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Article

Validity E-Learning of Chemistry Learning Based on PjBL (Project Based Learning) model for Basic Chemistry Law Material with the Flipped Classroom Approach for Ten Grade High School

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Abstract— Project-based learning (PjBL)-based e-learning of the basic chemistry law document after applying the flipped classroom approach to the identified learning process. This type of study is Research and Development (R and D), and the technology used in this study is an improved version of the use of 4D design. The implementation phases define, design, develop, and deploy. Due to time and cost constraints, the implementation phase was not implemented. The survey materials used are the verification questionnaire and the actual questionnaire. The authentic questionnaire generated one chemistry instructor from the Department of Mathematics and Natural Sciences and one teacher from MAN 2 Pesisir Selatan. Data were analyzed using kappa moments. The validity test for a mean kappa time amount of 0.84 in the very high potency category. Component validity checks for a mean kappa moment of 0.78 in the high category. Thus, it can turn the classroom approach upside down and make online project-based learning (PjBL) of the fundamental laws of chemistry relevant and practical for use in the classroom learning program.

Keywords— **E-Learning, PjBL, Basic Chemical Laws, Flipped Classroom**

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I. INTRODUCTION

The development of globalization in the 21st century tends to be based on science and technology. These two components are interconnected with each other, especially in the field of education for the present.

Quality education is shown by the production of students who have skills in accordance with the demands of the times. There

are nine learning criteria that are able to train 21st century skills, namely: a curriculum that is relevant to the daily lives of students, learning that involves various disciplines, developing higher order thinking skills, applying the knowledge gained to other areas or other disciplines that intersect with everyday lifeday, teaching how to learn, learning that counteracts misconceptions, learning in teams, utilizing technology, and encouraging the creativity of students [1].

During the Covid-19 pandemic, learning was conducted online. Where online learning demands the ability of teachers in utilizing technology. One of them is the utilization of e-learning based on project based learning (PjBL) and blended learning by applying flipped classroom (FC) method.

When student learning activities encounter obstacles, the teacher must provide direction to create conducive and effective learning activities. So the application of good learning media is needed to support good student learning activities. Media as a limited meaning, namely as e-learning [2]. The media that are available or that are made today cannot be separated from the help of a technology that includes various things including education. One type of technology that has great potential to be used as an Information Technology-based learning medium is the use of computer technology.

The use of computers as interactive learning media can be achieved by using various forms of computer-aided learning (CAL) programs, email and multimedia computers that can be used as a learning tool for individuals and groups. In this case, researchers use technology-based media, or e-learning [3]. E-learning is a learning process done over the network, e-learning can provide textbooks and store study guides anytime, anywhere [4], [5].

The learning process is efficient and effective. E-Learning has proven to be effective in the learning process to improve conceptual understanding. The use of E-Learning applications in learning can significantly improve concept understanding compared to conventional learning [6]. In addition, in other studies, there is a significant difference between participants who only learn using conventional learning and participants who do learning through E-Learning [7]. Therefore learning using the internet can be used in the form of E-Learning, this will be a change for student activity because it will not be saturated just by listening [8],[9].

Project-based learning (PjBL), or project-based learning, is a learner-centered learning model that enables in-depth study of a topic [10]. Project-based learning is a student-centered learning model that provides learners with a meaningful learning experience. Students' learning experiences and concepts are based on products created in project-based learning [11].

While learning with blended learning implements the following stages: (1) Seeking of information, (2) Acquisition of infotmation, (3) Synthesizing of knowledge [12]. Flipped Classroom (FC) is basically a learning process where, the learning stage begins with understanding learning material outside the classroom (at home) and the next stage, applying and evaluating the concepts learned in the learning process in class [13].

Flipped classroom learns to reverse the traditional learning state. Just as students do homework (PR) outside of school or at home, flipped classrooms allow students to do homework, present materials at home through learning videos, and provide documentation and classroom discussions you can [14], [15]. Flipped classroom is a matter of ideology rather than a more specific methodology or proper approach to the rules [16]. Teachers are also free to add or create approaches based on first-hand experience in the classroom from the perspective of student effectiveness [17]. To facilitate the delivery of documents using flipped classroom templates, you need a way to apply the templates. The media comes from the Arabic word "medius". This means mediating, mediating, or referral. "Media wasail or wasilah means referral from an intermediary or sender to a recipient" [18]. Given the existence of media, flipped classrooms have tools for modeling themselves [19].

The application in learning in e-learning begins with the first stage of blended learning

that is Seeking of information includes the inclusion of information from various sources of information available onlie maupu offline. In the second phase of acquisition of infotmation, individual learners and cooperative-collaborator groups strive to find, understand, and confirm them using existing facilities [20]. The last stage of Synthesizing of knowledge, constructing knowledge through the process of assimilation and accommodation departs from the analysis, discussion and formulation of conclusions from the information obtained. The learning process implemented through e-learning is very valid to be used in chemistry learning [21],[22]. So that researchers are also interested in applying it to learning chemistry with the material of Basic Chemistry Laws [23].

According to the New Media Consortium (NMC) report, which annually releases the latest technology in the world of education, flipped classroom learning is classified as the latest innovation medium and is highly recommended for higher education throughout the world, aiming to build students' individual learning skills, teaching and critical thinking [24]. In research stated that the flipped classroom method has been applied all over the world both in schools for various fields of study [25]. By combining the learning approach, the technology base used, and the appropriate learning model, it will be very supportive of the 2013 curriculum learning process, which requires students to be more active and more able to learn independently in the learning process. The learning process with e-learning can increase student learning outcomes, increase student learning motivation, and have a high level of validity and practicality [26, 27, 28].

Based on this, research was conducted related to "Validity E-Learning of Chemistry Learning Based on PjBL (Project Based Learning) model for Basic Chemistry Law Material with the Flipped Classroom approach for Ten Grade High School".

II. METHODE

This type of research is Research and Development (R&D) research. R&D is the process of developing new products or improving existing products. The development model used is a 4-D model which consists of 4 stages, namely define, design, develop, and disseminate. However, this research is limited to the develop stage, namely the validity test. The subjects in this study were 1 chemistry teacher at the UNP and 1 chemistry teacher at MAN 2 Pesisir Selatan.

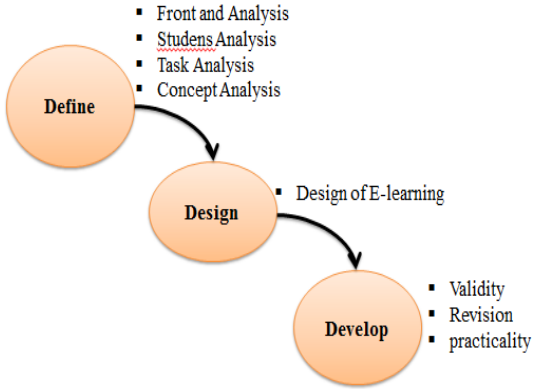

Figure 1. Stages of the 4-D development model

At step define (definition) define and define the requirements of learning. This stage includes: (a) front-end analysis; (b) student analysis; (c) task analysis; (d) concept analysis; (e) formulation of learning objectives. The design stage is carried out to designe-learning based on Project Based Learning (PjBL) with flipped classroom approach. The develop stage is carried out to produce e-learning based on Project Based Learning (PjBL) with the flipped classroom approachvalid and practical to be used in the learning process of high school students. The research data collection instrument used was a validity questionnaire (addressed to 1 chemistry lecturer at the UNP and 1 chemistry teacher at MAN 2 Pesisir Selatan).

The data obtained were analyzed using the Kappa Cohen formula below.

$$\text{momen kappa } (\kappa) = \frac{\rho_o - \rho_e}{1 - \rho_e}$$

Information:

κ = Kappa moment

ρ_o = Proportion that is realized

ρ_e = Unrealized proportion

Based on the Kappa moment values obtained, conclusions can be drawn as shown in table 1.

Table 1. Category of Decisions Based on Kappa Moments (κ)

Interval	Category
0.81 - 1.00	Very high
0.61 - 0.80	High
0.41 - 0.60	Moderate
0.21 - 0.40	Low
0.01 - 0.20	Very low
≤ 0.00	Invalid

III. RESULT AND DISCUSSION

3.1 Defining Stage

The define stage are obtained 5 datas from of:

3.1.1 Front end analysis

Front-end analysis (beginning-end) obtained data in the form of interview results which stated that students were not yet fully able to understand the concepts in the Basic Law of Chemistry material. Teachers must have more roles to be able to instill concepts, especially in this Basic Chemical Law material. Even more so in the current state of Covid. Learning during the Covid-19 pandemic requires the ability of teachers to be able to teach online (online). This requires teachers to adjust the learning methods and models to be applied. One form of learning that can be applied is with the help of e-learning based on project based learning (PjBL) and blended learning by applying the flipped classroom (FC) method.

3.1.2 Student analysis

Based on the analysis that has been carried out on students, it was found that online learning with the method of providing material links and assignments has a saturated effect on students in learning, then causes students to not understand the material well, as well as a lack of enthusiasm for students in learning.

3.1.3 Task analysis

The task analysis was conducted by analyzing basic competencies (KD) based on the curriculum syllabus 2013 revision 2018. Based on the syllabus of chemistry subjects curriculum 2013 revision 2018, there are 2 Basic Competencies (KD) that must be mastered by students namely KD 3.10. Apply the basic laws of chemistry, the concept of relative molecular mass, chemical equations, mole concepts, and substance levels to complete chemical calculations and KD 4.10. Analyze the data of the experiment results using the basic laws of quantitative chemistry. From both KD can be lowered to several GPA, including: 3.10.1. Describe the conclusions of Lavoisier's law and Proust's law; 3.10.2. Analyzing the legal benefits of mass immortality (Lavoisier) on daily life; 3.10.3. Analyzing the legal benefits of fixed comparison (Proust) on human life; 4.10.1. analyze the data of the results of the experiment to conclude the law of Lavoisier; 4.10.2. Analyzing the data of several compounds to prove the law of comparative multiples (Dalton's law); 4.10.3. Analyzing experimental data to prove the law of volume comparison (Gay Lussac law); 4.10.4. Analyzing trial data to prove Avogadro's legal law.

3.1.4 Concept analysis

The concepts contained in the Basic Law of Chemistry are arranged hierarchically into a concept map. These concepts are analyzed based on the university chemistry textbooks and high school chemistry. Some of the concepts are Lavoiseir's Law, Proust's Law, Dalton's Law, Gay-Lussac's Law, and Avogadro's Law.

3.1.5 Analysis of learning objectives

The learning objectives that have been formulated for the Basic Law of Chemistry material on e-learning based on Project Based Learning (PjBL) with the flipped classroom approach refer to the writing of learning objectives based on the 2018 revised 2013 Curriculum, namely: Through the e-learning model based on Project Based Learning (PjBL)) with the flipped classroom approach by extracting information from various learning sources, simple investigations and processing information, it is expected that students are actively involved during the teaching and learning process, have a curious attitude, are thorough in carrying out responsibility in answering questions, giving suggestions and criticism, and students analyze experimental data and the benefits of basic laws of chemistry in everyday life from the law of conservation of mass,

3.2 Design Stage

At this design stage, an e-learning learning and learning guide book with e-learning is produced as follows:

Figure 2. Display on E-learning

The cover section contains the identity which includes the name of the e-learning development title, the title of the material, the target user, the name of the e-learning developer. The name of the e-learning and the title of the material is published to provide information about the approach model used in e-learning, namely flipped classrooms and the title of the material used, namely the basic law of chemistry Cover is designed with attractive colors to be able to attract students to read and study it. The cover is also equipped with images related to the material.

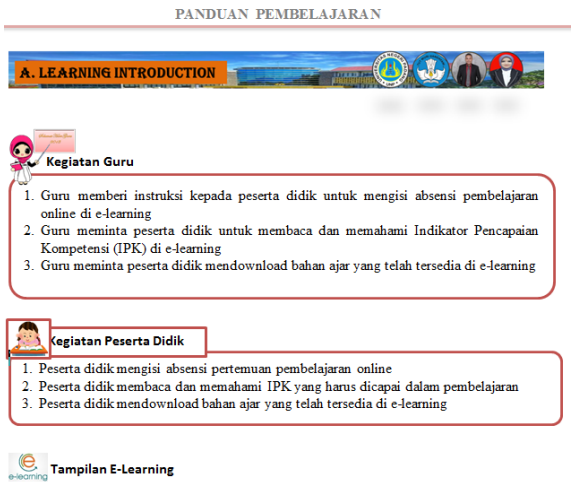

Figure 3. Guide to Using E-e-learning

The guide to using e-learning contains learning steps based on project based learning (PjBL) by applying the flipped classroom (FC) approach. So that teachers and students can use it properly and appropriately.

3.3 Development Stage

3.3.1 Validation test

The validity test is an assessment of the design of a product. The assessment aspect is divided into several components consisting of content, language, presentation, and graphics components [29]. The validity test is an assessment of the design of a product. The assessment aspect consists of content validity and construct validity [30]. Validation was carried out by 1 chemistry lecturer of Faculty of Mathematics and Natural Sciences UNP and 1 chemistry teacher at MAN 2 Pesisir Selatan as validators. The validator is an expert with a minimum number of at least 2 people [31]. Criticism, input, and suggestions from the validator were taken into consideration for revising e-learning based on project based learning (PjBL) and blended learning by applying the flipped classroom (FC) method. Based on the assessments that have been obtained. The data was processed using Cohen's kappa formula. The results of content validation obtained can be seen in the graph in Figure 4.

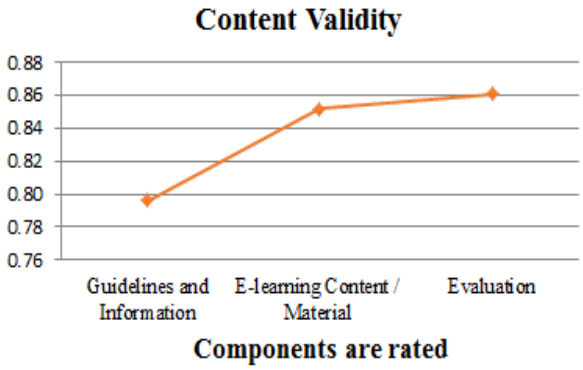

Figure 4. Results of Content Validity Data Analysis by the Validator

The results of data analysis from each component of the content validity test assessed

by the validator obtained a kappa moment, namely, the guide and information component was 0.80 with the high category, the content component/elerning material was 0.85 with a very high category, the evaluation component was 0.86 with very high category high.

The content validation sheet contains 22 aspects of assessment which contains 3 components, namely a guide and information component, a content component/e-learning material, and an evaluation component. Assessment data using the kappa cohen formula. Based on the results of the two validators' assessment of the E-learning developed, it was found that the e-learning developed had very high validity with an average value of the kappa moment of 0.84.

While the results of the construct validation obtained can be seen in Figure 5.

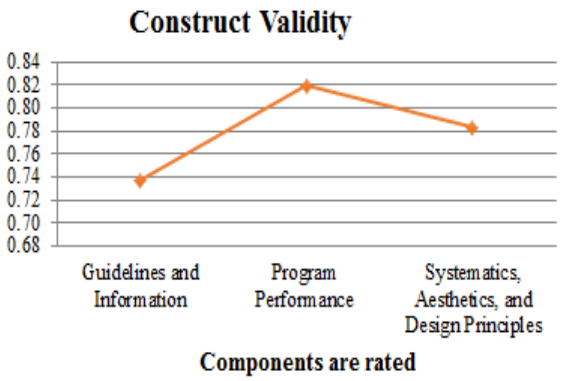

Figure 5. Results of Construct Validity Data Analysis by the Validator

The results of data analysis from each component of the construct validity test assessed by the validator obtained a kappa moment, namely, the guidance and information components were 0.74 in the high category, the program performance component was 0.82 with the very high category, the aesthetic systematics component and the design principle were 0, 78 in the high category.

The construct validation sheet contains 36 aspects of the assessment which contains 3 components, namely the guide and information component, program performance, and the aesthetic mathematical component and the design principle. Assessment data using the kappa cohen formula. Based on the results of the two validators' assessment of the developed e-learning, it was found that the e-learning developed had high validity with an average value of the kappa moment of 0.78. Thus the results of the e-learning developed are valid. This shows that e-learning based on Project Based Learning (PjBL) with the flipped classroom approach is in accordance with its components.

A development product is said to be valid if it is in accordance with adequate theory and all components are consistently interconnected[32].

Validity e-learning based on Project Based Learning (PjBL) with the flipped classroom approach even though it is declared to have high validity category, there are still several components that must be improved according to the suggestions given by the validator, so a revision is made to the developed LKPD to be more perfect.

3.3.2 Revision

Carried out based on suggestions from 2 validators. The recommended revision is replacing the learning procedure with the blended learning procedure.

Before revision

Before revision

3.3.3 Practicality

At this stage, practicality questionnaires were given to teachers and students of MAN 2 Pesisir Selatan. Practicality data was obtained from teacher and student response questionnaires. The results of the data analysis of the practicality assessment of Project Based Learning (PjBL)-based learning with a flipped classroom approach from teachers and students can be seen in Figure 6.

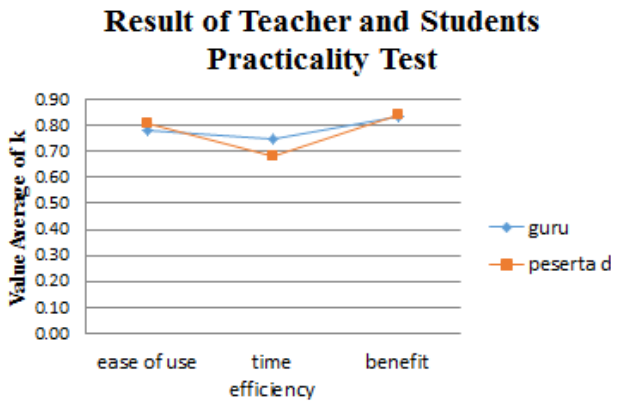

Figure 6. Results of Data Analysis for Practical Teachers and Students

Based on the graph above, the results of the assessment data analysis are obtained e-learning based on Project Based Learning (PjBL) with the flipped classroom approachby teachers and students each component, namely: Ease of use componente-learning The chemistry teacher obtained a kappa moment of 0.78 is a high category and for students a kappa moment was 0.81 is a very high category. The results of the assessment of the time efficiency component by the teacher obtained a kappa moment of 0.75 with a high category and students obtained a kappa moment of 0.68 is a high category. Furthermore, for the benefit componente-learning The teacher obtained a kappa moment of 0.83 is a very high category and students obtained a kappa moment of 0.84 is a very high category.

IV. CONCLUSION

Based on the research that has been done, e-learning based on Project Based Learning (PjBL) has been produced using a flipped classroom approach to the 4-D development model. The resulting e-learning has been tested for validity. Based on the data analysis, it was found that the content validity test with the average value of kappa moment was 0.84 with very high validity category and in the construct validity test the average value of kappa moment was 0.78 with high practicality category. Based on the results of the validity test, it can be concluded that e-learning based on Project Based Learning (PjBL) with a flipped classroom approach is valid.

REFERENCES

[1] Sari, I. P., & Zainul, R. (2021). Penyusunan Konten Pembelajaran E-learning Berbasis Aplikasi Moodle Pada Materi Asam Basa. *Entalpi Pendidikan Kimia*. DOI: https://doi.org/10.24036/epk.v0i0.101

[2] Zainul, R. (2016). Studi Literasi Menggunakan Endnote Dan Aplikasi Pembantu (Google Translator, Google Cendikia, Google Sites, Chemoffice 2008, e-learning, dan Snipping Tool).DOI: 10.31227/osf.io/5ncpe

[3] R. Servidio. 2018. Perle: An "Open Source", Elearning Moodle-Based, Platform. A Study of University Undergraduates'acceptance. Vol.8, Behavioral Sciences. DOI: https://doi.org/10.3390/bs8070063

[4] S.Sumarwati. 2020. Developing Mathematics Learning Media Based on Elearning Using Moodle on Geometry Subject to Improve Students' Higher Order Thinking Skills. Vol. 14, International Journal of Interactive Mobile Technologies, pp. 182-91. DOI: https://doi.org/10.3991/ijim.v14i04.12731

[5] Adri, M., Zainul, R., Wahyuningtyas, N., Wedi, A., Surahman, E., Aisyah, E. N., ... & Adnan, E. (2020, July). Development of Content Learning System in Professional Education Subjects for Educational Institutions in Indonesia. In *Journal of Physics: Conference Series* (Vol. 1594, No. 1, p. 012022). IOP Publishing. DOI:10.1088/1742-6596/1594/1/012023

[6] Zainul, R., Adri, M., Wahyuningtyas, N., Wedi, A., Surahman, E., Aisyah, E. N., ... & Adnan, E. (2020, July). Development of e-Learning Courses for Subjects about 'Learn and Learning'with Moodle-based for Prospective Teacher in Indonesia. In *Journal of Physics: Conference Series* (Vol. 1594, No. 1, p. 012023). IOP Publishing. DOI:10.1088/1742-6596/1594/1/012023

[7] R.R. Ayuyang. 2019. 'Interactive Learning (Ilearn) Tool: An Elearning Portal Designed Using Moodle for Cagayan State University in the Philippines', in *ACM International Conference Proceeding Series*, pp. 11-16. DOI:https://doi.org/10.1145/3330482.3330507

[8] Littlejohn, A., Falconer, I., & Mcgill, L. (2008). Characterising effective eLearning resources. *Computers & Education*, *50*(3), 757-771. https://doi.org/10.1016/j.compedu.2006.08.004

[9] Afrianti, T., & Zainul, R. (2021, February). e-Learning Development on Basic Chemical Law Materials in Senior High School (SMA/MA) to Improve High Order Thinking Skill Ability. In *Journal of Physics: Conference Series* (Vol. 1783, No. 1, p. 012128). IOP Publishing. Doi :10.1088/1742-6596/1783/1/012128

[10] Laelasari. 2018. 'Self Regulated Learning Trough Project Base Learning on the Prospective Math Teacher', in *Journal of Physics: Conference Series*.
Doi :10.1088/1742-6596/983/1/012156

[11] M.Giatman. 2019. 'Needs Analisys Pedagogy Project Management of Technology and Vocational Educational with the Approach of Project Base Learning in Higher Education', in *Journal of Physics: Conference Series*. doi:10.1088/1742-6596/1387/1/012066

[12] Kristanto, A. (2017). The Development of Instructional Materials E-Learning Based on Blended Learning. *International Education Studies*, *10*(7), 10-17. DOI: https://doi.org/10.5539/ies.v10n7p10

[13] G. Akçayır. 2018. The Flipped Classroom: A Review of Its Advantages and Challenges. Vol. 126, *Computers and Education*, pp. 334-45.DOI:https://doi.org/10.1016/j.compedu.2018.07.021

[14] Suranakkharin, T. (2017). Using the flipped model to foster Thai learners' second language collocation knowledge. *3L: Language, Linguistics, Literature®*, *23*(3). DOI: http://dx.doi.org/10.17576/3L-2017-2303-01

[15] H.Syakdiyah2018 'The Effectiveness of Flipped Classroom in High School Chemistry Education', in *IOP Conference Series: Materials Science and Engineering*. doi:10.1088/1757-899X/434/1/012098

[16] L.R. Murillo-Zamorano. 2019. How the Flipped Classroom Affects Knowledge, Skills, and Engagement in Higher Education: Effects on Students' Satisfaction. Vol. 141, Computers and Education. DOI: https://doi.org/10.1016/j.compedu.2019.103608

[17] F. Hinojo Lucena. 2019. Influence of the Flipped Classroom on Academic Performance. A Systematic Review. Vol. 8, *Campus Virtuales*, pp. 9-18. DOI:10.3390/math8122162

[18] H. Lin. 2019. Research Trends of Flipped Classroom Studies for Medical Courses: A Review of Journal Publications from 2008 to 2017 Based on the Technology-Enhanced Learning Model. Vol. 27, *Interactive Learning Environments*, pp. 1011-27. https://doi.org/10.1080/10494820.2018.1467462

[19] S. Sergis. 2018. *Investigating the Impact of Flipped Classroom on Students' Learning Experiences: A Self-Determination Theory Approach*. Vol. 78, *Computers in Human Behavior*, pp. 368-78. DOI: https://doi.org/10.1016/j.chb.2017.08.011

[20] L. Cheng. 2019. Effects of the Flipped Classroom Instructional Strategy on Students' Learning Outcomes: A Meta-Analysis. Vol. 67, *Educational Technology Research and Development*, pp. 793-824.

[21] I. Awidi. 2019. The Impact of a Flipped Classroom Approach on Student Learning Experience. Vol. 128, *Computers and Education*, pp. 269-83. https://doi.org/10.1016/j.compedu.2018.09.013

[22] Afrianti, Trayda., And Zainul, Rahadian. 2021. E-learning Development on Basic Chemical Law Materials in Senior High School (SMA / MA) to Improve High Order Thinking Skill Ability. Journal of physics, conference resies. DOI: https: // doi: 10.1088

/ 1742-6596 / 1783/1/012128 /

[23] Afrianti, T., & Zainul, R. (2021, February). e-Learning Development on Basic Chemical Law Materials in Senior High School (SMA/MA) to Improve High Order Thinking Skill Ability. In *Journal of Physics: Conference Series* (Vol. 1783, No. 1, p. 012128). IOP Publishing. Doi: 10.1088/1742-6596/1783/1/012128

[24] Casselman, M. D., Atit, K., Henbest, G., Guregyan, C., Mortezaei, K., & Eichler, J. F. (2019). Dissecting the flipped classroom: Using a randomized controlled trial experiment to determine when student learning occurs. *Journal of Chemical Education*, *97*(1), 27-35. DOI: https://doi.org/10.1021/acs.jchemed.9b00767

[25] Schultz, D., Duffield, S., Rasmussen, S. C., & Wageman, J. (2014). Effects of the flipped classroom model on student performance for advanced placement high school chemistry students. *Journal of chemical education*, *91*(9), 1334-1339. DOI: https://doi.org/10.1021/ed400868x

[26] Hakim, A. R. 2018. "Pengembangan E-Learning Berbasis Moodle Sebagai Media Pengelolaan Pembelajaran. Kodifikasia," vol. 12, no. 2, pp.17. DOI: 10.21154/kodifikasia.v12i2.1516

[27] Wahyuningtyas, N., Zainul, R., Adri, M., Wedi, A., Surahman, E., Aisyah, E. N., ... & Adnan, E. (2020, July). Development of Moodle-based Content Learning System in MKDK Student Development Subjects at LPTK in Indonesia. In *Journal of Physics: Conference Series* (Vol. 1594, No. 1, p. 012021). IOP Publishing. DOI:10.1088/1742-6596/1594/1/012021

[28] Humairah, N., Damanik, M., & Eddyanto, E. (2018). The effect of e-learning media application using problem based learning models to activities and results of student learning in salt hydrolysis subject. *Jurnal Pendidikan Kimia*, *10*(3), 397-402. doi: https://doi.org/10.24114/jpkim.v10i3.12702

[29] Setiawan, A., Putra, D. R., Sujalwo, S., & Cahyo, A. N. (2019). Development of Moodle-based Learning Media using Blended Learning Methods in Graphic Design Subject. *IJID (International Journal on Informatics for Development)*, 52-54. https://doi.org/10.14421/ijid.2019.08201

[30] Betsch, M., Wild, M., Jungbluth, P., Hakimi, M., Windolf, J., Haex, B., ... & Rapp, W. (2011). Reliability and validity of 4D rasterstereography under dynamic conditions. *Computers in biology and medicine*, *41*(6), 308-312. https://doi.org/10.1016/j.compbiomed.2011.03.008

[31] Y.C. Chen, (2019), 'Deep Learning of Web Page Verification Code-Taking Project for Implementation of Remedial Instruction-Technology-Base Test Website as an Example', in *2019* IEEE International Conference on Consumer Electronics - Taiwan, ICCE-TW 2019. DOI:10.1109/ICCE-TW46550.2019.8991900

[32] D. Dushkova, (2020), Methodology for Development of a Data and Knowledge Base for Learning from Existing Nature-Based Solutions in Europe: The Connecting Nature Project. Vol. 7, *Methodsx*. https://doi.org/10.1016/j.mex.2020.101096