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Development of Acid-Base E-Module Based on Contextual Approach with REACT Strategy to Improve Students' Learning Outcomes

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Abstract: This study aims to produce teaching materials in the form of e-modules based on a contextual approach with a REACT (Relating, Experiencing, Applying, Collaborating, Transferring) strategy on acid-base materials.This development is a type of EDR (Educational Design Research) research with a plomp research model. Lecturers and teachers act as expert reviews, and 9 students become research subjects in this development research. The data obtained in the form of content validity, construct, linguistic and graphic data were processed using the AIken's V formula, while the practicality data was processed using practical percent. Based on the results of the study, the V value for content validity was 0.84, construct validity was 0.83, linguistic validity was 0.84 and graphic validity was 0.87, which were included in the valid category. Then the practicality results show a value of 90% with a very practical category and the results of the effectiveness test show that e-modules can improve student learning outcomes

Keywords: e-modul, contextual approach, REACT learning strategy, acid base

Abstrak: *Penelitian ini bertujuan untuk menghasilkan bahan ajar berupa e-modul berbasis pendekatan kontekstual dengan strategi REACT (Relating, Experiencing, Applying, Collaborating, Transferring) pada materi asam basa. Pengembangan ini merupakan jenis penelitian EDR (Educational Design Research) dengan model penelitian plomp. Dosen dan guru sebagai expert review, dan 9 mahasiswa menjadi subjek penelitian dalam penelitian pengembangan ini. Data yang diperoleh berupa data validitas isi, konstruk, kebahasaan dan kegrafisan diolah menggunakan rumus aiken's V, sedangkan data kepraktisan diolah dengan persen praktis. Berdasarkan hasil penelitian diperoleh nilai V untuk validitas isi 0,84 validitas konstruk 0,83 validitas kebahasaan 0,84 dan validtas kegrafisan 0,87 yang termasuk dalam kategori valid. Kemudian hasil praktikalitas menunjukkan nilai sebesar 90% dengan kategori sangat praktis dan hasil uji efektivitas menunjukkan bahwa e-modul dapat meningkatkan hasil belajar siswa. Sehingga dapat disimpulkan bahwa e-modul yang dikembangkan sudah valid dan praktis sehingga layak digunakan dalam pembelajaran*

Kata kunci: *e-modul , pendekatan konstekstual, strategi REACT, asam basa.*

▪ INTRODUCTION

Science and technology has experienced very rapid development in this 4.0 revolution era. The industrial revolution 4.0 has indirectly changed the perspective on 21st Century education (Burritt & Christ, 2016; Putri & Saputro, 2019). The main competencies that must be possessed by students in 21st century learning include learning and innovation skills, and mastering information media (Bao & Koenig, 2019; Trilling &

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Fadel, 2009). One of the efforts to support the progress of 21st century learning is to use technology-based teaching materials in the learning process.

Since the beginning of 2020 the world has been shocked by the emergence of virus outbreaks in various countries including Indonesia. In pandemic conditions that do not know when this will end and policies are still changing, electronic teaching materials are more needed in the learning process because they can be accessed anytime and anywhere (Zhang et al., 2021; Kumar, Saxena, & Haber, 2021) One variation of these teaching materials is the e-module (Nantomm et al., 2017). E-module is a form of presenting self-study materials that are systematically arranged into certain learning units, which are presented in an electronic format, where every learning activity in it is connected by a link as a navigation that makes students more interactive with the program, equipped with video presentations, animation and audio to enrich the learning experience (Kemendikbud, 2017).

The e-module developed in this study was arranged based on the REACT (Relating, Experiencing, Applying, Cooperating, Transfering) stages which are learning stages following the basic principles of constructivism learning theory (Crawford, 2001). The development of e-modules must be in accordance with the 2013 curriculum which expects students to be skilled in using media, technology, information and communication needed in the 21st century. The 2013 curriculum emphasizes students being the center of learning, where students must seek and find concepts from the material being studied (Kemendikbud. 2017).

Acid-base material is a material that is considered difficult by teachers and students because this material includes understanding other chemical materials such as chemical equilibrium, stoichiometry, chemical nature, and solutions (Amry et al., 2016). many examples in everyday life (Kala et al., 2012). Based on the characteristics of the acid-base material, this material is very suitable to be developed using the REACT strategy which is part of contextual learning (Ultay, 2016; Utamy, 2016). The contextual approach or CTL can be used to study acid-base material, because this approach connects the subject matter with real-life applications (Weinstein, 2018; Nursyahraini, 2020; Fauziah, 2020). The CTL approach is a learning design that involves the experience of students in real life with subject matter (Sariningsih, 2014; Sagita, 2021; Muhibbuddin, & Hayuni, 2021). Contextual learning with the REACT strategy is able to improve learning outcomes, science process skills, problem solving skills and chemical literacy of students (Syintia et al., 2018, Marliani, & Gazali, 2020, Hadinugrahaningsih & Kurniadewi, 2019; Handayani, 2015; Suhendi, 2019). Based on the descriptions above, this research has a direction to develop an acid-base e-module based on a contextual approach with the REACT strategy.

▪ METHOD

The research was conducted based on Educational Design Research, which designs, develops, and evaluates interventions such as programs, strategies, teaching materials, products and learning systems that become problems in the education cycle (Plomp & Nieveen, 2013). The Plomp model becomes the implementation guideline in this research with the following stages: preliminary research, prototyping and assessment stages. At the preliminary research stage, needs analysis, context analysis, literature study, and framework development are carried out. Furthermore, at the prototyping stage, researchers design products, learning tools, instruments, and validations. The e-module is designed in Microsoft word and Flip PDF Professional application. At the assessment

stage, researchers conducted a trial of e-module product development to measure the effectiveness and practicality of learning. The module was used in learning for four meetings. When learning using e-modules, students bring their own smartphones or laptops in learning, then the e-modules will be distributed to students in the form of links that are shared on class group WhatsApp social media. Students access the e-module by clicking on the e-module link that has been shared. Then students read the material in the e-module and do practice questions for each learning activity by applying the REACT learning steps in the e-module. The research sample at the assessment stage is one class at SMA Negeri 14 Padang, namely class XI IPA 1, which consists of 40 students with a random sampling technique. This research was conducted from September 2021 to January 2022.

The instrument used to measure the validity of the e-module is a questionnaire in the form of an expert validation sheet. Aspects assessed include aspects of content, material, presentation, language, and graphics. The assessment technique in the questionnaire uses a Likert scale with a score range of 1-4, with a description of the value of 4 being very valid, 3 valid, 2 being less valid, and 1 being invalid. The score obtained from the validation sheet will calculate the percentage and average of the six validators, namely four chemistry education lecturers and two chemistry teachers. E-module is said to be valid if it gets a validity value > 0.78 (Aiken's, 1985)

The instrument used to measure the practicality of the e-module is a practicality questionnaire. Assessment aspects include ease of use, time efficiency and benefits. Researchers conduct acid-base learning using e-modules, then observers will assess the implementation of learning by filling out practicality sheets. The observers were six students of class XII science at SMAN 14 Padang and two chemistry teachers at SMA N 14 Padang. The assessment technique in the questionnaire uses a Likert scale with a score range of 1-4 and is calculated using the practicality formula. If the results of 40%-60% practicality are sufficient, 60%-80% high practicality and 80%-100% very high practicality (Gitnita, 2018). The value obtained from the learning implementation sheet will be calculated by the percentage and average of the eight observers.

The instrument used to measure the effectiveness of the e-module is a test in the form of a pre-test and post-test to assess students' acid-base learning outcomes. The results of the pretest and post-test will be analyzed using n-gain. The effectiveness of the e-module is obtained by looking at the increase in student learning outcomes from the results of the pre-test and posttest. If the result of n-gain < 0.30, the increase in pre-test and post-test is low. If the n-gain result is 0.30 g < 0.70, the increase is moderate, and if the n-gain result is ≥ 0.70, the growth is in the high category (Hake, 1998).

▪ RESULT AND DISCUSSION

1. Preliminary Research

The researcher analysed the problems and needs experienced in learning in this stage, as an initial description of the research that will be carried out through a literature study from previous research. The data was also obtained through interviews with chemistry teachers at SMA N 8 Padang, SMAN 14 Padang and MAN 2 Pesisir Selatan. Interviews were conducted to find out how the chemistry learning process was carried out in schools, which included the media used, the application of technology in learning, learning approaches, etc. Based on the results of the interview, it is known that the teacher has never implemented chemistry learning with the help of e-modules, the average value of student exams on acid-base material still does not meet the minimum completeness

criteria. The teaching materials used by the teacher are still worksheets, powerpoint materials, and learning videos sourced from youtube.

2. Prototyping

At this stage the researchers developed learning tools, research instruments, and e-modules. Learning tools are arranged in the form of a syllabus and lesson plans. The research instrument made consisted of e-module validation sheets, practicality sheets and pre-test and posttest questions. The e-module was designed using Microsoft word, the researcher made the e-module display starting from the cover, content, and practice questions about other e-module components. This e-module was developed to improve student learning outcomes. This is indicated by the preparation of materials and practice questions that are adapted to the stages of contextual learning with the REACT strategy (Relating, Experiencing, Applying, Collaborating, Transferring). In the Relating stage, students are presented with videos containing learning instructions, learning objectives, perceptions, motivations, and introductory materials. An example of the relating video display on the E-module can be seen in Figure 1. The experiencing stage is the stage for students to explore and carry out problem solving activities. At this stage students are given questions that guide and practical activities to find concepts. An example of the experiencing stage can be seen in Figure 2.

Figure 1. Video Relating

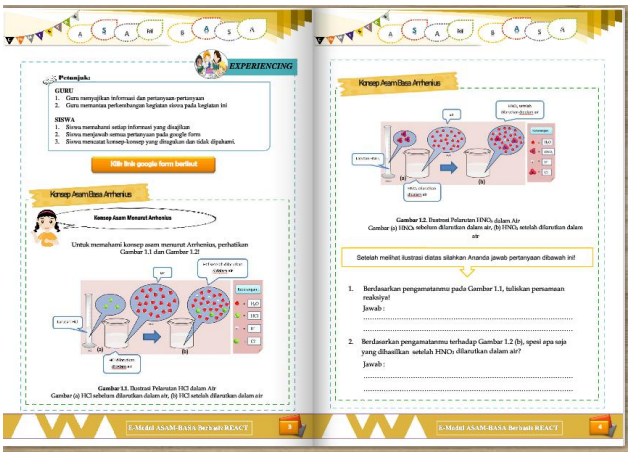

Figure 2. Questions at the Experiencing stage

The applying and collaborating stages are stages for students to apply the concepts that have been obtained in the experiencing stage (Karsli & Yigit, 2017; Ultay, 2012). At this stage, students are given exercises that are done in groups. An example of the applying stage can be seen in Figure 3. The transferring stage is the stage where students use the knowledge they already have in a new context (Bilgin et al., 2017 ; Jelatu & Ardana, 2018). At this stage students are given more varied exercises. An example of the transfer stage view can be seen in Figure 4.

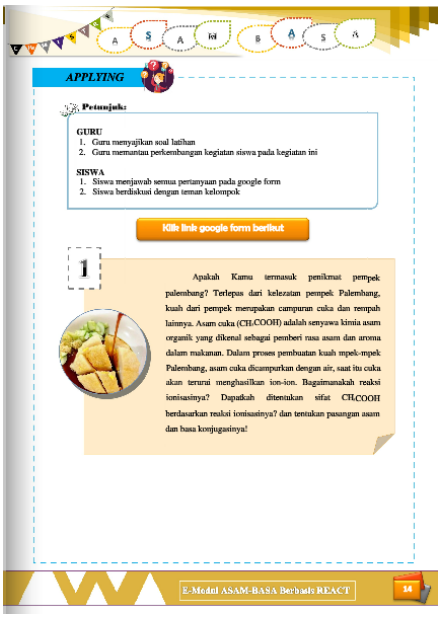

Figure 3. Applying stage

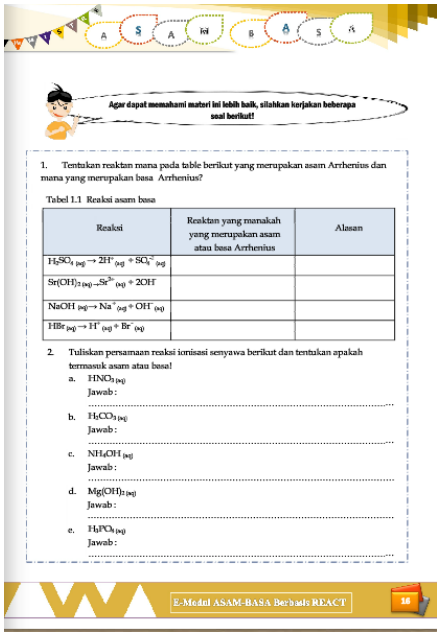

Figure 4. Transferring stage

Expert reviews are carried out by content experts and construct experts, by assessing and reviewing products carried out either with or without the presence of researchers(Tessmer, 1993). Validation was carried out by 4 chemistry lecturers and 2

teachers. Validation is carried out based on the guidelines of a valid validation sheet. In this process, several suggestions were obtained from the validator, which were then revised into input. After the revision was carried out, an assessment was obtained from each validator. Aspects of validator validity were measured using aiken's V formula, with a valid category of 0.78 for 6 validators (Aiken, 1985). The results of the validation analysis are presented in table 1.

Table 1. Media validation analysis results

Rated aspect	Percentage	Category Validity
Content components	84%	Valid
Construct components	83%	Valid
linguistic component	84%	Valid
Graphic component	87%	valid

The results of the e-module validation can be seen in Table 1. It is known that the average validity value of the six validators for the content component is 84%, the construct component is 83%, the linguistic component is 84% and the graphic component is 87% with valid categories. This result is in line with the opinion of Akbar (2013) that e-modules can be implemented in chemistry learning if the validity value is above 70% - 100%. Based on the validation results, it can be seen that the module shows a valid category and can be used. The e-module has been well structured in terms of content validity and construct validity. Nieveen (1999) states that a research development product is feasible if the product is adequate in terms of content and construct validity. Content validity means that the module has up-to-date requirements and circumstances. Construct validity means that all components of the e-module are consistently and interconnected. There are some suggestions from the validator that some of the writing and spelling of the words are wrong. This revised e-module will later be used in field trials to measure effectiveness and practicality.

3. Assessment Stage

Researchers carry out chemistry lessons on acid-base materials to evaluate the effectiveness and practicality of learning at this stage. When learning was held, students had no difficulty accessing e-modules, but some students had problems with the network and some did not have internet packages. These obstacles can be overcome by sharing the network with other friends to access the e-module. Practical evaluation was conducted on two teachers and six students. The results of the evaluation of the practicality of the e-module are shown in Table 2 and Table 3.

Table 2. Analysis of Student Practical Results

No	Rated aspect	Percentage	Category
1	Ease of Use	89.20%	Very Practical
2	Time efficiency	88.10%	Very Practical
3	Benefit	87.10%	Very Practical
Overall percentage		88.6%	Very Practical

Table 3. Teacher Practical Analysis Results

No	Rated aspect	Percentage	Category
1	Ease of use	91%	Very practical

2	Time efficiency	88%	Very practical
3	Benefit	90%	Very practical
Overall percentage		90%	Very practical

Student and teacher responses stated that each assessment component was practical in terms of ease of use, time efficiency, and benefits. Based on Table 2 and Table 3, it can be seen that the average practicality value of students is 88.6% and gut practicality is 90% which is included in the practical category. This is in line with Andriyani (2014) that the implementation of learning when the practicality value is more than 61%. So with the practical value of e-modules of 88.6% and 90%, it can be said that e-modules are very practical to be applied and used by students and teachers in learning chemistry on acid-base materials.

Table 4. Results of E-Module Effectiveness

Data	**Treatment**	
	Pretest	**Posttest**
Total students	40	40
Lowest score	15	60
Highest score	55	92.5
Average score	30.69	78.69
Standard deviation	8.49	6.63
N-gain	0.69	
Criteria	**Medium**	

Based on Table 4, the result of the N-gain analysis is 0.69 and according to Hake (1998) this result is in the medium category. So it can be said that there is an increase in student learning outcomes by learning using e-modules, with the increase being in the medium category. These results are in line with Astalini et al. (2019) that the use of e-modules in learning can train students' abilities and skills effectively. Based on the results of the N-gain analysis, the developed e-module is quite effective in improving student learning outcomes. According to Ratumanan & Laurent (2010), the learning process is effective if it follows the goals and achieves the desired results. The most inadequate ability is reasoning why a phenomenon can occur. The results of the development research show that the e-module is included in the valid, practical, and effective categories. E-modules can be used in chemistry learning, especially on acid-base materials to improve student learning outcomes in eleventh grade of science class. This follows Nieveen's (1999) statement that product development can be successful if the resulting product meets valid, practical, and effective criteria.

▪ CONCLUSION

Based on the results of research and study of e-module products based on the contextual approach with the REACT strategy, it can be concluded that the results of the expert's assessment of the e-module based on the contextual approach with the REACT strategy on acid-base material for eleventh grade of science class obtained valid and very practical criteria seen from the participants' responses. students and teachers to the developed and effective e-module used in the chemistry learning process, especially on acid-base material. Based on research, the use of e-modules can improve student learning outcomes.

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