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Development of an Interactive Website based on Chemo-edutainment using Google Sites on Chemical Bonding Material

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ABSTRACT

The research aims to develop an interactive website based on Chemo-edutainment using Google Sites as a learning medium on chemical bonding material. This research was motivated by students low understanding of the abstract and complex concept of chemical bonds, as well as learning methods that still tend to be monotonous. A chemo-edutainment approach that integrates elements of education and entertainment can make learning more interesting and enjoyable. The research method used is research and development (Research an Develoment) with the Lee and Owens model (Analysis, Design, Development, Implementation, Evaluation). The Research results show that : (1) the website development process is carried out through the stages of needs analysis, media design, interactive content development, and implementation for students; (2) The Validation results from material and media experts show that the website is suitable for use in the "Very good" category, (3) Teacher assessments and student responses to the website show high enthusiasm, the majority of students feel helped in understanding the concept of chemical bonds through this media. Thus, chemo-edutainment based website have proven to be effective in increasing students motivation, interest in learning and understanding of chemical bonding material.

Keywords: Chemo-edutainment, Chemical bond, Google Site

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1. INTRODUCTION

Education is a conscious and planned effort that aims to create a learning atmosphere so that students can actively develop their potential, as regulated in the National Education System Law (UU SISDIKNAS) No. 20 of 2003. One effort to achieve the goal of quality education is to utilize technology, such as the internet, as a supporting learning media. Technology integration aims to form competencies in students' attitudes, knowledge and skills.

The Merdeka Curriculum in Indonesia is designed to improve students' mastery of concepts and competencies through a more diverse intracurricular learning approach, giving students the opportunity to explore the material in more depth. This curriculum also introduces the six main elements in the Pancasila Student Profile, namely faith and piety, global diversity, mutual cooperation, independence, critical reasoning and creativity. These elements are internalized in daily life through school culture, and applied in intracurricular, co-curricular and extracurricular learning. Apart from that, the Merdeka Curriculum also utilizes digital technology to support learning which is expected to create an interesting, safe, fun and memorable learning atmosphere for students (Fildza et al., 2023).

At high school level, chemistry is often considered difficult and less interesting by students, making it one of the less popular subjects(Priliyanti et al., 2021). To overcome this, learning media needs to be designed by integrating elements of entertainment and education to make it more interesting, enjoyable, and able to increase student interest and understanding.

Chemical bonding is one of the important basic concepts in chemistry. However, in practice, many students experience difficulty in learning this material. These difficulties are caused by abstract and complex chemical concepts, so they require in-depth understanding(Sariati et al., 2020). Understanding concepts is one aspect that needs special attention from teachers in the learning process (Miharti et al., 2024). In chemical bonding material, students often face challenges in understanding sub-concepts such as

electronic configuration, number of valence electrons, Lewis structures, writing molecular formulas, the tendency of elements towards stability, evaluating compliance with the octet or duplet rule, predicting the formula of the compound formed, and types of bonds based on Lewis structure (Ismail & Alexandro, 2020).

The results of interviews and observations conducted on August 22 2024 with chemistry teachers at Al Falah Islamic High School, Jambi City revealed several problems in the learning process. One of the main problems is students' difficulty in understanding the material, especially the concept of chemical bonds, whose level of understanding only reaches 50-60%. Another influencing factor is students' lack of focus when studying material that involves calculations. Therefore, it is necessary to develop learning media that is able to integrate various concepts in chemical bonding material to facilitate students' understanding. The learning media currently used, such as PPT and textbooks, are still monotonous and only limited to lecture methods, so students tend to be passive and have difficulty learning independently. Even though the facilities and infrastructure in schools, such as focus in each class, are adequate, varied learning techniques are still an obstacle. Al Falah Islamic High School, which has implemented the Independent Curriculum, provides flexibility for teachers and students in carrying out learning that suits their needs and environment, so the development of innovative learning media is very important.

Based on the results of a needs analysis through a questionnaire, as many as 63.3% of Al Falah Islamic High School students in Jambi City stated that they strongly agreed that they had a smartphone, and 53.3% of them often used the internet to study. However, even though access to technology is quite high, 63.3% of students still experience difficulties in understanding chemistry material, especially on the topic of chemical bonds. Some students expressed difficulty in understanding concepts such as Lewis structures, the octet or duplet rule, and the types of bonds in compounds. The majority of students stated that learning media in the form of websites containing text, images, videos and games would really help them in studying chemical bonding material. Apart from that, the students also emphasized that they had never studied chemical bonding material through chemo-edutainment-based websites. As many as 76.7% of students stated the need to develop a chemo-edutainment-based website equipped with games to create more interesting and enjoyable learning. Furthermore, 73.3% of students agreed that an interactive website based on chemo-edutainment on chemical bonding material needed to be developed to help their learning process.

Chemo-edutainment (CET) is an effective chemistry learning method that integrates elements of education and entertainment through learning media. This approach aims to create a pleasant learning experience, according to the principle of edutainment, which combines entertainment and education in one medium (Awang et al., 2022). This game is designed to provide a fun experience for students while helping to achieve learning goals (Sipayung & Purba, 2024). Chemo-edutainment consists of two words, namely "chemo" and "edutainment." The word "chemo" comes from "chemistry," which means chemistry, while "edutainment" refers to the concept of education that is packaged in a fun way in terms of language.(Suryana & Imam Supardi, 2018).In accordance with the Independent Curriculum, a pleasant learning atmosphere is very necessary to support student understanding (Mellyzar, Ratna Unaida, Muliani, 2021). Through Chemo-edutainment, material on chemical bonds which tends to be difficult to understand can be conveyed through educational media that is interesting, interactive and not boring. Technology is one solution to reduce boredom in learning, especially through the efficient application of digital media in space and time(Maulana et al., 2019). Even though it has great potential, the results of interviews with teachers at Al Falah Islamic High School show that a chemo-edutainment-based approach has not been implemented at the school.

A website is an information medium that consists of various components, such as text, images, sound and animation, which are designed to attract attention and encourage visitors to access it (Kurniawan et al., 2020).The website doubles as a promotional tool and source of teaching materials that can be accessed by various parties. Therefore, almost all educational institutions currently have websites as part of their learning strategy (Wiryotinoyo et al., 2020). One platform that is often used to create websites is Google Sites, a free platform from Google that allows users to develop websites according to various needs (Sembung et al., 2022). Google Sites can be used as a learning medium that can be accessed at any time by teachers and students. Based on the results of interviews with teachers at Al Falah Islamic High School,

Jambi City, it is known that the Google Sites platform has never been used at the school. However, research by (Wahyudi et al., 2023) shows that using Google Sites as a learning medium can increase students' motivation, interest in learning, and understanding of concepts.

2. RESEARCH METHOD

The type of research carried out is development research or Research and Development (R&D) which produces products in the form of Chemo-edutainment based interactive websites using Google sites in chemical bonding material. The development model used in this research is the Lee & Owens development model. This model has five stages, namely assessment/analysis which consists of needs analysis and front-end analysis, design, development, implementation, and evaluation. This research was only carried out at the evaluation stage.

1. **Analysis:** At this stage the researcher carried out an analysis of learning problems at Al Falah Islamic High School, Jambi City. There were five analyzes carried out, namely (a) needs analysis, (b) analysis of student characteristics, (c) goal analysis, (d) material analysis, (e) analysis of educational technology.

2. Design: After the analysis stage is complete, the next step is product design. In planning this research, the next step is to create a product design that will be developed into teaching media in the form of an interactive website product based on Chemo-Edutainment using Google Sites, which will be applied to chemical bonding material. The product design plan for developing this media is explained as follows. (a) Team Building, (b) Research Schedule, (c) Media Specifications (d) Structure of Matter, (e) Making Flowcharts (f) Making Storyboards (g) Evaluation.

3. Development: At the development stage, it includes: (a) product manufacturing, (b)Material expert validation, (c) Media expert validation, (d)Teacher assessment.

4. Implementation: At this stage, products that have been improved and declared feasible by a team of experts will be tested on small groups consisting of 10 participants to obtain data about the quality of the learning media. Sample selection was carried out based on recommendations from the chemistry teacher.

5. Evaluation: The evaluation stage was carried out to assess the extent to which the developed Chemo-Edutainment based interactive website succeeded in achieving its objectives and met expectations. The evaluation carried out is in the form of a formative evaluation. The results of the formative evaluation are used as feedback to make improvements.

Data collection techniques in this research include qualitative and quantitative data. Qualitative research aims to understand phenomena in depth through descriptive interpretation and analysis, while quantitative research aims to measure and analyze data statistically (Kholidah, Hidayat, Jamaludin, Leksono & ISSN, 2023).Qualitative data was obtained through observation, interviews with teachers, as well as validation questionnaires from media experts, material experts and teachers, which were equipped with suggestions and input for improving the products being developed. Meanwhile, quantitative data was obtained from assessment scores given by media experts, material experts, teachers, as well as student responses to Chemo-edutainment-based interactive websites using Google Sites on the chemical bond material that will be developed. The instruments used in this research were interviews with chemistry teachers, student needs, validation by media experts and material experts, teacher assessments, and student responses.

After the data is collected, the next step is to carry out an analysis of the assessment results from the initial analysis questionnaire, material expert validation questionnaire, media expert validation questionnaire, teacher assessment questionnaire, and student response questionnaire.

1. Validation Questionnaire for Media Experts, Material Experts and Teacher Assessment

Data analysis carried out on validation questionnaires for media experts, material experts and teacher assessments includes qualitative data in the form of suggestions and comments, as well as quantitative data. For the interval distance on the Likert scale, the following formula is used.

$$Interval\ distance \frac{Highest - Lowest\ score}{Number\ Of\ interval\ classes}\ 100\%$$

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Table 1. Validation and teacher assessment criteria

Number	Mean Answer Score	Criteria
1.	>4,2 – 5,0	Very worthy
2.	>3,4 – 4,2	Worthy
3.	>2,6 – 3,4	Not worthy
4.	>1,8 – 2,6	Not Feasible
5.	>1,0 – 1,8	Very Unworthy

2. Student responses

$$K = \frac{F}{N \times I \times R} \times 100\%$$

Table 2. Criteria for student responses

Number	Percentage	Criteria
1.	81 – 100%	Very good
2.	61 – 80%	Good
3.	41 – 60%	Not good
4.	21 – 40%	Not good
5.	0 – 20%	Very not good

3. RESULTS AND DISCUSSION

A. Analysis

Based on the results of interviews, observations and needs analysis at Al Falah Islamic High School, Jambi City, several main problems were found in learning chemistry, especially chemical bonding material, such as lack of student focus when studying calculation material, low student understanding (50-60%), as well as monotonous learning techniques through PPT media and textbooks, so that students have difficulty learning independently. Adequate facilities and infrastructure, such as focus in each class and the implementation of an independent curriculum, provide opportunities to develop innovative learning media. Based on the questionnaire, 63.3% of students have smartphones, 53.3% often use the internet to study, but 63.3% still find it difficult to understand Lewis structures, octet or duplet rules, and types of chemical bonds. As many as 76.7% of students stated the need for a chemo-edutainment-based website that contains text, images, videos and interactive games to help learning, and 73.3% of students supported the development of this website to make learning more interesting, independent and effective in understanding. abstract concepts on chemical bonding material.

B. Design

After the analysis stage is complete, the next step is product design. In planning this research, the next step is to create a product design that will be developed into teaching media in the form of an interactive website product based on Chemo-Edutainment using Google Sites, which will be applied to chemical bonding material. The resulting product is an interactive website based on Chemo-Edutainment using Google sites which contains a cover, Learning Outcomes (CP), Learning Objectives (TP), Learning Objectives Flow (ATP), Chemical bond material, Videos related to chemical bond material, Games, Evaluation questions and development profile. The appearance of the website being developed can be seen in Figure 1.

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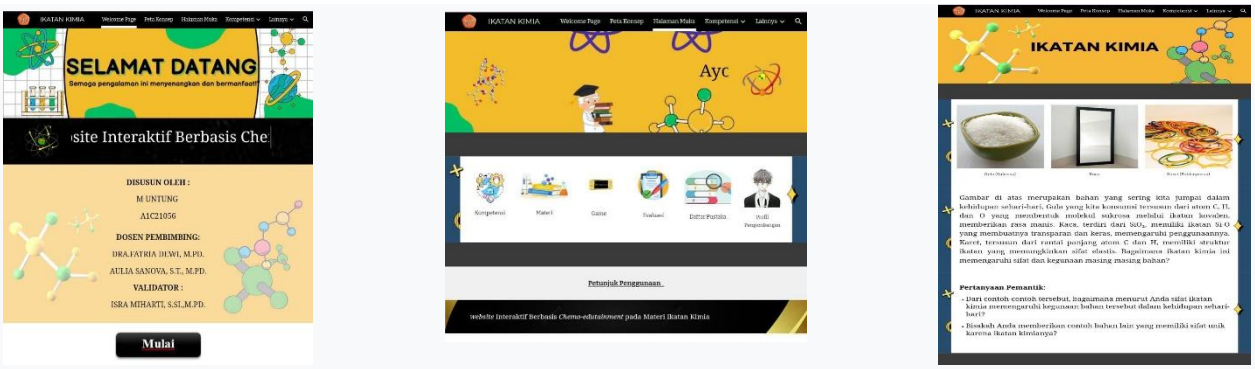

Fig 1. Appearance of the chemo-edutainment based learning website

C. Development

The products that have been made are then validated by a team of experts, namely material experts and media experts to find out whether the e-module that has been created is feasible or not conceptually, the product will later be tested. Product those that have been assessed will be revised according to suggestions and comments from the expert team. After validation was carried out and declared suitable for further assessment by the teacher.

Table 3. Material validation results

Amount	**49**
Average	**4,08**
Category	**worthy**

From the validation data by material experts in the table above, it is obtained total score of 49 with an average of 4.08 is in the interval > 3.4-4.2 in the category "Worthy". All suggestions are provided by material experts at the validation stage has been carried out, so from the table above it can be seen that everything is appropriate with what is suggested. This second stage of validation obtained results that the material The teaching developed was declared suitable for testing in the field without repair or revision.

Table 4. Media Validation Results

Amount	**64**
Average	**4,2**
Category	**worthy**

From the validation data by media experts as in the table above, it was obtained a total score of 64 with an average of 4.2 is in the interval > 4.3-5.0 in the category “Very Worth It”. The validation score states that the website is chemo-edutainment based What the developer has done is worthy of being tested in the field.

4. Implementation

Before entering the implementation stage of website product development, First, the developer asks for the subject teacher's assessment and response chemistry on the website that has been created. Teacher assessment is carried out before the product is tested on students small group. At this stage, the developer gives a questionnaire to the chemistry teacher to ask for assessments and suggestions on the website.

Table 3 Data on Assessment Instrument Results and Teacher Responses

Amount	**57**
Average	**4,3**

Category	worthy

Based on the results of the teacher assessment instrument, a total score of 57 was obtained an average of 4.3 is in the interval >4.3-5.0 in the "Very Eligible" criteria. Beside Moreover, the teacher also provides general comments and suggestions regarding the product developed, namely an e-module product that is easy to use by students, the material is presented is easy to understand so that it attracts students' interest in learning Can be used as teaching material independently.

Next, students operate chemo-based website productsedutainment, researchers ask students to fill in participant response instruments educate about chemo-edutainment based e-module products that have been developed by filling in the distributed sheet.

Table 4. Small Group Trial Results Data

Total number	**546**
Percentage	**86,3 %**
Criteria	**Very good**

Based on the calculation above, the percentage of all answers is obtained 86.3% of respondents, this value is in the value range 81% - 100%, namely the criteria student response "Very Good". Based on data obtained from both teacher assessment and student responses, it can be concluded that the teaching materials are has been developed to be very interesting and very good at supporting learning on Chemical Bonding material.

4. CONCLUSION

Based on the findings from the development research and discussions regarding the use of a chemo-edutainment-based website for learning Chemical Bonding material, the following conclusions can be drawn:

1. Feasibility and Validation:
   The chemo-edutainment-based website on Chemical Bonding material has been deemed highly suitable for use in educational contexts. This conclusion is supported by validation scores from media and material experts, with an average media expert validation score of 4.2 and an average material expert score of 4.08, placing it in the "Decent" category. These results suggest that the website is a viable and effective open material resource for teaching chemistry, providing an engaging alternative to traditional methods.
2. Teacher and Student Evaluations:
   For the chemo-edutainment-based website on colloidal materials, an average teacher assessment score of 4.3 was recorded. Additionally, the small group trial yielded a positive response, with a percentage of 86.3%, classifying it in the "Very Good" category. These results indicate that the website effectively enhances student understanding and engagement, demonstrating its suitability as a learning tool in chemistry education.

Implications for Education and Research:

The findings highlight the potential of chemo-edutainment as an innovative approach to improve student engagement and comprehension in chemistry. This approach aligns with the growing demand for interactive and technology-based learning media. Future research could explore the following areas:

- Expanding the chemo-edutainment concept to other complex chemistry topics or disciplines.
- Investigating the long-term impact of such tools on student performance and interest in STEM fields.
- Developing more personalized or adaptive features within the website to cater to diverse learning styles and needs.
- Conducting larger-scale trials to validate the effectiveness of the approach across different educational settings.

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