

Implementation of an Interactive E-Module to Improve Concept Understanding of Students

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ABSTRACT

Background of this study is based on the information obtained that the students still experience difficulty in understanding the concept of redox material. Additionally, from the interview results, the teachers in learning processes used handbooks and had used PowerPoint (PPT), yet the handbooks and PowerPoint are considered less able to assist in explaining abstract chemical concepts. This study aimed at discovering the influence of interactive e-module implementation using kvisoft flipbook maker application to improve the students' conceptual understanding of the redox material of 10th grade. The design of the study used was pre-experimental using a pretest-posttest design which engaged one class as the experimental class. The sampling technique used purposive sampling that obtained one sample class namely 10th class MIA 5 of Madrasah Aliyah Negeri (MAN) 2 Pekanbaru. The data analysis results of study using Wilcoxon test showed the Z score of -4,792 with the p-value (asymptotic, Sig. 2-tailed) of 0,000; thus, the hypothesis decision taken is that the H_a is accepted. The conclusion is that there is a significant increase or improvement in the implementation of interactive e-module using the kvisoft flipbook maker on redox material to the students' conceptual understanding of 10th grad at MAN 2 Pekanbaru.

Keywords: *Interactive E-module, Concept understanding, Oxidation-reduction, Kvisoft flipbook maker application.*

1. INTRODUCTION

Along with the development of the 21st century, which is marked as the century of globalization, human life in the 21st century has undergone fundamental changes that are different from the order of life in the previous century [1]. These changes occur very quickly and difficult to be predicted in all aspects of life covering the fields of economy, transportation, technology, communication, information, education, and others [2, 3, 4].

Indonesia in dealing with the 21st century must be able to balance so that life can develop according to the times, one of them is thru education. Moreover, learning in the 21st century is stated to be the age of education [5]. Currently, the teachers are urged to develop the 21st Century skills of the students in

schools by means of the core skills area (Communication, Collaboration, Critical Thinking and Problem-Solving and Creativity and innovation) and special skills, namely the use of technology, information and communication (ICT) (TIK) [6].

Learning is carried out thru an interaction process between the students and the teacher in the learning environment. The Government Regulation Number 19 of 2005 article 19 paragraph 1 reveals that the learning process in education is held interactively, inspirational, in a fun, challenging manner, can motivate the students to participate actively, and provide sufficient space for the initiative, creativity, and independence according to the talents, interests, and physical and psychological development of students.

Thru the Government Regulation Number 19 of 2005 article 19 paragraph 1, in the learning, the students are expected to be able to use method and even learning material which engages the students actively and creates fun, interesting, and interactive atmosphere adapted to the developmental stage of thinking, characteristics and student learning conditions. To realize these goals, the teachers should have skills in choosing, using methods, teaching material, and doing new innovation in creating an effective and efficient learning environment for the students. The use of good teaching material will influence the learning processes in class to be better and the students will be more enthusiastic in learning.

However, so far, the teaching materials used by the teachers are packaged in a non-interactive form, so that they cannot stimulate the process of students' conceptual understanding. The conceptual understanding refers to the students' ability to relate new knowledge to the existing knowledge in different ways of conveying it without changing its true meaning [7]. Therefore, teaching material is needed to explain the material in more detail, visualize abstract material, understand good concepts, train the students to think and be able to solve problems. Based on the circumstances, the utilization of interactive multimedia as utilization of information technology (IT) development is very appropriate to be utilized in discussing the material so that the students are familiar to use the IT-based teaching material, in which it is in accordance with the development of technology and can compete globally [8, 9, 10, 11, 12].

Interactive multimedia provides a concept thru an interesting combination of images, animation, and even voices. By using these displays, students' boredom due to the monotonous learning will be reduced; hence, the students will be more motivated and more interested in understanding the material delivered [13, 14, 15]. Thru these media, the students are expected to produce effective learning environment [16, 17] and they are better to understand material concepts in real [18]. Furthermore, conceptual understanding is very important in learning, since by understanding the concept, the students can develop their abilities in each learning material. Additionally, it can generate motivation in the learning activities. One of the interactive media is E-module.

E-module is used as a digital learning media or non-printed media that is made systematically for independent study needs [19, 20]. E-module is an electronic version from the printed module, where the module is a component which has crucial role in the learning processes [21, 22, 23] and it is printed while the e-module can be read in the computer and it is

designed using a software [24, 25, 26]. The development of e-module using an application i.e. kvisoft flipbook maker. Kvisoft Flipbook Maker becomes one of media to convert the document in the form of PDF to be digital publication, in which it is displayed like a digital magazine that is varied, innovative, and efficient [27]. The gains of this program are not only in textual form but it is able to integrate sound, images, animation, video, movies, so that the information presented is richer compared to the conventional books and makes the learning to be more interactive and interesting so that the learning is not monotonous [28, 29].

The use of e-module during the learning processes can advance the students' participation [30] and make them to understand the real concept of the material. The conceptual understanding refers to the students' ability to connect new knowledge with the existing knowledge [7] and by possessing a good conceptual understanding the students are able to develop their abilities in each learning material. This is in line with the statement of Novitasari [13] in her study that by using the interactive multimedia, in this term is e-module which provides a concept using an interesting combination of images, animation, and even sounds. Using such a display, the students' boredom due to monotonous learning will be reduced, so that the students will be more interested in understanding the material given.

Chemistry is a distinctive scientific discipline, one of its peculiarities is that it contains abstract concepts, yet chemistry is closely related to everyday life [31]. Redox reaction is one of the chemistry concepts that is interesting to be learned in the school. However, there are ongoing reports of students' difficulty in understanding the concept of redox [32].

Based on the interview results of chemistry teacher in MAN 2 Pekanbaru, it is obtained the information that the students still get difficulties in understanding the concept of redox material, since the students are still confused with the concepts of redox, determining the oxidation number of an element in a compound or ion, redox reactions and determining the nomenclature of compounds according to IUPAC. Furthermore, from the interview results, in the learning process, the teacher uses handbooks and has used PowerPoint (PPT), it's just that the handbooks and PowerPoints are considered not able to help in explaining the abstract chemical concepts. Consequently, according to the background explanation above, the researcher is interested to conduct an investigation entitled "The Implementation of Interactive E-Module using Kvisoft Flipbook Maker Application to Improve Students' Conceptual Understanding of the Redox Material".

2. METHOD

This study was conducted during the covid-19 pandemic at MAN 2 Pekanbaru on the even semester of the academic year of 2019/2020. The method used in this study was pre-experimental research method by means of one group pretest-posttest research design [33].

Table 1. One group pretest-posttest design

Subject	Pre-Test	Treatment	Post Test
1 group	O ₁	X	O ₂

Where:

O₁: pre-test score before being given the treatment

X: treatment

O₂: Score of posttest after being given the treatment

This study involved one class, namely the experimental class without the control. Sample determination used purposive sampling which involved 1 group, namely the experimental group. The population of this study was the students of 10th grade at MAN 2 Pekanbaru. From the population, 1 class was taken as the sample, namely X MIA 5 (Mathematics and Natural Science).

The data of students' conceptual understanding were obtained thru an instrument i.e objective test, in which it consisted of 40 items of redox material that had been organized based on the indicators of conceptual understanding. The indicators used to measure the conceptual understanding consisted of 7 indicators that were in accordance with the National Education Standards Agency (BSNP) [34], namely: (1) Restating a concept, (2) Classifying the object based on certain characteristics (based on the concept), (3) Giving example and Non-example from the concept, (4) Providing the concept in various form of mathematical representation, (5) Developing the necessary or sufficient conditions of a concept, and (7) Selecting certain procedures, Implementing the concept or algorithm of problem-solving. The test was used to observe the conceptual understanding of redox material in the form of multiple-choice item that comprised 40 items.

The test was in the form of 40 objective questions given to the students before and after the implementation of interactive e-module. After the pretest and posttest data were collected, data processing was carried out by using the SPSS V 23 program. The data processing used in the analysis was normality test, in which it was Shapiro-Wilk test. After conducting the hypothesis test, the Wilcoxon test was conducted, of which test had stipulation if

the value of Asymp.Sig. (2-tailed) was smaller < 0.05; then, H_a was accepted or if the value of Asymp.Sig. (2-tailed) was smaller than > 0.05, the H_a was rejected. The hypotheses of this study are:

H_a: There is a significant improvement from the implementation of interactive e-module using Kvisoft Flipbook Maker application to improve the students' conceptual understanding of the redox material of 10th grade at MAN 2 Pekanbaru.

H_o: There is no significant improvement from the implementation of interactive e-module using Kvisoft Flipbook Maker application to improve the students' conceptual understanding of the redox material of 10th grade at MAN 2 Pekanbaru.

3. RESULT AND DISCUSSION

Pre-test and posttest were carried out in this study. The pretest was tested before starting the study to discover the initial ability of the students. Whereas the posttest was tested after the study to measure the conceptual understanding that had been obtained by the students. The effectiveness of e-module to the improvement of students' conceptual understanding can be seen from the improvement of result score of pretest and posttest, where the obtained score will be analyzed using percentage descriptive statistics. The results of conceptual understanding improvement of students after using the e-module in the learning process could be seen in the Table 2 and Figure 1:

Table 2. Improvement percentages of conceptual understanding before and after using the e-module

No	Indicators	Percentage	
		Before using e-module	After using e-module
1	Restating a concept	49%	88%
2	Classifying the object based on certain characteristics (based on the concept)	34%	85%
3	Giving example and Non-example the concept	24%	92%
4	Using, utilizing, and selecting certain procedures	17%	82%
5	Providing a concept in various form of mathematical representation	17%	90%
6	Developing the necessary or sufficient conditions of a concept	10%	93%
7	Implementing the concept or algorithm of problem-solving	25%	93%

No	Indicators	Percentage	
		Before using e-module	After using e-module
	Average achievement of conceptual understanding indicators	25%	89%

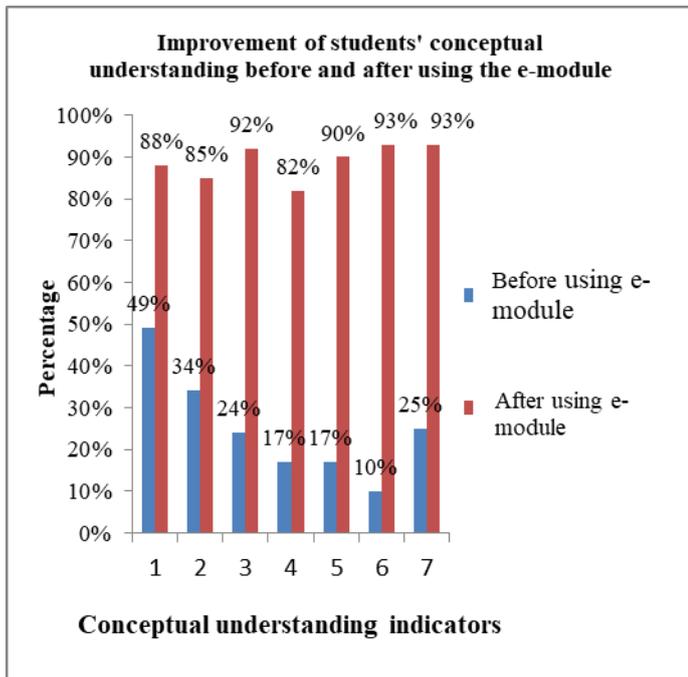


Figure 1. Improvement percentage of conceptual understanding before and after using the e-module

Based on the Table 2 and Figure 2, the calculation results were obtained that the average score of pretest was 25%, while the average score of posttest was 89%, in which it was higher than the pretest score, it meant that the students' conceptual understanding to use the e-module was better than the students' conceptual understanding that did not use the e-module.

The data of students' conceptual understanding from the results of pretest and posttest were then analyzed. The analysis results of normality test used the Shapiro Wilk test, where the normality test was carried out to discover whether the data of pretest and posttest score were normally distributed or not, it could be seen in the Table 3:

Table 3. The normality test result data of conceptual understanding

	Shapiro-Wilk		
	Statistic	df	Sig.
Pretest	0.937	30	0.076
Posttest	0.873	30	0.002

According to the Table 3 above, it could be seen that the data score of pretest and posttest of the experimental class had the respective sig values of 0,076 and 0,002, it meant that the pretest data score was normally distributed since the data had the sig > 0,05, while the posttest score was declared not normally distributed since the data had the sig < 0,05; thus it could be concluded that the data for the hypotheses test of this study were then continued with the Wilcoxon test, in which it was a non-parametric test to measure the significance of the difference between two groups of paired data with an ordinal or interval scale but not normally distributed. The Wilcoxon Match Pair Test is an alternative test of the Paired Sample T-Test if it does not meet the normality assumption with the determination that Ha is accepted if the p-value (asymptotic Sig. 2-tailed) is less than the critical research limit of 0.05.

Based on the results of Wilcoxon signed Rank Test, it was obtained the Z score of -4,792 with the p-value (asymptotic Sig. 2-tailed) of 0,000 so that the hypothesis decision was that the Ha was accepted. It means that there is a significant improvement from the implementation of interactive e-module using the Kvisoft Flipbook Maker application to improve the students' conceptual understanding of the redox material of 10th grade of MAN 2 Pekanbaru, it can be seen from the Table 4:

Table 4. The analysis result data of Wilcoxon test

	Posttest - Pretest
Z	-4.792 ^b
Asymp. Sig. (2-tailed)	0.000

This is because the interactive e-module using the Kvisoft flipbook maker application on redox material is in accordance with the needs of students in understanding the concept of redox material. The interactive e-module that is applied to the learning process is equipped with explanations, examples of questions on the material that make it easier for students to understand the redox material. In addition, this interactive e-module is also equipped with images, animations, videos, and interactive buttons and evaluations.

The exercise items which have function to evaluate the students' ability to master the material that has been studied. The material and exercises are delivered interactively so that the students can directly discover whether the answer given is correct or not. In accordance with Utomo's theory in Nita [35] that by using the module, the students can learn according to their level of ability and after completing the lesson, the students can expose the level of success achieved. The existence of the module gives the students an opportunity to remedial or fix the weaknesses, mistakes or deficiencies of

students and the students can find out their own evaluations that are given continuously.

The interactive e-module on the redox material will make the learning to be more effective, easy, and fun and the learning can be done by coming through the space and time. Moreover, the researcher conducted the study during the Covid-19 pandemic which makes the learning cannot be done face-to-face but through google classrooms so that it helps and it is very efficient with the use of interactive e-module with redox material. In accordance with the benefits of e-module, it can make the learning process more interesting, interactive, and it can be done anytime and anywhere and also improve the quality of learning [20]. This is in line with Prastowo (2013) that the module is one of teaching material form that can assist the students to improve their understanding and teaching material as well, in which it can explain well and easily since it is arranged systematically which completed by various images, directions, and brief explanation so that it is easy for students to understand. A study conducted by Nita Sunarya Herawati and Ali Muhtadi [35], electronic module (e-module) is used as an effective learning sources to improve the students' conceptual understanding in the mastery of Chemistry material of 12th grade of Natural Science (IPA) of even semester on the acid-base material. A study of Moh. Wahyudi Catur Raharjo, et al., [36] assert that the use of interactive e-module can construct the concepts on chemical bonding materials and can apply these concepts in everyday life.

4. CONCLUSION

Departing from the results obtained in this study, the improvement of conceptual understanding before implementing the interactive e-module using the kvisoft flipbook maker application on the redox material had the average score of 25 and after implementing the interactive e-module using the kvisoft flipbook maker application on the redox material, the average score increases to 85,83. The final data analysis in this study uses the Wilcoxon test, in which it is obtained the Z score of -4,790 with the *p-value (asympt. Sig 2 tailed)* of 0,000. Consequently, the hypothesis decision is that the H_a is accepted. The conclusion of this study is that there is an influence of students' conceptual understanding to the implementation of interactive e-module of the redox material of 10th grade.

REFERENCES

- [1] E.Y. Wijaya, D.A. Sudjimat, A. Nyoto, Transformasi Pendidikan Abad 21 Sebagai Tuntutan Pengembangan Sumber Daya Manusia

Di Era Global, dalam Prosiding Seminar Nasional Pendidikan Matematika, Universitas Negeri Malang, Malang, vol. 1, 2016, pp. 263-278.

- [2] I .W. Redhana, Mengembangkan Keterampilan Abad Ke-21 dalam Pembelajaran Kimia, dalam Jurnal Inovasi Pendidikan Kimia, vol. 13, no. 1, 2019, pp. 2239-2253.
- [3] R.L. Mahajan, R. Mueller, J. Reed, C.B. Williams, T.A. Cambell, and N. Ramakrishnan, Cultivating Emerging and Balck Swan Technologies, in ASME Proceeding, International Mechanical Engineering Congress and Exposition, 2012, pp. 549-557.
- [4] F.S. Irwansyah, I. Lubab, I. Farida, M.A. Ramdhani, 2017, Interactive Electronic Module in Chemistry Lessons, in Journal of Physics: International Conference on Mathematics and Science Education (ICMScE), Program Studi Pendidikan Kimia, UIN Sunan Gunung Djati, Bandung, no. 895, 2017, 1-7. DOI: <https://doi.org/10.1088/1742-6596/895/1/012009>
- [5] T.MT. Soh, N.M. Arsad, K. Osman, 2010, The relationship of 21st century skills on students' attitude and perception towards physics, dalam Procedia Social and Behavioral Sciences, vol. 7(C), 2010, pp. 546–554. DOI: <https://doi.org/10.1016/j.sbspro.2010.10.073>
- [6] A. Ball, H.D. Joyce, D.A. Butcher, (2016). Exploring 21st Century Skills and Learning Environments for Middle School Youth, in International Journal of School Social Work, vol. 1, no. 1, 2016, pp. 1-15. DOI: <https://doi.org/10.4148/2161-4148.1012>
- [7] I. Jjbeili, The Effect of Cooperative Learning with Metacognitive Scaffplding on Mathematics Conceptual Understanding and Procedural Fluency, in International Journal foe Research in Education, Arab East Colleges for Graduate Studies – K.S.A, no. 32, 2012, pp. 45-71.
- [8] Z.F. Khan, S.R. Alotaibi, Design and Implementation of a Computerized User Authentication System for E-Learning, in International Journal of Emerging Technologies in learning (iJET), vol. 15, no. 9, 2020, pp. 4-18.
- [9] O. Tarawi , A.M. Noer, R. Linda, The Development of Acid-Base E-Chemistry Magazine as Interactive Teaching Materials, in Journal of Physics: Conference Series, The 5th International Seminar on Science Education, no 1440, 2020, pp. 1-8. DOI:

- <https://doi.org/10.1088/1742-6596/1440/1/012012>
- [10] S. Wahyuni, Erman, S. Y. Sudikan, B. Jatmiko, Edmodo-Based Interactive Teaching Materials as an Alternative Media for Science Learning to Improve Critical Thinking Skills of Junior High School Students, in *International Journal of interactive Mobile Technologies (Ijim)*, vol. 14, no. 9, 2020, pp. 166-181. <https://doi.org/10.3991/ijim.v14i09.13041>
- [11] M.A. Ramdhani, E.R. Wulan, The Analysis of Determinant Factors in Software Design for Computer Assisted Instruction, in *International Journal of Scientific & Technology Research*, vol. 1, no. 8, 2012, pp. 69-73.
- [12] M.A. Ramdhani, H. Muhammadiyah, The Criteria of Learning Media Selection for Character Education in Higher Education, in *International Conference of Islamic Education: Reforms, Prospects and Challenges*, Malang, 2015, pp. 174-182.
- [13] D. Novitasari, Pengaruh Penggunaan Multimedia Interaktif Terhadap Kemampuan Pemahaman Konsep Matematis Siswa, dalam *Jurnal Pendidikan Matematika & Matematika*, vol. 2, no. 2, 2016, pp. 8-18.
- [14] W. Wiana, M.S. Barliana, A.A.Riyanto, The Effectiveness of Using Interactive Multimedia Based on Motion Graphic in Concept Mastering Enhancement and Fashion Designing Skill in Digital Format, in *International Journal of Emerging Technologies in learning (iJET)*, vol. 13, no. 2, 2018, pp. 4-20. <https://doi.org/10.3991/ijet.v13i02.7830>.
- [15] H. Aulawi, A.S. Amin, E-Learning Analysis And Design Based On Technology Acceptance Model, in *International Journal Of Scientific & Technology Research*, vol. 8, no. 4, 2019, pp. 126-132.
- [16] S. Nusir, I. Alsmasi, M. Al-Kabi, F. Sharadgah, Studying the Impact of Using Multimedia Interactive Programs on Children's Ability to Learn Basic Math Skills, in *Journal E-Learning and Digital Media*, vol. 10, no. 3, 2013, pp. 305-319. <http://dx.doi.org/10.2304/elea.2013.10.3.305>.
- [17] I. Farida, The Importance of Development of Representational Competence in Chemical Problem Solving Using Interactive Multimedia, in *Proceeding of The Third International Seminar on Science Education*, Bandung, 2009, pp. 259-277.
- [18] K. Osman, T.T. Lee, Impact Of Interactive Multimedia Module With Pedagogical Agents On Students' Understanding And Motivation in The Learning Of Electrochemistry, in *International Journal of Science and Mathematics Education*, 2014, pp. 395-421. DOI: <https://doi.org/10.1007/s10763-013-9407>.
- [19] A. Jaenudin, Baedhowi, T. Murwaningsih, The Effectiveness of the E-Module of Economics Learning on Problem-Based Learning used to Improve Students' Learning Outcomes, in *Advances in Social Science, Education and Humanities Research (ASSEHR)*, vol. 158, 2017, pp. 30-36.
- [20] F. A. Perdana, Sarwanto, Sukarmin, I. Sujadi, Development Of E-Module Combining Science Process Skills and Dynamics Motion Material to Increasing Critical Thinking Skills and Improve Student Learning Motivation Senior High School, in *International Journal of Science and Applied Science*, vol. 1, no. 1, 2017, pp. 45-54. <https://doi.org/10.20961/ijsascs.v1i1.5112>.
- [21] Parmin, E. Peniati, Pengembangan Modul Mata Kuliah Strategi Belajar Mengajar IPA Berbasis Hasil Penelitian Pembelajaran, dalam *Jurnal Pendidikan IPA Indonesia*, vol. 1, no. 1, 2012, pp. 8-15.
- [22] W. Istuningsih, B. Baedhowi, K.B. Sangka, The Effectiveness of Scientific Approach Using E-Module Based on Learning Cycle 7E to Improve Students' Learning Outcome, in *International Journal of Educational Research Review*, vol. 3, no. 3, 2018, pp. 75-85.
- [23] Z. Abidin dan S.E. Walida, Interactive E-Module Model of Transformation Geometry Based on CASE (Creative, Active, Systematic, Effective) as a Practical and Effective Media to Support Learning Autonomy and Competence, in *International Journal of Development Research*, vol. 9, no. 1, 2019, pp. 25156-25160.
- [24] S.I. Wahyuni, A.M. Noer, R. Linda, Development of Electronic Module Using Kvisoft Flipbook Maker Application on the Chemical Equilibrium, in *Proceeding of the 2nd URICES*, Pekanbaru, 2018, pp. 178-189.
- [25] I.M. Suarsana, G.A. Mahayuti, Pengembangan E-Modul Berorientasi Pemecahan Masalah Untuk Meningkatkan Keterampilan Berpikir Kritis Mahasiswa, dalam *Jurnal Pendidikan Indonesia*, vol. 2, no. 2, 2013, pp. 264-275.
- [26] B. Oktari, Susilawati, J. Copriady, Implementation of Oriented Literated Science E-

- Module to Improve Critical Skills Thinking About in Hydrocarbon Material, in *Journal of Educational Sciences*, vol. 4, no. 2, 2020, pp. 347-356. <https://doi.org/10.31258/jes.4.2.p.347-356>.
- [27] S, Fahmi, S.W. Priwanto, R.A. Cahdriyana, A. Hendroanto, S.N. Rohmah, L.C. Nisa, Interactive Learning Media Using Kvisoft Flipbook Maker for Mathematics Learning, in *Journal of Physics: Conference Series*, The Sixth Seminar Nasional Pendidikan Matematika Universitas Ahmad Dahlan 2018, no. 1188, 2019, pp. 1-6. <https://doi.org/10.1088/1742-6596/1188/1/012075>.
- [28] Syamsurizal, Haryanto, & N. Chairani, Pengembangan E-Modul Berbasis Keterampilan Proses Sains Pada Materi Kesetimbangan Kimia Untuk Tingkat SMA. in *Prosiding SEMIRATA 2015 bidang MIPA BKS-PTN Barat*, 2015, pp. 655-661.
- [29] R. Linda, Herdini, I. Sulistya, T.P. Putra, Interactive E-Module Development through Chemistry Magazine on Kvisoft Flipbook Maker Application for Chemistry Learning in Second Semester at Second Grade Senior High School, in *Journal of Science Learning*, vol. 2, no. 1, 2018, pp. 21-25. <https://doi.org/10.17509/jsl.v2i1.12933>.
- [30] N. Ganesan, Rapid Development of Multimedia Instructional Modules for Information Technology Education, in *Journal of International Technology and Information Management*, vol. 18, no. 1, 2009, pp. 83-98.
- [31] Faizah, S.S. Miswadi, S. Haryani. Pengembangan Perangkat Pembelajaran Berbasis Masalah Untuk Meningkatkan Soft Skill Dan Pemahaman Konsep, dalam *Jurnal Pendidikan IPA Indonesia*, vol. 2 no. 2, 2013, pp. 120-128.
- [32] K.A. Gyamfi, J.G. Ampiah, Students' Alternative Conceptions Associated With Application of Redox Reactions in Everyday Life, in *Asian Education Studies*, vol. 4, no. 1, 2019, pp. 29-38. <https://doi.org/10.20849/aes.v4i1.590>.
- [33] Sugiyono, *Metode Penelitian Pendidikan*, Alfabeta, Bandung, 2019.
- [34] Badan Standar Nasional Pendidikan (BSNP), *Model Penilaian Kelas*, Depdiknas, Jakarta, 2006.
- [35] N.S. Herawati, A. Muhtadi, Pengembangan Modul Elektronik (E-Modul) Interaktif Pada Mata Pelajaran Kimia Kelas XI SMA, dalam *Jurnal Inovasi Teknologi Pendidikan* vol. 5, no. 2, 2018, pp. 180-191. <http://dx.doi.org/10.21831/jitp.v5i2.15424>.
- [36] M.W.C. Raharjo, Suryati, Y. Khery, Pengembangan E-Modul Interaktif Menggunakan Adobe Flash Pada Materi Ikatan Kimia Untuk Mendorong Literasi Sains Siswa. Dalam *Jurnal Ilmiah Pendidikan Kimia "Hydrogen"*, vol. 5, no. 1, 2017, pp. 8-13.