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Development of Interactive Media For A Virtual Laboratory on Chemical Equilibrium Using Articulate Storyline 3

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Abstract: Development Of Interactive Media For A Virtual Laboratory On Chemical Equilibrium Using Articulate Storyline 3. This research aims to develop an interactive media Virtual Laboratory on the topic of chemical equilibrium. This research was conducted at SMA Negeri 1 Galang. This type of research uses the development method (R&D) with the ADDIE model, which includes the stages of analysis, design, development, implementation, and evaluation, but this research is limited to the development stage. This research uses a sample of 28 students in 1 class, 1 chemistry teacher, and 2 expert validators. Data collection in this study was conducted through interviews and questionnaires. The validation results by media experts indicate that this virtual laboratory is valid with an average feasibility percentage of 84.71%, while validation by content experts obtained a percentage of 90%. Teacher responses indicate validity with an average of 95.55%, and student responses provide an average of 96.45%, all of which fall into the "very feasible" category.

Keywords: : Virtual Laboratory, Chemical Equilibrium, Articulate Storyline 3, Development, Interactive Media

Abstrak: Pengembangan Media Interaktif Virtual Laboratory Berbasis Articulate Storyline 3 Materi Kesetimbangan Kimia. *Penelitian ini bertujuan untuk mengembangkan media interaktif Virtual laboratory pada materi kesetimbangan kimia. Penelitian ini dilakukan di SMA Negeri 1 Galang. Jenis Penelitian ini menggunakan metode pengembangan (R&D) dengan model ADDIE, yang mencakup tahapan analisis, desain, pengembangan, implementasi, dan evaluasi, namun penelitian ini dibatasi sampai tahap pengembangan. Penelitian ini menggunakan sampel sebanyak 28 siswa dalam 1 kelas, 1 guru kimia, dan 2 validator ahli. Pengumpulan data pada penelitian ini dilakukan melalui hasil wawancara dan angket. Hasil validasi oleh ahli media menunjukkan bahwa laboratorium virtual ini valid dengan persentase kelayakan rata-rata 84,71%, sedangkan validasi dari ahli materi memperoleh persentase 90%. Tanggapan guru menunjukkan validitas dengan rata-rata 95,55%, dan tanggapan siswa memberikan rata-rata 96,45%, yang semuanya termasuk dalam kategori "sangat layak".*

Kata kunci: *Virtual Laboratory, Kesetimbangan Kimia, Articulate Storyline 3, Pengembangan, Media Interaktif*

▪ INTRODUCTION

Chemistry is the science that studies the properties of substances or matter and their applications in daily life (Lestari et al., 2023). The combination of concrete and abstract concepts in chemistry can be challenging to visualize, making it difficult for students to understand (Al-Nakhle, 2022). Chemistry learning involves not only mastering concepts but also discovery through scientific methods, requiring active student participation like observation and laboratory activities for meaningful learning (Syam & Kurniasih, 2023). Practical activities are essential in chemistry learning as they can enhance students' skills and interest in the subject (Sapriati et al., 2023).

Based on the results of an interviews with the chemistry teacher at SMA Negeri 1 Galang, it was stated that a common obstacle in conducting chemistry practical activities is the limited availability of laboratory facilities and infrastructure. Currently, no media is available for teachers to use as a substitute for practical activities. This fact was revealed through interviews with 11th-grade students at SMA Negeri 1 Galang regarding challenges in chemistry practicals, particularly on chemical equilibrium. It was found that no media is available to replace laboratory practices in chemistry learning. Teachers rely solely on simple experiments, such as making agar with precise measurements, to explain chemical equilibrium. Sugiharti (2022) states that direct practicals cannot be maximized without adequate laboratory facilities, leading to student boredom and reduced creativity due to limited opportunities for experimentation. From this, students sometimes feel bored and it can cause them to become uncreative because they lack many opportunities to explore experiments, as the learning is too abstract and to gain knowledge about the implementation process of practical work, it needs to be practiced directly (Hidayat et al., 2022). One effort that needs to be made is the innovation of the learning process through the development of visual media in the form of a virtual laboratory to provide students with a comprehensive understanding of the concept of chemical equilibrium (Jaya et al., 2023

A virtual laboratory is defined as a series of laboratory tools in the form of interactive multimedia-based software), such as simulations, animations, or experiments, either locally or remotely via the internet, to simulate activities as in a real laboratory (Anggraeni et al., 2021). Fatayah, in his research report, stated that the limitations of real experiments can be overcome with an alternative experiment in the form of a virtual experiment, which allows each student to conduct practical work virtually using a smartphone or computer (Fatayah, 2023). This is in line with Amanda's opinion that the advancement of educational technology today can be utilized to improve the quality of learning in schools through the development of learning media in the form of virtual laboratories (Amanda et al., 2022).

Previous research relevant to this plan is the study by Muchson (2019), which focuses on the use of virtual laboratory media. Muchson stated that the feasibility percentage of the virtual laboratory, based on expert and user assessments in learning acid-base material, is categorized as very feasible for implementation in education. Similarly, the research results from (Sugiharti et al., 2022) indicate that the development of smartphone-based virtual laboratory media is categorized as very good. It means that the use of smartphone-based virtual reality labs is a suitable medium for learning.

Meanwhile, the research conducted by Fatayah (2023), found that the use of virtual laboratories is effective in improving students' learning completeness.

Considering that the topic of chemical equilibrium in learning must be supported by practical experiments to understand the shift in the direction of equilibrium. Meanwhile, until now, practical experiments in chemical equilibrium learning have not been conducted at SMA Negeri 1 Galang due to the lack of supporting facilities for the implementation of the said practical experiments. Therefore, this research needs to be conducted as an innovation and development of a learning media in the form of a virtual lab that can be used as a learning medium for chemical equilibrium.

▪ METHOD

This research adopts the research and development (R&D) method with the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation (Nurmalasari et al., 2022). The reason the researchers used the ADDIE development model is that it is more suitable for developing web-based learning media or software, due to its systematic and easily understandable development stages in the process of developing learning media (Indartiwi et al., 2020). Meanwhile, according to Sugihartini & Yudiana, (2018), the stages used in this model are systematic, so the resulting product will be a valid and ready-to-use product. The product produced is an interactive learning media in the form of a virtual laboratory based on Articulate Storyline 3, which will be applied to the topic of chemical equilibrium for 11th-grade science students. This research is limited to the development stage of a virtual laboratory based on Articulate Storyline 3.

The research was conducted at SMA Negeri 1 Galang, Deli Serdang Regency. The time allocated for this research activity is from March 2024 to November 2024. This research involves 28 students in one class as samples, as well as a chemistry teacher and two expert validators, namely a content expert validator and a media expert validator. The data collection methods used include: 1) field studies, 2) validation by media and material experts, 3) feedback from teachers and students. This research develops a virtual laboratory based on Articulate Storyline 3 for the topic of chemical equilibrium. The data collection techniques used were interviews and questionnaires. Scoring is conducted using a Likert scale divided into four categories. Table 1.

Table 1. Item Response Criteria for the Validation Instrument with a Likert Scale

NO.	Answer	Score
1.	Disagree	1
2.	Slightly Disagree	2
3.	Agree	3
4.	Very Agree	4

Modification from (Mardianto et al., 2022).

The percentage of each sub-variable is calculated using the formula:

$$P(s) = \frac{f}{N} x100\%$$

(Widoyoko, 2016).

Explanation:
P(s) : percentage of the sub-variable
f : number of scores obtained
N : maximum number of scores

The above calculation yields the following range of percentage for the qualitative criteria: Table 2.

Table 2. Range of Percentage Qualitative Criteria

Score	Category
81,25% > Score ≤ 100%	Very Feasible
62,50% > Score ≤ 81,25%	Feasible
43, 75% > Score ≤ 62,50%	Fairly Feasible
25% ≥ Score ≤ 43,75%	Less Feasible

Modification from (Damayanti et al., 2020).

▪ RESULT AND DISCUSSION

In this research, there are many steps that must be taken to obtain results from the development process of a virtual laboratory based on Articulate Storyline 3 on the topic of chemical equilibrium, using the ADDIE development model which consists of analysis, design, development, implementation, and evaluation. However, this research will be limited to the development stage. (pengembangan). The feasibility of this virtual laboratory is assessed based on initial data, including validation results from media experts, subject matter experts, and feedback from teachers and students.

The research stages begin with analysis, where the researcher examines various aspects that form the basis for designing and developing the product, as well as analyzing the feasibility and development requirements. Next, the design phase becomes the next step in the development of the virtual laboratory. In this phase, researchers analyze the syllabus, prepare the materials, determine the format of the virtual laboratory to be used, and design the research instruments. The development phase is carried out after the design is completed, starting with the process of creating the virtual laboratory. The main components of the virtual laboratory product include an introduction, materials, practical activities, evaluation, and developer profiles. The research results will be explained in detail as follows:

Results of the Media Expert Assessment

The assessment by media experts of the Virtual Laboratory is conducted to evaluate the product developed by the researchers (Anggraeni & Rahmawan, 2024). The data obtained from the validation results are converted into percentages and compared with the feasibility criteria to determine whether the product is viable or not. This process aims to improve the quality of the developed product. Figure 1.

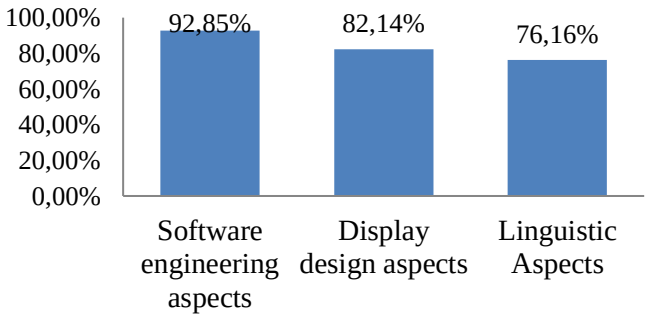


Figure 1. Results of the Feasibility Level of the Virtual Laboratory by Media Experts.

Based on the results of media expert validation, the Virtual Laboratory is declared valid with a feasibility percentage of 92.85% in the software engineering aspect, 82.14% in the display design aspect, and 79.16% in the linguistic aspect. The overall average feasibility percentage is 84.71%, which falls into the "very feasible" category. Thus, it can be concluded that the developed Virtual Laboratory meets the feasibility criteria and is suitable for use in chemistry learning, especially for the topic of chemical equilibrium.

Results of the Assessment by Subject Matter Experts

Material validation for the Virtual Laboratory is conducted to obtain assessments from subject matter experts regarding the developed product (Audina & Syuhada, 2024). The evaluation data is converted into percentages and compared with the eligibility criteria to determine whether the product meets the requirements or not. This validation process aims to ensure and improve the quality of the produced product. Figure 2.

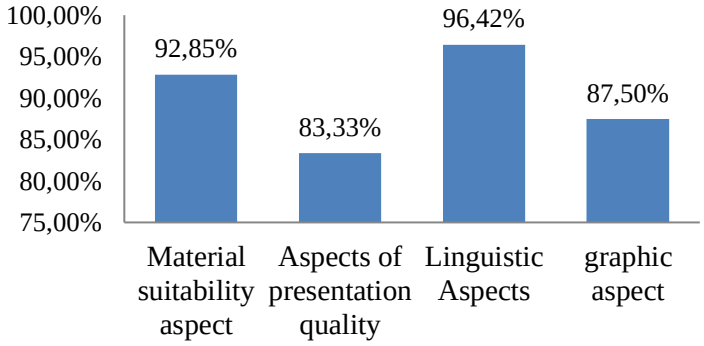


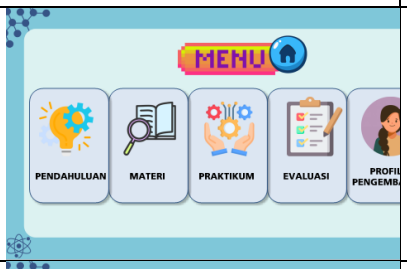
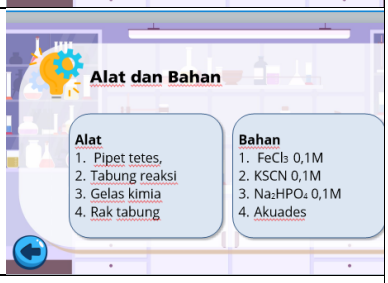
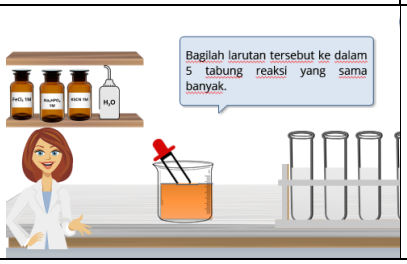
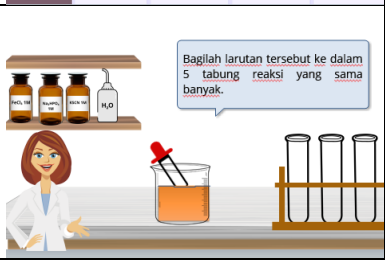
Figure 2. Results of the Feasibility Level of the Virtual Laboratory by Material Experts.

Based on the validation results by subject matter experts, the developed Virtual Laboratory is declared valid with the following feasibility percentages: material suitability 92.85%, presentation 83.33%, language 96.42%, and graphic aspects 87.5%. The overall average percentage reaches 90%, which falls into the "very feasible" category. Thus, it can be concluded that this Virtual Laboratory has met the feasibility criteria and can be used in chemistry learning, particularly on the topic of chemical equilibrium.

Revised By The Validator

After the media expert and material expert provide their evaluations, feedback and suggestions will be obtained. Table 1

Table 1. Revised By The Validator

Suggestions	Before	After
Image selection should match the title.		
Chemical formulas should be written correctly.		
Button navigation should be in the appropriate place.		

Teacher's Response Analysis Results

After the revision process is complete and the product is declared valid by media experts and material experts, the next step is to provide the product to teachers to obtain feedback. The feedback from teachers aims to gather information that can be used as material for evaluation and further improvement to enhance the quality of the developed Virtual Laboratory.

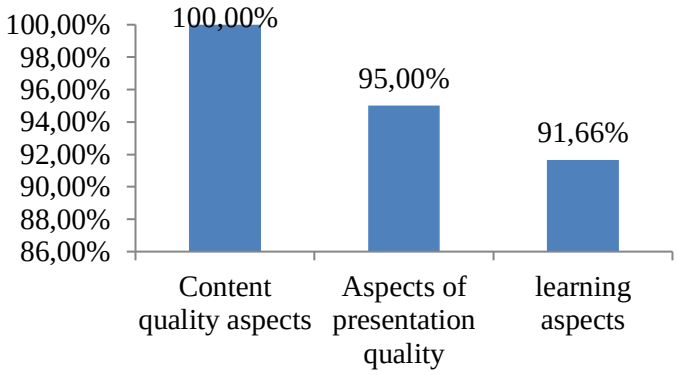


Figure 3. Teacher's response results

Based on the feedback from chemistry teachers, the Virtual Laboratory is deemed valid with the following average feasibility percentages: content and objectives 100%, presentation 95%, and learning 91.66%. The overall average is 95.55%, which falls into the "very feasible" category. Providing the Virtual Laboratory to teachers aims to ensure that this product meets the needs and development of students, considering that teachers have a deeper understanding of the conditions and needs of the students in the classes they teach.

Student's Response Analysis Results

The student response test was conducted with the 28 students of class XI Science 2. Students' responses to the Virtual Laboratory were measured through observation using a student response questionnaire.

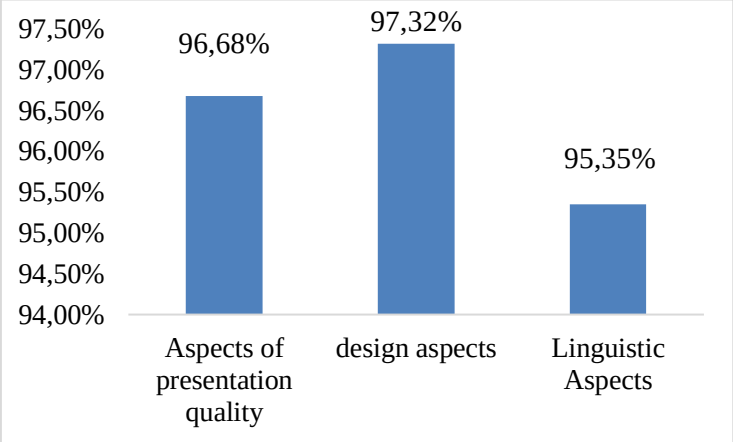


Figure 4. Student's response results

Based on the data in Figure 4, student's responses to the Virtual Laboratory show very positive results. From the aspect of presentation, a percentage of 96.68% was obtained, the design aspect reached 97.32%, and the linguistic aspect received 95.35%. Overall, the average student response from various aspects was 96.45%, which falls into the "very feasible" category. This indicates that the Virtual Laboratory was very well received by the students and is considered suitable to support the learning process.

After undergoing a validation process that included input and suggestions from subject matter experts and media experts, which showed a feasibility percentage in the "very feasible" category, as well as receiving responses from teachers and students in the "very feasible" category, it can be concluded that the developed Virtual Laboratory product is complete and meets the feasibility standards for use in learning. Based on the research conducted by Safiatuddin & Asnawi in 2023, the use of virtual laboratories is effective in improving learning outcomes with a moderate category. This indicates that the use of virtual laboratories can enhance students' motivation and learning outcomes (Safiatuddin & Asnawi, 2022). In accordance with the research conducted by Hidayat in 2023, which focused on the use of Virtual Laboratory, the results of his study show that the Virtual Laboratory media is suitable for use as a learning medium and is highly appropriate for development.

▪ CONCLUSION

Based on the validation results from media experts, material experts, teachers, and students, the developed Virtual Laboratory is declared valid with an excellent feasibility percentage. The feasibility percentage from media experts is 84.71% (very feasible), material experts 90% (very feasible), teacher responses 95.55% (very feasible), and student responses 96.45% (very feasible). Thus, it can be concluded that this Virtual Laboratory meets the feasibility criteria and can be used in chemistry learning, particularly on the topic of chemical equilibrium.

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