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Development of an Acid-Base E-Module Based on Project-Based Learning (PjBL) Assisted by Canva Application

Nur Fadillah, Ani Sutiani

Departement Chemistry Education, Faculty of Mathematics and Natural Science, Universitas Negeri Medan, Jl. Williem Iskandar, Pasar V, Medan, Indonesia..

*Correspondinge-mail: nrfdillah.20.10@gmail.com

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Abstract: Development of an Acid-Base E-Module Based on Project-Based Learning (PjBL) Assisted by Canva Application. This study aims to develop an interactive e-module on acid-base material based on Project Based Learning (PBL) with the help of the Canva application. This study uses a 4D development model (Define, Design, Develop, Disseminate) at the disseminate stage, limited distribution. The instruments used include student needs analysis questionnaires, media and material expert validation, and teacher student response questionnaires and data analysis using a Likert scale. Respondents in this study were 3 lecturers from the chemistry department of Medan State University, 2 chemistry teachers at MAN and 20 students, MAN 2 Model Medan. The results of the needs analysis showed a high need for interactive e-modules. Validation from media and material experts was assessed by 2 experts, namely two material experts and two media experts, each showing very high validity with an average percentage of 90.7% and 86.2%. The results of the teacher's response to the e-module were 85.3% and the results of the student responses were 93.2%, indicating that the e-module was very feasible to use. The acid-base e-module developed is valid, practical, and feasible to use in chemistry learning.

Keywords: E-Module, Project Based Learning (PjBL), Canva, Acid Base.

Abstrak: Pengembangan E-Modul Asam Basa Berbasis Project Based Learning (PjBL) Berbantuan Aplikasi Canva. *Penelitian ini bertujuan untuk mengembangkan e-modul interaktif pada materi asam basa berbasis Project Based Learning (PjBL) dengan bantuan aplikasi Canva. Penelitian ini menggunakan model pengembangan 4D (Define, Design, Develop, Disseminate) pada tahap disseminate dilakukan penyebaran terbatas. Instrumen yang digunakan meliputi angket analisis kebutuhan siswa, validasi ahli media dan materi, serta angket respon guru siswa dan analisis data menggunakan skala likert. Responden dalam penelitian ini adalah 3 orang dosen jurusan kimia Uniersitas Negeri Medan, 2 orang guru kimia MAN dan 20 orang siswa MAN 2 Model Medan. Hasil analisis kebutuhan menunjukkan kebutuhan tinggi terhadap e-modul interaktif. Validasi dari ahli media dan materi dinilai oleh 2 ahli yaitu dua ahli materi dan dua ahli media, masing-masing menunjukkan kevalidan sangat tinggi dengan rata-rata persentase 90,7% dan 86,2%. Hasil Respon guru terhadap e-modul sebesar 85,3% dan hasil respon peserta didik sebesar 93,2%, menunjukkan bahwa e-modul sangat layak digunakan. E-modul asam basa yang dikembangkan valid, praktis, dan layak digunakan dalam pembelajaran kimia.*

Kata kunci: *E-Modul, Project Based Learning (PjBL), Canva, Asam Basa.*

▪ INTRODUCTION

The process of acquiring knowledge is inseparable from learning activities. The quality of human resources is strongly influenced by the quality of education received. One crucial aspect in realizing quality education is the creation of an effective learning process between teachers and students. In addition, high-quality teaching materials play an important role as a medium for knowledge transformation in the learning process (Abdullah & Anwar, 2021).

The rapid advancement in science and technology has also impacted the field of education. In this context, learning materials must be continuously adapted to the development of science and technology to avoid being outdated. Therefore, the education sector is required to be adaptive and responsive to these changes (Triana et al., 2020).

In practice, chemistry is often perceived as a difficult subject by students due to its many abstract concepts (Wahyuni et al., 2022). One of the complex topics in chemistry is acid-base. This material includes factual, conceptual, and procedural knowledge (Mangubat, 2023).

One of the chemical materials, namely acids and bases, which is very closely related to everyday life, is not only about theory, but also requires high reasoning and creative ideas from students (Salamiyah et al., 2023). Acid-base chemistry is considered a difficult subject because it provides factual, conceptual, and procedural knowledge (Matakupani, 2023). Acids and bases are dense materials because they involve many concepts, namely the properties and definitions of acids and bases, acid-base theory, acid-base strength, neutralization, titration, pH, acid-base indicators (Ilma et al., 2022).

An interview with a chemistry teacher revealed that acid-base material presents a particular challenge for students due to its high complexity. Teachers still rely heavily on textbooks available at school, resulting in a less engaging learning process. The chemistry teacher at the school continues to use a conventional approach in which the teacher leads the learning activities, making it teacher-centered. A needs analysis survey conducted among eleventh-grade students also indicated that the development of an acid-base e-module based on Project-Based Learning (PjBL) supported by Canva is highly needed to enhance the quality of chemistry learning.

These issues can be addressed by developing instructional materials using various learning models and media. One of the learning resources that aligns with current developments in science and technology is the Electronic Module or E-Module (Azis & Yulkifli, 2021). An E-Module is a learning tool that contains a set of materials, methods, exercises, and evaluations, designed systematically and attractively to achieve the expected competencies in accordance with the level of complexity in electronic form (Wibowo, 2021).

The development of the e-module in this research will be integrated with the Project-Based Learning (PjBL) model. PjBL is an approach that encourages students to actively participate in the learning process through group work and problem-solving, enabling them to understand core learning concepts more deeply. In practice, students are guided to complete a specific project or task. This model helps train students' abilities to identify problems, conduct investigations, collect and interpret data, and evaluate the information obtained throughout the project, all of which are relevant to the subject matter being studied (Kanza et al., 2020).

Electronic modules can be created using various applications developed alongside technological advancements. The usefulness of Canva in design is unquestionable, and its features are very user-friendly for both teachers and students. Canva is an application

that facilitates educators in designing instructional media in a practical and efficient manner (Irkhamni et al., 2021). Canva also allows for the integration of visual elements such as text, images, and videos into a single flexible design tailored to teaching needs. The final product created with Canva can be saved in various formats such as JPEG, JPG, and PDF in high quality, and it can be shared via direct links (Yuliana et al., 2023).

Previous research that discusses this topic, namely research, Dewi & Siregar (2024) showed that the use of e-modules based on project-based learning on acid-base material resulted in an average student learning outcome, which was higher and increased from the KKM, namely, 75. Research by Erdi & Padwa (2021) explains that the development of electronic modules with modifications, up to the addition of project-based learning models can overcome the problem of student boredom in the learning process. Research (Dewi & Lestari, 2020) shows that interactive project-based e-modules allow students to build and shape their knowledge. making them more involved in their learning, influencing their learning outcomes and making them more meaningful, According to research by Rahmayanti and Jaya (2020) making electronic modules using the Canva application is a learning medium that can have a greater impact on student learning outcomes compared to other media creation applications. The Canva application is considered suitable for making electronic modules.

The integration of PjBL in an e-module designed using Canva is expected to not only improve students' conceptual understanding of acid-base chemistry but also foster their skills in communication, collaboration, and digital literacy. It addresses both the cognitive and affective domains of learning by offering meaningful projects, collaborative tasks, and digital content that caters to diverse learning styles. This research aims to evaluate the module through expert validation in terms of material and media, as well as to assess feedback from chemistry teachers and students.

▪ METHOD

Research Location and Time

This research was conducted at MAN 2 Model Medan, a senior high school (SMA/MA level) located at Jl. Williem Iskandar No. 7A, Bantan Timur, Medan Tembung District, Medan City, North Sumatra. The research took place in the even semester of the 2024/2025 academic year. The planned research period was from January to February 2025.

Research Subjects and Objects

The subject of this research is the electronic module (E-Module) based on Project-Based Learning (PjBL). The object of this research is the chemistry topic of acids and bases. The E-Module developed in this study was validated by subject matter experts and media experts and was also evaluated based on feedback from two chemistry teachers and twenty 11th-grade students of class XI F1-D at MAN 2 Model Medan using questionnaires. These responses were collected to assess students' interest in the developed e-module.

Type and Design of Research

This research utilized the Research and Development (R&D) method. R&D is a research method used to validate and develop educational products. It aims to create new product designs, test the effectiveness of existing products, and innovate new educational

tools. Once validated and proven effective, the product can improve the ease, speed, quality, and quantity of learning outcomes (Borg and Gall in Yuliani, 2021).

The development model applied in this research is the 4D model, consisting of four stages: Define, Design, Develop, and Disseminate. However, in this study, the dissemination stage was carried out on a limited basis.

Data Collection Techniques

Data collection techniques are methods used by researchers to obtain data. In this study, the following techniques were used:

Interview: The interview was conducted with a chemistry teacher to explore the teaching process and the types of learning materials used. The interview also aimed to gather information on student characteristics to help design an appropriate electronic module.

Questionnaire: The questionnaire is a research instrument containing a series of questions or statements to collect data or information that respondents answer based on their opinions (Zainal Arifin, 2011, in Ernawati, 2021). The questionnaires used in this study included: a student needs analysis questionnaire, validation questionnaires for material and media experts, and feedback questionnaires for teachers and students after limited product trials.

Data Analysis

Validation results and responses from experts, teachers, and students were analyzed to determine whether the acid-base e-module based on Project-Based Learning (PjBL) using Canva was valid and appropriate for use.

The data analysis technique involved calculating validation and response scores using a Likert scale with the following classifications:

Table 1. Assessment Scoring Guidelines

Assessment	Information	Score
SS	Strongly Agree	5
S	Agree	4
KS	Disagree	3
TS	Dont Agree	2
STS	Strongly Disgree	1

(Source: Hanafiah, dkk., 2020)

To calculate the percentage, the validity of the data obtained from the assessment item scores using the formula (Modification of Bannang et al., 2023):

$$Vs = \frac{\sum x}{\sum n} \times 100\ \%$$

Description:
Vs = Validity Percentage
∑x = Total score of item assessments
∑n = Maximum possible total score

The obtained percentage was then classified based on the following criteria:

Table 2. Validity Test Interpretation Scales

Percentage (%)	Criteria
0≤ Vs<21	Not Valid
21≤ Vs<41	Less Valid
41≤ Vs<61	Fairly Valid
61≤ Vs<81	Valid
81≤ Vs<100	Very Valid

(Source: Fuadah et al., 2021)

▪ RESULT AND DISCUSSION

Define Phase

The Define phase aims to identify needs in developing the e-module through several types of analysis: front-end analysis, learner analysis, task analysis, concept analysis, and learning objective analysis. The goal is to gain a deep understanding of the issues in teaching acid-base concepts and design a suitable solution in the form of a Project-Based Learning (PjBL)-based e-module supported by Canva.

- Front-end analysis through teacher interviews and student questionnaires revealed several challenges: difficulty understanding acid-base concepts, limited use of learning media (mostly textbooks), conventional teacher-centered approaches, and students' lack of familiarity with Canva as an engaging educational tool.
- Student Analysis, this phase focused on identifying student characteristics and needs to ensure the e-module aligns with their capabilities. Questionnaires were distributed to 20 students, evaluating perceptions, chemistry learning experience, and the potential of Canva-assisted PjBL.
- Task Analysis, Task analysis identified the necessary skills and steps students should master to understand acid-base topics through PjBL.
- Concept Analysis, Concept analysis structured the relevant concepts systematically to be taught using the e-module.

Design Phase

The Design phase is the initial step in developing the e-module after analyzing student needs. This phase includes several actions such as selecting the media, choosing the e-module format, and designing the initial structure of the e-module.

- Media Selection: Canva was chosen as the media tool for designing the e-module.
- E-Module Format Selection: The e-module utilized various Canva features such as document templates (A4 size), Times New Roman font (12 pt for body text), 1.5 line spacing, and supporting design elements to enhance visual appeal and colorfulness.
- Initial E-Module Structure: The design includes the following components: Cover Page, Preface, Table of Contents, List of Figures, List of Tables, List of Videos, Introduction, Concept Map, Core Material, Summary, Evaluation, Glossary, References, Image Sources, Video Sources, and Author Biography.

Develop Phase

This phase resulted in a product revised based on expert input. It consists of two main activities: the creation of the e-module and the validation of the module.

a. Making E-Module

The module was created using Canva and comprised four main subtopics. Each topic was structured following the steps of the Project-Based Learning model. The module includes a front cover, module identity, learning outcomes, learning objectives, PjBL steps, and other components.

The following is the creation of an e-module which can be seen in the image below, more details can be accessed at the following link.
https://online.flipbuilder.com/bwply/rnxy/

1) The creation of the front cover of the e-module as seen in Figure 1, includes the title, learning materials, images that support the learning materials, the PiBL model and its media, class level, Unimed and Tut Wuri Handayani logos, the name of the compiler and the supervising lecturer.

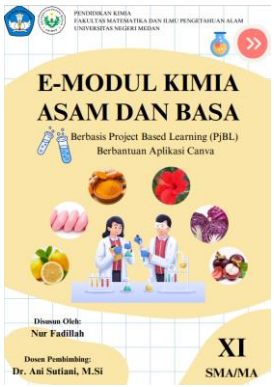

Figure 1. Making Front Cover E-Modul

2) In the introduction section of the e-module involved in Figure 2, there is the e-module Identity, learning achievements, and learning objectives to be achieved in accordance with the curriculum, Independence in learning.

Figure 2. Introductory part of the E-Modul

3) In the Steps section of the learning model for each topic of acid-base material. The steps (syntax) of PjBL as involved in Figure 3, include Determining Basic Questions. Project Planning, Project Scheduling, Project Progress Monitoring. Project Result Testing and Experience Evaluation.

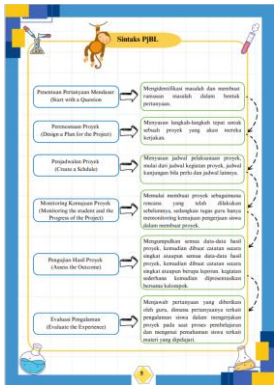

Figure 3. Steps of the Project Based Learning (PjBL) learning model

b. E-Module Validation

In validation, there is questionnaire validation, material expert validation and media validation.

1) Questionnaire Validation

The questionnaire validation was carried out by 1 person from the Chemical Education Department who was called the non-test instrument validator to see the feasibility of each item on the instrument questions that would be used by the researcher.

The questionnaires that were validated and used by researchers in this study consisted of an expert validation questionnaire, material validation questionnaire, media expert validation questionnaire, teacher response questionnaire and student response questionnaire.

Table 3. Results of Validation of Questionnaire Material, Media, Teacher Response, Student Response

No	Aspect	Questionnaire Validation				Average (%)
		Material	Media	Teacher Response	Student Response	
1	Clarity	100%	100%	100%	100%	100%
2	Content Accuracy	100%	100%	80%	100%	95%
3	Relevance	100%	100%	100%	100%	100%
4	Content Validity	80%	80%	80%	100%	85%
5	Unbiased	80%	80%	80%	80%	80%
6	Language Accuracy	100%	100%	100%	93%	98%
Average		**93%**	**93%**	**90%**	**96%**	**93%**

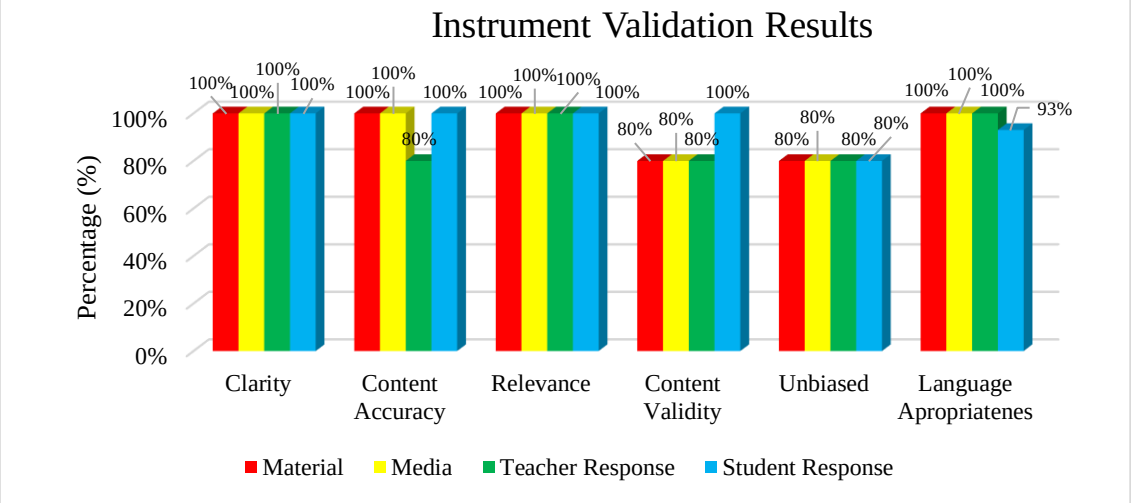

Figure 4. Graph of Validation Results of Questionnaire Material, Media, Teacher Responses, Student Responses

The results of the validation of the Material, Media, Teacher Response, Student Response questionnaires, then the percentage results can be involved, the average obtained in the material expert questionnaire, which is 93% (very high value) which indicates that the material expert questionnaire is suitable for use for the next validation stage. In the media expert questionnaire, the average percentage results obtained are 93% (very high value) which indicates that the media expert questionnaire is suitable for use for the next validation stage. In the chemistry teacher response questionnaire, the average percentage results obtained are 90% (very high value) which indicates that the teacher response questionnaire is suitable for use for the next teacher assessment stage. In the student response questionnaire, the average percentage results obtained are 96% (very high value) which indicates that the student response questionnaire is "suitable" for use for the next student interest assessment stage.

2) Validation by material experts

The purpose of the Electronic Module (e-module) is to validate using validated instruments to obtain values, suggestions and input as a reference in Revise the e-module so that it is declared valid and suitable for use. Expert validation of this material was carried out by 2 expert lecturers from Chemistry Education.

Table 4. Results of Validation by Material Experts

No	Aspect	Everage Percentage		Everage (%)
		Validator 1	Validator 2	
1	Content Eligibility	86,7%	86,7%	86,7%
2	E-Modul Characteristics	88,0%	84,0%	86,0%
3	Language	80,0%	80,0%	80,0%
4	Component Eligibility	92,0%	80,0%	86,0%
5	PjBL Frameworks	85,0%	100,0%	92,5%
Everage (%)		86,3%	86,1%	86,2%

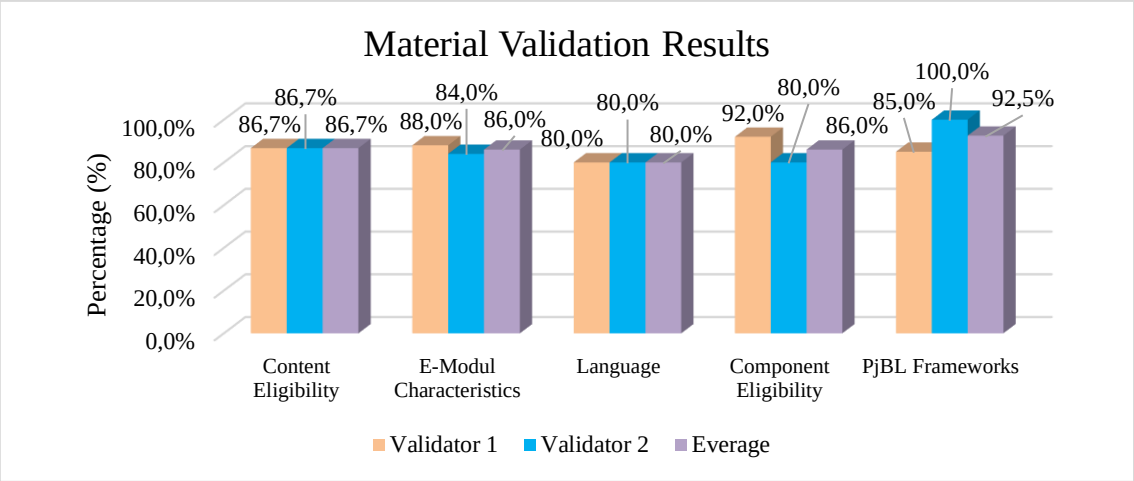

Figure 5. Graph of Material Validation Results

Based on the validation results of the material, the average percentage results obtained were 86.2%, which in this case shows that the material in the e-module acids and bases based on project-based learning assisted by the Canva application is said to be "suitable" for use.

3) Media expert validation

The purpose of the Electronic Module (e-module) is validated using validated instruments to obtain values, suggestions and input as a reference in revising the e-module so that it is declared valid and suitable for use. Expert validation of this material was carried out by 2 expert lecturers from Chemistry Education.

Table 5. Media Expert Validation Results

No	Aspect	Average Percentage		Average (%)
		Validator 1	Validator 2	
1	Writing View	92,0%	92,0%	92,0%
2	Graphic Design	86,7%	93,3%	90,0%
3	Characteristic of E-Modul	100,0%	80,0%	90,0%
Average (%)		92,9%	88,4%	90,7%

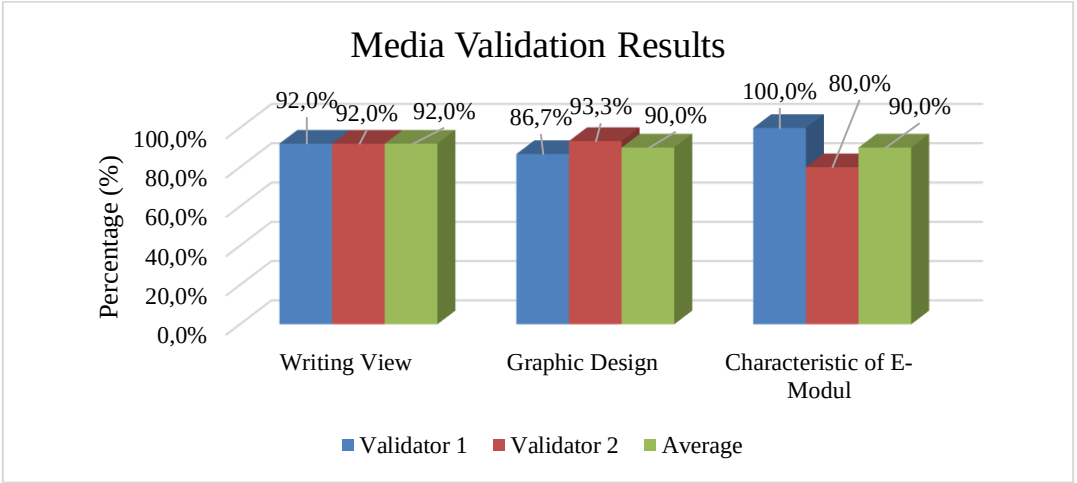

Figure 6. Graph of Madia Validation Results

The results of the media validation can be seen from the percentage results, the average obtained is 90.7% which in this case shows that the acid-base e-module based on project-based learning assisted by the Canva application is said to be "worthy" of use.

Disseminate Phase

E-Module was distributed limitedly to class XI F1-D MAN 2 Model Medan consisting of 20 students and 2 kimją teachers. The Acid Base E-Module based on project based-learning assisted by the Canva application was accessed by teachers and students through a link or barcode provided to researchers obtained from Canva. At this limited distribution stage, data collection was carried out on teacher and student responses to the questionnaire provided.

1) Chemistry Teacher Response

In the response stage of chemistry teachers, the questionnaire responses were given to 2 chemistry teachers as a reference to see the attractiveness of the e-module that had been created by the researcher. In the assessment of the e-module by chemistry teachers using an assessment sheet, which contains 4 assessment aspects and 14 questions. The assessment aspects consist of 4 aspects, namely the appropriateness of the content, freedom, appearance and completeness of the components.

Table 6. Chemistry Teacher Assessment Results

No	Aspect	Average (%)		Average (%)
		Teacher 1	Teacher 2	
1	Content Eligibility	93,3%	73,3%	83,3%
2	Language	80,0%	80,0%	80,0%
3	Appearance	88,0%	88,0%	88,0%
4	Component Completense	86,7%	93,3%	90,0%
Average (%)				85,3%

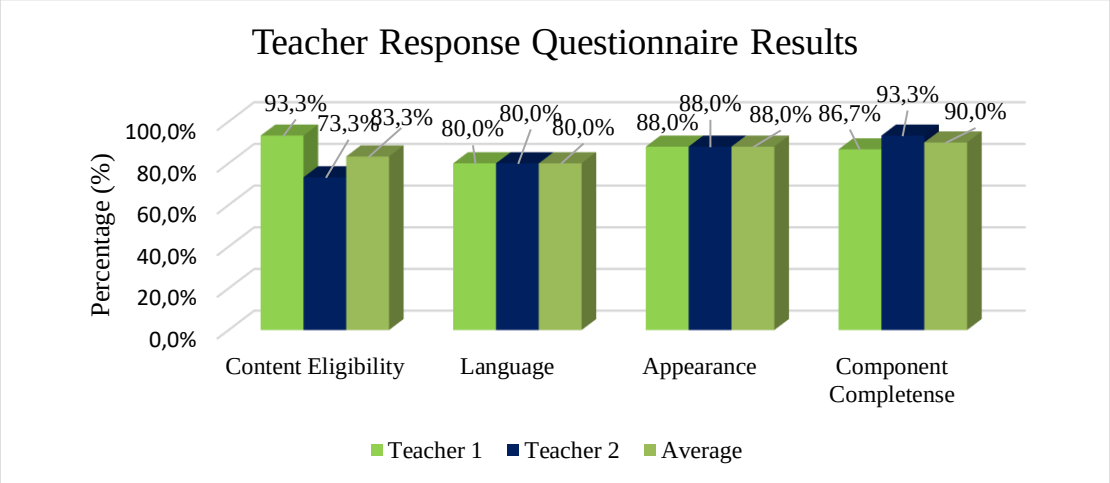

Figure 7. Graph of Chemistry Teacher Assessment Results

It can be seen from the average percentage results obtained, namely 85.3%, which in this case shows that this research product is very interesting to be used as one of the teaching materials in chemistry learning.

2) Student Response

At the student response stage, the response questionnaire was given to 20 students as a reference to see the attractiveness of the e-module that had been created by the researcher. In the assessment of the e-module by students using an assessment sheet which contains 4 assessment aspects and 11 questions. The assessment aspects consist of 4 aspects, namely content, learning benefits, language and function of the e-module.

Table 7. Student Assessment Results

No	Aspect	Percentage (%)
1	Contents	95,0%
2	Benefits of learning	89,0%
3	Language	96,0%
4	Function of E-Modul	92,7%
Average (%)		**93,2%**

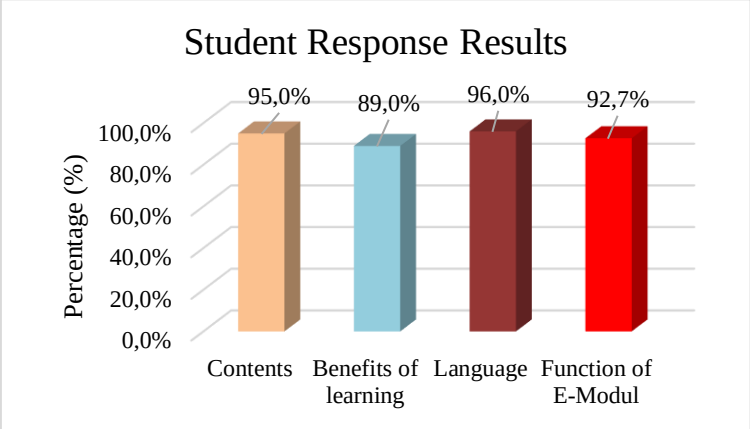

Figure 8. Graph of Student Assessment Results

It can be seen that the average percentage results obtained were 93.2%, which in this case shows that this research product is very interesting for students to use in the learning process.

▪ CONCLUSION

Based on the results of research and discussion of the development of acid-base e-modules, based on Project Based Learning (PIBL) assisted by the CANYA application, the conclusions that can be obtained are as follows:

The results of the analysis of student needs and interviews with chemistry teachers obtained results that support the development of an acid-base e-module based on project-based learning assisted by the Canva application. The validation results from 2 experts consisting of material experts and media experts on the e-module were obtained at 86.2% by the material experts and 90.7% by the media experts with very valid criteria, and declared suitable for use. The results of teacher responses to the developed e-module obtained an average of 85.3% which is categorized as very interesting and can be used in the learning process. The results of the response of Class XI FI-D MAN 2 Model Medan students to the e-module distributed to a limited number of 20 students were 93.2% with a very interesting category.

▪ REFERENCES

Abdullah, A., Danial & Anwar, M. (2021). Pengembangan E-Modul Asam Basa Berbasis Problem Based Learning melalui Google Classroom pada Sekolah Menengah Kejuruan (SMK). *CER: Chemistry Education Review*, 5(1), 86–99. DOI: https://doi.org/10.26858/cer.v5i1.13315

Ahmad Yani, M. P. (2021). *Model Project Based Learning Untuk Meningkatkan Motivasi Belajar Pendidikan Jasmani*. Ahlimedia Book.

Akbar, S. (2013). *Instrumen Perangkat Pembelajaran*. Remaja Rosdakarya.

Amelia, N., & Aisya, N. (2021). Model pembelajaran berbasis proyek (project-based learning) dan penerapannya pada anak usia dini di TK IT Al-Farabi. *BUHUTS AL ATHFAL: Jurnal Pendidikan dan Anak Usia Dini*, 1(2), 181-199. DOI: https://doi.org/10.24952/alathfal.v1i2.3912

Ansori, T., Wasis, W., & Nasrudin, H. (2019). Development of Physics Learning Instrument with Model Project Based Learning to Train Students' Critical Thinking Skills. *International Journal of Multicultural and Multireligious Understanding*, 6(5), 74.

Azis, H. (2021, April). Preliminary research in the development of smartphone-based e-module learning materials using the ethno-STEM approach in 21st century education. In *Journal Of Physics: Conference Series* (Vol. 1876, No. 1, p. 012054). IOP Publishing. doi:10.1088/1742-6596/1876/1/012054.

Bannang, A., Uloli, R., & Abdjul, T. (2023). Pengembangan Perangkat Pembelajaran Menggunakan Model Pembelajaran Kooperatif Dengan Pendekatan Inkuiri Pada Materi Fluida Statis. *Aksara: Jurnal Ilmu Pendidikan Nonformal*, *9*(1), 749-760. DOI: http://dx.doi.org/10.37905/aksara.9.1.749-760.2023

Barus, A. M., Sari, W. W., Stephanie, L., & Rahayu, I. P. (2022). *Panduan dan Praktik Baik Project-Based Learning: Menginspirasi, Mencipta dan Mendedikasi Karya.* PT Kanisius.

Day, R. A., & Underwood, A. L. (2002). *Analisis Kimia Kuantitatif*. Jakarta: Erlangga

Dewi, C. A., & Kurniasih, Y. (2020). *Kimia Asam-Basa Berbasis Kontekstual*. Penerbit Deepublish.

Dewi, I. M., & Siregar, L. H. (2024). Pengembangan e-Modul Berbasis Project Based Learning dengan Menggunakan Kvisoft Flipbook Maker pada Materi Asam Basa. *Jurnal Pendidikan Kimia FKIP Universitas Halu Oleo*, 9(2), 193-206. DOI: https://doi.org/10.36709/jpkim.v9i2.88

Dewi, M. S. A., & Lestari, N. A. P. (2020). E-modul interaktif berbasis proyek terhadap hasil belajar siswa. *Jurnal Ilmiah Pendidikan Dan Pembelajaran*, 4(3), 433-441. DOI: https://doi.org/10.23887/jipp.v4i3.28035

Dewi, W. S., Murtiani, Sari, S. Y., & Mairizwan. (2022). The validity of physics learning evaluation teaching material based on project-based learning and portfolio assessment. *Journal of Physics: Conference Series*, 2309(1). DOI: 10.1088/1742-6596/2309/1/012082

Dianawati, E. P. (2022). *Project Based Learning (PjBL): Solusi Ampuh Pembelajaran Masa Kini.* Penerbit P4I.

Erdi, P, N., & Padwa, T, R. (2021). Penggunaan E-Modul Dengan Sistem Project-Based Learning. *Jurnal Vokasi Informatika*. 1(1). 23-27. DOI: https://doi.org/10.24036/javit.v1i1.13

Ernawati, I., & Setiawaty, D. (2021). Efektifitas Layanan Bimbingan Kelompok Dengan Teknik Psikodrama Dalam Meningkatkan Motivasi Belajar Siswa Kelas Viid di

Smp Negeri 11 Yogyakarta Tahun Ajaran 2017/2018. *G-Couns: Jurnal Bimbingan dan Konseling*, 5(2), 220-225.

Fahrurrozi, M. (2020). *Pengembangan perangkat pembelajaran: tinjauan teoretis dan praktik* (Vol. 1). Universitas Hamzanwadi Press.

Fuadah, A., Susilawati, Nugraha, A. H., & Sulisworo, D. (2021). Respon Peserta didik terhadap program edmodo dalam model pembelajaran blended learning. *Berkala Fisika Indonesia: Jurnal ilmiah fisika, Pembelajaran dan Aplikasinya*, 12(2). 49-53. DOI: http://dx.doi.org/10.12928/bfi-jifpa.v12i2.20340

Hanafiah, Sutedja, A., & Ahmaddien, I. (2020). *Pengantar Statistika.* Bandung: Widina.

Harjunowibowo, D., Azzahra, S. A., Hasanah, M. U., & Rahmawati, A. D. (2022). *Tutorial Mendesain dengan Canva*. Penerbit Lakeisha.

Ilma, H. Marlina, L., & Pratiwi, R.Y. (2022). Penuntun Praktikum Elektronik Berbasis Green Chemistry dengan Model Pembelajaran *Learning Cycle-7e* pada Materi Asam-Basa. *Orbital: Jurnal Pendidikan Kimia*, 6(1), 61–77. DOI: https://doi.org/10.19109/ojpk.v6i1.12018

Inayah, R., Aswirna, P., & Asrar, A. (2022). Pengembangan E-Modul Berbasis Etno-STEM Berbantuan Canva terintegrasi gordang sambilan terhadap keterampilan komunikasi peserta didik. *Jurnal Cerdas Mahasiswa*. 4(2), 189-200. DOI: https://doi.org/10.15548/jcm.v4i2.4784

Irkhamni, I., Izza, A. Z., Salsabila, W. T. & Hidayah, N. (2021). Pemanfaatan Canva Sebagai E-Modul Pembelajaran Matematika Terhadap Minat Belajar Peserta Didik. *Prosiding Konferensi Ilmiah Pendidikan*. 2, 127-134.

Kamilati, N. (2006). *Mengenal Kimia 1*. Yudhistira: Ghalia Indonesia.

Kanza, N. R. F., Lesmono, A. D., & Widodo, H. M. (2020). Analisis Keaktifan Belajar Siswa Menggunakan Model Project Based Learning Dengan Pendekatan Stem Pada Pembelajaran Fisika Materi Elastisitas Di Kelas Xi Mipa 5 Sma Negeri 2 Jember. *Jurnal Pembelajaran Fisika*, 9(2), 71.

Kosasih, E. (2021). *Pengembangan Bahan Ajar*. Bumi Aksara.

Kustini, S., Syutaridho, & Zahra, A. (2022). Pengembangan Modul Elektronik Menggunakan Pendekatan Pembelajaran Kontekstual Untuk Siswa Kelas X Madrasah Aliyah Negeri 1 Pangkalpinang. *Jurnal Of Education in Mathematics, Science, and Technology*, 5(3), 56–65. DOI: https://doi.org/10.30631/jemst.v5i2.80

Mangubat, F. M., & Picardal, M. T. (2023). Predictors Of Chemistry Learning Among First Year University Students. *International Journal of Instruction*, 16(2), 15- 30.

Melati, R.R. (2019). *Asam Basa dan Garam*. Jakarta: Penerbit Duta.

Mutawally, A. F. (2021). Pengembangan Model Project Based Learning Dalam Pembelajaran Sejarah. *Universitas Pendidikan Indonesia*, 1–6.

Najuah, Lukitoyo, P. S., & Wirianti, W. (2020). *Modul Elektronik: Prosedur Penyusunan dan Aplikasinya*. In Yayasan Kita Menulis.

Prastowo, A. (2016). *Pengembangan Bahan Ajar Tematik: Tinjauan Teoritis dan Praktis.* Kencana.

Pratama, H., Matsun., & Puspitasari, Y. D. (2024). *Buku Petunjuk Penggunaan Ph Meter, NPK, Suhu, Kelembapan, dan Konduktivitas*. Jawa Tengah: PT Nasya Expanding Management.

Pratiwi, U. (2021). *Mudah Belajar Desain Grafis Dengan Aplikasi CANVA*. DIVA Press.

Prihatiningtyas, S., & Sholihah, N. F. (2020). Project Based Learning E-Module to Teach Straight-Motion Material for Prospective Physics Teachers. *Pendidikan Fisika*, 8(3), 223–235. DOI: 10.26618/jpf.v8i3.3442

Purba, J., & Sembiring, B. A. (2023). Development of Project-Based Learning Modules on the Subject of Chemical Equilibrium. *Jurnal Inovasi Pembelajaran Kimia (Journal of Innovation in Chemistry Education)*, 5(1), 52-61.

Putri, Desyandri. (2024). PENGEMBANGAN E-MODUL BERBANTUAN CANVA DENGAN MODEL PROJECT BASED LEARNING PADA MATERI RAGAM HIAS DI KELAS V SEKOLAH DASAR. *Pendas: Jurnal Ilmiah Pendidikan Dasar*. 9(3). 362-371. DOI: https://doi.org/10.23969/jp.v9i3.17396

Putri, I. T., Oktaviyanthi, R., & Khotimah. (2022). Perancangan E-Modul Interaktif Berbasis Technological Pedagogical Content Knowledge (TPACK) untuk Memfasilitasi Kemampuan Pemcahan Masalah Matematis. *JPM: Jurnal Pendidikan MIPA*, 12(3), 820–830. DOI: https://doi.org/10.37630/jpm.v12i3.693

Rofiyadi, Y. A., & Handayani, S. L. (2021). Pengembangan Aplikasi E-Modul Interaktif Berbasis Android Materi Sistem Peredaran Darah Manusia Kelas V Sekolah Dasar. *JPDI: Jurnal Pendidikan Dasar Indonesia*, 6(2), 54–60.

Rohmah, F., Amir, Z., & Zulhidah. (2022). Pengembangan E-Modul Interaktif Berbasis Kontekstual pada Materi Volume Bangun Ruang SD/MI. *Jurnal Basicedu*, 6(2), 1947–1958. DOI: 10.31004/basicedu.v6i2.2262

Salamiyah, S., Astutik, T. P., & Wicaksono, A. T. (2023). Efektivitas Lembar Kerja Peserta Didik (LKPD) Berbasis Kearifan Lokal dengan Pendekatan STEAM pada Materi Asam Basa. *Orbital: Jurnal Pendidikan Kimia*, *7*(1), 57-65. DOI: https://doi.org/10.19109/ojpk.v7i1.16137

Sariati, N. K., Suardana, I. N., & Wiratini, N. M. (2020). Analisis Kesulitan Belajar Kimia Siswa Kelas XI pada Materi Larutan Penyangga. *Jurnal Imiah Pendidikan dan Pembelajaran*, 4(1), 86-97. DOI: https://doi.org/10.23887/jipp.v4i1.15469

Sari, L. P., Hatchi, I., & Siregar, D. A. (2019). *Pengembangan Modul Ajar Berbasis Based Learning Guru Fisika di Padangsidimpuan*. 370–379.

Samsudin, M. A., Jamali, S. M., Zain, A. N. M., & Ebrahim, N. A. (2020). The effect of STEM project-based learning on self-efficacy among high-school physics students. *Journal of Turkish Science Education*, 17(1), 94–108. DOI: https://doi.org/10.36681/

Setiawan, L., Wardani, N. S., & Permana, T. I. (2021). Peningkatan kreativitas siswa pada pembelajaran tematik menggunakan pendekatan project-based learning. *Jurnal Pembangunan Pendidikan: Fondasi Dan Aplikasi*, 8(1), 1879–1887. DOI: https://doi.org/10.31004/basicedu.v5i4.1068

Susilawati, L., Ramdhani, E. P., & Yulita, I. (2020). Analisis Kesulitan Belajar Siswa Kelas X MIPA pada Materi Sistem Periodik Unsur di SMA 1 Teluk Bintan. *Student Online Journal (SOJ) UMRAH-Keguruan dan Ilmu Pendidikan*, 1(2), 500-506.

Sutri, E., & Juwita Ningsih, T. (2023). Analisis Kebutuhan Guru Dan Siswa Mengenai Pengembangan E-Modul Kimia Berbasis Problem Solving Pada Materi Kimia Kelas X Untuk Meningkatkan Keterampilan Berpikir Kritis. DOI: https://digilib.unimed.ac.id/id/eprint/51038

Triana, D., Anggraito, Y. U., & Ridlo, S. (2020). Effectiveness Of Environmental Change Learning Tools Based on Stem-Pjbl Towards 4c Skills of Students. *Journal of*

Innovation Science Education, 9(2), 181-187. DOI: http://journal.unnes.ac.id/sju/index.php/jise

Wahyuni, N. D., Purwoko, A. A., & Andayani, Y. (2022). Pengaruh Pembelajaran Daring Terhadap Minat Belajar Siswa pada (Mata Pelajaran Kimia) di Masa Pandemi Covid-19. *Jurnal Teknologi pendidikan: Jurnal Penelitian dan Pengembangan Pembelajaran*, 7(2), 234-241. DOI: https://doi.org/10.33394/jtp.v7i2.5599

Wardani, R.K., & Arifiyana, D. (2020). *Suhu, Waktu dan Kelarutan Kalsium Oksalat Pada Umbi Porang.* Gresik: Penerbit Graniti.

Wibowo, H. S. (2023). *Canva: Panduan Lengkap untuk Desain Grafis dengan Cepat dan Mudah*. Tiram Media.

Wiyati, A. (2020). *Modul Pembelajaran SMA Kimia: Larutan Asam dan Basa Kimia Kelas XI.* Direktorat SMA, Direktorat Jendral PAUD, DIKDAS, dan DIKMEN.

Yuliana, D., Baijuri, A., Suparto, A. A., Seituni, S., & Syukria, S. (2023). Pemanfaatan Aplikasi Canva Sebagai Media Video Pembelajaran Kreatif, Inovatif, Dan Kolaboratif. *Jurnal Pendidikan Teknologi Informasi (JUKANTI)*, 6(2), 247-257. DOI: https://doi.org/10.37792/jukanti.v6i2.1025

Yuliani, W., & Banjarnahor, N. (2021). Metode penelitian pengembangan (rnd) dalam bimbingan dan konseling. *Quanta Journal*, 5(3), 111-118. DOI: https://doi.org/10.22460/q.v5i3p111-118.3051

Yulkifli, Y., Yohandri, Y., & Azis, H. (2022). Development Of Physics EModule Based on Integrated Project-Based Learning Model with Ethno-Stem Approach On Smartphones for Senior High School Students. *Momentum: Physics Education Journal*, 93–103. DOI: https://doi.org/10.21067/mpej.v6i1.6316

Yunika, E., Iriani, T., & Saleh, R. (2020). Pengembangan media video tutorial berbasis animasi menggunakan 4d untuk mata kuliah praktik batu beton. *Prosiding Snitt Poltekba*, 4, 299-306.