers or Android devices so that material can be repeated anytime and anywhere as well as HOTS materials and questions, compiled based on CBT to train and improve student literacy HOTS.

**Keywords:** e-module, CBT, HOTS literacy

## **9** INTRODUCTION

The development of modernization and globalization of the 21st century has had **9** tremendous impact. One of the worrisome impacts is the inability of children (students) independently to know, understand, and overcome problems around them. For the Indonesian people, another impact that is felt due to the challenges of modernization and globalization is the low thinking **2** skills of students [1]. The results of the PISA study show that the achievement of reading literacy, mathematical literacy, and scientific literacy achieved by Indonesian students is very low and has only been able to occupy the bottom 10 of 65 countries. Furthermore, based on the 2012 Education for All Global Monitoring Report issued by UNESCO, Indonesian education is ranked 64th out of 120 countries. This is because many test materials are not included in the Indonesian curriculum, especially those related to technological and information advancements. In addition, education in Indonesia still places too much emphasis on the cognitive aspect which is still limited to finding numbers, not students' critical analysis abilities of events **5** encountered in everyday life [2].

The low level of higher order thinking skills (HOTS) is not only experienced by students at the school level, but this also happens to students at the tertiary level. The results of the initial study conducted, it was found that there were still many new students whose higher-order thinking skills were still low, including in the General Chemistry course. The results of the analysis, it was found that most students still had difficulty solving HOTS questions on indicators C4, C5, and C6 [3].

Studying in university should be very different from studying in pre-university schools. Learning at the university does not only provide courses, topics, and strategic concepts, but is also expected to provide a learning experience that allows students' independent learning abilities to develop. Independent learning is learning with your own initiative, responsibility, and effort [4]. However, the main problem in **16** learning in higher education is how to plan and prepare lecturers to manage learning in order to achieve the desired competencies in students [5].

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When students are directed to be able to think critically, creatively and able to solve problems, it means that students are targeted to have high-order thinking **25** skills (HOTS) [6]. HOTS is learning designed to prepare the 21st century generation. The 21st century generation must be prepared to have competencies and skills which include: critical thinking and problem solving competence, creativity, communication skills, and the ability to work together [7]. HOTS measures the ability to: a) transfer concepts, b) process and apply information, c) relate different kinds of information, d) solve problems using information, and e) examine ideas and information critically. HOTS is defined as the ability to use the mind to solve problems at hand. Therefore, one must understand, interpret, analyze, and interpret information. HOTS also teaches a person to be critical in evaluating information, making conclusions, and making generalizations. In the revised Bloom's Taxonomy, HOTS is a cognitive ability at the level of application, analysis, evaluation, and innovation [8].

The most important thing in 21st century education is to encourage students to have a deep knowledge base and understanding to be able to become life-long learners. Thus, the education system needs to consider a number of aspects that are domains in 21st century education, one of the most important domains in 21st century education **3** is digital-age literacy. In the 21st century, literacy skills are not only limited to the ability to read, listen, write and speak **3** orally, but more than that, literacy skills are emphasized on literacy skills that are connected to one another in the current digital era [9].

The success of learning, including in higher education, must also be accompanied by the availability of learning tools, including teaching materials. Teaching materials are not only in the form of books or worksheets based on print media. Non-print-based teaching **1** materials can also be used in learning, for example in the form of electronic teaching materials. Currently, electronic-based teaching materials can be easily obtained due to the presence of information technology network devices. Through this information technology network, educators can use it as teaching materials

easily. The ease of accessing networks and information technology is an advantage for the world of education. The world of education can be used as a means of advanced learning and learning is not only conventional but can also be integrated through online.

One form of online learning is by utilizing media and teaching materials in the form of e-modules or can be called electronic modules. An E-Modul or electronic module is an electronic version of a printed module that can be read on a computer and designed with the required software. E-module is a tool or learning tool that contains materials, methods, limitations and ways of evaluating which are designed systematically and attractively to achieve the expected competencies according to level of complexity electronically. E-module is a display of information in book format that is presented electronically using a hard disk, diskette, CD, or flash disk and can be read using a computer or electronic book reader [10].

In addition to the ability to develop the learning process, an educator, both teachers and lecturers, is required to have the ability to evaluate and assess student learning outcomes. The ability of educators in mastering evaluation techniques is indicated by their ability to design evaluation patterns, develop instruments, set goals, see the results obtained by students, and choose appropriate actions as an effort to follow up on the results of evaluations and assessments. Therefore, an educator, both teachers and lecturers, must be able to make the right evaluation media, because the evaluation media is very influential in increasing students' understanding and learning achievement. On the other hand, if the evaluation media is not appropriate, there will be errors in measuring learning outcomes and students' understanding.

The 21st century, with the rapid development of information and technology, also demands changes and adjustments in evaluation activities which generally use paper and pencil based tests (PBT) which have now turned into computer based tests (CBT), namely evaluation activities or assessments using computer media and based online, managed by server [11]. CBT is a test used to measure learning achievement using a computer [12], through internet access with the assessment carried out automatically by the computer [13], so don't need paper, pen or pencil to answer every question [14]. Student responses to tests can be stored and analyzed electronically and widely used [15].

Seeing the existing phenomena related to the development of modernization and globalization of the 21st century as well as the rapid development of information and technology, it is necessary to develop an e-module on CBT in integrated General Chemistry learning which is expected to support the implementation of an effective and efficient learning process. The development of the integrated CBT e-module is expected to facilitate lecturers and students in the learning process of General Chemistry (Biochemistry, Solutions, Thermochemistry) and is expected to assist lecturers in conducting diagnostic tests and in making academic policies for students.

The e-module developed in this study uses the Flipbook Maker software or application, which is an application to create e-books, e-modules, e-papers and e-magazines. In general, this multimedia device can include files in the form of pdf, images, videos and animations so that the flip book maker is made more attractive. In addition, flip book maker has design templates and features such as background, control buttons, navigation bar, hyperlinks and back sound. Students can read by feeling like reading a book

physically because there is an animation effect where when switching pages will look like physically opening a book. The final result can be saved to html, exe, zip, screen saver and app formats [16].

## 2. METHOD

This research belongs to the type of research and development (R&D), and the result of this development research is an integrated CBT e-module in General Chemistry courses (Biochemistry, Solutions, Thermochemistry). The development model used refers to the ADDIE development model which is a more generic learning design model, namely as one of its functions to build training program tools and infrastructure that are effective, dynamic and support the performance of the training itself [17].

The ADDIE development model uses 5 stages as the name implies, namely: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model in designing instructional systems uses a systems approach. The essence of the systems approach is to divide the learning planning process into several steps, to organize the steps into logical sequences, then use the output of each step as input for the next step [18].

The procedure for developing an integrated CBT e-module is carried out through several stages, including: (a) Analysis, namely conducting an analysis to collect information related to student needs and reviewing literature related to the product being developed; (b) Design, is the stage carried out to identify goals and design teaching materials and learning media to be developed; (c) Development, is the stage to realize the design into a product that is ready to be implemented; (d) Implementation, namely implementing the developed product in the form of an integrated CBT e-module; and (e) Evaluation, namely conducting an evaluation by analyzing the effectiveness of the integrated CBT e-module on students' higher order thinking skills (HOTS).



Figure 1. ADDIE Development Model

The techniques and instruments used in this study include (a) interviews used for data collection when conducting research as a preliminary study material to look for problems to be studied and used in product trials both during validation to experts and product trials in the field as consideration in improving the developed e-module; (b) validation sheet used to obtain data on the results of expert validation on the integrated CBT e-module developed to test its feasibility or validity; and (c) a test instrument designed to obtain data on CBT-based student literacy HOTS. CBT is prepared and developed in accordance with HOTS literacy indicators including C4, C5 and C6 on Biochemistry, Solutions, Thermochemical materials.

The research data were analyzed in stages to determine the feasibility and effectiveness of the developed CBT integrated e-module. The data from the validation of the experts were analyzed by considering the input, comments, and suggestions from the validator. The results of the analysis are used as guidelines for revising the developed teaching materials. The validity of the e-module that has been made can be analyzed from the validation sheet filled in by the expert validator and the results of questions and answers during the validation process. The effectiveness of the developed CBT integrated e-module is obtained from the results of CBT on students' higher order thinking skills (HOTS). The effectiveness test was analyzed from increasing literacy HOTS with a t-test with a paired sample t-test approach with the help of the SPSS program.

### 3. RESEARCH RESULT

The product developed in this study is in the form of an integrated CBT e-module in the General Chemistry course on Biochemistry, Solutions and Thermochemistry. E-modules are compiled and developed using the Kvisof Flipbook Maker application so that students can read by feeling like reading a book physically with the help of a computer, laptop or Android because there is an animation effect where when switching pages it will look like physically opening a book. Validation or feasibility of the integrated CBT e-module is evaluated by expert validators in their field. The products produced and have been declared feasible by expert validators are then applied to students to analyze the effectiveness of the products produced.

#### 3.1 Product feasibility

The feasibility (validity) of the e-module in the General Chemistry course for Biochemistry, Solutions and Thermochemistry developed, evaluated and assessed by expert validators based on the feasibility of the material and the feasibility of the media.

**Table 1. E-module validation results on the material aspect**

Course	Aspects of assessment	Mean Score	Criteria
Biochemistry	Content feasibility	4.11	Valid
	Serving feasibility	4.23	Valid
	Language feasibility	4.15	Valid
	HOTS rating	4.20	Valid
	Total Mean	4.16	Valid
Solutions	Content feasibility	4.28	Valid
	Serving feasibility	4.10	Valid
	Language feasibility	4.26	Valid
	HOTS rating	4.27	Valid
	Total Mean	4.23	Valid
Thermochemistry	Content feasibility	4.11	Valid
	Serving feasibility	4.23	Valid
	Language feasibility	4.15	Valid

HOTS rating	4.20	Valid
Total Mean	4.16	Valid

Table 1, shows the results of the assessment and evaluation of material expert validators in the e-module of the General Chemistry course for Biochemistry, Solutions and Thermochemistry. The results of expert validation on biochemical material obtained an average total score of 4.16 or declared valid. The results of expert validation on the solution material obtained an average total score of 4.23 or declared valid. The results of expert validation on thermochemical material obtained an average total score of 4.16 or declared valid. Thus, overall the results of the material expert validator's assessment concluded that the e-module of the General Chemistry course on Biochemistry, Solutions and Thermochemistry developed had met the valid criteria in the material aspect so that it was feasible to be applied in learning.

**Table 2. E-module validation results on the media aspect**

Course	Aspects of assessment	Mean Score	Criteria
Biochemistry	Software	4.30	Valid
	Interface view	4.11	Valid
	Visual communication	4.04	Valid
	Characteristics of e-module	4.27	Valid
	Total Mean	4.18	Valid
Solutions	Software	4.23	Valid
	Interface view	4.19	Valid
	Visual communication	4.13	Valid
	Characteristics of e-module	4.27	Valid
	Total Mean	4.20	Valid
Thermochemistry	Software	4.30	Valid
	Interface view	4.11	Valid
	Visual communication	4.04	Valid
	Characteristics of e-module	4.27	Valid
	Total Mean	4.18	Valid

Table 2, shows the results of the assessment and evaluation of media expert validators in the e-module of the General Chemistry course for Biochemistry, Solutions and Thermochemistry. The results of media expert validation on biochemical material obtained an average total score of 4.18 or declared valid. The results of media expert validation on the solution material obtained an average total score of 4.20 or declared valid. The results of media expert validation on thermochemical material obtained an average total score of 4.18 or declared valid. Thus, overall the results of the media expert validator's assessment concluded that the e-module of the General Chemistry course on Biochemistry, Solutions and

Thermochemistry developed had met the valid criteria in the media aspect so that it was feasible to be applied in learning.

### 3.2 Achievement of student literacy HOTS

Student literacy HOTS achievements are obtained through CBT-based tests given before and after utilizing the resulting CBT integrated e-module. This stage is carried out to 30 students and each material is carried out in 3 (three) stages including: (1) the initial stage, namely giving a CBT-based pretest before students take action using the resulting CBT integrated e-module, (2) the second stage, namely the learning process in which students learn online by utilizing the integrated CBT e-module, and (3) the third stage, namely the administration of the CBT-based final HOTS test (posttest).

Table 3. Achievement of student literacy HOTS

HOTS Literacy	Min	Max	Mean	S.Dev	K-S Test	Sig
Pretest	48	72	60.87	6.073	0.953	0.324
Posttest	76	100	90.47	5.865	1.113	0.168

Table 3 shows the achievement of the students' initial literacy HOTS test results (pretest) before being given the e-module, the lowest score was 48, the highest score was 72 with an average value of 60.87 and a standard deviation of 6.073 and the data had a normal distribution with the Kolmogorov-Smirnov score. test = 0.953 and  $p = 0.324$ . After taking action through learning using integrated CBT e-module, the posttest results obtained the lowest score of 76, the highest score of 100 with an average student literacy HOTS score of 90.47 and a standard deviation of 5.865 and the data has a normal distribution with the Kolmogorov-Smirnov value. test = 1.113 and  $p = 0.168$ .

### 3.3 Product effectiveness

The effectiveness of the developed General Chemistry e-module was analyzed from the increase in student learning outcomes in completing the literacy HOTS test using a pretest-posttest design. The test results were analyzed using a t-test or a paired sample t-test approach using the SPSS program.

Table 4. Test results paired sample t-test

	Paired Differences	t	df	Sig
Pair 1 Posttest -pretest	29.600 8.024	20.205	29	0.000

Table 4 shows the results of the t-test with the paired sample t-test approach and the average difference or difference in the posttest-pretest HOTS scores for student literacy is 29.600 with a standard deviation of 8.024 and a t-value of 20.205 with probability or Sig. of  $0.000 < 0.05$ . Thus, it is concluded that the application of integrated online teaching material based on HOTS-based media that has been developed has proven to be effective in increasing student HOTS in General Chemistry courses (Stoichiometry, Inorganic Compounds and Organic Compounds material).

## 4. CONCLUSION

This research and development resulted in an integrated CBT e-module in General Chemistry courses (Biochemistry, Solutions and Thermochemistry materials). E-Modules are developed using the Kvisof Flipbook Maker software or application through the ADDIE development model. The resulting CBT integrated e-module has met the valid criteria and has been proven to be effective in increasing student literacy HOTS. The validity is met qualitatively based on the assessment of the validators of material experts and media experts which are overall stated in the valid category. The effectiveness is fulfilled based on the implementation of learning using integrated CBT e-modules and evidenced by the increase in student literacy HOTS achievements and from the results of statistical hypothesis testing. Student responses to the resulting e-modules are also very positive because the e-modules are designed using the Kvisof Flipbook Maker application so that students can read by feeling like reading a book physically because there is an animation effect when moving page by page it will look like physically opening a book. This e-module can also be opened on a laptop, computer or android device and can be run offline so that the material can be repeated anytime and anywhere, besides that the material and questions contained in the e-module are arranged in an integrated CBT.

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