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Interactive Website Media to Improve Learning Outcomes of Chemical Bonding Materials

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***Abstract*:** *This research aims to obtain website which is feasible to improve student learning outcomes in chemical bonding material. This research uses Research and Development (R&D) with a 4-D model but limited to stages develop. Qualifications website developed is guided by validity, practicality and effectiveness. Data was obtained by filling out a validation questionnaire to determine validity website; response questionnaires and student activity observation sheets to find out practicality website; as well as learning outcomes tests to determine effectiveness website. The research results show that website that was developed can be declared valid by obtaining a modus score of 5. Website there was an increase in learning outcomes which were analyzed using the classical completeness test and the Wilcoxon test. The percentage results of the classical completeness test were 96.87% of students who were declared complete and the Wilcoxon test results obtained a sig value. of 0.000. From the results of this analysis website developed can be said to be effective. Based on the results of the validity and effectiveness analysis, it was found that website developed is suitable for use as learning media.*

***Keywords*:** *development; website; interactive; chemical bond*

INTRODUCTION

In the 21st century, digital technology is becoming increasingly important. Skills in using digital technology can speed up the reception of information and improve students' life and development skillsieasier to accept learning. Wrongione effort that can be made toiimprove student learning achievementinamely changing conventional learning methods and making more use of digital technology so that more innovative learning can be created to support optimal learning. Mediai Appropriate learning can support the learning process better (Budiyono, 2020).

From the results of a pre-research questionnaire carried out at SMAN 3 Surabaya, the results showed that as many as 78% of participants stated that the learning media that teachers often use to convey chemistry material is Power Point. This shows that currently the use of technology-based learning media by teachers is still limited Power Point in the teaching and learning process as a tool to convey material. This obstacle arises from a lack of knowledge and skills in developing learning media among

teachers, so that the use of more advanced learning media is still very limited. Then as many as 75% of the participants stated that the media used by the teacher could not make it easier to understand chemistry material well. As many as 92% of students revealed that during the chemistry learning process teachers had never used interactive learning media.

Interactive learning media is media designed to actively involve students in the learning process. With interactive learning media, students are given the opportunity to participate directly in the learning experience through direct interaction with the content in the learning media.

Interactive learning refers to a learning approach in which studentsi play an active role in the learning process, both directly and through media and technology. This method emphasizes two-way interaction between studentsiwith teachers, as well as between studentsiwith materialilearning. Use of media-based learning website can increase students' learning enthusiasm and motivationibecause there is a lot of information that is easy to find in it. An interactive and attractive design can also influence students' learning motivation, so that websites can become an interesting teaching method and increase students' interest in learning.

The use of learning media in interactive learning is very important because it allows the use of various tools and technology to increase student interaction and involvement. Learning media such as animation, simulations, interactive learning videos, and platform online not only enriches students' learning experiencesibut also facilitate deeper understanding through visual, auditive and interactive experiences. This creates a more dynamic and learning environmentiinteresting, which can optimize students' learning motivation and prepare them to face the demands of learning in today's digital era. Thus, teachers are expected to be able to develop interactive learning media considering the importance of using learning media as an effort to solve problems in a series of learning activities (Pradana et al., 2020).

Learning chemistry is wrong a lesson that is classified as complex because chemistry can not only be understood through theory, but needs to be studied through three aspects, namely macroscopic, microscopic, and symbolic (Purba & Siregar, 2020). The level that is the intellectual basis for explaining chemical phenomena is related to chemical concepts connected to the macroscopic and symbolic levels. Therefore, in studying chemistry, students are required to have the power of imagination to describe particles such as electrons, atoms and molecules which are included at the molecular level.

One chemical material that requires visualization to study is chemical bonding. Chemical bonds are abstract material and are only known to students when they are in high school. Chemical bonding material requires visualization because it requires submicroscopic explanation. According to (Dasopang & Jahro, 2020) Bonding material Chemistry is an abstract material so that need learning. Based on the results of the pre-research questionnaire, 69% of students had difficulty studying chemical bonding material. In the results of the interview, the teacher explained that there were still students who did not complete the material on chemical bonds. Difficulties in understanding chemical bonding material are generally caused by less than optimal communication processes between teachers and students.

Based on the description of these problems, efforts are needed to help students visualize chemical bonding material. One of them is by using interactive learning media website. Website enables dynamic visualization through interactive animations and simulations. This can make it easier for students to understand changes in atomic structure and chemical bonds real time. This helps students understand difficult concepts through dynamic visual representations. Website Interactive allows students to interact with material through various tools and

features, such as 3D models and simulations virtual lab. This provides a deeper and more varied learning experience compared to the use of other media.

Media website It can also be accessed anytime, anywhere, thus providing flexibility in learning and allowing students to study outside of class hours. Besides, in website can provide various types of media such as text, images, videos, and simulations simultaneously in one platform. This is different from other media which may require the use of separate tools and materials and is more difficult to integrate. Media website equipped with features that provide feedback directly to students after completing an exercise or quiz. This helps students to immediately recognize and correct understanding errors. This is in line with research conducted by (Paye et al., 2021) which shows that the use of web-apps on chemical bonding material can lead to an increase in mastery of the material.

Based on the explanation that has been described, a learning media is needed that can support learning on the main subject of chemical bonds. According to the author's study, currently this media is not yet available so it is necessary to develop an interactive learning media based website on chemical bonding. Utilization website as an interactive learning media, it allows students to participate actively which creates an interactive learning experience. An interactive learning approach can increase students' understanding and motivation by actively involving students in the learning process.

LITERATURE REVIEW

Interactive Learning Media Based Website

The definition of media in the teaching and learning process can be interpreted as a physical or non-physical aid that is intentionally used as an intermediary between teachers and students in understanding learning materials to be more effective and efficient (Silaban & Pangabean, 2022). Learning with interactive learning media aims to facilitate the learning process and foster the creativity and innovation of teachers in designing the learning process (Saluky, 2016). Website can be used as educational media containing scientific information.

Chemical Bonding

Atoms can be bonded together into a compound through a force called a chemical bond. Chemical bonds can occur for several reasons, but the essence of why chemical bonds exist is because atoms tend to have electron configurations similar to noble gases - that is, stable electronic structures (Buthelezi et al., 2017).

METHODS

This research is a type of research Research and Development (R&D) with the 4-D development model, namely a development model consisting of 4 main stages, namely: Define (definition), Design (planning), Develop (development), and Disseminate (deployment). This research is carried out or limited to stages develop (expansion) (Ibrahim & Wahyusukartingsih, 2014). Website It can be said to be feasible if it meets the aspects of validity, practicality and effectiveness. Limited trials were carried out on 32 students of SMAN 3 Surabaya.

Data collection methods, namely validation carried out by 3 validators, student response questionnaires, observation of student activities, and learning outcomes tests.

Validity data analysis can be determined through validity data results website from the validator is then analyzed using a quantitative description method to provide an overview of the research regarding feasibility website based on Likert scale calculations with the assessment criteria being invalid with a value of 1, less valid with a value of 2, quite valid with a value of 3, valid with a value of 4, and very valid with a value of 5 (Riduwan, 2015).

According to (Lutfi, 2021), ordinal data is data that is not comparable or not can be calculated using arithmetic operations mathematics so that validation results can be obtained calculated using the modus. From

this modus, a score will be obtained which is identified according to the Likert scale categories. A product is declared valid if it gets a modus score ≥ 4.

After that, a test was carried out website which had been developed on 32 students, then carried out pretest and posttest to show improvement in learning outcomes after the trial. Data analysis uses due diligence, testing paired sample t test, and the Wilcoxon test as an alternative test paired sample t test.

Interactive learning media based website with individual learning completeness set at ≥75 in accordance with the school's KKTP and clasical completeness set at ≥85%.

RESULT AND DISCUSSION

The following is a discussion of the stages that have been passed in this development research.

Define

The definition stage is carried out to obtain an analysis of the needs and conditions that need to be achieved in the product development process in the form of *website* so that in the end you will get it *website* that suits the user. The steps in this stage are initial-finish analysis, student analysis, task analysis, and goal specification.

Design

The second stage is the design stage. At this stage it is done to create *design prototipe* from *website* which was developed. Results of the design stage *website* can be seen in Figure 1-5.

Figure 1. Page login

Figure 1 shows the initial page that will appear when accessing *website*. On this page, students must enter their account in order to access it *website*.

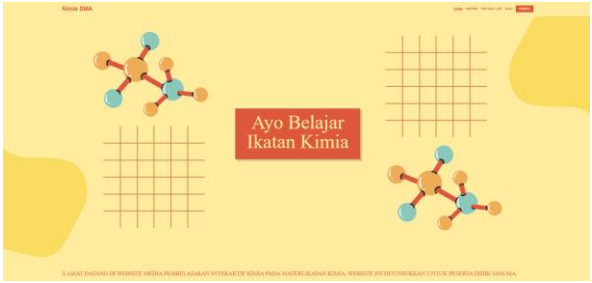

Figure 2. Home page

Figure 2 shows the home page when access is successful *website*. On this page the title of the material to be studied is displayed. This page contains several features available on *website*.

Figure 3. Introduction page

Figure 3 shows the introductory page which contains the learning achievements and objectives that must be achieved by students.

Figure 4. Learning materials

Figure 4 shows the materials available on *website.* Users can choose one of the four available sub-materials.

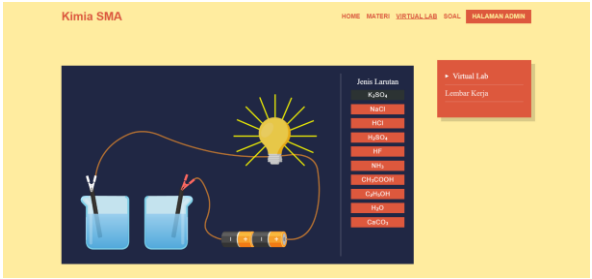

Figure 5. Virtual lab page

Figure 5 shows the page *virtual laboratory.* In this menu, students can simulate practical activities accompanied by LKPD after students have carried out the simulation.

Develop

The third stage is development. At this stage, product validation is carried out to determine the quality of the product and the suitability of the learning-based media *website* before testing the product.

Media validity is reviewed from content and construct validity to determine feasibility *website* so it is suitable to help learning chemistry. The results of content and construct validity can be observed in the following table.

Table 1. Validation results

Components to be assessed	Evaluation of Learning Media *Website*			Modus
	V1	V2	V3	
Concept truth	4	4	4	4
Material suitability	5	4	5	5
Media interactive level	4	4	5	4
Suitability of presentation	5	4	5	5
Ease of use	5	4	5	5

Based on Table 3, it is known that media validation obtained modus scores of 4 and 5. By obtaining these modus scores it can be said that *website* that was developed is valid because it meets the valid criteria.

Content validity aims to determine the relationship between the learning multimedia developed and the learning materials (Dzikro & Dwiningsih, 2021). Content validity is related to the validator's assessment of the suitability, adequacy, depth and accuracy of the content of the material in the media being developed. In this research, content validity is viewed from the suitability of the material to the curriculum and the aspect of suitability of the content to the learning material.

Based on the results of the content validity assessment by the validator, the modus for the suitability aspect of the material with the learning objectives is at a score of 5 which is included in the very valid category. The modus obtained for the aspect of conformity with the learning objectives is difficult to meet the valid requirements set, namely the modus for this aspect is on the score ≥4. The valid category in the aspect of suitability of the material to the curriculum shows that the description of the material and the practice questions used in the media are in accordance with the curriculum and learning objectives as well as the concept of chemical bonds (Asri & Dwiningsih, 2022). Suitability of material to the curriculum will facilitate the process of delivering material to students and can avoid errors in accepting concepts (misconceptions) by students.

The assessment indicators in this aspect mean that the material on chemical bonds and the questions contained in it *website* is in accordance with existing concepts in chemistry. According to (Junaidi, 2019), the suitability of learning media to support learning of facts, concepts, principles or generalizations must be one of the criteria that must be considered. This statement states that the choice of material in learning media must be considered so that there are no wrong concepts.

According to (Nurfadhillah et al., 2021) the learning media used must be relevant and targeted to achieve learning objectives so that the teacher's intentions and messages can be understood more clearly during the teaching and learning process.

Construct validity aims to determine the suitability of the substance administered in interactive media *website.* In construct validity, there are three aspects assessed, namely the interactive component, presentation component, and ease of use component.

The assessment of the interactive component aims to determine the interactive level of the learning media developed with

students. In this component there is one assessment, namely inviting students to learn interactively. What is meant by interactive is the interaction between students and the learning content. In the presentation component there are three aspects of assessment which aim to determine the suitability of color, graphic size and animation in the learning media being developed. The easier of use component aims to determine the ease of use of the learning media being developed.

To see improvements in learning outcomes, students are given a pre-test before learning and a post-test after learning. Complete pre-test and post-test results can be seen in Table 2.

Table 2. Mark pretest and posttest learners

Data Type	*Pretest*	*Posttest*
Number of students	32	32
The highest score	80	100
Lowest Value	30	60
Students complete	2	31
Students do not complete	30	1
% Completeness	0.06%	96.87%

Based on Table 2, it can be seen that before using media-based learning *website* Many students still haven't finished the material on chemical bonds. Meanwhile, after learning with media-based learning *website* almost all students completed. Based on the % completeness results, a percentage of 96.87% was obtained. Percentage results obtained ≥75% so it can be said that students in one class achieved their learning. After calculating the achievement criteria, an increase in results was obtained *pretest* and *posttest*.

Apart from analyzing the achievement of grades, tests are also carried out *paired sample t-test* to see success on the score *pretest* and *posttest*. To do a test *paired sample t-test* It is necessary to carry out a prerequisite test, namely the normality test. After the normality test was conducted, it turned out that the data was not normally distributed, so the hypothesis test could not be carried out using parametric statistics (*t-test*), but the hypothesis test was carried out using a non-parametric statistical test (*Wilcoxon test*) (Yunsyahana et al., 2022).

Based on the results of the Wilcoxon test, a sig value was obtained. 0,000. These results show that the sig value. ≤ 0.05 so it can be said that there is an increase in value *pretest* and *posttest*. This proves that there is an increase in results *pretest* and *posttest* before and after using interactive media-based learning *website* which was developed.

CONCLUSION

Based on the research, it can be concluded that the interactive learning website developed is valid and feasible for improving student learning outcomes on chemical bonding material. The significant improvement in student performance after using the website compared to before its use demonstrates that integrating interactive media into learning can enhance educational effectiveness. These findings imply that the development of interactive digital learning tools can contribute to advancements in science education and foster the integration of technology to improve learning outcomes.

REFERENCE

Asri, A. S. T., & Dwiningsih, K. (2022). Validitas E-Modul Interaktif sebagai Media Pembelajaran untuk Melatih Kecerdasan Visual Spasial pada Materi Ikatan Kovalen. *PENDIPA Journal of Science Education*, *6*(2), 465–473. https://doi.org/10.33369/pendipa.6.2.465-473

Budiyono, B. (2020). Inovasi Pemanfaatan Teknologi Sebagai Media Pembelajaran di Era Revolusi 4.0. *Jurnal Kependidikan: Jurnal Hasil Penelitian Dan Kajian Kepustakaan Di Bidang Pendidikan, Pengajaran Dan Pembelajaran*, *6*(2), 300. https://doi.org/10.33394/jk.v6i2.2475

Buthelezi, T., Dingrando, L., Hainen, N., Wistrom, C., & Zike, D. (2017).

Glencoe Chemistry: Matter and Change. New York: McGraw-Hill.

Chang, R. (2004). *Kimia Dasar: Konsep-Konsep Inti Edisi Ketiga Jilid 1*. Erlangga.

Dasopang, K., & Jahro, I. S. (2020). Pengembangan KIT Pembelajaran Dari Limbah Pada Materi Ikatan Kimia Untuk Meningkatkan Hasil Belajar Siswa. *Jurnal Inovasi Pembelajaran Kimia (Journal Of Innovation in Chemistry Education)*, *2*(2), 116-120. https://doi.org/10.24114/jipk.v2i2.19816

Dewi, B. E. K., & Sumarni, W. (2020). Efektivitas Penggunaan Media E-Learning berbasis Website terhadap Hasil Belajar Kognitif Peserta Didik. *Journal of Chemistry in Education*, *9*(2), 1–6. http://journal.unnes.ac.id/sju/index.php/chemined

Dzikro, A. Z. T., & Dwiningsih, K. (2021). Kelayakan Media Pembelajaran Berbasis Laboratorium Virtual pada Sub Materi Kimia Unsur Periode Ketiga. *Chemistry Education Practice*, *4*(2), 160–170. https://doi.org/10.29303/cep.v4i2.2389

Ibrahim, & Wahyusukartingsih. (2014). Model Pembelajaran Inovatif Melalui Pemaknaan. Surabaya: UNESA University Press.

Junaidi, J. (2019). Peran Media Pembelajaran Dalam Proses Belajar Mengajar. *Diklat Review : Jurnal Manajemen Pendidikan Dan Pelatihan*, *3*(1), 45–56. https://doi.org/10.35446/diklatreview.v3i1.349

Lutfi, A. (2021). *Research and Development (R&D): Implikasi dalam Pendidikan Kimia*. Surabaya: Jurusan Kimia FMIPA Universitas Negeri Surabaya.

Nurfadhillah, S., Ningsih, D. A., Ramadhania, P. R., & Sifa, U. N. (2021). Peranan Media Pembelajaran Dalam Meningkatkan Minat Belajar Siswa SD Negeri Kohod III. *PENSA : Jurnal Pendidikan Dan Ilmu Sosial*, *3*(2), 243–255. https://ejournal.stitpn.ac.id/index.php/pensa

Paye, C. L., Dunnagan, C. L., Tredwell, D. A., & Gallardo-Williams, M. T. (2021). *Connecting the Dots*: Lewis Structure Builder Web App as a Review Tool for Organic Chemistry: *Journal of Chemical Education*, 98(8), 2704-2708 https://doi.org/10.1021/acs.jchemed.1c00213

Pradana, I., Setyosari, P., & Sulthoni, S. (2020). Pengembangan Multimedia Pembelajaran Interaktif Berbasis Android Pada Mata Pelajaran Ilmu Pengetahuan Alam Materi Cahaya. *JINOTEP (Jurnal Inovasi Dan Teknologi Pembelajaran): Kajian Dan Riset Dalam Teknologi Pembelajaran*, *7*(1), 26–32. https://doi.org/10.17977/um031v7i12020p026

Purba, J., & Siregar, N. (2020). Pengembangan Bahan Ajar Berbasis Proyek Di SMA Negeri 2 Lintongnihuta pada materi Asam dan Basa. *Jurnal Inovasi Pembelajaran Kimia (Journal of Innovation in Chemistry Education)*, *2*(2), 110-115. https://doi.org/10.24114/jipk.v2i2.19619

Riduwan. (2015). *Skala Pengukuran Variabel-variabel Penelitian.* Alfabeta.

Saluky, S. (2016). Pengembangan Bahan Ajar Matematika Berbasis Web Dengan Menggunakan Wordpress. *Eduma : Mathematics Education Learning and Teaching*, *5*(1), 80–90. https://doi.org/10.24235/eduma.v5i1.685

Silaban, R., & Panggabean, V. M. (2022). Pengembangan Media Pembelajaran

Berbasis Android Pada Materi Kesetimbangan Kimia. *Jurnal Inovasi Pembelajaran Kimia (Journal of Innovation in Chemistry Education), 4(1),* 1-9. https://doi.org/10.24114/jipk.v4i1.24085

Taufik, M., Sutrio, S., Ayub, S., Sahidu, H., & Hikmawati, H. (2018). Pelatihan Media Pembelajaran Berbasis Web Kepada Guru Ipa Smp Kota Mataram. *Jurnal Pendidikan Dan Pengabdian Masyarakat*, *1*(1). https://doi.org/10.29303/jppm.v1i1.490

Thiagarajan, S., Semmel, D. S., & Semmel, M. I. (1974). *Instructional Developme nt for Training Teachers of Expection al Children.* Leadership Training Institute/Special Education, University of Minnesota.

Trianto. (2010). *Mendesain Model Pembelaj aran Inovatif-Progresif.* Kharisma Putra Grafika.

Yunsyahana, F., Auliah, A., & Djangi, M. J. (2022). Keefektifan Model Pembelajaran Discovery Learning Terhadap Hasil Belajar Peserta Didik Kelas X MAN Bantaeng. *Jurnal Inovasi Pembelajaran Kimia (Journal of Innovation in Chemistry Education)*, *4*(1), 92-100. https://doi.org/10.24114/jipk.v4i1.33436