Prisma Sains: Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram
https://e-journal.undikma.ac.id/index.php/prismasains/index
e-mail: prismasains.pkpsm@gmail.com

July 2025. Vol. 13, No. 3
p-ISSN: 2338-4530
e-ISSN: 2540-7899
pp. 388-401

Android-based Application Development on Thermochemistry using Kvisoft Flipbook Maker and Apps Geyser

***Dwi Gilang Romadhon, Setia Rahmawan**
UIN Sunan Kalijaga, Marsda Adisucipto Street. Special Region of Yogyakarta 55281, Indonesia.
Corresponding author e-mail: setia.rahmawan@uin-suka.ac.id

Received: February 2025; Revised: March 2025; Published: July 2025

Abstract

The complexity of thermochemistry and its abstract nature is often difficult for students to study. To address this issue, we designed an Android-based application using Kvisoft FlipBook Maker and AppsGeyser to help their study process. This research focuses on improving students' understanding of thermochemistry through digital learning tools. Using the ADDIE (Analyze, Design, Develop, Implement, and Evaluate) development model, we created an interactive learning module in the form of an android application. The reason for using an android application is because there is no longer a risk that the learning module will be hidden or forgotten with other files, the application can also be accessed easily as long as it has an android device. Previous research has also indicated that a digital teaching tool can improve the understanding of chemistry learning due to attractive visualization and self-learning opportunities. This study involved validation from media and material experts, as well as assessment from chemistry teachers and students of SMA Muhammadiyah 7 Yogyakarta. The final product received high validation scores, with 97.8% from media experts, 93.3% from material experts, and 90.3% from chemistry teachers. In addition, 95.8% of students responded positively to the app. These findings suggest that the developed application is highly effective for independent student learning and can enhance engagement with thermochemistry concepts.

Keywords: ADDIE; Android App; Appsgeyser; Thermochemistry

How to Cite: Romadhon, D., & Rahmawan, S. (2025). Android-based Application Development on Thermochemistry using Kvisoft Flipbook Maker and Apps Geyser. *Prisma Sains : Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram*, *13*(3), 388-401. doi:https://doi.org/10.33394/j-ps.v13i3.14641

https://doi.org/10.33394/j-ps.v13i3.14641

INTRODUCTION

Thermochemistry is a part of chemistry with the object of study that discusses heat energy (heat) and changes associated with physics-chemical reactions (Subagiyo, 2019). Thermochemistry material contains a system environment with exotherm-endotherm reactions, enthalpy changes, calorimeters, Hess' law, and bond energy. Thermochemical material requires a deep understanding of the concepts of reaction equations and the concept of moles. A deep understanding is needed to master thermochemistry. The reaction equation and mole concept are the basic concepts in studying thermochemistry (Chen et al., 2018). If students do not understand the structure of atoms, molecules, physicochemical changes, and chemical bonds, they may have difficulties learning the whole of thermochemical material (Zakiyah et al., 2018). Based on the author's observations at SMA Muhammadiyah 7 Yogyakarta and interviews with chemistry teachers at the school show that chemistry is a subject that is often avoided by students, and thermochemical material is one of the challenges that come when students often avoid thermochemistry because of its complexity. It was also found that all students in the school have mobile devices. Based on these observations, this research focuses

on making digital materials to make learning thermochemistry easier. The teaching material developed is in the form of an Android application; the reason for its selection is that, with the Android application, there is no worry that the learning material will be forgotten or buried with other files (Nechypurenko et al., 2018). The application can be accessed anytime and anywhere if the learner has an Android device. Teaching materials are much cheaper than printing costs. Also, digital teaching materials provide a much more engaging visual experience, such as videos, interactive animations, feedback, simulations, sound, and interactive quizzes that increase learner interest.

The digital era also develops continuously. The community wants all aspects to be more practical and efficient, giving rise to a relentless digital era (Yoga, 2019). Based on this situation, the development of teaching materials from printed books to electronic media is very relevant and acceptable to the public (Dietrich et al., 2020). *Kvisoft FlipBook Maker is an application that converts PDF files into a content-based flipbook file format* (Diani & Hartati, 2018). This software can support the presentation of learner support books in an attractive virtual format (Yulaika et al., 2020). His software can insert animation, images, videos, etc. (Wibowo, 2018). Appsgeyser is an online software service that can convert website content into an Android app (*Appsgeyser: Free App Maker | Create an App Without Code*, 2022). Appsgeyser allows users to create Android apps from their web content. Videos, images, audio, and animations can be used as content in the application.

There are previous studies (Astuti et al., 2018) that developed interactive multimedia on chemical periodic table material and also research (Andani & Yulian, 2018) that developed products in the form of electronic books on basic chemical law material, but only a few specifically created android-based chemistry learning modules. Compared to electronic books and web-based interactive multimedia, products in the form of android applications provide easier accessibility because they are not buried with other files, can be accessed anytime anywhere only with an android device and provide a more interesting use experience (Kartini & Putra, 2020). This research aims to develop and validate Android-based thermochemical learning modules and evaluate their effectiveness in high school education.

Digital learning media, especially those designed for science education, can significantly improve conceptual understanding by reducing cognitive load. According to Constructivism Theory, learning is an active process in which students construct new knowledge based on their previous experiences (Muzakki, 2021). Constructivism prioritizes that learning should be relevant to the daily context and the times, as the knowledge gained should be directly applicable in real life. This theory supports the use of Android apps in this study, as they allow students to learn interactively and flexibly according to their needs and the times (Muhajirah, 2020). This allows students to continuously adapt and update their knowledge according to the latest developments, so that learning becomes more relevant and contextual as well because the app allows students to learn interactively and flexibly according to the needs and development of the era.

METHOD

This research is a type of Research and Development (R&D). R&D is research with a method that produces a particular product (Zakariah et al., 2020). The ADDIE model was selected for this research due to its structured and systematic approach, which includes five clear phases: Analyze, Design, Develop, Implement, and Evaluate (University of Washington Bothell, 2025). The reason for using this model because the ADDIE facilitates interactive design and continuous improvement, ensuring that the final product is both effective and valid. ADDIE's flexibility allows it to be applied to various educational projects, making it particularly suitable for developing digital-based educational materials (Cahyadi, 2019). Additionally, its emphasis on involving stakeholders such as media experts, material experts,

teachers, and students in the evaluation process helps ensure that the developed application is relevant, beneficial, and user-friendly.

The data for the assessment instrument consists of senior lecturers in chemistry education and media experts who are highly competent in their fields (Jailani, 2023). The chemistry education experts were selected based on their extensive experience and expertise in chemistry education, ensuring that the educational content is accurate and effective. The media experts were chosen for their deep understanding of engaging media design, including selecting appealing images and appropriate elements, fonts, and colors. The rating by competent teachers, specifically high school chemistry teachers, is carried out to assess the extent to which the product is feasible in real learning scenarios based on their direct teaching experience (Hidayat & Sukitman, 2020). In the ADDIE research model, the validator's assessment is considered sufficient as a reference in stating the validity of a development product (Astuti et al., 2018).

The research subjects were high school students in grades XI who had received chemistry lessons on thermochemical material. Participants were selected using cluster sampling, focusing on students who had previously struggled with thermochemistry to ensure the relevance and effectiveness of the developed application. The study involved two groups: an experimental group (class XI IPA 1) where the module was implemented, and a control group (class XI IPA 2) which continued with traditional learning methods. The research subjects were high school students in grades XI and XII who had received chemistry lessons on thermochemical material. Participants were selected using cluster sampling, with class XI IPA 1 as the experimental group where the module was implemented, and class XI IPA 2 as the control group which continued with traditional learning methods. Cluster sampling is a technique where the population is divided into smaller groups, or clusters, and entire clusters are randomly selected to be part of the sample (Sumargo, 2020). This method was chosen because it allows the inclusion of entire classes, making it practical and efficient for educational settings where classes are naturally divided into groups. This approach ensures that the research can be conducted within a real classroom environment, providing more accurate and generalizable results.

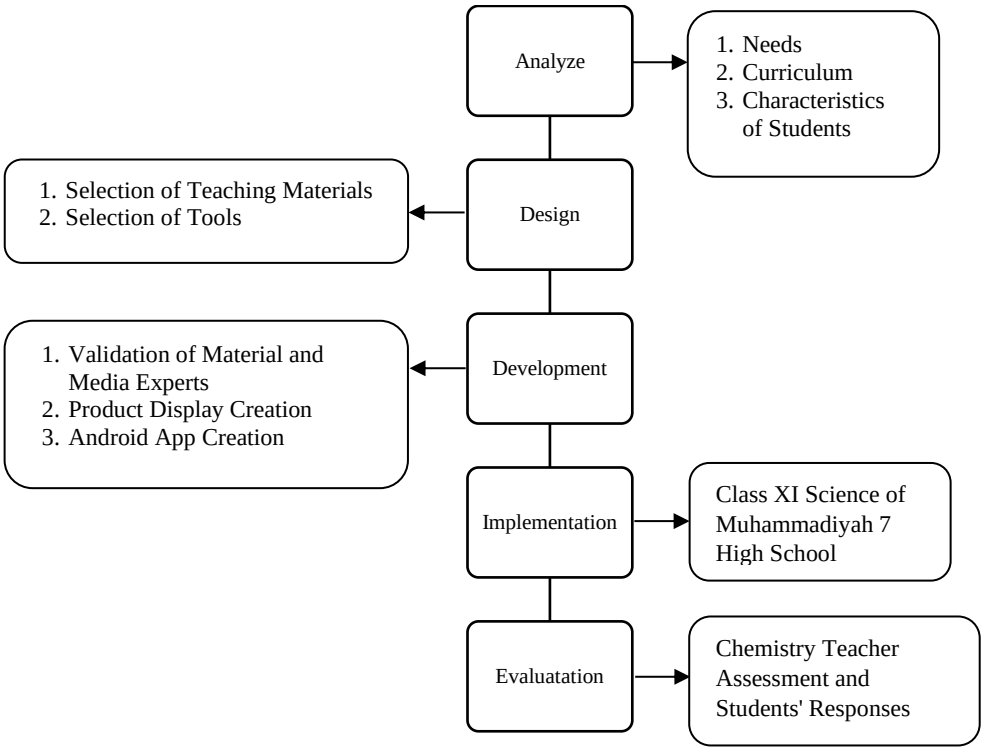

Figure 1. ADDIE flow used

The data analysis technique used is descriptive analysis (Loeb et al., 2017). Based on data obtained from media and material expert validation (Desnylasari et al., 2016). As well as product feasibility based on teacher assessments and responses of high school students majoring in science. Then, the data obtained in quantitative form is converted to qualitative data according to the table (Arda, 2016; Sidel et al., 2018). Quantitative analysis using the category in Table 1.

Table 1. Conversion formula of quantitative data to qualitative data

Score	Category
$X > \bar{x} + 1.8 \times SBi$	**Very Good (A)**
$\bar{x} + 0.6\ SBi < X \leq \bar{x} + 1.8\ SBi$	Good (B)
$\bar{x} - 0.6\ SBi < X \leq \bar{x} + 0.6\ SBi$	Enough/Fair (C)
$\bar{x} - 1.8\ SBi < X \leq \bar{x} + 0.6\ SBi$	Less (D)
$X \leq \bar{x} - 1.8\ Sbi$	Very Less (E)

Explanation:

$\bar{x}$ $= \frac{1}{2} \times$ (highest score + lowest score)

SBi $= \frac{1}{6} \times$ (highest score - lowest score)

$\bar{x}$ = average score

Reliability analysis was conducted using Cronbach's alpha to ensure the consistency of the questionnaire responses from 35 students. Cronbach's alpha is a measure of internal consistency, indicating how closely related a set of items are as a group (Barbera et al., 2021). A Cronbach's alpha value of 0.85 was obtained, which is considered acceptable, as a value of 0.70 or higher indicates good reliability (Taber, 2018). This result demonstrates that the questionnaire items reliably measure the intended constructs, ensuring the data collected are consistent and dependable.

For the evaluations conducted by media and material experts, Cronbach's alpha was not utilized due to the small number of experts involved. Statistical reliability analysis like Cronbach's alpha requires a larger sample size to produce meaningful results (Forero, 2023). Instead, the reliability of their assessments was ensured qualitatively by considering their extensive expertise and qualifications in their respective fields. Expert evaluators are carefully selected based on their credentials and experience, their judgments can be considered reliable even without statistical measures of reliability (Colson & Cooke, 2018). This approach is appropriate in research contexts where the number of experts is limited but their expertise is profound.

RESULTS AND DISCUSSION

The results of this study is an Android application that contains learning on thermochemistry material for grade XI students. The results of the study can be described as follows.

Analyze

In the initial stage, the author carried out three stages of analysis: analysis of student characteristics, needs analysis, and material analysis (T. D. Kurnia et al., 2019). Needs analysis, thermochemistry is one of the chapters in the chemistry subject taught to grade XI high school students. Practical teaching materials are needed, namely, those that can be accessed anytime and anywhere (Safitri & Nurkamilah, 2020). Attractive and easy-to-use study materials are needed by students to facilitate the understanding process. Digital-based teaching materials have advantages that print media do not have, such as easy access, a more attractive visual experience, and low production costs (Iswara et al., 2020).

Curriculum analysis, an analysis of the curriculum used in SMA Muhammadiyah 7 Yogyakarta, was conducted. The author chose the 2013 curriculum as a reference for the curriculum used with Basic Competencies. The curriculum is chosen because the learning media must be adjusted to the curriculum standards applicable in SMA Muhammadiyah 7 Yogyakarta.

Student Characteristics. Analysis refers to when the author conducted an Introduction to Educational Fields and interviews with chemistry teachers at SMA Muhammadiyah 7 Yogyakarta on September 26 - November 26, 2022, it was found that students had difficulty in learning chemistry lessons in the thermochemistry chapter because of its complexity. This is based on research conducted by Mulia in 2021, which results in the learning process on geometric transformation material using an application that increases students' reading interest (Mulia, 2021). Students at SMA Muhammadiyah all have gadgets. Considering that printed books are insufficient for video visualization, this study seeks to utilize technology to create more interactive and engaging digital teaching materials (Zainudin & Pambudi, 2019).

The results consist of the research findings, including descriptions of the data collected, data analysis, and interpretation of the data using relevant theories. The results of the research should be written clearly and concisely. The discussion should explore the significance of the research results, not rewrite the results. Avoid extensive citations and discussions of published literature.

Design

The author designs the selection of reference materials, software selection, and creation of validation instruments. In creating modules and creating chapter indicators that will be used in thermochemistry material are 1) Definition of thermochemistry, 2) Systems and Environment, 3) Exothermic and Endothermic, 4) Enthalpy changes, 5) Calculation of reaction enthalpy consisting of calorimetry, Hess's law, bond energy and formation enthalpy data (Sriyanto, 2020). This ensures that all important aspects of thermochemistry are covered thoroughly and presented using the proper method to facilitate student understanding.

The learning module is designed using design software such as CorelDRAW, Adobe Illustrator, and Canva. CorelDRAW and Adobe Illustrator are graphic design software based on vectors, illustrations, and CAD (*Computer Aided Design*) used to design various things. While Canva has the same meaning, it is *online-based.* (*About Canva*, 2023) . The graphic design software was chosen because it is the most popular, so many tutorials can help you use it when you are confused. The instrument was created to assess the quality of the product being developed (Harmurni, 2019). The validation instrument will be submitted to material experts, media experts, educator assessments, and student responses.

Development

At the development stage, the author begins to develop the product based on the indicators determined at the design stage. The results of this stage can be described as follows.

Product Display Design

The product display is created through several stages: 1) selecting a color theme, 2) selecting a font, and 3) selecting elements/images. The primary color red was chosen because it powerfully depicts thermochemistry, which comes from the Greek *θερμός thermos*, which means heat. The author chooses a combination of white background color with a red theme and its derivatives, such as orange, yellow, brown, variations of red, etc. The choice of color is critical because it can determine the reader's mood (Majidah et al., 2019). The choice of red is considered very appropriate for the material and aesthetics of art.

Figure 2. Selection of colors used (variations of red, orange, and yellow)

The typeface used is a sans-serif style. The reason for using this font is because this style can symbolize simplicity, efficiency, and modernity and has high readability. It is proven that many parties use this font because of these properties (Bowles, 2019). Companies like Google, Spotify, and Gojek changed their logos to a sans-serif style.

Figure 3. Logo Change to a Sans-Serif Style Font

Figure 4. Selection of sans-serif style fonts used

The selection of elements used when making modules adds to the variety of colors and uniqueness, and it will increase reading interest (Listya, 2019). Meanwhile, the images used when making modules can increase the level of understanding of readers while adding color variations and uniqueness that will increase reading interest (Mirnawati, 2020).

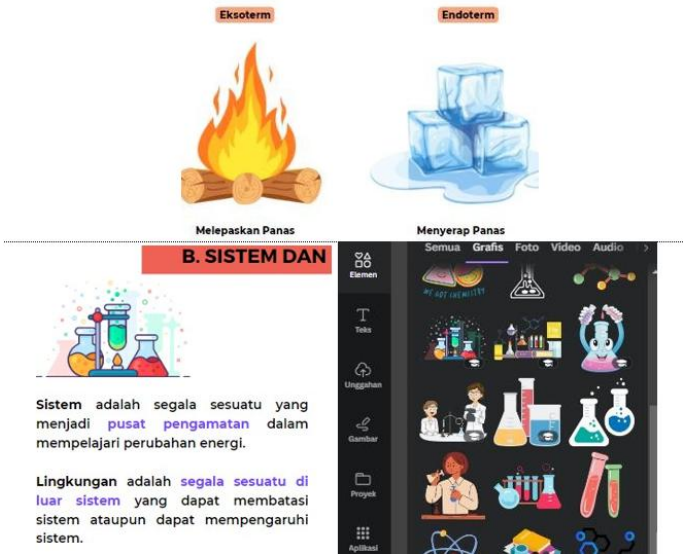

Figure 5. Selection of images and elements used

Application Development

After the module creation is complete, the module is converted into a flipbook using Kvisoft Flipbook Maker in PDF format to HTML5 format, like a book but in a digital form that can be converted into an application. In making the product display, several stages are carried out, namely.

a. Download Module: After the module has been created using the graphic design software, the module is downloaded in PDF format.

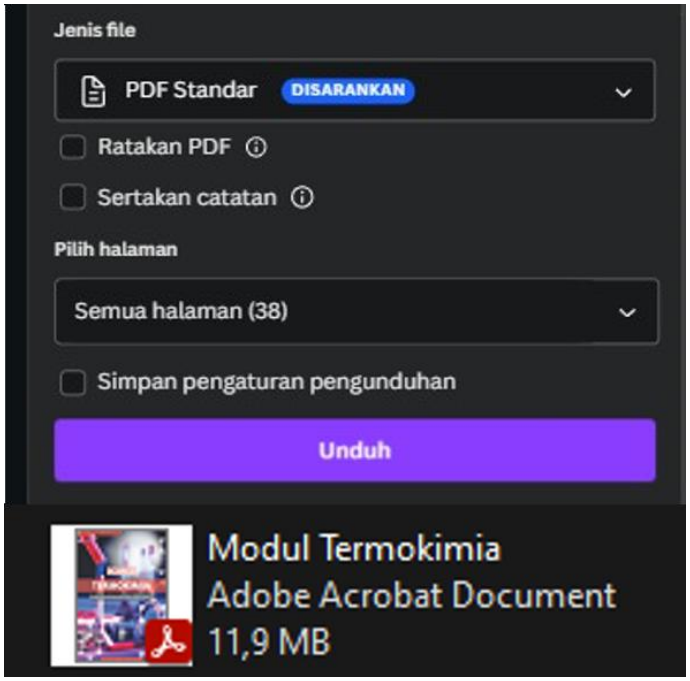

Figure 6. PDF module download and formatting process

b. Flipbook Creation The module has been downloaded in PDF format, and the next step is to convert it into a flipbook form. The last step in making a flipbook is exporting on the "export" menu; in this step, make sure the Flipbook is converted to HTML5 format to be converted into an Android application.

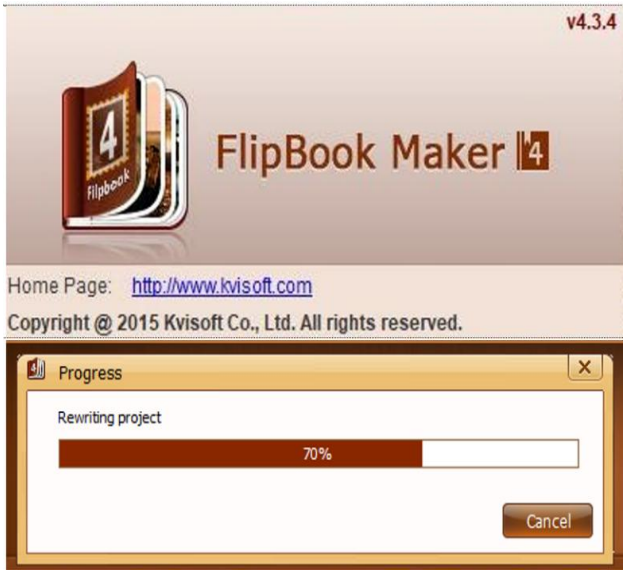

Figure 7. Flipbook maker view and conversion process to Flipbook

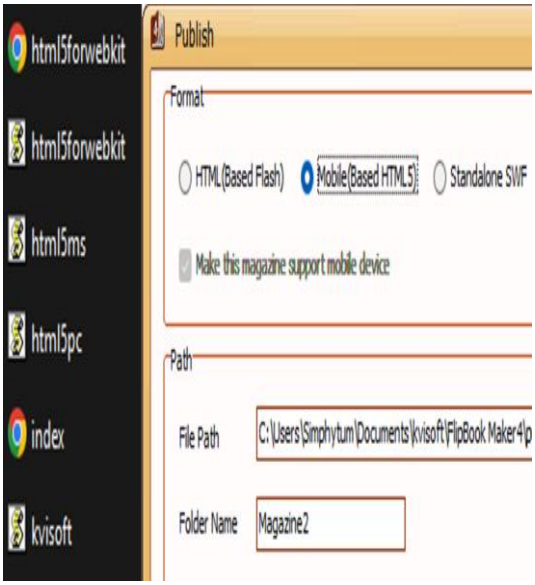

Figure 8. Convert Flipbook to HTML5 form

c. Making apps after the module is converted into a flipbook, an Android application is made using the app geyser to convert content from HTML5 format into an Android application. So that the product to be produced can be opened on an Android system. Making applications is carried out in the following steps:

1) Open the *app geyser website*
2) Select the "*create app*" menu and choose "*individual*."
3) Scroll down until you find the *HTML template*
4) Select the *HTML5 file* that will be converted into an Android app
5) Wait for the process, then download

After the application creation is complete and downloaded, the application can be installed on an Android-based device and is ready for use. The application can be downloaded on the page https://bit.ly/3rSu3Ag.

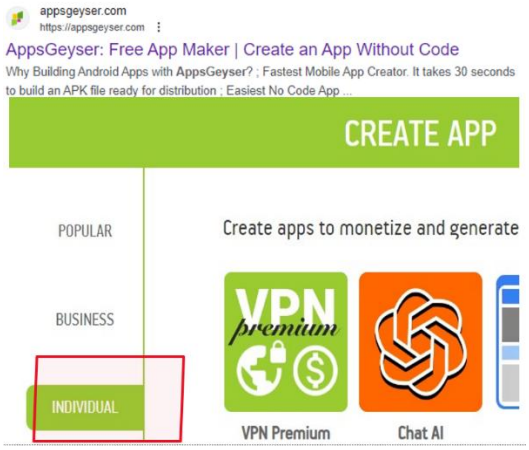

Figure 9 *Website* view

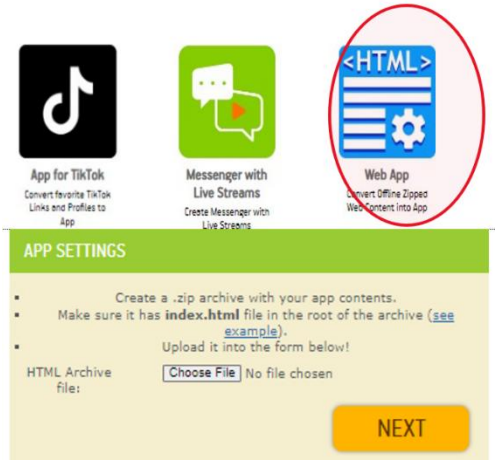

Figure 10 Convert *HTML5* file to Android apps

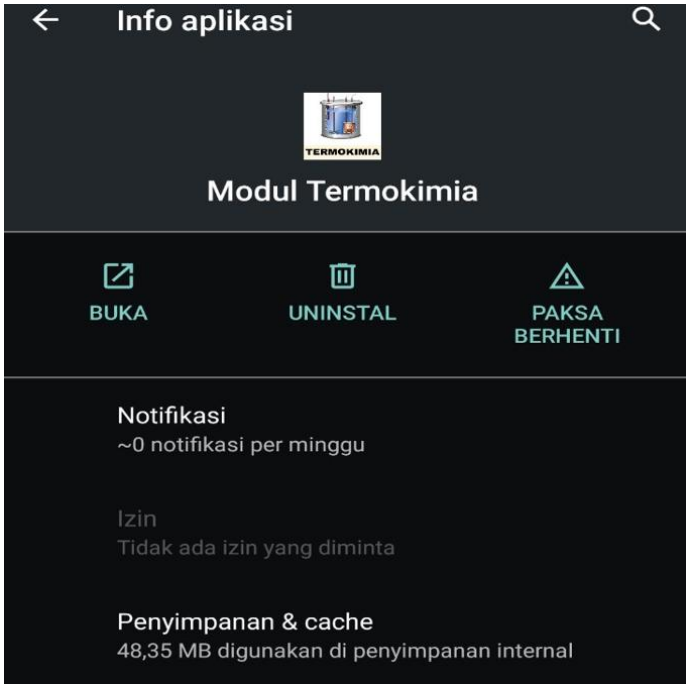

Figure 11 Application information display

Implement

The products are validated by expert lecturers, namely media and material experts. After being validated, several things need to be improved. Revision is reviewing and improving on

a result (F. Zhang et al., 2017). Revisions must be made to make the final product more perfect with the required standards.

The validated product was then implemented at at SMA Muhammadiyah 7 Yogyakarta on July 31, 2023. with four teacher assessment respondents and all students in class XI IPA 1 (35 respondents) as an experimental class and XI IPA 2 (35 respondents) as control class. To evaluate the application's effectiveness compared to traditional methods, both classes were given thermochemistry exam papers and the results obtained were that the experimental class with used the Android application got an average score 82. While the control class with used printed modules got an average score of 70. The experimental class showed a 17% improvement over the control class, demonstrating that the Android application significantly enhances student learning outcomes compared to traditional methods. Content with animated images and videos provides more comfort for learning (Fitri & Pahlevi, 2020)

Figure 12. Classroom learning activities

Evaluate

The results of the media expert validator assessment obtained a score of 41 with a percentage of 97.62% (Very Good). These results show that digital-based learning media is very flexible and relevant to use at this time (Wibowo & Pratiwi, 2018). such as providing a fun learning experience with attractive designs and features, there are interactive quizzes that can provide real-time feedback on students' understanding (Nurdiyanti et al., 2022). The results of the media expert validation received a very high score because it met the writing and design aspects. In the writing aspect, the font type, letter size, color selection and writing layout are proportional and comfortable to look at. In the design aspect, it has the right theme with thermochemistry, attractive images and icon elements, clear image display quality.

The material expert validator assessment results obtained a score of 42 with a percentage of 93.33% (Very Good). These results show that the material contained in the module is based on curriculum developments. Relevant and up-to-date material can affect the quality of the module developed (Anggina, 2020). Content containing evaluation sheets can assess how far students understand the material learned so that instant feedback is needed (L. D. Kurnia et al., 2022). The results of the validation of material experts received very high scores because they met the aspects of material content and presentation and language. In terms of material content, it is in accordance with student characteristics, scientific truth and material depth, there are examples in real life, there are instructions for using the application and ease of access.

The results of the educator's assessment obtained a score of 419 with a percentage of 90.33% (Very Good). These results show that the developed module can be used in classroom learning. The application has an attractive visual display with images, includes example questions, and is easy to use even for senior teachers.

The response results of 35 students obtained a score of 998 with a percentage of 95.05% (Very Good). These results show that students can use the developed module for independent learning. Learning media by utilizing technology such as Android applications is very suitable for the current generation of students (Novaliendry et al., 2020). The education sector that utilizes technology has become a new norm for students and teachers since the COVID-19 pandemic, which forced learning online (L. Zhang et al., 2022) The application is relevant for

students who frequently use smartphones. The content covers thermochemistry aspects thoroughly, is easy to access, and includes interactive quizzes and videos accessible via QR codes or links.

While the application shows promising results, it has limitations. The app can only be accessed on Android OS devices, specifically Android version 10 and above, with testing conducted up to Android 12. Potential challenges include device compatibility issues, requiring further testing on different Android versions and screen sizes. Additionally, technical issues or digital literacy barriers may affect usability, which needs to be addressed through support and guidance.

To determine whether the learning improvements are sustained over time, we conducted a follow-up during the semester chemistry exam, which included four topics: acid-base solutions, buffer solutions, colloid systems, and thermochemistry. Students still remembered the thermochemistry material and reported that it was easy to relearn because they could access it via their smartphones. This indicates that the application not only enhances immediate learning outcomes but also supports long-term knowledge retention.

The feasibility of the final product in the form of learning applications shows promising results. This can be proven by the value of thermochemistry in classes that use application products, which is superior to other classes that use printed modules. The learning application also shows higher enthusiasm from students compared to printed modules, this can be proven during practicum, students are much more active, come early, and are excited compared to classes that use printed modules.

CONCLUSIONS

The development of an Android-based thermochemistry module using the ADDIE model has resulted in an effective learning tool that aligns with the 2013 curriculum. The application covers essential topics such as the understanding of thermochemistry, systems and surroundings, exothermic and endothermic reactions, enthalpy changes, calculation of reaction enthalpy including calorimetry, Hess's law, bond energy, and enthalpy of formation data and includes evaluation questions with answer keys.

The findings confirm that the Android-based application is a highly effective and engaging tool for thermochemistry learning. Positive feedback from media and material experts, educators, and students highlights its potential to enhance understanding and retention of complex concepts. The application significantly improved student learning outcomes compared to traditional methods, demonstrating its value as a modern educational resource.

RECOMMENDATION

To further enhance the effectiveness and accessibility of the application, future research and development should focus on the following areas:

1. Expand Usability Testing
   Future research should expand usability testing to include different school settings and a more diverse student population. This will help evaluate the application's effectiveness in various educational environments and ensure it meets the needs of a broader audience.
2. Develop Cross-Platform Compatibility
   Developing an iOS version of the application is crucial to broaden accessibility and allow students using different operating systems to benefit from the learning tool.
3. Integrate Advanced Technologies
   Future research should explore the integration of augmented reality (AR) features to enhance interactive learning experiences and increase student engagement through immersive technology.
4. Compare Effectiveness with Alternative Digital Learning Methods

Conduct comparative studies with other digital learning tools such as virtual reality (VR) applications or interactive simulations to assess the relative effectiveness of different digital methodologies in teaching thermochemistry concepts.

5. Continuous Content Updates
   It is essential to regularly update the content to align with the latest curriculum developments. This ensures that the material remains current, accurate, and relevant to ongoing educational standards.

Addressing these areas, the application can be further refined to meet evolving technological advances and educational needs, ultimately contributing to improved learning outcomes in thermochemistry.

REFERENCES

Andani, D. T., & Yulian, M. (2018). Pengembangan Bahan Ajar Electronic Book Menggunakan Software Kvisoft Flipbook Pada Materi Hukum Dasar Kimia di SMA Negeri 1 Panton Reu Aceh Barat. *JIPI*, *2*(1), 1–6. https://doi.org/10.24815/jipi.v2i1.10730

Anggina, S. (2020). *Pengembangan Media Pembelajaran Dengan Menerapkan Aplikasi Ispring Suite Dan Appsgeyser Pada Materi Trigonometri Kelas X SMA S Adhyaksa 1 Jambi* [Doctoral dissertation, Universitas Jambi]. https://repository.unja.ac.id/id/eprint/13323

Appsgeyser: Free App Maker | Create an App Without Code. (2022, September 22). https://appsgeyser.com/

Arda. (2016). Pengembangan Media Pembelajaran Interaktif Pokok Bahasan Gaya dan Hukum Newton untuk Siswa SMP. *Jurnal Ilmiah d'Computare Volume 7 Edisi Januari*, *6*.

Astuti, F. K., Cahyono, E., Supartono, S., Van, N. C., & Duong, N. T. (2018). Effectiveness of Elements Periodic Table Interactive Multimedia in Nguyen Tat Thanh High School. *IJIET*, *2*(1), 1–10. https://doi.org/10.24071/ijiet.v2i1.951

Barbera, J., Naibert, N., Komperda, R., & Pentecost, T. C. (2021). Clarity on Cronbach's Alpha Use. *Journal of Chemical Education*, *98*(2), 257–258. https://doi.org/10.1021/acs.jchemed.0c00183

Bowles, J. H. (2019). *Typography 1: 100 Iterations*. https://academicworks.cuny.edu/cgi/viewcontent.cgi?article=1220&context=cc_oers

Cahyadi, R. A. H. (2019). Pengembangan bahan ajar berbasis ADDIE model. *Halaqa: Islamic Education Journal*, *3*(1), 35–42.

Chen, X., Zhang, Z., Qi, C., Ling, X., & Peng, H. (2018). State of the art on the high-temperature thermochemical energy storage systems. *Energy Conversion and Management*, *177*, 792–815.

Colson, A. R., & Cooke, R. M. (2018). Expert Elicitation: Using the Classical Model to Validate Experts' Judgments. *Review of Environmental Economics and Policy*, *12*(1), 113–132. https://doi.org/10.1093/reep/rex022

Desnylasari, E., Mulyani, S., & Mulyani, B. (2016). Pengaruh model pembelajaran project based learning dan problem based learning pada materi termokimia terhadap prestasi belajar siswa kelas XI SMA Negeri 1 Karanganyar tahun pelajaran 2015/2016. *Jurnal Pendidikan Kimia*, *5*(1), 134–142.

Diani, R., & Hartati, N. S. (2018). Flipbook Berbasis Literasi Islam: Pengembangan Media Pembelajaran Fisika Dengan 3D Pageflip Professional. *Jurnal Inovasi Pendidikan IPA*, *4*(2), 234–244.

Dietrich, N., Kentheswaran, K., Ahmadi, A., Teychené, J., Bessière, Y., Alfenore, S., Laborie, S., Bastoul, D., Loubière, K., Guigui, C., Sperandio, M., Barna, L., Paul, E., Cabassud, C., Liné, A., & Hébrard, G. (2020). Attempts, Successes, and Failures of Distance

Learning in the Time of COVID-19. *Journal of Chemical Education*, *97*(9), 2448–2457. https://doi.org/10.1021/acs.jchemed.0c00717

Fitri, E. R., & Pahlevi, T. (2020). Pengembangan LKPD Berbantuan Kvisoft Flipbook Maker pada Mata Pelajaran Teknologi Perkantoran di SMKN 2 Nganjuk. *JPAP*, *9*(2), 281–291. https://doi.org/10.26740/jpap.v9n2.p281-291

Forero, C. G. (2023). Cronbach's Alpha. In F. Maggino (Ed.), *Encyclopedia of Quality of Life and Well-Being Research* (pp. 1505–1507). Springer International Publishing. https://doi.org/10.1007/978-3-031-17299-1_622

Harmurni, L. (2019). *Instrumen penilaian & validasinya*. Uwais Inspirasi Indonesia. https://books.google.com/books?hl=id&lr=&id=OZyxDwAAQBAJ&oi=fnd&pg=PR3&dq=Harmurni,+L.+(2019).+Instrumen+penilaian+%26+validasinya.+Uwais+Inspirasi+Indonesia.&ots=OzHZCrVR6r&sig=95kR5NdQEkTKFO7vAlqJfpLmDrE

Hidayat, H., & Sukitman, T. (2020). Model pembelajaran pendidikan karakter di mi tarbiyatus shibyan jadung dungkek sumenep. *Autentik: Jurnal Pengembangan Pendidikan Dasar*, *4*(1), 33–41.

Iswara, G. P. S., Kuswandi, D., & Husna, A. (2020). Pengembangan multimedia interaktif dilengkapi dengan simulasi untuk memvisualisasikan reaksi kimia pada materi larutan penyangga SMA kelas XI. *JINOTEP (Jurnal Inov. Teknol. Pembelajaran)*, *6*(2), 5868.

Jailani, M. S. (2023). Teknik pengumpulan data dan instrumen penelitian ilmiah pendidikan pada pendekatan kualitatif dan kuantitatif. *IHSAN: Jurnal Pendidikan Islam*, *1*(2), 1–9.

Kartini, K. S., & Putra, I. N. T. A. (2020). Respon siswa terhadap pengembangan media pembelajaran interaktif berbasis android. *Jurnal Pendidikan Kimia Indonesia*, *4*(1), 12–19.

Kurnia, L. D., Haryati, S., & Linda, R. (2022). Pengembangan instrumen evaluasi higher order thinking skills menggunakan quizizz pada materi termokimia untuk meningkatkan kemampuan berpikir tingkat tinggi peserta didik. *Jurnal Pendidikan Sains Indonesia (Indonesian Journal of Science Education)*, *10*(1), 176–190.

Kurnia, T. D., Lati, C., Fauziah, H., & Trihanton, A. (2019). Model addie untuk pengembangan bahan ajar berbasis kemampuan pemecahan masalah berbantuan 3d pageflip. *Prosiding Seminar Nasional Pendidikan Matematika (SNPM)*, *1*(1), 516–525. https://www.academia.edu/download/90831393/844-1705-1-PB.pdf

Listya, A. (2019). Konsep dan pengunaan warna dalam infografis. *Jurnal Desain*, *6*(01), 10–19.

Loeb, S., Dynarski, S., McFarland, D., Morris, P., Reardon, S., & Reber, S. (2017). Descriptive Analysis in Education: A Guide for Researchers. NCEE 2017-4023. *National Center for Education Evaluation and Regional Assistance*. https://eric.ed.gov/?id=ED573325

Majidah, M., Hasfera, D., & Fadli, M. F. M. (2019). Penggunaan warna dalam disain interior perpustakaan terhadap psikologis pemustaka. *RISTEKDIK: Jurnal Bimbingan Dan Konseling*, *4*(2), 95–106.

Mirnawati, M. (2020). Penggunaan media gambar dalam pembelajaran untuk meningkatkan minat baca siswa. *Didaktika: Jurnal Kependidikan*, *9*(1), 98–112.

Muhajirah, M. (2020). Basic of learning theory:(behaviorism, cognitivism, constructivism, and humanism). *International Journal of Asian Education*, *1*(1), 37–42.

Mulia. (2021). *Pengembangan Media Pembelajaran Online Berbasis Android Berbantu Aplikasi Appsgeyser Materi Transformasi Geometri Pada Kelas XI MA Darul Ulum Kembang Kuning Tahun Pelajaran 2020/2021* [Universitas Islam Negeri Antasari Banjarmasin]. http://idr.uin-antasari.ac.id/id/eprint/17131

Muzakki, H. (2021). Teori belajar konstruktivisme Ki Hajar Dewantara serta relevansinya dalam kurikulum 2013. *Southeast Asian Journal of Islamic Education Management*, *2*(2), 261–282.

Nechypurenko, P. P., Starova, T. V., Selivanova, T. V., Tomilina, A. O., & Uchitel, A. D. (2018). Use of augmented reality in chemistry education. *Proceedings of the 1st International Workshop on Augmented Reality in Education Kryvyi Rih, Ukraine, October 2, 2018*, *2257*, 15–23. https://lib.iitta.gov.ua/id/eprint/712768/

Novaliendry, D., Darmi, R., Hendriyani, Y., Nor, M., & Azman, A. (2020). Smart learning media based on android technology. *International Journal of Innovation, Creativity and Change*, *12*(11), 715–735.

Nurdiyanti, Wajdi, M., & Fadhilah, N. (2022). Validitas dan Kepraktisan Modul Digital Berbasis Socio Scientific Issue. *JIPI*, *6*(1), 33–44. https://doi.org/10.24815/jipi.v6i1.23461

Safitri, E. R., & Nurkamilah, S. (2020). Pengembangan Bahan Ajar Digital Berbasis Android untuk Peserta Didik Berkebutuhan Khusus. *JOEAI*, *3*(2), 296–304. https://doi.org/10.31539/joeai.v3i2.1612

Sidel, J. L., Bleibaum, R. N., & Tao, K. W. C. (2018). Quantitative Descriptive Analysis. In S. E. Kemp, J. Hort, & T. Hollowood (Eds.), *Descriptive Analysis in Sensory Evaluation* (1st ed., pp. 287–318). Wiley. https://doi.org/10.1002/9781118991657.ch8

Sriyanto, W. (2020). Modul pembelajaran kimia SMA Kelas XI: konsep dasar perubahan entalpi. *Kementerian Pendidikan Dan Kebudayaan*.

Subagiyo, S. (2019). Penerapan Model Blended Learning Untuk Meningkatkan Pemahaman Konsep Termokimia Siswa. *Journal of Educational Chemistry (JEC)*, *1*(1), 1–8.

Sumargo, B. (2020). *Teknik sampling*. Unj press. https://books.google.com/books?hl=id&lr=&id=FuUKEAAAQBAJ&oi=fnd&pg=PA1&dq=apa+itu+cluster+sampling&ots=nzWn0O4v8N&sig=Jo-DOLXzfA4dbYkzeA9gZi_0dhM

Taber, K. S. (2018). The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. *Research in Science Education*, *48*(6), 1273–1296. https://doi.org/10.1007/s11165-016-9602-2

Tentang Canva. (2023). https://www.canva.com/id_id/about/

University of Washington Bothell. (2025). *ADDIE Model*. Information Technology. https://www.uwb.edu/it/addie

Wibowo, E. (2018). *Pengembangan Bahan Ajar E-Modul Dengan Menggunakan Aplikasi Kvisoft Flipbook Maker*. (Doctoral dissertation, UIN Raden Intan Lampung).

Wibowo, E., & Pratiwi, D. D. (2018). Pengembangan Bahan Ajar Menggunakan Aplikasi Kvisoft Flipbook Maker Materi Himpunan. *Desimal: Jurnal Matematika*, *1*(2), 147–156.

Yoga, S. (2019). Perubahan Sosial Budaya Masyarakat Indonesia Dan Perkembangan Teknologi Komunikasi. *Jurnal Al-Bayan: Media Kajian Dan Pengembangan Ilmu Dakwah*, *24*(1).

Yulaika, N. F., Harti, H., & Sakti, N. C. (2020). Pengembangan Bahan Ajar Elektronik Berbasis Flip Book Untuk Meningkatkan Hasil Belajar Peserta Didik. *JPEKA: Jurnal Pendidikan Ekonomi, Manajemen Dan Keuangan*, *4*(1), 67–76.

Zainudin, Z., & Pambudi, B. (2019). Efektifitas penerapan perangkat pembelajaran fisika dasar berbasis keterampilan berpikir kritis menggunakan aplikasi edmodo berplatform android. *Prisma Sains: Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, *7*(1), 17–26.

Zakariah, M. A., Afriani, V., & Zakariah, K. M. (2020). *Metodologi Penelitian Kualitatif, Kuantitatif, Action Research, Research and Development (RnD*. Yayasan Pondok Pesantren Al Mawaddah Warrahmah Kolaka. https://books.google.com/books?hl=id&lr=&id=k8j4DwAAQBAJ&oi=fnd&pg=PA82&dq=penelitian+Research+and+Development&ots=14Tu3f37uJ&sig=BgcO31fNy0mFJC7LYypWd8CuJtM

Zakiyah, Z., Ibnu, S., & Subandi, S. (2018). Analisis Dampak Kesulitan Siswa Pada Materi Stoikiometri Terhadap Hasil Belajar Termokimia Dan Upaya Menguranginya Dengan Metode Pemecahan Masalah. *EduChemia (Jurnal Kimia Dan Pendidikan)*, *3*(1), 119–134.

Zhang, F., Schunn, C. D., & Baikadi, A. (2017). Charting the routes to revision: An interplay of writing goals, peer comments, and self-reflections from peer reviews. *Instructional Science*, *45*(5), 679–707. https://doi.org/10.1007/s11251-017-9420-6

Zhang, L., Carter, R. A., Qian, X., Yang, S., Rujimora, J., & Wen, S. (2022). Academia's responses to crisis: A bibliometric analysis of literature on online learning in higher education during COVID-19. *British Journal of Educational Technology*, *53*(3), 620–646. https://doi.org/10.1111/bjet.13191