

The Development of Electronic Publication Module Integrated with Means-Ends Analysis Learning Model to Improve Students' Analytical Thinking Skill in Stoichiometry Materials

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Abstract—Research on the development of integrated epub modules with means-ends analysis learning models on stoichiometry material aims to produce valid, practical, and effective epub modules. This development uses the ADDIE model. The epub-module trial that was developed was carried out on MAN 3 Banjarmasin students in 2018/2019 Academic Year. The trials carried out namely individual trials, small groups, and limited. Data collection techniques using validation sheets, readability questionnaires, response questionnaires and tests. Data analysis uses descriptive analysis. The results showed the developed epub-modules met the following criteria: (1) Valid, both from the aspect of the appropriateness of content, presentation, language, and media. (2) Practical, seen from the readability of epub-modules in individual and small group tests and students' responses to the use of epub-modules. (3) Effective, seen from the results of analytical thinking skills tests. The results of the development show that the use of epub-modules integrated means-ends analysis learning model on stoichiometry material is declared feasible, effective and can be used in chemistry learning.

Keywords: *epub-module, means-ends analysis, ADDIE*

I. INTRODUCTION

Chemistry is a science that discusses the composition, structure, properties, and reactions of a material. One chemical that studies the problem of chemical reactions in class X High School is stoichiometry. The concept of stoichiometry must be understood by students because it is used to study other chemical materials [1]. Stoichiometry is a material that is quite difficult for students [2]. The results of the chemistry teacher interview at Madrasah Aliyah Negeri 3 Banjarmasin also stated the same thing that there were many grades of students under the KKM in the 2017/2018 school year. That is due to the low ability to analyze the questions given so the difficulty in solving them [3].

Analyzing (C4) is a basic thinking skill from higher-order thinking skills [4]. The low ability to analyze this requires learning that can improve students' analytical thinking skills such as learning using the model means-ends analysis. The application of a means-ends analysis learning model in MAN 2 Banjarmasin Model and

Pekalongan State High School to improve the students' analytical skills and learning achievement [3] [5].

Learning media also play an important role in supporting learning. Along with the era of globalization, technology also affects learning media such as modules that are packaged in the form of e-learning namely e-modules [6]. Electronic modules (e-modules) that contain text, images, animations, and videos through electronic devices. E-modules can also be used as a choice of learning media that are efficient and effective, and interactive [7].

The experience of Field Teaching Practices at MAN 3 Banjarmasin shows that the chemistry subjects used are only printed books and Student Worksheet books which are very concise, not using e-modules. Whereas, the use of interactive learning modules (e-modules) with problem-based learning models on stoichiometry material proved to be more effective than using conventional methods [8].

Google, Inc. Survey through consumerbarometer.com shows that smartphone users in Indonesia are mostly under 24 years old. Teenage interest in Indonesia towards smartphones is widely used for entertainment, not yet leading to learning [9]. Therefore, it is necessary to develop e-modules that can also be accessed by smartphones such as epub-modules. Epub is a form of a digital book containing multimedia files, html5, CSS, XHTML, XML which can be accessed by various electronic devices [10].

The implementation of e-books with an epub extension has proven to be very good in increasing the interest and learning achievement of students with high criteria [11]. Which states there is an increase in the competence of students [12]. Research also shows that e-books with an epub extension are suitable for use as learning media. E-modules can also be developed in the form of epub [13]. The development of epub-modules in the discussion of electrolytes and non-electrolytes is even feasible for the visually impaired [14].

Based on these problems, the media and the use of learning models are needed to make it easier for students to understand stoichiometry material. The researcher wants to develop an integrated module-module learning model means-ends analysis to improve students' analytical thinking skills on stoichiometry material. The development of the epub-module is intended to facilitate students in solving the problems given when studying stoichiometry material.

II. METHOD

The study was conducted at MAN 3 Banjarmasin in class X IPA 3 semester II academic year 2018/2019. As a sample in individual trials, small and limited groups were used 3 people, 8 people and 33 people.

The research method used is the development of Analysis, Design, Development, Implementation, and Evaluation (ADDIE) models, which are research procedures based on analytical thinking (analytical thinking) or scientific thinking (scientific thinking). ADDIE model consists of stages namely analysis, design, development, implementation and evaluation. The design is presented in Figure 1 [15].

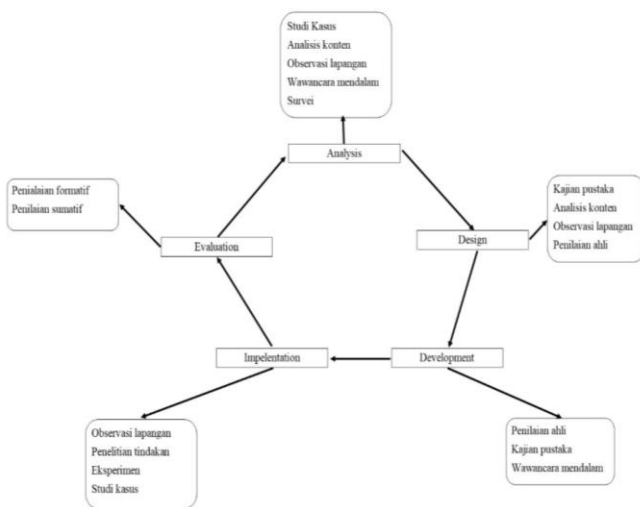


Fig. 1. ADDIE Development Research Design

Data are obtained through the results of observations, questionnaires and tests. Observations were made before the research. The questionnaire aims to obtain data from media experts, materials, test readability and response to the developed epub-module. The test is conducted to see changes in students' analytical thinking skills through tests before and after the use of epub-modules.

III. RESULTS AND DISCUSSION

The epub-modules have been successfully developed by using ADDIE model which is:

a. Analysis Stage

This stage consists of an analysis of needs such as curriculum, characteristics, prerequisite abilities, beginning and end of students as well as an analysis of the learning environment. Learners find it difficult to understand the material in the printed student worksheet

book because it is too short too incomplete, so it is necessary to develop more innovative and more complete books in describing a material such as epub-modules because it is equipped with videos and also web site links.

b. Design Stage

Researchers determine the development team consisting of validators, media experts, materials, programmers, technicians and users. Validators used were 5 people consisting of 1 media expert and 4 material experts, while the researcher himself conducted the programmer and technician.

c. Development Stage

The epub-module was developed by gathering materials for media making which then integrated the syntax of the means-ends analysis learning model in problem-solving, making a validation questionnaire, validating the epub-module then making improvements based on the improvements given by the media validator and material experts. The content validity aspect gained 93% (very valid), 92.08% presentation (very valid), Language 91.92% (very valid) and media 94, 38% (very valid).

Based on the results of these percentages, the integrated modules of the learning model means-ends analysis are very valid so that they are feasible to be used without revision. However, the validator provides input to improve some of the words used in sentences to make it easier to understand the material presented in the epub-module.

The epub-modules developed were valid according to the material experts and media experts, with a value on the contents of the epub-module content of 93% (very valid). This acquisition can't be separated from several aspects, namely: (1) The material contained in line with learning objectives. (2) Learning materials are made accurate both in the explanation of concepts, example problems, pictures and illustrations. (3) Supporting the presentation material in order to increase interest, interest and be more communicative through videos and website links so that students can expand their knowledge. The learning process utilizing technology makes learning interesting so that students are motivated [16]. (4) Writing content using up-to-date reference books in accordance with scientific development and the needs of students so that it is feasible to disseminate the development carried out must be in accordance with the development of time and science [17].

An evaluation of the presentation of the epub-module obtained a percentage of 92.08% (very valid). This acquisition is inseparable from several aspects, namely: (1) Consistent and sequential epub-module presentation techniques. (2) Supporting the complete presentation of preface, epub-module characteristics, table of contents, bibliography, summary, analytical thinking skills test, evaluation, answer key and glossary. (3) Presentation of learning involves students, namely the presence of stages in solving problems using the syntax of means-ends analysis learning model that consists of determining the

current state, subgoals and goal state (4) a complete presentation that is the introduction, content and closing.

The epub-module assessment of grammar obtained a percentage of 91.92% (very valid). This acquisition is inseparable from several aspects, namely: (1) The contents of the material in straightforward epubs namely the precise sentence structure, effective, and standard terms. (2) The contents of the material in communicative epub modules namely having a readability of the information conveyed and the accuracy of the use of language rules. (3) Epub-modules are dialogic and interactive because they are able to motivate, encourage analytical thinking or make students ask deeper questions. (4) Corresponds with students' thoughts and emotional development. (5) The flow of thought that is collapsed and integrated. (6) Consistent use of symbols, terms, or icons.

The assessment of the media obtained a percentage of 94.38% (very good). This acquisition is inseparable from several aspects, namely: (1) The appearance and content of the epub-modules have a composition of colors, illustrations, images, letters, layout and attractive videos. The proportionality of font size, variation, color attractiveness, and layout placement make students motivated and interested in learning epub-modules [18]. (2) The use of epub-modules using Android makes it easy for students to access learning all the time so that learning becomes fun and is the use of Android in a positive direction [19].

d. Implementation Stage

The implementation stage is carried out in class X IPA MAN 3 Banjarmasin in Academic Year 2018/2019. The implementation is carried out in three stages, namely individual and small group legibility testing, and students' responses to find out the practicality of the epub-module through the readability questionnaire and students' responses. After the trial is conducted, researchers correct the deficiencies and overcome the problems that still occur when the epub-module is used. The comparison of readability test results on individual and small group tests is presented in Figure 2 as follows:

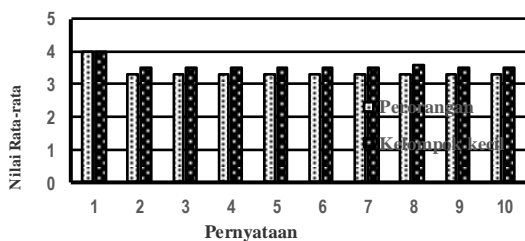


Fig. 2. Individual and Small Group Readability Test

In Figure 3 it can be seen that after the revision of the individual test, there has been an increase in small group trials.

Learners also respond to the application of learning using epub-modules developed to find out practicality through a questionnaire provided by researchers. Students'

responses to the epub-module in the limited trial are presented in Figure 3 as follows:

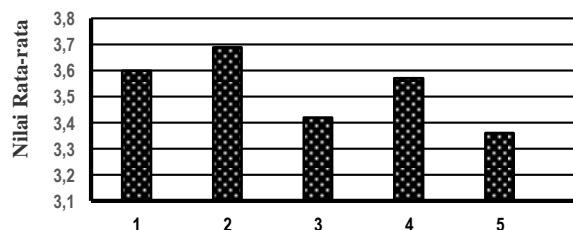


Fig. 3. Average results of students' responses

The average student response results in statements 1-7 have an average value between 3.25-4.0, which means it is included in the excellent category.

Based on the assessment of students in the epub-module readability test, it is said that it is practically seen from the results of individual tests of 3.43 and small groups of 3.55, including the excellent category. This is inseparable from several things, namely: (1) The design of covers and drawings in epub-modules in accordance with the stoichiometric material studied and clear and not opaque. (2) The writing in the epub-module uses clear letters, the combination of letters, colors, and pictures is harmonious and the sentences are communicative and the terms are easy to understand. (3) Videos in the modules are clear and easy to understand. The statement of learning using video makes students enthusiastic and active in learning compared to conventional learning [20].

Based on the results of the epub-module student responses, it was considered practical, obtaining a score of 3.56 (excellent). This is inseparable from a number of things, namely: stoichiometric material can be understood by participants appropriately and clearly, making it easier to solve problems both independently and in groups to foster communication between students and teachers, and foster awareness and students are more motivated to solve problems which is presented through the steps of analysis.

e. Evaluation Stage

The evaluation stage is carried out to analyze the shortcomings of the epub-module at the implementation stage. If there are no more revisions, then it is declared to be appropriate. Students are given analytical thinking skills tests to find out the effectiveness of using epub-modules to help improve students' analytical thinking skills in achieving learning goals as seen through the N-gain value of test results. The average analytical thinking skills test results are presented in Figure 5 below:

Fig. 5. Before Test and After Test in Limited Trials

The figure above shows that the test value before was 5.69% after the test was 72.24%, it was seen an increase with an N-gain of 0.703. This is caused by the use of epub-modules presenting problem solving using the syntax of the means-ends analysis learning model. Increased analytical thinking skills indicate that epub-module is effectively used in learning.

The developed epub-module was declared to be effectively used in stoichiometry material based on a high

N-gain value of 0.703. The development of interactive learning modules (e-modules) with learning models using problems in the stoichiometry discussion proved to be more effective than using conventional methods [8]. The learning in this study uses problems in the discussion of material such as means-ends analysis models that are integrated into epub-modules. This learning model makes students think more actively and improve their analytical skills so they can get the right solution.

IV. CONCLUSION

In this study, it can be concluded that the integrated modules of the learning model mean that ends analysis of the developed stoichiometry material is very valid in terms of content, presentation, language and media. The epub-module is also stated to be practical and effective which is seen based on the results of the readability test and the students' response which is very good as well as the value of N-gain obtained is included in the high category.

REFERENCES

- [1] R. Chang. *Kimia Dasar*. Jakarta: Erlangga, 2005.
- [2] N. Laela. Penerapan Strategi Komandan (Kompetensi Maju ke Depan) pada Stoikiometri Kimia untuk Meningkatkan Aktivitas dan Hasil Belajar Peserta Didik. *Jurnal Penelitian Pendidikan*, Vol. 19 (2), pp. 145-155, 2016.
- [3] N. Jurniyarti. Penerapan Model Pembelajaran Means Ends Analysis dalam Setting DI untuk Meningkatkan Hasil Belajar Siswa. *Jurnal Berkala Pendidikan Fisika*, pp. 283-292, 2014.
- [4] T. Irawati, and M. Mahmudah. Pengembangan Instrumen Kemampuan Berpikir Analitis Siswa SMP dalam Menyelesaikan Soal Pemecahan Masalah Matematika. *Jurnal Kadikma*, pp. 1-11, 2018.
- [5] F. Karima, and K. Supardi Penerapan Model Pembelajaran MEA dan REact pada Materi Reaksi Redoks. *Jurnal Inovasi Pendidikan Kimia*, Vol. 9 (1), pp. 1431-1439, 2015.
- [6] K. M. Nugroho, S. B. Raharjo, and M. Masykuri. Pengembangan E-Modul Kimia Berbasis Problem Solving dengan Menggunakan Moodle pada Materi Hidrolisis Garam untuk Kelas XI SMA/MA Semester II. *Jurnal Inkuiri*, Vol. 6 (1), pp. 175-180, 2017.
- [7] I. Suarsana, and G. Mahayuti. Pengembangan E-modul Berorientasi Pemecahan Masalah untuk Meningkatkan Keterampilan Berpikir Masalah untuk Meningkatkan Keterampilan Berpikir Kritis Mahasiswa. *Jurnal Pendidikan Indonesia*, Vol. 2 (2), pp. 264-275, 2013.
- [8] D. Simbolon. Perkembangan Modul Pembelajaran Interaktif dengan Menggunakan Pembelajaran Berbasis Masalah untuk Meningkatkan Prestasi Siswa dalam Pengajaran Stoikiometri. *Prosiding Serata Bidang MIPA BKS-PTN Barat*, pp. 411-417, 2015.
- [9] E. K. Aribowo. Penggunaan aplikasi Smartphone untuk Mendukung Mobile Learning. *Optimalisasi Pembelajaran Bahasa Indonesia yang Berkualitas pada Era MEA*. Surakarta: Seminar Nasional Pendidikan Bahasa Indonesia 2015, pp. 31-38, 2015.
- [10] K. Umam. Pengembangan Media Pembelajaran Buku Digital Elektronik Publication (EPUB) pada Mata Pelajaran Teknik Mikroprosesor di SMK. *E-Journal Universitas Negeri*, Vol. 7 (5), pp. 399-409, 2017.
- [11] H. Hasbiyati, and L. Khusnah. Penerapan Media E-Book Berekstensi EPub untuk Meningkatkan Minat dan Hasil Belajar Siswa pada Mata Pelajaran IPA. *Jurnal Pena Sains*, Vol. 4 (1), pp. 16-21, 2017.
- [12] M. Aji, and D. Widjanarko. Pengembangan Media Pembelajaran Memahami dan Memelihara Sistem Starter Tipe Konvensional Berbasis Buku Digital Electronic Publication (EPUB). *Jurnal Pendidikan Teknik Mesin*, Vol. 16 (1), pp. 37-42, 2016.
- [13] A. Sari. Pengembangan Buku Digital Melalui Aplikasi Sigil pada Mata Kuliah Cookies dan Candys. *Jurnal Science Tech*, Vol. 1 (2), pp. 46-54, 2016.
- [14] B. Satrio. Modul Kimia Berbasis Epub untuk Siswa Tunanetra. *Journal of Disability Studies*, pp. 87-108, 2016.
- [15] M. Rusdi. *Penelitian Desain dan Pengembangan Kependidikan*. Depok: Rajawali Press, 2018.
- [16] A. Zahir. Pengaruh Pemanfaatan Teknologi Pembelajaran Terhadap Motivasi Belajar Siswa SMPN 1 Lanrisang Kabupaten Pinrang. *Jurnal Universitas Negeri Makasar*, pp. 1-6, 2018.
- [17] S. Rahayu, and I. G. Mertha. Pengembangan Bahan Ajar Micro Teaching untuk Melatih Kompetensi Pedagogik Calon Guru. *Jurnal Fisika dan Teknologi*, Vol. 3, No. 2, pp. 232-238, 2017.
- [18] M. Hersandi, I. K. Mahardika, and Nuriman. Pengembangan Bahan Ajar Lembar Siswa (LKS) dalam Bentuk Brosur untuk Pembelajaran IPA di SMP Ditinjau dari Aspek Kegrafikaannya. *Jurnal Pembelajaran dan Pendidikan Sains*, pp. 57-64, 2017.
- [19] G. Hendrastomo, and N. E. Januarti. Pengembangan Bahan Ajar Berbasis Teknologi Informasi Bagi Guru Sosiologi Kabupaten Purworejo (Aplikasi Game HTML 5 dengan Construct 2). *Jurnal Pendidikan, Sosiologi dan Antropologi*, Vol. 2 (1), pp 92-104, 2018.
- [20] F. Kurniawan. The Use Of Audio Visual Media In Teaching Speaking. *Education Journal*, Vol.5 (2), pp. 180-193, 2016.