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Validity and Practicality of Flipped Classroom Based on Structured Inquiry Using LMS Moodle on the Material of Chemical Equilibrium for Phase F High School

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Abstract— Chemical equilibrium is one of the abstract materials with concrete examples. This material is considered difficult by students. This study aims to determine the validity and practicality of a structured inquiry-based flipped classroom learning system using LMS Moodle on chemical equilibrium material high school phase F. The type of research is EDR (Education Design Research) research with the Plomp development model. The flipped classroom learning system was validated by three chemistry lecturers FMIPA UNP and two chemistry teachers in SMA Negeri 12 Padang obtained the average Aiken's V of 0.87 with valid category. Practicality conducted by two chemistry teachers in SMA Negeri 12 Padang obtained an average result of 94% with a convenient category. Practicality conducted by nine students of SMA Negeri 12 Padang obtained an average result of 94% with a convenient category. The results showed that the structured inquiry-based flipped classroom learning system using LMS Moodle on high school phase F chemical equilibrium material proved to be valid and practical

Keywords— Flipped Classroom Learning System; Structured Inquiry; LMS Moodle, *Chemical Equilibrium.*

I. INTRODUCTION

Chemical equilibrium material is one of the materials that is considered difficult by students, because chemical equilibrium material is abstract[1][2] and there are many calculations. This makes students often experience misconceptions and are less interested in learning the material, causing inactivity [2]. Students tend to understand this chemical equilibrium material by memorizing it without understanding the concept [3]. To overcome these problems, teachers must choose the right learning methods and models and use the right learning strategies to overcome student difficulties [4]. An effective learning model to make students become active and think critically is inquiry learning [5].

The inquiry model is in line with the constructivism approach in which the teacher is a facilitator in learning. Knowledge is not given directly by the teacher to students but is developed by students. Based on the level of teacher involvement in the learning process, the inquiry learning model is divided into confirmation inquiry, structured inquiry, guided inquiry, and open inquiry [6][7]. Selection of the level of inquiry that is suitable as a learning model must consider the level of ability of students in scientific thinking and the level of difficulty of the material to be taught [3]. Chemical equilibrium material is material that is difficult for students to understand [8]. Therefore, this material is suitable to be paired with a structured inquiry learning model [3] because it requires a considerable role of the teacher in the learning process. The structured inquiry learning model is not fully learner-centered because the teacher provides questions, problems, and even procedures like a “cookbook” but does not provide the result [9].

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The stages of structure d inquiry learning are observation, making hypotheses, collecting and organizing data, and writing conclusions [10]. Learning using a structured inquiry model makes learning more interesting, motivating, and oriented towards students to improve student learning outcomes [11]. Structured inquiry can make learners remember information longer, and direct learners to sustainable knowledge [12]. The structured inquiry learning model has been applied in natural science learning, the results show that the structured inquiry learning model has a high effect on student learning outcomes [13]. The physics learning outcomes of students who use structured inquiry models showed significantly improved learning out comes than learning outcomes using conventional models [14]. Based on the results of observations and interviews that have been conducted in three high schools in Padang City (SMA Negeri 12 Padang, SMA Pembangunan Laboratorium UNP, and SMA Pertiwi 1 Padang) the learning methods used by teachers are lectures and discussions. This makes learning still centered on the teacher, causing students to be inactive.

One solution to overcome this is to use a flipped classroom learning system. Flipped classroom is an alternative learning that is a solution to teacher-centered learning [15]. Flipped classroom learning material is not delivered directly to students but teachers only guide students to find it, students are responsible for setting their own learning pace [16]. The flipped classroom learning system has been applied to buffer solution material, the results showed that the application of the flipped classroom learning model has a positive effect on learning outcomes and can improve student learning outcomes [17]. The flipped classroom learning system is proven to improve the cognitive and affective aspects of learners [18].

A flipped classroom learning system can be applied using LMS Moodle which can be accessed by students using mobile phones anytime and anywhere. Development and utilization of Moodle can be implemented in online learning, supporting the role of teachers in the context of online learning [19]. The use of a flipped classroom learning system applied by using LMS Moodle is one of the innovations in learning. Innovation in education needs to be done to improve teaching standards [20]. Based on the findings of observations and interviews with teachers and learners in three schools in Padang City, it is found that there is still a need for more innovation in learning. Teachers and learners want technology-based learning that can be done flexibly. Therefore, it is necessary to develop a structured inquiry-based flipped classroom learning system using LMS Moodle on high school phase F chemical equilibrium material to determine its validity and practicality level.

II. METHODS

The type of research used is EDR (Education Design Research) research with the Plomp development model consisting of preliminary research, prototyping phase, and assessment phase [21]. The instrument used in this study was a questionnaire equipped with practicality and validation sheets. The validation test was conducted by three UNP chemistry lecturers and two chemistry teachers in SMA Negeri 12 Padang, while the small group practicality test was conducted by nine SMA Negeri 12 Padang students and two chemistry teachers in SMA Negeri 12 Padang. The results of the data analysis were calculated using Aiken's V formula [22]. The validity assessment category based on Aiken's V formula can be seen in Table 1.

$$V = \frac{\sum s}{n\,(c-1)}$$
$$s = r - Io$$

Description :

V = Validator agreement index

R = Validator's preferred category score

lo = The lowest validity assessment number (lo = 1)

c = The highest validity assessment number (c = 5)

n = Number of validators

Table 1 displays the validity assessment categories based on Aiken's V formula.

Table 1. Validity Data Based on Aiken's V

***Aiken's V* interval**	**Category**
V ≥ 0,8	Valid
V < 0,8	InValid

The practicality data obtained was analyzed using a modified formula by Purwanto [36]

$$NP = \frac{R}{SM} \times 100$$

Description :

NP = percent value sought (practicality of the product)

R = Total value obtained from the questionnaire

SM = Maximum score in the questionnaire

Practicality assessment categories based on the modified formula by Purwanto can be seen in Table 2

Table 2. Criteria for assessing prettiness

Score	**Criteria**
86% - 100%	Very Practical
76% - 85%	Practical
60% - 75%	Practical enough
55% - 59%	Less practical
00 - 54%	Not Practical

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III. RESULTS AND DISCUSSION

The results of research on the development of a structured inquiry-based flipped classroom learning system using LMS Moodle on chemical equilibrium material are as follows.

3.1 Preliminary Research

Preliminary research was conducted to determine and prepare the requirements needed for this research. Preliminary research was conducted through four stages, including :

3.1.1 Requirement analysis

At this stage, interviews were conducted with one chemistry teacher from SMA Negeri 12 Padang, one chemistry teacher from SMA Pembangunan Laboratorium UNP, and one chemistry teacher from SMA Pertiwi 1 Padang. This stage aims to see a description of the conditions or circumstances identified with the problems that occur during the learning process [23]. The results of the needs analysis are as follows :

1) Learning has not been student-centered, causing learners to not be independent.
2) The learning method used is still the lecture method so students tend to be passive causing learning to be inactive.
3) Students have difficulty repeating learning at home because chemical equilibrium material is abstract.
4) The teaching materials used are less interesting so students tend to be too lazy to repeat learning at home.
5) Students expect a learning system that can be accessed via cell phone anytime and anywhere

3.1.2 Analysis curriculum

This analysis is carried out to find out the curriculum applied at school, such as learning outcomes (CP), learning objectives (TP), and the flow of learning objectives (ATP). The learning outcomes for phase F :

Learners can understand the concept of mole and stoichiometry in solving chemical calculations; chemical bonding about interactions between particles of matter and physical properties of matter; collision theory between particles of matter as the basis for the concept of reaction rate; chemical equilibrium to observe the behavior of reactants and products at the microscopic level; the correlation between the pH of acidic, basic, salt and buffer solutions and their application in life; thermochemistry; the concept of redox and electrochemical cells as an implication of changes in matter and energy accompanying chemical reactions and their application in daily life; carbon compounds, hydrocarbons and their derivatives and their uses in daily life. Learning objectives understand the concept of chemical equilibrium [24].

3.1.3 Literature study

The results of the literature study related to the research are as follows:

1) Chemical equilibrium material is difficult to understand because it is abstract with concrete examples [25] [26] To help learners understand this material, a flipped classroom learning system can be used.
2) The flipped classroom learning system is a learning system that combines synchronous learning (face-to-face) with asynchronous learning (online) [18] [27]

3) Flipped classroom learning can be implemented by using a LMS. The LMS used in asynchronous activities is Moodle. The development and utilization of Moodle can help teachers with online learning and synchronous activities carried out face-to-face in the classroom [19].

4) Moodle is a useful and flexible learning management system that can be used to deliver learning to students. Moodle allows users to become active learners [28]

3.1.4 Conceptual framework development

The conceptual framework is a combination of all opinions that underlie product development:

1) Learning has not been learner-oriented so the character of independent learners has not been created. The bright learning methods used by teachers are not appropriate, as well as the lack of teacher innovation in learning. Students find it difficult to understand chemical equilibrium material. Learning is still teacher-oriented. The unavailability of a learning system that can be accessed by students via cell phones anytime and anywhere.
2) The solution offered to solve these problems is the development of a structured inquiry-based flipped classroom learning system using LMS Moodle.
3) The stages used for product development are the Plomp development stages which are carried out up to validity and practicality tests.

3.2 Prototyping Phase

3.2.1. Prototype I

Prototype 1 is the result of the initial product of a structured inquiry-based flipped classroom learning system using Moodle LMS on chemical equilibrium material. The flipped classroom learning system is adjusted to the syntax of structured inquiry, for asynchronous learning is carried out with observation and hypothesis syntax. Synchronous learning is carried out with the syntax of data collection organization and conclusions.

3.2.2. Prototype II

At this stage, formative evaluation through self-evaluation of prototype I was conducted. Self-evaluation is done to see the mistakes in the flipped classroom learning system. Development research includes activities that produce prototypes (prototype products) including evaluating product quality [29]. Self-evaluation is conducted using a checklist. The were found in the flipped classroom learning system are as follows: the video sound on the learning system is less clear, and the instructions on Moodle are less clear. So that the resulting prototype II.

3.2.3 Prototype III

At this stage, formative evaluation is carried out through one-to-one trials and expert review to produce the validity of the flipped classroom learning system. The validity test was carried out using a validation instrument that assessed aspects of the content component, presentation component, linguistic component, and graphical component carried out by three chemistry lecturers from FMIPA UNP, and two chemistry teachers from SMA Negeri 12 Padang. The validity test aims to reveal the validity of the product developed [30]. The results of the validity assessment of the structured inquiry-based flipped classroom learning system using LMS Moodle on chemical equilibrium material Phase F SMA can be seen in Figure 1

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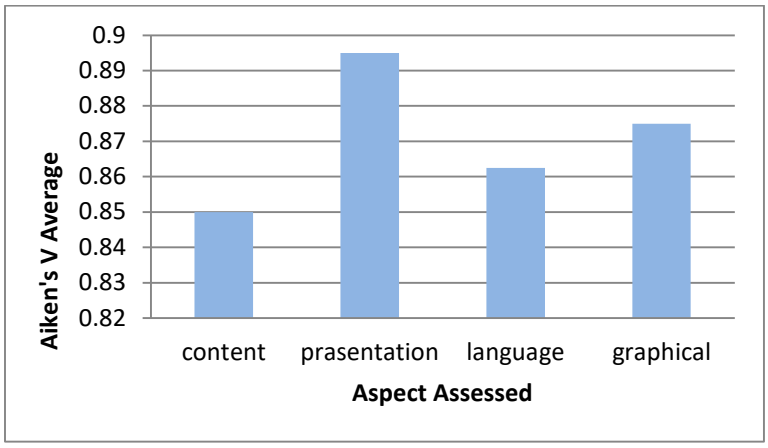

Figure 1. Validity Data Analysis Results

Overall, the validity value of the structured inquiry-based flipped classroom learning system using LMS Moodle obtained an average validity value of 0.87 with a valid category. The details of each aspect are as follows:

In the content component aspect, the average value was 0.85 with the valid category. This data showed that the chemical equilibrium material contained in the flipped classroom learning system is by the learning objectives and the flow of learning objectives. This was theory that states the product can be said to be valid in the content component by curriculum needs [6]. The product was said to be valid if the components presented have a relationship with one another [31]. In the construct component (presentation) obtained an average value of 0.89 with a valid category. This data showed that the components of the flipped classroom learning system presented were by the structured inquiry syntax. The learning system developed has been equipped with exercises to help students find concepts. Learning used structured inquiry facilitates students in concept discovery with direct investigation activities [11].

In the aspect of language component, the average score was 0.86 with a valid category. This data showed that the language used in the preparation of the flipped classroom learning system was easy to understand. This is to the theory that sad that the product can be said to be valid in the language component if it can be read, has clear information, and has the suitability to write correct Indonesian spelling rules [16]. In the aspect of the graphic component, the average value is 0.87 with a valid category. One of the factors that determine the success of the learning process is the media used. The media must be designed attractively so that students' attention focuses on the material presented [32]. One of the improvements suggested by the validator can be seen in Figure 2 and Figure 3

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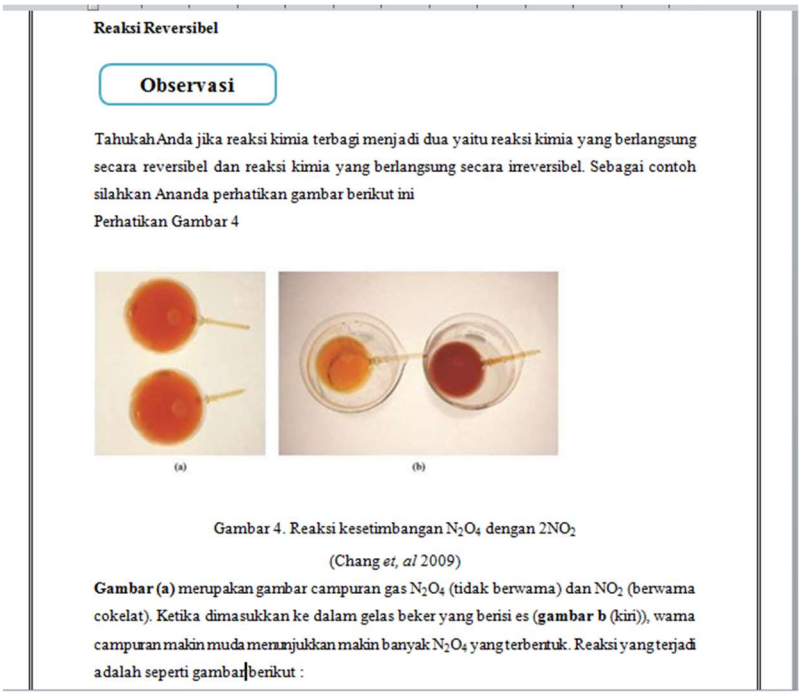


Reaksi Reversibel

Observasi

Tahukah Anda jika reaksi kimia terbagi menjadi dua yaitu reaksi kimia yang berlangsung secara reversibel dan reaksi kimia yang berlangsung secara irreversibel. Sebagai contoh silahkan Ananda perhatikan gambar berikut ini

Perhatikan Gambar 4

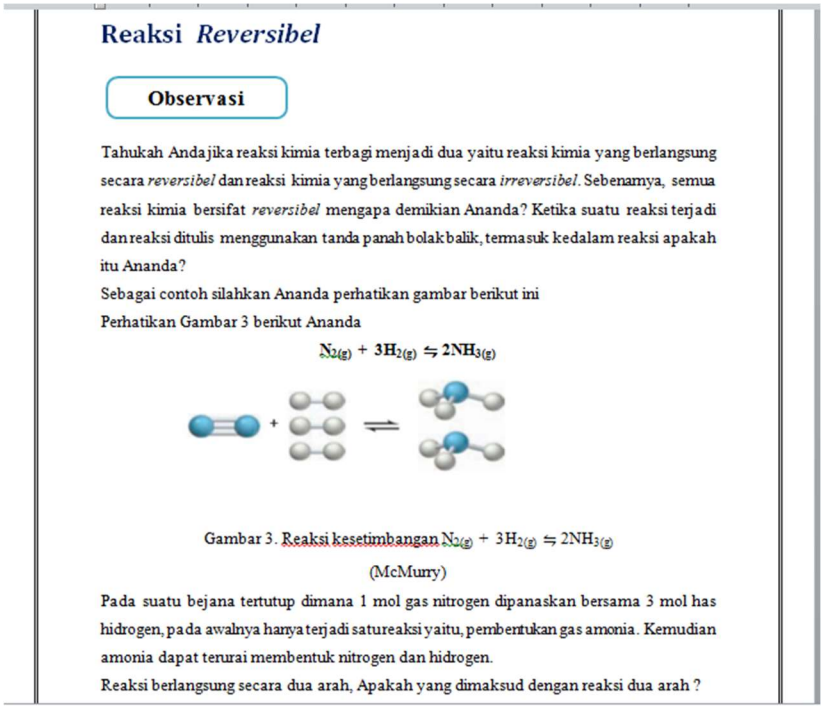
(a) (b)

Gambar 4. Reaksi kesetimbangan N_2O_4 dengan $2NO_2$

(Chang *et, al* 2009)

Gambar (a) merupakan gambar campuran gas N_2O_4 (tidak berwarna) dan NO_2 (berwarna cokelat). Ketika dimasukkan ke dalam gelas beker yang berisi es (**gambar b** (kiri)), warna campuran makin muda menunjukkan makin banyak N_2O_4 yang terbentuk. Reaksi yang terjadi adalah seperti gambar berikut :

Gambar 2. Before it is revised



Reaksi *Reversibel*

Observasi

Tahukah Anda jika reaksi kimia terbagi menjadi dua yaitu reaksi kimia yang berlangsung secara *reversibel* dan reaksi kimia yang berlangsung secara *irreversibel*. Sebenarnya, semua reaksi kimia bersifat *reversibel* mengapa demikian Ananda? Ketika suatu reaksi terjadi dan reaksi ditulis menggunakan tanda panah bolak balik, termasuk kedalam reaksi apakah itu Ananda?

Sebagai contoh silahkan Ananda perhatikan gambar berikut ini

Perhatikan Gambar 3 berikut Ananda

$$N_{2(g)} + 3H_{2(g)} \leftrightharpoons 2NH_{3(g)}$$

Gambar 3. Reaksi kesetimbangan $N_{2(g)} + 3H_{2(g)} \leftrightharpoons 2NH_{3(g)}$

(McMurry)

Pada suatu bejana tertutup dimana 1 mol gas nitrogen dipanaskan bersama 3 mol has hidrogen, pada awalnya hanya terjadi satureaksi yaitu, pembentukan gas amonia. Kemudian amonia dapat terurai membentuk nitrogen dan hidrogen.

Reaksi berlangsung secara dua arah, Apakah yang dimaksud dengan reaksi dua arah ?

Gambar 3. After revision

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The validator suggested replacing the picture in the observation syntax, Figure 2 on the concept of reversible reactions using Figure 3 three levels of chemical representations that make it easier for students to find the concept of reversible reactions

The next stage was a one-to-one evaluation with interviews with six students of class XII SMA Negeri 12 Padang. This stage was conducted to see the learners' response to the flipped classroom learning system produced. The student's assessment shows that the video sound displayed on Moodle is very clear. Moodle was arranged using language that is easy to understand, the learning stages on Moodle are clear between asynchronous learning and synchronous learning. Images of three levels of chemical representation displayed can make students understand the material.

3.2.4 **Prototype IV**

The valid flipped classroom learning system was tested for practicality through a small group test. Practicality data is generated from a practicality questionnaire given to two chemistry teachers of SMA Negeri 12 Padang, and nine students of SMA Negeri 12 Padang. Assessment of the level of practicality can be seen in terms of usefulness, time efficiency, and usefulness [33]. The results of the research on the level of practicality of the flipped classroom learning system based on structured inquiry using LMS Moodle on high school phase F chemical equilibrium material can be seen in Figure 4

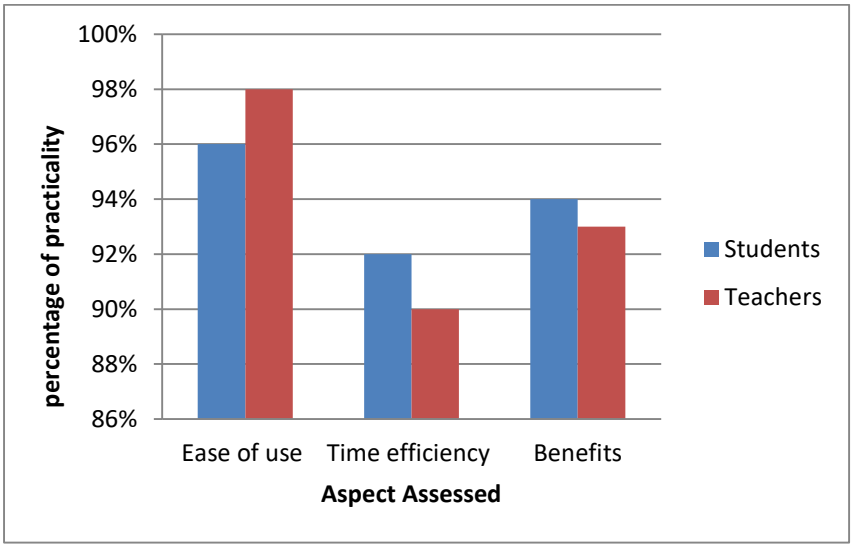

Figure 4. Practicality Result of Students and Teachers

The results of the practicality test of the structured inquiry-based flipped classroom learning system using LMS Moodle obtained the results of the small group test of the average student practicality of 94% with a very practical category, and the average results of teacher practicality of 94% with a very practical category. The details of each aspect are as follows:

In the aspect of ease of use, the practicality value is 98% of the average teacher response and 96% of the average student response with a very practical category. The level of practicality in ease of use can also be seen by considering whether the

product is easy to understand or not and can be used by teachers and students under normal circumstances [16]. This shows that the use of the product is practical and can be used in the learning process. In the aspect of time efficiency, the practicality value is 90% of the average teacher response and 92% of the average learner response with a very practical category. This showed that the use of a flipped classroom learning system using LMS Moodle can increase the effectiveness of learning time [34] and allow students to learn at their own pace [35].

In the benefit aspect, the average value of teacher practicality was 93% and the average value of students was 94% with a very practical category. This shows that using a flipped classroom learning system can help students to understand chemical equilibrium material, images, videos and tables on LMS Moodle can help students answer the leading questions presented on LMS Moodle. LMS Moodle was an alternative interactive learning media that develops the active, independent, and creative attitudes of students [34].

IV. CONCLUSION

Based on the results of the research and data analysis conducted, the resulting flipped classroom learning system based on structured inquiry using LMS Moodle on chemical equilibrium material for phase F SMA that has been developed was valid and practical.

REFERENCES

[1] S. Mulyani and Hardeli, "Entalpi Pendidikan Kimia Praktikalitas E-Modul Kesetimbangan Kimia Berbasis Discovery Entalpi Pendidikan Kimia," Entalpi Pendidik. Kim., vol. 3, no. 4, pp. 24–30, 2022.

[2] N. Sundami and M. Azhar, "Pengembangan Modul Kesetimbangan KimiaBerbasis Inkuiri Terstruktur dengan Menggunakan Tiga Level Representasi Kimia Untuk Siswa Kelas XI SMA," EduKimia, vol. 1, no. 1, pp. 11–20, 2019, doi: 10.24036/ekj.v1i1.104018.

[3] Nurhasanah, M. Azhar, and A. Ulianas, "Validity and practicality of chemical equilibrium module based on structured inquiry with three levels representation for students grade XI of senior high school," J. Phys. Conf. Ser., vol. 1481, no. 1, 2020, doi: 10.1088/1742-6596/1481/1/012084.

[4] A. P. Rinovia and M. Azhar, "Aurellia Putri Rinovia and 1* Minda Azhar," vol. 43, no. 1, pp. 28–34, 2024.

[5] P. V. Dhamayanti, "Systematic literature review: Pengaruh Strategi Pembelajaran Inkuiri Terhadap Kemampuan Berpikir Kritis Peserta Didik," Indones. J. Educ. Dev., vol. 3, no. 2, pp. 209–219, 2022, [Online]. Available: https://ojs.mahadewa.ac.id/index.php/ijed/article/view/1966/1530

[6] D. H. Rahma and M. Azhar, "Pengembangan Modul Berbasis Inquiri Terstruktur Pada Materi Larutan Penyangga pada SMA/MA," Edukatif J. Ilmu Pendidik., vol. 3, no. 3, pp. 1067–1074, 2021, [Online]. Available: https://edukatif.org/index.php/edukatif/article/view/512

[7] R. Bell, "Many Levels," 2005.

[8] I. Helsy and L. Andriyani, "Pengembangan Bahan Ajar Pada Materi Kesetimbangan Kimia Berorientasi Multipel Representasi Kimia," JTK (Jurnal Tadris Kim., vol. 2, no. 1, pp. 104–108, 2017, doi: 10.15575/jta.v2i1.1365.

[9] W. K. Ayunda and M. Azhar, "Pengembangan LKPD Materi Kesetimbangan Kimia Berbasis Inkuiri Terstruktur Pada Liveworksheet Untuk Fase F SMA," vol. 7, pp. 16582–16588, 2023.

[10] M. Zion and R. Mendelovici, "Moving from structured to open inquiry: Challenges and limits," Sci. Educ. Int., vol. 23, no. 4, pp. 383–399, 2012.

[11] Nurhikmah, "Meningkatkan Hasil Belajar Matematika Tema Kecepatan dan Debit dengan Menggunakan Model Inkuiri Terstruktur pada Siswa Kelas V SD Negeri Hap- ingin," Penelit. Tindakan Dan Pendidik., vol. 7, no. 2, pp. 25–32, 2021.

[12] D. Adriani, M. Azhar, L. Dj, A. Putra, and Yerimadesi, "Validity and Practicality Level of Acid-Base Electronic Module Based on Structured Inquiry Containing Three Levels of Chemical Representation for Senior High School Student," J. Phys. Conf. Ser., vol. 1788, no. 1, 2021, doi: 10.1088/1742-6596/1788/1/012038.

[13] D. I. K. Iv, "*h*????? 14,56," pp. 1–10.

[14] S. N. Hafsyah and T. Prihandono, "VIRTUAL-LAB PADA PEMBELAJARAN FISIKA DI SMP," pp. 158–164.

[15] M. R. Gaja and M. Mawardi, "Sistem Pembelajaran Flipped Classroom Berbasis Inkuiri Terbimbing Pada Materi Larutan Elektrolit dan Larutan Nonelektrolit untuk Siswa Kelas X SMA/MA," J. Pendidik. Tambusai, vol. 5, pp. 3173–3179, 2021, [Online]. Available: https://www.jptam.org/index.php/jptam/article/view/1366

[16] P. Studi, P. Kimia, and U. N. Padang, "Pengembangan Sistem Pembelajaran Flipped Classroom Berbasis Inkuiri Terstruktur Menggunakan Lms Moodle Pada Materi Laju Reaksi Kelas XI SMA / MA," vol. 7, pp. 16292–16302, 2023.

[17] R. Khumairah, A. Sundaryono, and D. Handayani, "Pengaruh Model Pembelajaran Flipped Classroom Terhadap Hasil Belajar Kimia Siswa Pada Materi Larutan Penyangga Di Sman 5 Kota Bengkulu," Alotrop, vol. 4, no. 2, pp. 92–97, 2020, doi: 10.33369/atp.v4i2.13832.

[18] M. Zuhaery and D. Hidayati, "Efektivitas Pembelajaran Flipped Classroom sebagai Solusi Pembelajaran Pasca Pandemi Covid 19," JIIP - J. Ilm. Ilmu Pendidik., vol. 6, no. 6, pp. 4149–4154, 2023, doi: 10.54371/jiip.v6i6.1746.

[19] A. X. Guterres et al., "SEBAGAI SARANA PENUNJANG PEMBELAJARAN MAHASISWA DI UNIVERSITAS NASIONAL TIMOR L OROSA ' E DILI Abstrak," pp. 33–46.

[20] L. Mubarokah, U. N. Azizah, A. Riyanti, B. N. Nugroho, and T. A. Sandy, "Pentingnya Inovasi Pendidik untuk Meningkatkan Kualitas Pendidikan," JIRA J. Inov. dan Ris. Akad., vol. 2, no. 9, pp. 1349–1358, 2021, doi: 10.47387/jira.v2i9.224.

[21] "Educational Design Research Educational Design Research".

[22] I. Review, "Facility location models for distribution plamning," no. 1972, 1985.

[23] I. A. Ismail and M. Mawardi, "Sistem Pembelajaran Kelas Terbalik Inkuiri Terpandu Aktif Materi Termokimia Untuk Siswa SMA Kelas XI," pp. 280–287, 2021.

[24] C. Alkalah, "済無No Title No Title No Title," vol. 19, no. 5, pp. 1–23, 2016.

[25] A. Indriani, I. B. Suryadharma, and Y. Yahmin , "Identifikasi Kesulitan Peserta Didik Dalam Memahami Kesetimbangan Kimia," J-PEK (Jurnal Pembelajaran Kim., vol. 2, no. 1, pp. 9–13, 2017, doi: 10.17977/um026v2i12017p009.

[26] Y. Yerimadesi, B. Bayharti, F. Handayani, and W. F. Legi, "Pengembangan Modul Kesetimbangan Kimia Berbasis Pendekatan Saintifik Untuk Kelas Xi Sma/Ma," Sainstek J. Sains dan Teknol., vol. 8, no. 1, p. 85, 2017, doi: 10.31958/js.v8i1.444.

[27] M. Eaton, "The flipped classroom," Clin. Teach., vol. 14, no. 4, pp. 301–302, 2017, doi: 10.1111/tct.12685.

[28] P. D. A. N. I. E-learning, M. Moodle, and D. A. N. Vicon, "DEVELOPING AND IMPLEMENTING E-LEARNING USING MOODLE," vol. 6, no. 1, 2016.

[29] S. F. Zahro' and I. Ismono, "Analisis Kemampuan Multirepresentasi Siswa Pada Materi Kesetimbangan Kimia di Masa Pandemi Covid-19," Chem. Educ. Pract., vol. 4, no. 1, p. 30, 2021, doi: 10.29303/cep.v4i1.2338.

[30] R. Sagita, F. Azra, and M. Azhar, "Pengembangan Modul Konsep Mol Berbasis Inkuiri Terstruktur Dengan Penekanan Pada Interkoneksi Tiga Level Representasi Kimia Untuk Kelas X Sma," J. Eksakta Pendidik., vol. 1, no. 2, p. 25, 2017, doi: 10.24036/jep.v1i2.48.

[31] T. Rachmawati, M. Azhar, S. Aini, and F. Azra, "Validity and Practicality of the Salt Hydrolysis Electronic Module Based on Structured Inquiry with Interconnection of Three Levels of Chemicals Representation," J. Phys. Conf. Ser., vol. 1788, no. 1, 2021, doi: 10.1088/1742-6596/1788/1/012039.

[32] R. Rahmatullah, I. Inanna, and A. T. Ampa, "Media Pembelajaran Audio Visual Berbasis Aplikasi Canva," J. Pendidik. Ekon. Undiksha, vol. 12, no. 2, pp. 317–327, 2020.

[33] A. Asmiyunda, G. Guspatni, and F. Azra, "Pengembangan E-Modul Kesetimbangan Kimia Berbasis Pendekatan Saintifik untuk Kelas XI SMA/ MA," J. Eksakta Pendidik., vol. 2, no. 2, p. 155, 2018, doi: 10.24036/jep/vol2-iss2/202.

[34] M. Samsudin and J. Ni Nyoman Utami, "Pengembangan Pembelajaran E-learning Dengan Moodle (Modulator Object-Oriented Dynamic Learning Environment)," J. Sist. dan Inform., vol. 14, no. 1, pp. 1–8, 2019, doi: 10.30864/jsi.v14i1.210.

[35] H. Pitra, "Flipped Classroom Sebagai Strategi Pembelajaran Pada Era Digital," pp. 54–58.

[36] N. Purwanto, Prinsip-Prinsip dan Teknik Evaluasi Pengajaran. Bandung: PT Remaja Rosdakarya, 2010