UNESA Journal of Chemical Education *ISSN: 2252-9454*
Vol.12, No.1, pp. 8-16, January, 2023

DEVELOPMENT E-MODULE FLIPBOOK BUFFER SOLUTION BASED ON DISCOVERY LEARNING MODEL

Syamriani Syamriani, Jusniar Jusniar*, Hardin Hardin
Jurusan Kimia, FMIPA, Universitas Negeri Makassar

e-mail: jusniar@unm.ac.id

Abstract

This research and development aim to produce a valid, practical, and effective e-module buffer solution flipbook. The development of this e-module refers to the ADDIE development model which includes the analysis stage, the design stage, the development stage, the implementation stage, and the evaluation stage. There are four subjects in this research, namely media experts and material experts as validity test subjects, chemistry teachers as the practicality test subject,ct, and 35 students in class XI MIPA 3 as the practicality and effectiveness tests subjects. The instruments used for validity are validation sheets by media experts and material experts, practicality, namely observation sheets on the implementation of e-module, teacher and student response questionnaires, and effectiveness, namely learning outcomes tests. The results of this study are: (1) the validity of the digital module from the material expert is 3,6 and the media expert is 3,5 which is in the very valid category with a consistency test between validators are 100% which is in very high criteria, (2) the average percentage of e-module practicality is 85,66%, where the percentage of practicality based on the questionnaire responses of students and teachers the to the digital issue is 85,33% and 86% in the very practical category, 3) e-module meet the effective criteria (≥85%) based on the achievement of class completeness with percentage 88,57%. Based on these data, it is concluded that the e-module flipbook buffer solution developed with the ADDIE model is valid, practical, and effective for use in learning.

Keywords: *ADDIE, E-Module, Buffer Solution*

INTRODUCTION

21st Century Learning is learning that combines literacy skills, knowledge skills, skills and attitudes, and mastery of technology. The use of technology as a learning medium is familiar, ranging from very simple technology to sophisticated technology. Technology can be used to attract students' interest in learning so that learning becomes more effective and efficient [1].

The 2013 curriculum is developed in an integrative, dynamic, comprehensive, accommodating, and an aspirational way to the challenges faced in the future [2]. The characteristics of the 2013 curriculum demand various changes in the learning process in schools. The demands for these changes include learning with a process approach, training or familiarizing students to think critically, creatively, and innovatively, implementing a scientific approach, and utilizing technology [3].

Concepts in chemistry are interrelated and require high reasoning [4]. One of the main materials that require high reasoning in chemistry learning is buffer solution material so this material has the potential to cause students' low understanding of concepts. This is in results of Sariati's research (2020), which states that students' understanding student's components of a buffer solution are still lacking, students' understanding of the concept of abasedseid base is still low, and students' abilities in stoichiometry (chemical calculations) are still weak [5].

One way to improve learning outcomes is by using media so that students can be more active and easy to understand the material. Arsyad (2010) states that the use of media in the teaching and learning process can generate new desires and interests, generate motivation and

stimulation of learning activities, and can even bring psychological effects on students [6].

Learning media should be designed as attractive as possible so that the expected learning objectives can be achieved. One of the media variations that can be used is the flipbook e-module. This flipbook is shaped like a book but in digital form. Flipbooks can be created using a flipbook maker application that allows us to create interactive learning content with several supporting features [7]. This application not only inserts text, but can also insert pictures, graphics, sound, links, and videos on the worksheet. In general, this media device can include files in the form of pdf, images, videos, and animations, to make teaching materials more interesting. In addition, Flipbook Maker has design templates and features such as backgrounds, control buttons, navigation bars, and backsounds [8].

The advantage of the flipbook e-module learning media is that it is very good for independent learning activities because it can be accessed at various times and places, and students are not bored with reading the material being studied even though it is in the form of a book. But behind the advantages of this media, there are also disadvantages, namely, it requires careful planning and a long time to modify the media. The development concept used in this research is the development of the ADDIE model (Analysis, Design, Development, Implement, Evaluate). Gunawan (2018), shows that e-module teaching materials developed for learning have a potential effect on learning outcomes as well as increasing student activity [9].

The use of learning media will be more effective if it collaborates with an appropriate learning model which has been suggested by the 2013 curriculum, one of which is the discovery learning model. The discovery learning model is one of the learner-centered learning models st it involves the ability to investigate and find students systematically, creatively, and logically [10]. So that the discovery learning model is expected to be suitable for collaboration with media that can increase students' interest in learning.

Based on the description above, the researcher intends to conduct a study under the title "*Development of E-Module Flipbook Buffer Solution Based on Discovery Learning Model"*

METHOD

The research method used is research and development. Research and Development is a research method used to create certain products and test their effectiveness of certain products [11]. This research refers to the ADDIE development model (Analysis, Design, Development, Implement, Evaluate).

The flipbook e-module is implemented in the learning process at SMA Negeri 9 Maros for the 2021/2022 academic year. The subjects of this study were: media experts are two lecturers of learning technology and material experts are two chemistry lecturer to determine the validity of the developed media; Teachers in the field of chemistry studies to determine the practicality of flipbook e-modules, and 35 students of class XI MIPA 3 as respondents to determine the practicality and effectiveness of the media.

The instrument used to assess the feasibility of the e-module, the validity test is a validation sheet for material experts and media experts. Material expert are people who are experts in particular fields, in this case by lecturers in chemistry departement, state university of Makassar. Media experts are people who understand the media to be developed in the form of e-module, in this case by lecturers in chemistry departement, state university of Makassar. The practicality test is the implementation observation sheet, and student and teacher questionnaire sheets. The effectiveness test is a posttest question at the end of the lesson to determine the results of the cognitive abilities of students after being given learning using the media that has been developed. Learning tools that support this research are lesson plans and syllabus so that the learning

process is structured and the learning objectives can be achieved.

Data analysis techniques used in this study are qualitative and quantitative data analysis techniques. Qualitative data analysis is the process of organizing, analyzing, and interpreting data to explain the validity, practicality and effectiveness of media [19]. The analysis of the results of the validation of the feasibility of the flipbook e-module using the Likert scale percentage score.

RESULTS AND DISCUSSION

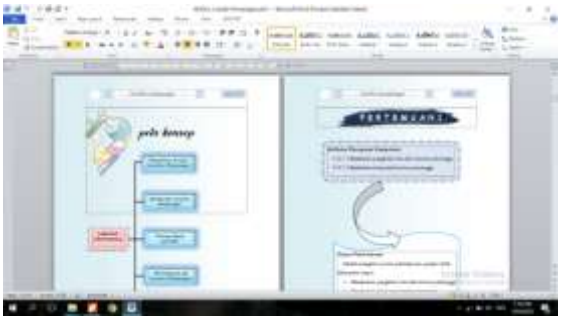
1. Research result

Base on research that has been done before there is an increase in student is understanding of the concept using learning modules with students who do not use module. To student learning interest there is an increase in learning by using modules rather than student who learn not to use the module [20]. In accordance with the use of current technology, media development in the form of e-module is carried out.

Research and development of the resulting flipbook e-module learning media were developed using the ADDIE model which consists of:

Analysis, at this stage the researcher conducts a performance analysis and needs analysis as a basis for development. Performance analysis shows that the learning media used are conventional media in the form of textbooks and printed modules. In terms of the attractiveness and novelty of the media used, it has not been able to make chemistry subjects interesting. Needs analysis resulted that learning media innovation is needed that can increase learning motivation in the form of audio-visual and attractive designs. so that it can increase the spirit of learning and attract the attention of students in learning.

Design, the design stage is very important because at this stage a flipbook e-module learning media design will be produced based on data from the results of the analysis stage. At this stage, several steps were carried out, namely making a flipbook e-module, and making research instruments. Flipbook e-module design using Microsoft Word and Flip PDF Professional applications.



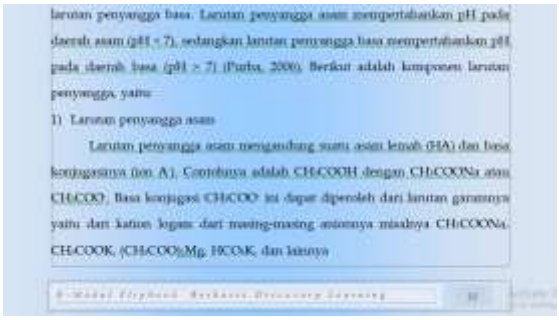
Picture 1. E-Module Design Process With Microsoft Word Application

Development, products that have been designed are realized into products that are ready to be implemented, which are expertly validated first by material experts and media experts. Validation by material experts covers three aspects, namely aspects of material content, presentation of material, and aspects of language feasibility. The content aspect of the material aims to determine the suitability of the material presented by the expected basic competencies. The aspect of material presentation aims to find out whether the material presented is arranged systematically to fulfill basic competencies. Meanwhile, the language feasibility aspect aims to whether find out the language used in the content is easy to understand and clear. The data from the validation by material experts are as follows:

Table 1. Material Expert Assessment Data

Assessment Aspect	V1	V2	Average Score	Category
Contents	3,7	3,5	**3,6**	Very Valid
Material Presentation	3,6	3,6	**3,6**	Very Valid
Language Eligibility	4	3,6	**3,8**	Very Valid
Average			**3,66**	**Very Valid**

One of the improvements to the flipbook e-module media based on the advice given by material experts is to add examples of a weak acid and weak base compounds.



(a)

(b)

Picture 2. Revision of Content Examples of Weak Acids and Weak Bases (a) before and (b) after revision

In addition to material experts, the flipbook e-module is also validated by media experts. Validation by media experts covers two aspects, namely operational aspects, and media display or design aspects. The data from the validation results by media experts are as follows:

Table 2. Media Expert Assessment Data

Assessment Aspect	V1	V2	Average Score	Category
Operation	3,6	3,6	**3,6**	Very Valid
Appearance	3,4	3,5	**3,4**	Very Valid
Average			**3,5**	**Very Valid**

At this stage, the flipbook e-module was revised based on suggestions given by media experts. One of the improvements to the e-module media based on the suggestions given is the improvement of the flipbook e-module cover.

Implement, this stage is carried out after the product developed is declared valid and ready to be implemented in the learning process. Media implementation is carried out at SMA Negeri 9 Maros in the even semester of the 2021/2022 academic year. E-modules are implemented in the learning process in class XI MIPA 3 as many as 35 students will become respondents to determine the practicality and effectiveness of the developed e-modules. The practicality of the e-module was assessed from the observation sheet on the implementation of learning, and ent response questionnaires and teacher response questionnaires. The observation sheet on the implementation of the e-module is used to see the implementation of the developed media which is filled in by the observer. The following are the results of the learning implementation observation sheet.

Table 3. Results of the Learning Implementation Observation Sheet

Aspect	Average	Category
Preliminary Stage	97,5%	Sangat praktis
Core activities		
Stimulation	100%	Very practical
Problem Statment	100%	Very practical
Data Collection	100%	Very practical
Data Processing	100%	Very practical
Verification	100%	Very practical
Generalization	100%	Very practical
Closing Activities	96%	Very practical
Average	**99,2%**	**Very practical**

The results of the student response questionnaire and the teacher response questionnaire both from the aspect of ease of use, attractiveness, and the benefits that can be provided from the use of this media in the learning process are as follows:

Table 4. Student Responses to E-Modules

Assessment Aspect	Percentage	Category
attractiveness	85,43%	Very practical
Benefit	83,14%	Very practical
Ease of use	87,43%	Very practical
Average	**85,3%**	**Very practical**

Table 5. Teacher Responses to E-Modules

Assessment Aspect	Percentage	Category
Contents	85%	Practical
Content	80%	Practical
attractiveness	90%	Very practical
Benefit	85%	Practical
Ease of use	90%	Very practical
Average	**86%**	**Very practical**

In addition, to determine the effectiveness of the flipbook e-module, a learning outcome test is given to measure the ability of students which is carried out with multiple choice questions consisting of 20 questions. The following are the results of the student learning outcomes test:

Table 6. Student Learning Outcomes

Variable	Score XI MIPA 3
Research subject	35
Ideal Score	100
Material Completeness Criteria	75
Average	82,85
Maximum Score	96
Minimum Score	64
Number of Completed Students	31
Number of Uncompleted Students	4
Class Completion Percentage	88,57%

Evaluation is carried out at every stage of the process from the analysis stage to implementation by using a limited evaluation to produce a flipbook e-module that is suitable for use in learning.

2. Discussion

a. Flipbook E-module Media Development Process

The development of this flipbook e-module learning media follows the ADDIE (Analysis, Design, Development, Implement and Evaluate).

Analysis, this stage carried out two activities, namely performance analysis and needs analysis. Performance analysis during the learning process at SMAN 9 Maros experienced problems in providing digital media that could be accessed easily by students. While the printed books used in learning are difficult to understand and make students less motivated in learning because there are only text and images that are not colored. During learning, it is expected that students will be able to learn independently so media are needed that can help them learn independently. Teachers are required to innovate on the use of learning media by utilizing information technology and communication such as electronic media and e-learning or learning online [12].

In the needs analysis, three activities were carried out, namely curriculum analysis adapted to the basic competencies to be achieved in the buffer solution sub-material, analysis of student needs to be adapted to the diverse characteristics of students which can be used as an illustration in developing flipbook e-

modules and material analysis carried oidentifyingentify the main material by compiling the sub material of the buffer solution.

Design, this stage includes collecting materials and images, selecting applications, and compiling content and instruments used in the form of validation sheets and questionnaires compiled to evaluate the e-modules that have been made.

Development, at this stage the researcher realizes the design has been made into a finished product in the form of a flipbook e-module. In addition, this process also validates the media that has been developed, where at this validation stage the researcher involves media experts and material experts to provide assessments and input on the developed media.

Implement, at this stage, the valid e-module media is implemented in SMAN 9 Maros class XI MIPA 3 for as many as 35 students. The purpose of this implementation is to see the implementation of this media in real learning and also to get responses about the practicality of the media develby from students and teachers. In addition, to determine the effectiveness based on student learning outcomes tests so that later practical and effective media are obtained to be used in the learning process.

Evaluate, this stage is done by revising the shortcomings of the e-module that was developed based on the input and suggestions for improvement given. States that the evaluation stage is very important to evaluate each step to achieve the goal with the design and in the instructional materials to meet the needs of students. The evaluation stage carried out is a limited evaluation. This stage is carried out at each stage so that later it can produce e-modules that are valid, pra c, tical, and effectively used in the learning process [13].

b. The Validity, Practicality, and Effectiveness of the Flipbook E-Module

1) Flipbook E-Module Validity

The material expert assessment includes three aspects, namely aspects of material content, material presentation, and language feasibility. Based on Table 1, the aspect of material content obtained an average score of 3.6 in the very valid category. This shows that the material contained in the developed flipbook e-module media is suitable for achieving basic competencies. With some improvements according to the direction of the material expert. The selection of learning media needs to consider the content in the circular-relevance point, meaning that the use of media must be in accordance wibycontent and the objectives are clear [14].

In the aspect of presenting the material, it obtained an average score of 3.6 with a very valid category. This shows that the material presented in the flipbook e-module content is clear and has clear sources. A coherent presentation of material can make it easier for students to learn the material presented so that students can gain knowledge. In addition to the content of the material and its presentation, the language used in a learning media is also a very important factor in the delivery of learning materials. Based on the assessment of material experts, the language used in the flipbook e-module has an average score of 3.8 with a very valid category, this indicates that the language used is easy to understand.

The media expert's assessment can be seen in Table 2. In the operational aspect, it obtained an average score of 3.6 with a very valid category. This shows that the flipbook e-module media developed with Flip PDF Professional software is easy to use and access so this operation is declared to be very valid. In line with Ummah's opinion (2021) that good learning media can be accessed easily by users, have appro the private size, color, use of language, and suitability of animation and illustration forms on the media.

In the aspect of appearance, the average score is 3.4 and is included in the very valid category. Based on the validation results of this display aspect, it shows that the developed media has an attractive appearance.

2) The Practicality of the Flipbook E-Module

The practicality of the media was obtained based on the results of data analysis from the observation sheet on the implementation of the media and the questionnaire given to students and teachers. The results of the implementation of learning using the discovery learning model show very practical results which indicate that the aspects of learning using e-modules in learning to meet the practical criteria based in Table 3. This is shown by all steps having an implementation rate of more than 50% with an average percentage for all stages in the learning process obtained by of 9.2% with a very high category.

The next practicality is seen from the response of media users, in this case, students and teachers, er. Based othehe sstudents'responses in Table 4 and the teacher's responses in Table 5, it can be seen that thestud is responses to the attractiveness aspect were 85.43% with a very practical category. While the response given by the teacher is 85% in the practical category. This shows that the appearance of this e-module is attractive and easy to read so it is very practical to use in the learning process. Media display can also attract students' interest in learning.

Based on the responses of teachers and students, it can be seen that the developed flipbook e-module media has great benefits in the learning process where the positive response of students is 83.14% in the practical category. Meanwhile, the teacher's response was 85% in the practical category. The response to this aspect of usefulness shows that the media developed is very helpful in the learning process. In addition, the presence of audio-visual media in the form of videos contained in e-modules can help students understand the material being taught.

In the aspect of ease of use, the response of students was 87.43% with a very practical category. This result is also in line with the response given by the teacher, which is 90% with a very practical category. This shows that this media is easy to use for learning for students and teaching by teachers and can be used repeatedly so it is very practical if used in the learning process.

In addition to the aspects of attractiveness, benefits, and ease of use, the teacher's response to the content of the material and the correctness of the content are also considered. This is to see the teacher's response to the suitability of the material contained in the e-module. Based on the analysis of teacher response data of 85% with the practical category, this shows that the material contained in the developed media is suitable for achieving basic competencies. The teacher's response to the content is 80% in the practical category, meaning that the material content contained in the media developed is correct.

Based on the results of the responses given by students and teachers as well as the results of the overall implementation of learning media, this media is very practical to use. As stated by Yamasari, that learning media can be declared practical if it is practical in practice, namely the response from teachers and students shows a positive response [15]. This practicality is assessed from several aspects, namely ease of use, appearance, and benefits of e-module media in the learning process. This is also in line with the research conducted by Fuad Hildan and Muhidin, that appearance and usability are aspects that become a response to media practicality [16].

3) Flipbook E-Module Effectiveness

The effectiveness of the developed flipbook e-module can be seen from the student learning outcomes test which functions to determine the cognitive level of students towards the material of reaction rate being taught. The developed media is declared effective if the class completeness reaches 80% based on the material completeness criteria applicable at the school, which is 75.

The results obtained by students are quite good with the acquisition of the percentage of class completeness in class XI MIPA 3 reaching 88.57%. Based on these results indicate that the developed media meet the criteria for effectiveness. This is in line with the regulation of the Ministry of National Education, that

learning is said to be complete if classically students who complete based on the KKM reach 85% of the total number of students. The results of the development research regarding the effectiveness of the media are by the theory of Slameto, that one of the factors that influence the achievement of learning outcomes is the learning media used during the learning process [17].

Based on the results of the analysis of the validity, practicality, and effectiveness of the developed learning media, it can be seen that this e-module media meets the criteria for use in the learning process. This is the opinion of Syahbana who states that producing good quality learning products, must meet three criteria, namely validity, practicality, and effectiveness [18].

c. Development Limitations

The limitations of the flipbook e-module media based on the development research conducted are:

1) The resulting flipbook e-module media product is only able to convey one sub-material in chemistry subjects, namely the buffer solution material and does not include other related materials such as acid-base and salt hydrolysis.
2) The resulting product does not meet the interactive criteria. This media has not been able to provide direct responses to students.

CONCLUSION

Based on the research and development of flipbook e-module learning media on the buffer solution sub-material that has been carried out, it can be concluded:

1. The flipbook buffer solution e-module can be developed by applying the ADDIE development model which consists of five stages, namely: a. Analysis stage which consists of performance analysis and needs analysis, b. The Design phase includes the design of the module and the selection of the software to be used, c. The development stage, namely making products and validating and revising based on input and advice from media experts and material experts. d. Implement stage, namely the implementation of media that has been valid at SMAN 9 Maros. e. The Evaluate stage is carried out at each stage of the ADDIE model development.
2. The flipbook e-module learning media meets the criteria for proper use, this feasibility is based on the validity value of media experts and material experts stating that it is very valid, and the practicality obtained from student and teacher response questionnaires states that it is very practical and based on student learning outcomes tests staeffectivelytive.

SUGGESTION

The suggestions that can be given by further researchers are:

1. Can further refine the application design of this product and conduct trials or wider implementation so that later this product can be used in bulk.
2. Development can also be done on other chemical materials to help the learning process.

BIBLIOGRAPHY

1. Kurniawan, C., dan Dedi K. 2021. *Pengembangan E-Modul Sebagai Media Literasi Digital Pada Pembelajaran Abad 21.* Lamongan: Academica Publication.

2. Shobirin, M. 2016. *Konsep dan Implementasi Kurikulum 2013 di Sekolah Dasar.* Yogyakarta: Deepublish.

3. Anwas, O. M. 2013. Peran Teknologi Informasi dan Komunikasi dalam Implementasi Kurikulum 2013. *Jurnal Teknodik*, 17(1).

4. Marsita, R. A., et al. 2010. Analisis kesulitan belajar kimia peserta didik SMA dalam memahami materli larutan penyangga dengan menggunakan two-tier multiple choice diagnostic instrument. *Jurnal Inovasi Pendidikan Kimia*, 4(1), 513-520.

5. Sariati, N. K., et al. 2020. Analisis Kesulitan Belajar Kimia Peserta didik Kelas XI Pada Materi Larutan Penyangga. *Jurnal Ilmiah Pendidikan dan Pembelajaran,* 4(1), 86-97.

6. Arsyad, A. (2010). *Media Pembelajaran.* Jakarta : Raja Grafindo Persada.

7. Himmah, E. F. 2019. Pengembangan E-Modul Menggunakan Flip PDF Professional Pada Materi Suhu dan Kalor. *Skripsi.* Lampung: FTIK UIN.

8. Hidayatullah, M. S., dan Lusia R. 2016. Pengembangan Media Pembelajaran Berbasis Flipbook Maker Pada Mata Pelajaran Elektronika Dasar di SMK Negeri 1 Sampang. *Jurnal Pendidikan Teknik Elektro*, 5(1), 83-88.

9. Gunawan, H. 2018. Efektifitas Penggunaan e-Modul Terhadap Keaktifan dan Hasil Belajar Peserta didik. *Prosiding Seminar Nasional*. ISBN: 976-602-52451-0-7.

10. Meliawati, R. 2019. Pemahaman Konsep Sifat Jari-jari Atom dan Keelektronegatifan pada Mahasiswa Pendidikan Kimia Semester IV Tahun Ajaran 2016/2017 Hasil Pembelajaran Menggunakan Model *Discovery Learning. Jurnal Ilmiah Kanderang Tingang*, 10(1), 38-45.

11. Rayanto, Y. H., dan Sugianti. 2020. *Penenlitian Pengembangan Model ADDIE dan R2D2 : Teori Praktek.* Pasuruan: Lembaga Academic & Research Institute.

12. Salsabila, Unik Hanifah., et al. 2020. Pemanfaatan Teknologi Media Pembelajaran Di Masa Pandemi Covid-19. *Jurnal Pendidikan Dasar*, 2(2), 1-13.

13. Aldoobie, N. 2015. ADDIE Model. *American International Journal of Contemporary Research,* 5(6).

14. Harjanto. (2008). Perencanaan Pengajaran. Jakarta: Rineka

15. Yamasari, Y. 2010. Pengembangan Media Pembelajaran Matematika Berbasis ICT yang Berkualitas *Seminar Nasional Pascasarjana*. X-ISBN No 979545-0270-1.

16. Fuad, A., Hilda K., dan Muhiddin P. 2020. Pengembangan Media Pembelajaran *E-Magazine* sebagai Sumber Belajar Biologi Peserta didik Kelas XII. *Jurnal Biology Teaching and Learning*, 3(1), 38-45.

17. Slameto. 2010. *Belajar & Faktor-faktor yang mempengaruhi*. Jakarta: Rineka Cipta.

18. Syahbana, A. 2012. Pengembangan Perangkat Pembelajaran Berbasis Kontekstual untuk Mengukur Kemampuan Berpikir Kritis Matematis Peserta didik SMP. *Jurnal Edumatica,* 2(2), 17-26.

19. Helaluddin., dan Hengki W. 2019. *Analisis Data Kualitatif: Sebuah Tinjauan Teori & Praktik*. Jakarta : Sekolah Tinggi Theologia Jaffray.

20. Lasmiyanti., dan Idris H. 2014. Pengembangan Modul Pembelajaran untuk Meningkatkan Pemahaman Konsep dan Minat SMP. *Pythagoras: Jurnal Pendidikan Kimia*, 9(2), 161-174.