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Validity and Practicality of Guided Inquiry-Based Interactive Multimedia on Topic of Acid-Base for Senior High School Learning

Easy Kurniawati[1*], Syamsi Aini[1]

[1]Study Program of Chemistry Education Postgraduate, Universitas Negeri Padang, Padang, Indonesia.

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Corresponding Author:
Easy Kurniawati
easykurniawatizyluv@gmail.com

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Abstract: This research aims to generate a guided inquiry-based interactive multimedia on an Acid-Based product. It also categorizes its validity and practicality. The method of research used in this paper is research that will create a certain product called Research and Development (R&D). Three phases of the Plomp Model will be used in this research including preliminary research phase, prototyping phase, and assessment phase. In this research, the instrument will be used in a questionnaire consisting of a validity sheet and practicality sheet. The actual product was validated by 6 chemistry expert validators and 3 multimedia expert validators. The practicality test was carried out by 2 chemistry teachers and 33 students of XI MIPA 3 from SMAN 2 Padang Panjang. The data analysis technique used is Aiken's V technique for validity and the percentage technique for practicality. The result of the analysis of the chemistry expert validation and multimedia expert validation data based on Aiken's V value showed a result of 0.92 and 0.98 with a valid category. The practicality of interactive multimedia results was 88.33 and 87.60 with a very high practice. The interactive multimedia that has been produced is valid and practical to be used.

Keywords: Guided inquiry; Interactive multimedia; Acid-based.

Introduction

Learning about acids and bases is one of the chemistry materials studied by senior high school's students. Characteristics of acid and base materials are very complex (Silberberg, 2010; Chang & Overby, 2011) and interrelated with previous studies, where the acids and bases concepts are closely related to ionization reactions, equilibrium reactions, chemical calculations, and neutralization reactions. The characteristics of the acid and base material itself include comparing the development of acid and base theory, understanding the ionization reaction of acid and base compounds to determine their strength, calculating the pH value, and seeing the function of acid and base indicators to determine the nature of the acid and base solutions (Utami et al., 2017).

Based on the preliminary research in SMAN 1 Batipuh, SMAN 2 Padang Panjang, and SMAN 3 Padang Panjang, around 90% of the students studied stated that the material for acids and bases was quite difficult for them to understand where only about 60% of students can achieve the Minimum Completeness Criteria (Known with KKM). The teacher who was the respondent stated that the obstacles that caused the students to have difficulty in: (1) understanding the acids and bases concept, (2) distinguishing between strong acids, strong bases, weak acids, and weak bases, (3) calculating the pH value, and (4) difficulty in describing the ionization reaction of a compound. In addition, based on the results of student questionnaires, they also find it difficult to determine the formula to be used in solving acid and base questions.

Efforts that can be made to reduce these obstacles are to stimulate students' chemical representation capabilities including the macroscopic, the submicroscopic, and the symbolic levels (Ahmad et al., 2021). Acids and bases are chemical concepts that have characteristics related to the chemical representation. At the macroscopic level, students can examine natural

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phenomena such as the sour taste of lime juice or the bitter and slippery taste of soapy water. In addition, students can also observe macroscopic events in the laboratory through practical activities for determining pH values using a pH meter or pH Universal. Meanwhile, at the submicroscopic level of representation, we can show the shapes of molecules or ions involved in the proton ion transfer process when dissolving an acid or base in water. Then symbolically, a proton ion transfer reaction equation can be made in an acid solution or a basic solution in the form of a symbol (Sari & Helsy, 2018). So that by honing the ability of chemical representation, making students understand chemical events in acids and bases that make learning more meaningful.

However, the COVID-19 pandemic has made teaching and learning activities in schools very limited (Nuraisyah et al., 2021). Practical activities also often cannot be carried out in the laboratory. Whereas practicum activities include important skills that students must have to create meaningful learning by connecting theories and concepts learned in class with chemistry related to everyday life (Kartimi et al., 2021). Some alternative learning methods carried out by teachers are by sending learning videos, practicum videos (demonstrations), and independent assignments to students online for them to study and do at home (Saputro et al., 2021; Muliadi et al., 2021). This situation requires students to study without guidance from the teacher it can cause feelings of stress and anxiety because they must study alone (Bhamani, et al., 2020). Therefore, we need a learning media that can guide students to learn even though it is a long distance.

Distance learning or online require adaptive media, models, and learning strategies so that students can understand learning even though they must study independently in their respective homes. This can be produced because technological developments that occur at this time allow us to design creative learning media that does not only use one media but can combine various kinds of media in one display of learning media which is termed multimedia (Hadiyanti & Widya, 2018). Multimedia is a combination of several types of media can be text, images, animation, video, or sound. The combination of several media is integrated into a computer to be processed and presented in one media format simultaneously (Lestari, 2020). Interactive multimedia (the existence of two-way communication or more than several communication components) is stimulating students to analyze the learning materials displayed and answer questions related to the learning materials actively so that students can draw conclusions from the learning materials they have learned (Rahmi et al., 2021; Yulianci et al., 2021). One application that is often used to create interactive multimedia in learning is the Microsoft PowerPoint application. This is supported by menus that allow users to create and develop interactive and fun learning media (Lestari, 2020). Moreover, at this time Microsoft has updated the PowerPoint 2010 application to PowerPoint 2019 and PowerPoint 365 which have better features and make it easier for users to design interactive learning media that can stimulate students to actively learn with guidance from the PowerPoint media. The advantage of Microsoft PowerPoint is that it doesn't need to be installed to be able to access it because there are already computers that use Microsoft Office on average. In addition, the use of the Microsoft PowerPoint application is quite easy for teachers and students to use compared to other interactive multimedia applications such as Macromedia Flash and Adobe Flash (Wirangga et al., 2018).

The interactive multimedia PowerPoint is to be arranged based on the Competency Achievement Indicators (Known with IPK) expected by the curriculum, a suitable learning model that can guide students to learn easily. One of the best learning models that strongly suggested by Permendikbud No. 22 of 2016 is a guided inquiry-based learning model. So, the guided inquiry-based learning media is expected to encourage students to gain knowledge through investigation and help students identify concepts related to learning materials (Lepiyanto & Pratiwi, 2015). The guided inquiry learning model encourages students to learn to think, understand the process of science, provide real experiences to students, and invites students to make discoveries, observe, classify, predict, measure, and make conclusions according to the characteristics of the material (Ulfa et al., 2022) (Nurohman, Sunarno, Sarwanto, & Yamtinah, 2021). This research aims to build an interactive multimedia in a PowerPoint media based on guided inquiry-based on the acid-base topic for senior high school students. The validity and practicality of this interactive multimedia are also determined.

Method

The product is generally created as an interactive multimedia on acid-based material was developed using PowerPoint 365. Interactive multimedia was developed using the Plomp development model seriously. This research model was in some phases including preliminary research, prototyping, and assessment (Akker et al., 2010). A guided inquiry learning model in an interactive multimedia was consisting of five syntaxes including orientation syntax, exploration syntax, concept formation syntax, application syntax, and closing syntax (Hanson, 2005).

The interactive multimedia validation was carried out by six chemists' validators and three multimedia expert validators. Then the practicality was implemented by two teachers who teach chemistry and

33 students who in the XI SMA class. The validity of interactive multimedia was analyzed using Aiken's V formula (Equation 1).

$$V = \frac{\sum s}{n(c-1)} \quad (1)$$

Keterangan:
s = r - Io
r = the validator's number given
Io = the lowest validity rating
c = the highest number of assessments
n = number of validators (Aiken, 1985).

Interactive multimedia practicality was analyzed using the percent practicality formula (Equation 2) (Yanto, 2019).

$$\%\ \text{Practicality} = \frac{\text{Total score}}{\text{Maximum score}} \times 100\% \quad (2)$$

Table 1. Categories of Practically Assessment

Achievement Rate	Category
81 – 100	In Very Practical
61 – 80	In Practical
41 – 60	In Quite Practical
21 – 40	In Less Practical
0 – 20	In Not Practical

Result and Discussion

Preliminary Research

Activities that are implemented at the Preliminary Research stage are needs, context, and concept analysis. In the needs analysis stage, interviews with chemistry teachers were conducted as respondents and students filled out online questionnaires via Google Forms. After the interviews and questionnaires, the results show that learning resources and learning media that are widely used by teachers during the COVID-19 pandemic are learning videos on the internet. Making student hard to understand the material because there is no direct guidance from the teacher. So that students also find it difficult to continue the next material that is related to each other.

Furthermore, context analysis is obtained from an analysis of the curriculum on acid-base material. The curriculum used is the COVID-19 Pandemic Emergency Curriculum. Then the concept analysis was obtained from the analysis of the concepts of acid-base based on general chemistry books and relevant high school chemistry books.

Prototyping Phase

The interactive multimedia activity or design process is made using PowerPoint 365 according to the stages of the guided inquiry by Hanson (2005) applied by Moog (2011); Moog and Farrell, (2011). The interactive multimedia design consists of several components like the cover, main menus, main menus instructions, profiles, user manuals, competencies, material menus, and materials. Interactive Multimedia is designed using orange which is included in the warm color category. Warm colors are colors that attract the eye and evoke emotions. At work (or study) warm colors can increase motivation and attract attention. A warm color scheme makes work faster, cheerful, and full of energy (Chang et al., 2018; Cholilawati, 2021). The result of this design interactive multimedia process called Prototype I. Here is some view of the components in Figures 1, 2, and 3.

Figure 1. Interactive Multimedia Cover

Figure 2. Exploration and Conceptual Formation

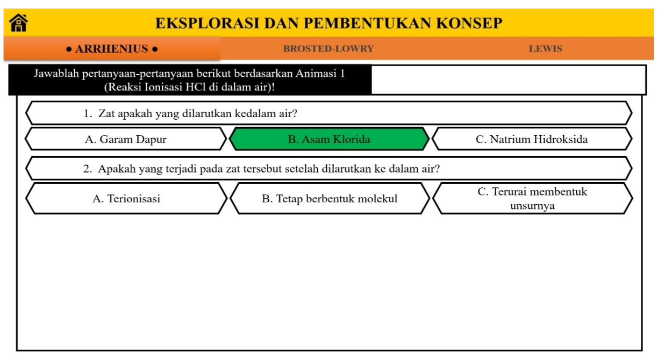

Figure 3. Interactive Questions

The Prototype I focus on the completeness of interactive multimedia as the required elements that should exist in interactive multimedia, the completeness phase of the guided inquiry-based learning model, and chemical representation. The result of this evaluation will be named as the Prototype II.

The expert review and one-to-one evaluation are implemented in the next step. There are nine expert validators including six chemistry expert validators and three multimedia expert validators who have validated this interactive multimedia development. The result of expert review evaluation from chemistry expert validation based on Aiken’s V value showed a result of 0,92 with a valid category. This result is summarized in Table 2.

Table 2. Chemistry Expert Validity Test Result

Rated Components	V	Category
Component of Contents	0.91	Valid
Component of Constructs	0.93	Valid
Component of Language	0.94	Valid
Component of Graphics	0.93	Valid
Average	0.92	Valid

In table 2 above shows in terms of content components, this interactive multimedia has a valid score in all categories with Aiken's value of 0.91. These data indicate that interactive multimedia is appropriate with the curriculum used and developed with a strong theoretical study. The suitability in terms of content components can be seen based on motivation, a model that has used chemical representation including macroscopic, submicroscopic, and symbolic, interactive questions, exercises, and conclusion questions that have been in accordance with guided inquiry.

Guided inquiry learning is an effective pedagogy to teach nature of matter (Özkanbaş & Kırık, 2020) and chemical representation play an important role in helping learner to understand chemical contents (Head, Yoder et al., 2017). Designing it in an interactive multimedia can provide environments that support guided inquiry learning and channel students into productive inquiry (Moore et al., 2013).

Furthermore, the construct component, interactive multimedia has a Valid category with Aiken's value of 0.93. These data indicate that the interactive multimedia developed has been systematically arranged. The presentation of interactive multimedia is considered systematic in terms of presentation of interactive multimedia components, presentation of learning stages, presentation of material, presentation of models, and presentation of interactive questions.

The presentation of interactive multimedia is considered to have been systematic in accordance with the interactive multimedia components consisting of cover, main menu, main menu instructions, profiles, usage instructions, competencies, material menus, and materials. Interactive multimedia is systematic and in accordance with the guided inquiry learning cycle, starting from the orientation stage, then exploring and forming concepts, then the application stage, and finally closing.

The interactive multimedia has presented sequential learning materials ranging from acid-base theory, ionic balance in acid and base solutions, and pH calculations to acid-base indicators. Interactive multimedia has been systematic in presenting models in the form of illustrations of the chemical representation. The presentation of interactive questions has been systematic starting from factual questions with low-level cognitive (can be answered based on the model presented or previous knowledge) to abstract questions with high-level cognitive (stimulating students to think critically).

The assessment of the linguistic component and the graphic component is another important assessment in addition to the assessment in terms of the content component and the construct component of the product being developed. The linguistic component and the graphic component, interactive multimedia have a valid score with Aiken's average value of 0.94 and 0.93 respectively. This data shows that interactive multimedia has used language according to good and correct Indonesian rules. The product also has easy and clean instructions, information and interactive questions. Font type and size, layout, model and color selection are considered clear and attractive overall.

The suggested improvements can be seen in Figures 4 and 5. Validator suggests changing the use of symbols H^+/H_3O^+ to H_3O^+ so that students understand the actual situation that H^+ cannot stand alone and must bind to other compounds so that the situation is close to stable.

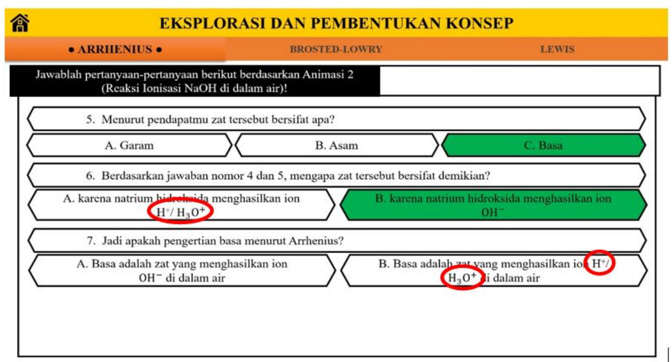

Figure 4. Before Revision

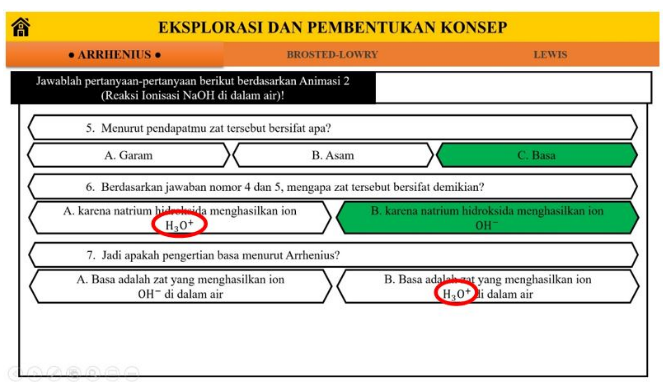

Figure 5. After Revision

Next is the result of expert review evaluation from multimedia expert validation based on Aiken's V value showed a result of 0,98 with a valid category. This result is summarized in Table 3.

Table 3. Multimedia Expert Validity Test Result

Rated Components	V	Category
Display Aspects	0.97	Valid
Media Aspects	1	Valid
Average	0.98	Valid

Assessment of display aspects and media aspects in Table 3 shows that interactive multimedia has a Valid category with Aiken's values of 0.97 and 1. These data indicate that the product is interactive multimedia based on guided inquiry-based on materials (acid and base topic) has been designed with a good and attractive appearance. The design of slides, videos, images, and animations as well as icons in interactive multimedia is already attractive. The type and size of the letter selection as well as the composition of the layout of the contents of the slides are appropriate and balanced. The use of the features contained in interactive multimedia is easy to understand and works well, besides that the animation effects used are also interesting.

PowerPoint animations is an interesting teaching strategy in model-based learning. Some chemistry concept cannot be merely by static drawings. Computer-based animations with PowerPoint can be used to make complete expressed models of the chemistry concept (Guspatni, 2021). Multimedia animation can make students acquired a better understanding of chemical concept and teachers agreed that the multimedia resource and its complementary activities had positive effects (Ollino et al., 2018).

The suggested improvements can be seen in Figures 6 and 7. The validator suggests improving the color contrast so that it can be seen comfortably by the eye.

Figure 6. Before Revision

Figure 7. After Revision

The next phase is one-to-one evaluation that was implemented by interviewing three students including low, moderate, and high ability in grade XII IPA at SMAN 1 Batipuh. The data from interviews with the three students after learning using interactive multimedia can be seen that students are very interested in the appearance of interactive multimedia both in terms of design, letters, language, models used, and ease of use. Students also stated that the material presented in interactive multimedia could help them easily understand the concepts of acids and bases by three levels of chemical representation. Models that use three levels of chemical representation help them understand the material by arousing their curiosity so that they feel challenged in understanding the three-level models of chemical representation presented. Students are also interested in interactive questions that help guide them to think critically in finding concepts during understanding learning. In addition, the stages of learning look well structured so that it does not make them confused and makes it easier for them to learn.

The Prototype II improvement now will be named as Prototype III. In the next phase on this prototype, there is a small group evaluation that was implemented to see the developed interactive multimedia practice before a test. There were nine students including low, moderate, and high ability who were used as the subjects of interactive multimedia testing as the evaluation. A learning process runs and at the end was given a questionnaire. Then, the outcomes of this step represent that the practicality aspect of interactive multimedia is 91.11 with a very practical category. Based on the very practical category in the prototype III, now it can be named as the Prototype IV, the phase that has a valid product for the field test.

Assessment Phase

The test at this phase was conducted by the chemistry teacher and students. After the learning process using Prototype IV was carried out in the field group, practicality questionnaires were given. In general, the practical value of the teacher and student response questionnaires shows a very practical category with a value of 88.33 for teacher responses and 87.60 for student responses. The practicality of interactive multimedia developed can be seen below.

Table 4. The Practical Test of Teacher and Student Response

Aspect	% Practicality of teacher responses	% Practicality of student responses
Ease of Use	96.67	87.78
Time Efficiency	80.00	81.56
Benefits	91.43	89.11
Average	88.33	87.60

As shown in Table 4, the assessment given is viewed including ease of use, time efficiency, and benefits. The data analysis assessment result of the ease of use of interactive multimedia, the value based on the teacher's response questionnaire of 96.67 and based on a student response questionnaire of 87.78. This result shows that the interactive multimedia developed has user-friendly instructions, images, videos, and animations that are easy to understand. The material and its macroscopic, submicroscopic, and symbolic representations are presented clearly and simply so that they can be understood. The language and letters used are clear and understandable. In addition, the steps of learning activities in interactive multimedia are clear and orderly.

The second term, the data analysis assessment result of the time efficiency aspect of interactive multimedia learning based on the teacher's response questionnaire of 80 and based on the student response questionnaire of 81.56. These data indicate that the developed interactive multimedia can make students' learning time more effective and efficient. An obstacle that occurs in the field is that students can understand the model presented, but they want the model (reaction equation or illustration of the location of electrons in an atom, etc.) to be described one by one by the teacher on the blackboard so that they better understand how to make models, so that time to repeat the explanation of interactive multimedia content in several sub-materials is quite time-consuming. Therefore, the practical results in terms of learning time efficiency are not too high but are included in the practical category.

The last term, the data analysis assessment result of the benefits based on the teacher's response questionnaire of 91.43 and based on a student response questionnaire of 89.11. This both scores including a very practical category. These data indicate that this product can help students learn independently. In interactive multimedia, there are some interactive questions that can help guide students to find concepts, solidify the material, and equalize perceptions of the material that has been studied.

Conclusion

Interactive multimedia PowerPoint based on guided inquiry that was developed was valid and practical to be used as a medium of learning on acid-base topics for senior high school learning.

References

Ahmad, N., Yakob, N., Bunyamin, M. A., Winarno, N., & Akmal, W. H. (2021). The Effect Of Interactive Computer Animation and Simulation On Students' Achiement and Motivation In Learning Elecrochemistry. *Jurnal Pendidikan IPA Indonesia*, 311-324. https://doi.org/10.15294/jpii.v10i3.26013

Aiken, L. R. (1985). Three Coefficients For Analyzing The Reliability and Validity Of Ratings. *Educational and Psychological Measurement*, 131-142. Retrieved from https://journals.sagepub.com/doi/10.1177/0013164485451012

Akker, J. v., Bannan, B., Kelly, A. E., Nieveen, N., & Plomp, T. (2010). *An Introduction to Educational Design Research.* Netherlands: Netzodruk, Enschede.

Bhamani, S., Makhdoom, A. Z., Bharuchi, V., Ali, N., Kaleem, S., & Ahmed, D. (2020). Home Learning in Times of COVID: Experiences of Parents. *Journal of Education and Educational Development*, 09-26. http://dx.doi.org/10.22555/joeed.v7i1.3260

Chang, B., Xu, R., & Watt, T. (2018). The Impact of Colors on Learning. *Adult Education Research Conference*, 1-6. Retrieved from https://newprairiepress.org/cgi/viewcontent.cgi?article=4001&context=aerc

Chang, R., & Overby, J. (2011). *General Chemistry The Essential Concepts.* New York: McGraw-Hill.

Cholilawati. (2021). *Teori Warna Penerapan dalam Fashion.* Bandung: PT. Panca Terra Firma.

Guspatni, G. (2021). Student-generated PowerPoint animations: a study of student teachers' conceptions of molecular motions through their expressed models. *Chemistry Education Research and Practice*. 2021(2). https://doi.org/10.1039/D0RP00229A

Hadiyanti, W., & Widya. (2018). Analyzing The Values and Effects Of PowerPoint Presentations. *Language and Language Teaching Journal*, 87-95. https://doi.org/10.24071/llt.2018.Suppl2108

Hanson, D. M. (2005). Designing Process-Oriented Guided-Inquiry Activities. Retrieved from http://www.pcrest.com/research/fgb/2_4_14.pdf

Head, M. L., Yoder, K., Genton, E., & Sumperl, J. (2017). A quantitative method to determine preservice chemistry teachers' perceptions of chemical representations. *Chemistry Education Research and*

Practice. 2017(4) https://doi.org/10.1039/C7RP00109F

Kartimi, Gloria, R. Y., & Anugrah, I. R. (2021). Chemistry Online Distance Learning During The Covid-19 Outbreak: Do TPACK and Teachers' Attitude Matter? *Jurnal Pendidikan IPA Indonesia*, 228-240. https://doi.org/10.15294/jpii.v10i2.28468

Lepiyanto, A., & Pratiwi, D. (2015). Pengembangan Bahan Ajar Berbasis Inkuiri Terintegrasi Nilai Karakter Peduli Lingkungan Pada Materi Ekosistem. *Bioedukasi*, 143-147. http://dx.doi.org/10.24127/bioedukasi.v6i2.344

Lestari, N. (2020). *Media Pembelajaran Berbasis Multimedia Interaktif.* Jawa Tengah: Penerbit Lakeisha.

Moog, R. S., & Farrell, J. J. (2011). *Chemistry: A Guided Inquiry.* New York: John Wiley & Sons, Inc,.

Moore, E. B., Herzog, T. A., & Perkins, K. K. (2013). Interactive simulations as implicit support for guided-inquiry. *Chemistry Education Research and Practice*. 2013(14) https://doi.org/10.1039/C3RP20157K

Muliadi, A., Prayogi, S., Bahalwan, F., Nirmala, W., & Verawati, N. N. (2021). Online Learning During the Covid-19 Pandemic: Preservice Teacher's Perception. *Jurnal Penelitian Pendidikan IPA*, 464-467. https://doi.org/10.29303/jppipa.v7i3.787

Nuraisyah, S., Harahap, R. D., & Harahap, D. A. (2021). Analysis of Internet Media Use of Student Biology Learning Interest During COVID-19. *Jurnal Penelitian Pendidikan IPA*, 213-217. https://doi.org/10.29303/jppipa.v7i2. 624

Nurohman, S., Sunarno, W., Sarwanto, & Yamtinah, S. (2021). The Validation Of Digital Analysis Tool-Assisted Real-World Inquiry (Digita-Ri) As A Modification Of The Inquiry-Based Learning Model In The Digital Age. *Jurnal Pendidikan IPA Indonesia*, 387-399. https://doi.org/10.15294/jpii.v10i3.30779

Ollino, M., Aldoney, J., Domínguez, A. M., & Merino, C. (2018). A new multimedia application for teaching and learning chemical equilibrium. *Chemistry Education Research and Practice*. 2018(1) https://doi.org/10.1039/C7RP00113D

Özkanbaş, M., & Kırık, Ö. T. (2020). Implementing collaborative inquiry in a middle school science course. *Chemistry Education Research and Practice*. 2020(4). https://doi.org/10.1039/C9RP00231F

Rahmi, R., Khaldun, I., & Mustanir, M. (2021). Development of Microsoft Excel-based Interactive Media on Chemical Reaction Balancing. *Jurnal Penelitian Pendidikan IPA*, 408-413. https://doi.org/10.29303/jppipa.v7i3.612

Saputro, B., Tortop, H. S., Zuhri, M., Mansur, & Saerozi, M. (2021). The Effictiveness Of The Learning Management System Of Saqural Learning Application On The Scientific Interpretation Learning Outcomes. *Jurnal Pendidikan IPA Indonesia*, 111-120. https://doi.org/10.15294/jpii.v10i1.27677

Sari, C. W., & Helsy, I. (2018). Analisis Kemampuan Tiga Level Representasi Siswa Pada Konsep Asam-Basa Menggunakan Kerangka DAC (Definition, Algorithmic, Conceptual). *Jurnal Tadris Kimiya*, 158-170. https://doi.org/10.15575/jtk.v3i2.3660

Silberberg, M. (2010). *Principle of General Chemistry Second Edition*. New York: McGraw-Hill.

Ulfa, M., Yusrizal, Huda, I., & Ilyas, S. (2022). The Influence of Guided Inquiry Learning Model with Radical Constructivism on Students' Critical Thinking. *Jurnal Penelitian Pendidikan IPA*, 109-113. https://doi.org/10.29303/jppipa.v8i1.906

Utami, D. B., Rahmawati, Y., & Slamet, R. (2017). Penggunaan Conceptual Change Text dengan Model Pembelajaran 5E untuk Mengatasi Miskonsepsi Siswa Pada Materi Asam Basa di SMAN 4 Tambun Selatan. *Jurnal Riset Pendidikan Kimia*, 30-37. https://doi.org/10.21009/JRPK.071.10

Wirangga, C., Ahda, Y., & Arsih, F. (2018). Development of Interactive Multimedia Based on PowerPoint at Fluid Preasure Material and Implementation in Life for Junior High School Students. *Bioeducation Journal*, 168-177. https://doi.org/10.24036/bioedu.v2i2.101

Yanto, D. T. (2019). Praktikalitas Media Pembelajaran Interaktif Pada Proses Pembelajaran Rangkaian Listrik. *Jurnal Inovasi Vokasional dan Teknologi*, 75-82. https://doi.org/10.24036/invotek.v19i1.409

Yulianci, S., Nurjumiati, Asriyadin, & Adiansha, A. A. (2021). The Effect of Interactive Multimedia and Learning Styles on Students' Physics Creative Thinking Skills. *Jurnal Penelitian Pendidikan IPA*, 87-91. https://doi.org/10.29303/jppipa.v7i1.529