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DEVELOPMENT OF ANDROID-BASED INTERACTIVE LEARNING MEDIA USING SMART APPS CREATOR (SAC) ON THERMOCHEMISTRY

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ABSTRACT

The integration of technology in learning allows the creation of various interactive media that can improve the effectiveness of learning. This study aims to develop interactive learning media based on Android using Smart Apps Creator on thermochemistry material. The development is carried out using the 4-D development model, which includes the stages of define, design, develop, and disseminate. However, this study is limited to the development stage. The research sample was students of Class XI MIA at SMA Negeri 31 Central Maluku. The instruments used were expert validation sheets and student response questionnaires. Data analysis was conducted descriptively quantitatively based on the assessment categories of media feasibility and practicality. The results of the study obtained showed that the average percentage of feasibility tests by material experts was 96% and media experts 94%, with a very feasible category, while the average percentage of practicality tests by students was 98%, with a very practical category. Thus, the interactive learning media based on Android using the Smart Apps Creator that was developed is very feasible and very practical to use in the chemistry learning process, especially thermochemistry materials.

Keywords: *Development, Learning Media, Android, Thermochemistry*

INTRODUCTION

Education in Indonesia continues to develop along with changes in the curriculum aimed at improving the quality of learning. The Merdeka Curriculum currently implemented emphasizes more flexible learning, oriented towards strengthening competencies, and project-based to develop 21st century skills (Ministry of Education, Culture, Research, and Technology, 2024). In this context, the use of technology in learning is becoming increasingly relevant to support the achievement of adaptive and innovative educational goals.

The development of digital technology has had a significant impact on the world of education. The integration of technology in learning allows the creation of various interactive media that can increase the effectiveness of knowledge transfer to students. In addition, technology also plays a role in increasing accessibility, personalization of learning, motivation and participation of students in the learning process (Armianti, *et al*., 2024). The use of digital technology in learning is one of the innovative solutions to improve the quality of learning, especially in explaining abstract concepts in science, including chemistry.

Thermochemistry is one of the materials in chemistry that has abstract characteristics and requires a deep understanding of the concept. This material is related to energy changes in chemical reactions that cannot be observed directly by students (Overby, 2022). Thus, teaching thermochemistry presents various challenges for teachers, especially in helping students understand the concepts of enthalpy, exothermic and endothermic reactions, bond energy, and calorimeters (Rasyidah *et al*., 2023).

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According to teachers at SMA Negeri 31 Central Maluku, these concepts are often only explained verbally and through illustrations in textbooks, so that students are less focused on learning and have difficulty understanding the concepts. These difficulties are further exacerbated by limited laboratory facilities in schools and lack of access to technology-based learning media. In addition, the nature of thermochemistry material which involves a lot of mathematical calculations makes it even more difficult for students to understand (Rasyidah *et al*., 2023). The lack of interactive learning media also contributes to students' low conceptual understanding and difficulty in applying concepts in problem solving. Therefore, it is necessary to develop more innovative and technology-based learning media to help students understand thermochemistry material more deeply.

Teachers are expected to be creative in selecting and developing learning media that are in accordance with the characteristics of the material and the needs of students. Choosing the right media can significantly support the development of students' potential while increasing their interest in learning (Sukarini & Manuaba, 2021). Along with the development of technology, teachers now have various options to design more interesting learning, one of which is through the use of interactive android-based learning media.

Various previous studies have proven that Android-based learning media is effective in improving student learning outcomes in chemistry subjects. For example, research by Khoiorni (2021) and Sinaga, *et al*. (2023) shows that the use of Android-based applications in chemistry learning can significantly increase motivation, chemical literacy, multiple chemical representation ability, conceptual understanding, and student learning outcomes. This finding is reinforced by research conducted by Solikhin and Wijanarko (2023), which revealed a significant difference in learning outcomes between the control class (without using Android) and the experimental class (with using Android). The learning outcomes of students in the experimental class were proven to be higher compared to the control class. The use of digital learning media not only makes the learning experience more interesting but also increases student interaction in understanding complex chemical concepts.

One of the applications that can be used to develop Android-based learning media is Smart Apps Creator (SAC) (Hutasoit, 2023). SAC is software that allows teachers to design learning applications independently without having to have complex programming skills. SAC is able to produce applications in HTML5 and exe formats, which are compatible with various devices such as computers, laptops, tablets, and smartphones (Khasanah & Rusman, 2021). With the interactive features provided, such as animation, simulation, and interactive quizzes, this application can help increase student engagement in the learning process. In addition, this application can also improve students' abilities in solving mathematical problems (calculations) (Mahuda, 2021). Like research conducted by Uliyandri and Sutarno (2023), showing an increase in student learning outcomes after using Android-based learning media assisted by SAC in the chemistry learning process.

The development of interactive learning media based on Android using SAC on thermochemistry material is expected to be an innovative solution in answering the challenges of learning chemistry, especially thermochemistry material. With this media, students can learn independently through mobile devices, explore thermochemistry concepts in more depth, and improve their understanding of the material being studied. Therefore, this study aims to develop interactive learning media based on Android with SAC and examine its practicality and effectiveness in improving students' understanding of thermochemistry material.

RESEARCH METHODS

The research method used in this study is the Research and Development (R&D) method. According to Sugiyono (2022), the R&D method is a research method used to produce certain products and test the effectiveness of those products.

p-ISSN 2722-8258
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The stages of this research refer to the 4-D development model introduced by Thiagarajan. This model consists of four main stages, namely Define, Design, Develop, and Disseminate. The define stage aims to identify problems and analyze needs in product development. Furthermore, the design stage involves the initial design of the product, including the creation of a storyboard or conceptual design. The develop stage focuses on the process of creating, validating and testing the product that has been designed to ensure its effectiveness and feasibility before being applied more widely. After the product is developed and tested, the final stage is disseminate where the product is disseminated and applied on a wider scale, but in this study the disseminate *stage* was not carried out.

The sample in this study was 24 students of class XI MIA. The location of the research was at SMA Negeri 31 Central Maluku, in the odd semester of the 2024/2025 academic year. The instruments used were validation questionnaires from media experts and material experts and student response questionnaires.

The data analysis conducted includes media feasibility analysis based on expert assessment, and media practicality analysis based on student responses to the media created. The analysis of media feasibility and practicality uses the formula:

$$P = \frac{\sum X}{N} \text{ x } 100\%$$

(Arikunto, 2010)

Information:
P : Percentage score
$\sum X$: Total scores obtained
N : Maximum score

Furthermore, the average percentage obtained from the assessment of the media expert validator and material expert regarding the suitability of the media is converted according to the percentage score range in **Table 1** .

Table 1. Criteria for assessing the suitability of interactive media

Percentage score (%)	Eligibility level
90-100	Very valid / Very worthy
65-89	Valid / Eligible
40-64	Less valid / Less eligible
0-39	Invalid / Not Eligible

(Arikunto, 2010)

Meanwhile, the average percentage obtained from student responses to the practicality of the media was converted according to the percentage score range in **Table 2** .

Table 2. Criteria for assessing the practicality of interactive media

Percentage score (%)	Level of Practicality
85-100	Very practical
70-84	Practical
50-69	Less practical
0-49	Not practical

(Akbar, 2013)

Based on Tables 1 and 2, learning media is considered valid or feasible if the results of the feasibility test reach a score percentage of 65-89%. Meanwhile, the media is declared practical if the results of the practicality test obtain a score in the range of 70-84%.

p-ISSN 2722-8258
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RESULTS AND DISCUSSION

This study aims to develop interactive learning media based on Android using SAC and examine its feasibility and practicality in learning thermochemistry material for class XI MIA students at SMA Negeri 31 Central Maluku. The process of developing interactive learning media based on Android is carried out through three stages, namely:

Define Stage

At this stage, an initial analysis was conducted to identify the main problems in chemistry learning faced by educators and students of class XI of SMA Negeri 31 Central Maluku. Based on the results of interviews with teachers and students, it is known that student learning outcomes in thermochemistry material are still relatively low, because the scores of some students are below the Minimum Completion Criteria (KKM). This is because thermochemistry is a complex material and involves mathematical calculations, so students have difficulty understanding it. In addition, the use of teaching methods that are still monotonous, and limited learning media, also contribute to the low interest of students in learning, which has an impact on their low learning outcomes.

Next, an analysis of student characteristics was conducted. Based on the results of observations and interviews, it is known that students at SMA Negeri 31 Central Maluku Class XI MIA tend to use existing technology such as mobile phones or androids in their daily activities including at school. Thus, students will be more interested in learning if they are facilitated using android-based learning media. Because in addition to being used in classroom learning, this media can also be used in independent learning, anytime and anywhere.

The final process of this definition stage is analyzing and identifying the needs in making media. In this process, the researcher discussed with the chemistry teacher to understand the learning needs. From the results of the discussion and analysis, the materials needed in media development were obtained, namely the syllabus, lesson plans, thermochemistry materials, and quiz questions and evaluations.

Design Stage

At this design stage, the researcher began to design the initial design of the product, namely the storyboard and learning media scenario. Storyboard done by designing the media layout, which includes beginning scene for opening containing intro page, cover, menu and instructions; main part containing learning objectives, quiz materials and evaluations; and the closing section containing references and profiles of the compilers. While in the learning media scenario section, the researcher compiled quiz questions and evaluations based on basic competencies and learning indicators. The final result of this stage is the storyboard and learning media scenario that are ready to be developed at the development stage.

Develop Stage

In the development stage, researchers develop products or media based on the initial design (storyboard). Media development is carried out using the SAC application. Furthermore, validation is carried out to test the feasibility of the media, and trials on students to determine the practicality of using the media. The stages of development are as follows:

a. Media Creation on SAC

The android-based interactive media for thermochemistry material developed contains an intro page, cover display, menu, user manual, learning objectives, materials, quizzes, evaluations, references and author profiles. The following are some displays of the media.

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Figure 1. Cover View

Figure 2. Menu View

Figure 3. Learning Objectives Display

Figure 4. Material Display

Figure 5. Learning Video Display

Figure 6. Example Question Display

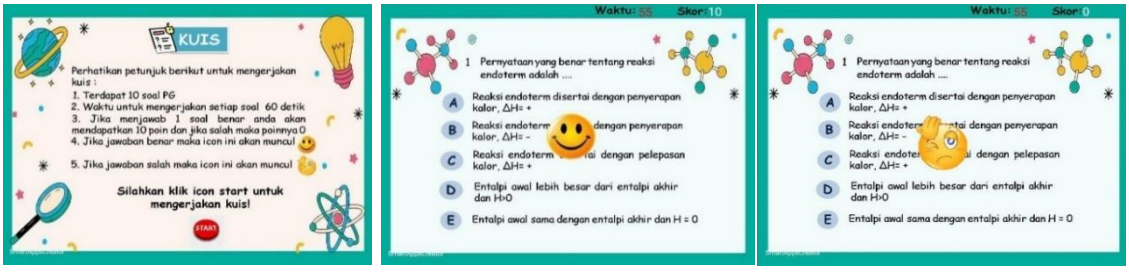

Figure 7. Quiz View

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Figure 8. Evaluation View

The learning media that has been created is then validated to determine the level of feasibility and practicality of its use.

b. Media Suitability Test

Media feasibility testing is a process to ensure that the content in android-based interactive learning media is valid and suitable for use by grade XI high school students in the learning process. Validation is carried out by competent experts in their respective fields, namely material experts and media experts. The assessment scale used is a Likert scale from 1 to 4 with the criteria, 1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree. The validation results obtained are as follows:

1) Subject Matter Expert Validation

Validation of material experts on android-based learning media designed using SAC was carried out by two material experts. The instrument used in the assessment consisted of 14 statement items covering two aspects of assessment, namely the content and language aspects. The validation results obtained from the experts were then converted into quantitative data using the scoring method. Then the percentage score and the average percentage from the two experts were calculated. The average percentage results were converted according to the category of eligibility levels adapted from Arikunto (2010). The results of the validation by material experts can be seen in **Table 3**.

Table 3. Results of Expert Validation of Material

No	Assessment Aspects	Number of statement items	Score	
			Subject Matter Expert 1	Subject Matter Expert 2
1.	Contents of the material	8	31	31
2.	Language	6	23	23
	Total Score		54	54
	Percentage		96%	96%
	Average Percentage		**96%**	
	Category		**Very Worthy**	

Based on Table 3, the validation results from two material experts show that the average percentage of media feasibility tests reached 96% with the category "very worthy." This validation result is without any suggestions for improvement. Therefore, the Android-based interactive

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learning media that has been developed can be tested on students or applied in chemistry learning on the concept of thermochemistry.

2) Media Expert Validation

Media expert validation was conducted to assess the learning media that had been developed from the media aspect. The validation process involved two media experts as validators. The assessment instrument used consisted of 23 statement items covering three aspects of assessment, namely media and interactivity aspects, linguistic aspects, and visual and audio display aspects. The validation results obtained from the two media experts were converted into scoring form and continued with percentage calculations and category determination based on feasibility level data. The results of the media expert validation are presented in **Table 4** .

Table 4. Media Expert Validation Results

No	Assessment Aspects	Number of statement items	Score	
			Media Expert 1	Media Expert 2
1.	Media and interactivity	7	26	27
2.	Linguistics	5	19	19
3.	Visual and audio display	11	42	41
	Total Score		87	87
	Percentage		94%	94%
	Average Percentage		**94%**	
	Category		**Very Worthy**	

Based on Table 4, it is known that the results of the feasibility test from media experts show an average percentage of 94%, with the category "very worthy." In addition, media expert 1 also provided suggestions for improving the media, especially in the audio section. Media expert 1 suggested reducing or eliminating the use of the word "*nah*" which is often said by the audio voice actor when explaining the material.

Following up on the suggestion, the researcher made a revision by re-recording the audio explanation of the material and eliminating the use of the word "*nah*" when explaining the material. The results of the media revision are presented in **Table 5** .

Table 5. Media View Before and After Revision

Before revision	After revision
	
In audio, there is a lot of use of the word “*nah*” when delivering material.	In the audio the word "*nah*" is already removed.

Based on the results of the validation and revision that have been carried out, interactive learning media based on Android can be applied in the learning process of thermochemistry material.

p-ISSN 2722-8258
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c. Media Practicality Test

The media practicality test was conducted to assess students' responses to the Android-based interactive media that had been developed. This test involved 24 students of class XI MIA of SMA Negeri 31 Central Maluku. The instrument used was a response questionnaire consisting of 27 statement items. The practicality aspects assessed were the content aspects, language, media use, and graphic display. Students filled out the questionnaire after participating in learning with Android-based media.

The questionnaire data were converted into quantitative form through a scoring method. The scores obtained were then calculated in percentage form and averaged. The results of this calculation were categorized based on the level of practicality adapted from Akbar (2013). The results of the student response test can be seen in **Table 6** .

Table 6. Results of Student Response Tests on Media Practicality

No	Assessment Aspects	Number of Statement Items	Percentage Practicality
1.	Contents	5	9 9 %
2.	Linguistics	6	9 7 %
3.	Use of Media	8	9 9 %
4.	Appearance graphic	8	99%
	Average Percentage		**9 8 %**
	Category		**Very Practical**

Based on the results of the practicality test shown in Table 6, it is known that the average percentage of student responses to android-based interactive learning media reached 98%, with the category "very practical." This shows that the media developed has ease in terms of material, language, and use, as well as attractiveness in terms of appearance. Thus, this media is in accordance with the needs of students, and is effective in supporting chemistry learning in thermochemistry material.

CONCLUSION

Development of learning media interactive Android based using Smart Apps Creator (SAC) on the material thermochemistry done through three stages, namely define, design, and develop. This process produce ten content main in learning media, includes intro page, cover view, menu, instructions use, purpose learning, materials, quizzes, evaluations, references, and profiles compiler. Validation results show that this media get average percentage eligibility by 96% of expert material and 94% of media experts, both including in category "very worthy". While that, practicality test based on response participant educate shows the average percentage by 98% with category "very practical". With thus, learning media interactive this Android based can used in learning chemistry, especially in materials thermochemistry.

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