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Article

Development of Google Sites Interactive Learning Media to Visualize the Concept of Atoms, Cells, and Compounds

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ABSTRACT

Learning media is a teaching material that contains learning tools so that it functions to help students master interactive learning. The method used in this study is to use R&D (Research and Development). The research procedure begins by using literature studies and interviews. The results of the analysis are used as a basis for developing a Google Sites website entitled "KATOSEN" which aims to describe atoms, cells, and compounds as the smallest units that make up living things based on aspects of digital learning at the SMP/MTs level which will then be validated by several experts, namely material experts, technology, design, learning and language suitability experts. The results of this validity are calculated in the form of a percentage and analyzed descriptively. The results we obtained from this study indicate that the validity of technology experts is 100% with a very good category, design experts and learning experts 93.75% with a very good category, language suitability experts 87.5% with a good category, and material experts 75% with a good category. The validity results show the highest percentage, namely technology, design, and learning, while the lowest percentage is language and material suitability. Thus, it can be concluded that the learning media "Google Sites" with the title "KATOSEN" with assessments from 5 validators is declared worthy of being tested with revisions according to suggestions and can be used as a learning media for junior high school/Islamic junior high school students.

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INTRODUCTION

Learning media is an open source that contains various learning tools, functioning to support students in mastering the interactive learning process (Komariah, 2016; Ilham et al., 2023). The learning process is highly dependent on teachers as a source of information, but in this situation, the role of teachers does not fully determine the course of learning (Alfan & Sulistiyo, 2015;

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Fauzi & Mustika, 2022). With the rapid development of science and technology, students can now learn anywhere and anytime, according to their interests or learning styles (Hidayah, 2020; Liriwati, 2023). This allows them to interact directly with objects that are happening (Astra et al., 2020; Topolšek et al., 2020). Therefore, the focus of media use must be on educators. Education needs to be designed to be able to face the changing times that affect individual behavior. The world now feels closer when someone holds a smartphone (Azhari et al., 2022).

Natural Sciences (IPA) is a group of sciences that study natural objects according to clear and general laws that apply anywhere and anytime (Harefa & Sarumaha, 2020). Natural science is also a collection of knowledge and processes obtained through certain methods: observation, experimentation, and derivation and formulation of theories (Gusmian, 2014; De Groot & Spikierman, 2020; De Right, 2017). Science provides benefits for human life both in terms of knowledge, skills and attitudes (Purwono et al., 2014). With this, various students have difficulty in learning science because it is abstract (Wicaksono et al., 2020). Therefore, it is necessary to develop science learning media that can help students understand (Aris & Muthoharoh, 2021; Dwijayani, 2019). The development of science learning media made by researchers is to visualize science learning materials including atoms, cells and compounds. With this visualization, it is hoped that students will be able to understand the science learning delivered by the educator.

Interactive learning encourages students to become the main actors in the learning process. Not just recipients of information, students are invited to actively participate, interact, and explore learning materials. Through various activities that stimulate critical thinking, creativity, and collaboration, students not only memorize, but also understand concepts more deeply and build meaningful knowledge. (Kirschner, PA, Sweller, J., & Clark, RE 2006). Learning visualization is a method that utilizes visual representations such as images, diagrams, graphs, or animations to facilitate understanding of concepts. By changing abstract information into concrete visual forms, visualization helps students build stronger connections between new information and existing knowledge. (Mayer, RE, & Moreno, R. 2003).

One of the learning media that can be utilized in the digital era is a website using Google Sites. According to Mukti & Anggraeni (2020), Google Sites-based learning media offers a start in the learning process and can be accessed via various devices, such as cellphones, laptops, and tablets, without the need to download applications. According to Taufik, Sutrio Ayub, Sahidu, and Hikmawati (2018), Google Sites is the newest and simplest method for educators to utilize web-based learning media (Salsabila & Aslam, 2022; Utami, 2023). Interestingly, users can easily organize and control access without the need for complicated programming knowledge, simply by using the drag and drop method. In addition, Google Sites can be accessed for free by anyone with an internet connection (Putri et al., 2023).

In an effort to present a more interesting and effective learning approach, researchers have developed an innovation of Google Sites website-based learning media called "KATOSEN". This digital platform is specifically designed to visualize abstract concepts in atomic, cell, and compound materials, which are the basic units of living things. With "KATOSEN", it is expected that junior high school/Islamic junior high school students can more easily understand this complex material through interactive and attractive visual displays, so that the learning process becomes more enjoyable and meaningful. In this study, to find out How can the development process of Google Sites "KATOSEN" as an interactive digital learning media to describe atoms, cells, and compounds for junior high school/Islamic junior high school students be carried out effectively and efficiently?

METHODS

The research conducted uses the R&D (*Research and Development*) method by going through the steps of research and data collection, planning, initial product development, and

product validation. Research and data collection in this method, in the research process will produce new products in the form of learning media that will be developed or refined so as to produce data that can be accounted for and data collection that aims to identify problems that may hinder the process of making products in the form of learning media, thus bringing up the shortcomings and advantages of a product (Farooq, R. 2024). Data collection is also useful to determine the feasibility of the quality of the selected media and learning materials used whether it is appropriate and can be applied in the learning process or not (Wang et al., 2024) Data collection carried out on the product testing of the "KATOSEN" *google sites* website is the result of the validity tested by the validator. Planning produces a design of the appearance and content for the Google Sites appearance. Initial product development is the creation of a web-based application appearance through Google Sites software. This stage includes the preparation of product materials and the creation of evaluation tools that will be tested. Product validation is a Google Sites website product entitled "KATOSEN" which aims to describe atoms, cells, and compounds as the smallest units of living things based on aspects of digital learning at the Junior High School/Islamic Junior High School level validated by material, technology, design, learning and language suitability experts. According to Kurniawan et al., (2021) the validation results are calculated in the form of a percentage calculated using the formula, and the feasibility is seen according to table 1. $\frac{total\ skor\ yang\ diperoleh}{total\ skor\ maksimal} \times 100 = hasil$

Table 1. Google Sites Learning Media Validity Assessment Criteria

Presentation	Eligibility
85.01%-100%	Very Valid
70.01%-85%	Quite Valid
50.01%-70%	Less Valid
01.01%-50%	Invalid

RESULTS AND DISCUSSION

Based on the results of the research conducted, a Google Sites website-based learning media entitled "KATOSEN" has been developed to describe atoms, cells, and compounds as the smallest units of living things at the junior high school/Islamic junior high school level. The validation results are presented in table 2.

Table 2. Expert Validation Data Results

Rated aspect	Category	Eligibility Level
Technology	Very Valid	100%
Design	Very Valid	93.75%
Learning	Very Valid	87.5%
Language Compatibility	Very Valid	87.5%
Material	Quite Valid	75%

Based on table 2, the validation results of the Technology Aspect are 100% with very valid criteria. The

Design Aspect is 93.57% with very valid criteria. The Learning Aspect is with very valid criteria. The Language Suitability Aspect is 87.5% with very valid criteria. The last is the Material Aspect is 75% with quite valid criteria. Based on the validation results, the highest percentages are technology and design, while the lowest percentages are learning, language suitability, and materials.

Discussion

The technological aspect is technology is a concept related to the type of use and knowledge of tools and skills, and how it can influence human ability to control and change things around them (H, 2019). The technological aspect gets the highest result of 100% in the validation of learning media because the Google Sites visualization that has been developed for atomic, cell, and compound materials has successfully met high technical standards. The use of Google Sites as a platform for presenting learning materials has proven effective in creating an attractive, interactive, and easily accessible display. The high technological aspect has an impact on providing a more interactive and effective learning experience for students. Thus, the learning media that has been produced not only meets the aesthetic aspect, but has also succeeded in answering the challenges in presenting abstract materials such as atoms, cells, and compounds visually and interactively, so that it is expected to improve students' understanding of these concepts.

The design aspect is a creative process in solving a problem in terms of designing an object that is functional or aesthetic. Which in principle looks at technical aspects, functions, materials, without releasing elements of color, lines, textures, compositional balance, and shapes "Beta (Agustini, 2015). The design aspect gets a score of 93.5% obtained in the design aspect of the Google Sites visualization learning media, which is high because the attractive and aesthetic design, which has been carefully designed using Canva, not only beautifies the appearance, but also plays an important role in facilitating the student learning process. Attractive visual elements, such as images, illustrations, and intuitive layouts. The high Design Aspect has an impact on helping students more easily understand abstract concepts related to atoms, cells, and compounds in increasing the effectiveness of learning, making the subject matter more alive and relevant to students.

The learning aspect is a learning process determined by the teacher to develop creative thinking, improve students' thinking skills, and improve their ability to construct new knowledge in improving subject mastery (Nur & Anisa, 2023). The learning aspect is low, getting a score of 87.5% because although Google Sites allows the creation of interactive media, it is possible that the interactivity presented is not yet fully optimal. The existing interactive features are not enough to stimulate students to be actively involved in the learning process. The low learning aspect has an impact on students' understanding of abstract concepts such as atoms, cells, and compounds being limited. Overall student learning outcomes also tend to be less than optimal. The use of technology in the learning process is less effective. The potential of technology to present material in a more interesting and interactive way is not achieved optimally, so the goal of improving the quality of learning is not achieved. what, what, what. The high technology aspect has an impact on increased interest in learning, students can understand the material more deeply and comprehensively, which has a positive impact on their overall learning outcomes. In addition, the success of this media also proves that technology, especially Google Sites, can be a very effective tool to support a more active and enjoyable learning process.what, what, what, what. The learning aspect can be improved by means of well-designed learning media and using various interactive elements such as quizzes, simulations, and videos, able to attract students' attention and increase their involvement in the learning process. The use of clear and attractive images, animations, and diagrams helps students visualize abstract concepts that are difficult to imagine.

The aspect of language suitability is an expression that contains the intention to convey something to others. Something intended by the speaker can be understood and comprehended by the listener or interlocutor through the language expressed (Rizky, 2012). The aspect of language suitability received a score of 87.5%, which is low because there are several obstacles in delivering the material. The use of language that is too technical and less varied makes it difficult for students to understand the abstract concepts presented. In addition, grammatical and spelling errors and the mismatch between the language level of the material and the language ability of students further exacerbate the situation. This causes students to have difficulty following the material, thus impacting their understanding and interest in learning. The low aspect of language suitability has an impact on students having difficulty understanding abstract concepts such as atoms, cells, and compounds, thus triggering the emergence of misconceptions. As a result, student learning outcomes tend to be low and their learning motivation decreases. In addition, obstacles in communication between students and teachers also occur because students have difficulty conveying questions or opinions due to a lack of understanding of the language used in the learning media. The high aspect of language suitability has a direct impact on the student learning process. When students can easily understand the material presented, their interest in learning will increase and they will be more actively involved in learning activities. In addition, a good understanding of the material will make it easier for students to connect the concepts they have learned with other learning materials. The aspect of language appropriateness can be improved by using simple language that is easy for students to understand, avoid scientific terms that are too complex without adequate explanation. Vary the use of language by using analogies, metaphors, or concrete examples that are relevant to students' daily lives. Furthermore, make sure there are no grammatical or spelling errors in the material. Adjust the language level to students' cognitive abilities and involve students in the process of creating or evaluating materials to get direct feedback on the appropriateness of the language used.

The material aspect is the material needed to form knowledge, skills and attitudes that must be mastered by students in order to meet the established competency standards (Julian, 2015). The material aspect gets a score of 75% which is low because the material presented may be too shallow or does not cover all the important concepts that students need to understand and the use of inadequate examples and illustrations can make the material abstract and difficult for students to visualize. Low material aspects have an impact on students' lack of overall knowledge and can be affected by misconceptions. High material aspects have an impact on relevant, accurate, and logically arranged material that will help students to more easily understand complex concepts. A strong understanding of basic concepts will be a good foundation for students to learn more advanced materials. The material aspect can be improved in the first way, enrich the depth of the material by adding relevant subtopics, more detailed concept elaboration, and concrete examples that are relevant to everyday life. Second, improve the order of presentation of the material to make it more logical and systematic, making it easier for students to follow the learning flow. Third, improve the quality of visualization by using interesting and informative images, diagrams, animations, or infographics. Fourth, update information regularly so that the material presented is always relevant and accurate. Finally, actively involve students in the learning process by providing interactive quizzes, discussion forums, or challenging assignments.

Although it is still classified as quite valid, this figure shows that efforts to visualize abstract concepts in science through the Google Sites platform have contributed to students' understanding. Although there is still room for improvement, these results can be used as a basis for refining the learning media to be more effective in delivering the material. This indicates that the selection of Google Sites as a visualization medium is appropriate and relevant to the topic discussed (Fikra, 2024).

Suggestions from validation on prokaryotic cell wall, cell membrane, and other cell structures need to be considered further. There are several points that need to be improved, such as an inaccurate understanding of the differences between cell walls and cell membranes, as well as the use of inappropriate terms, such as referring to mitochondria in the context of prokaryotic cells. In addition, the selection of images and videos also needs to be re-evaluated. It is better to choose simpler and more representative images for the concepts of atoms, cells, and organic compounds. The use of videos from the IPA website can be an alternative, but its relevance and quality need to be ensured. Too much text and repeated explanations can also confuse students. Therefore, it is necessary to simplify the material and adjust the order of delivery of the material to make it more logical and easy to understand and for other aspects it is quite sufficient.

Overall, the results of this validation provide a positive picture of the quality of the Learning Media that has been developed. By making improvements to the language and material aspects, this learning media has the potential to become a more effective tool in supporting the learning process.

In making this *Google Sites* website, it also involves other hardware and software as supporting applications such as Wordwall, Canva, and YouTube which are used to improve the appearance and attractiveness of the resulting learning site. The stages carried out in making this website are designing and designing, the purpose of developing this website is to collect the information needed during the manufacturing process (Bhardwaj et al,. 2024). The design display on this learning website consists of several pages arranged in the following order: home, learning objectives, materials, videos, LKPD, games, evaluation, bibliography, and creator profile. It can be seen in the picture below:

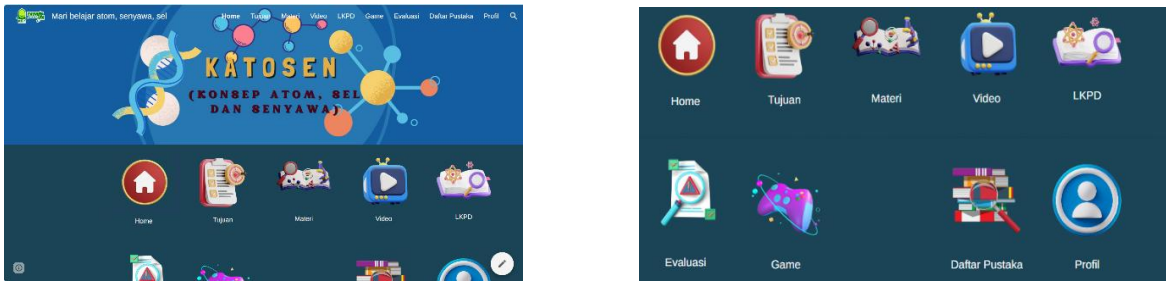

Figure 1. Home Page

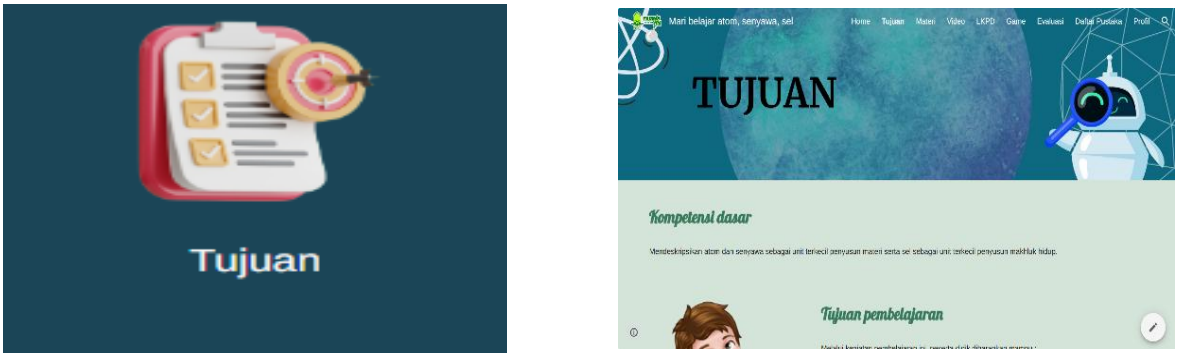

Figure **2.** Learning Objectives page

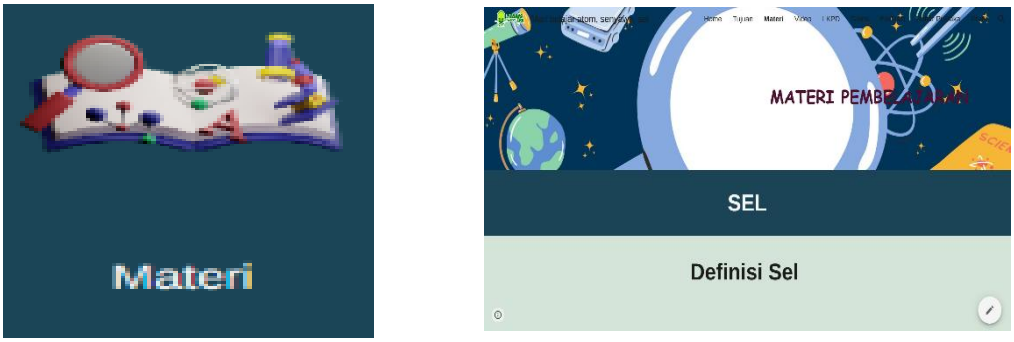

Figure 3. Material Page

Figure 4. Learning video page

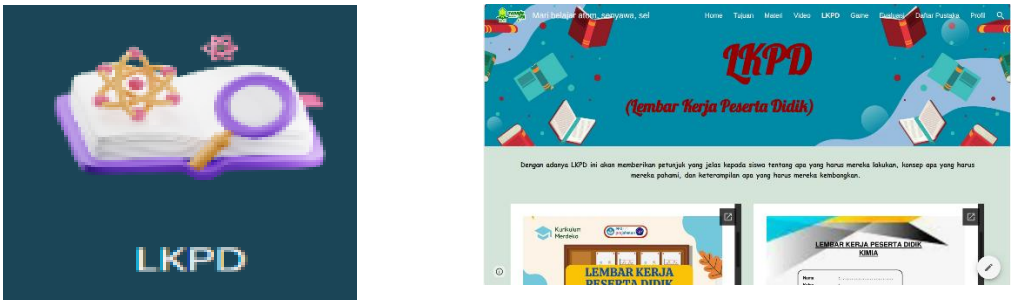

Figure 5. LKPD Page

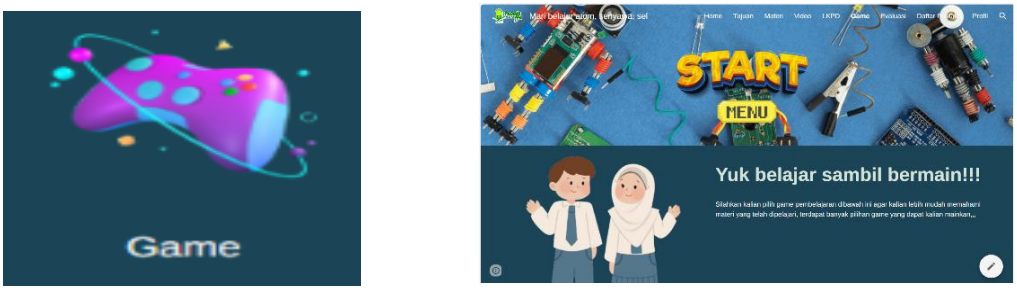

Figure 6. Game Page

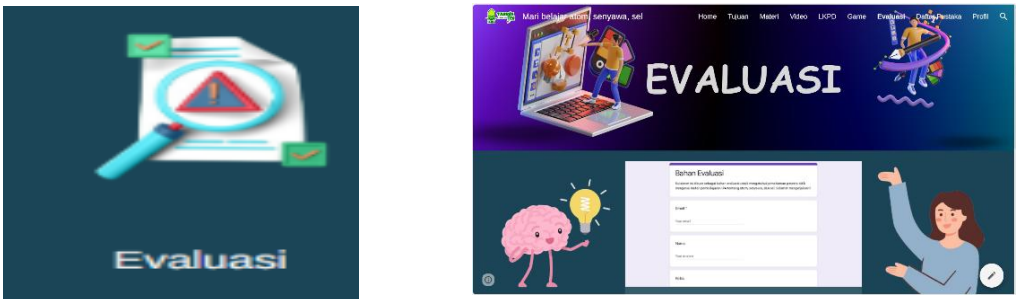

Figure 7. Evaluation page

Figure 8. bibliography page

Figure 9. Profile Page

CONCLUSION

Based on the results of the research conducted, it can be seen that the Learning Media that has been developed as a whole has met the validity criteria or can be said to be valid. This can be seen from the percentage obtained from various validations, the highest assessment obtained in the aspects of technology, design, and learning, where experts gave a score of 100% and 93.75%, indicating very good quality. Technical aspects such as the selection of technology, visual design, and learning methods used have been designed appropriately and effectively. However, it should be noted that there are several aspects that still need to be improved. The assessment of the suitability of language and material obtained a lower score, namely 87.5% and 75%, although it is still classified as a good category. However, this is also part of our research in the form of development where the low value is still appropriate to be said to be valid by experts. So that with the improvements, it is hoped that the learning media that has been developed is worthy of being applied in science learning, especially in cell, atom and compound materials, through this learning media it is expected to make students more interactive from the learning carried out by educators.

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