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Development of Digital Literacy Based Game Cards on Hydrocarbon Material

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Abstract: This research is motivated by the lack of learning media used in learning hydrocarbon material, so that student learning outcomes are not good. With the increasing development of digital technology in learning. Then it can be utilized in learning. Therefore, in this study, the researcher aims to develop digital literacy-based learning media in the form of game cards called Hy-Card cards so that learning is more enjoyable and learning outcomes are better. This study uses the ADDIE R&D model research method. The instruments used in this study were feasibility sheets and response questionnaires with a Likert scale. The results of the content feasibility test were obtained with an average of 98.5% (very feasible), the language was obtained with an average of 98% (very feasible), and the media was obtained with an average of 97% (very feasible). The results of the individual response trial obtained a result of 85% (very good), and the small group trial obtained an average of 89% (very good) and the large group trial obtained an average of 88% (very good). So, it can be concluded that the Hy-Card game card is very suitable for use in hydrocarbon learning with the average response trial obtaining very good results.

Keywords: Digital literacy; Game cards; Hydrocarbon

Introduction

The development of information technology is currently very rapid, almost all sectors have utilized information technology. With smartphones, it can have a huge impact on human life and provide many conveniences in its use. However, the use of smartphones is only used for social media and only a small number of them use it to help learning activities or human work (Jafar et al., 2023).

In this digital era, educators should be able to utilize technology in designing learning. Digital media is a learning medium that is very suitable to be applied in this digital age. Digital media can present material contextually, audio and visually in an interesting and interactive way so that digital literacy learning is inevitable. Digital literacy not only includes reading but reading with meaning and understanding (Gilster, 1997). Meanwhile, according to A'yuni (2015) digital literacy skills are the ability to understand and use information from various formats.

Naufal (2021) states that digital literacy is a form of ability to obtain, understand and use information from various sources in digital form. Digital literacy should be more than just the ability to use various digital sources effectively, but also a form of certain ways of thinking that are rooted in computer literacy and information literacy. Digital literacy is also interpreted as an individual's skill to apply functional skills to digital devices so that they can find information, think critically, be creative, collaborate with others (Zulkarnain et al., 2020).

Therefore, innovation is needed in learning, one of which is by using digital literacy-based game card media, so that students can learn in a more enjoyable atmosphere and students can use information from various sources in digital media (Naufal, 2021). This is in line with the results of the study Suherlin et al. (2023)

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chemistry card game learning media can make students more active and enjoyable and not feel bored when learning. So in this study, digital literacy-based game card media has been developed on hydrocarbon material.

Learning media can stimulate students' thoughts, abilities or skills (Suherlin et al., 2023). One of the learning media is playing cards. Several research results state that playing card media can help students understand various chemical concepts, even help overcome misconceptions experienced by students both in Indonesia and abroad (Buendía-Atencio et al., 2022; Erlina et al., 2018; Knudtson, 2015; Larasati et al., 2016; Lisdiana, 2021; Martí-Centelles & Rubio-Magnieto, 2014; Piyawattanaviroj et al., 2019; Samuelson, 2018; Sari et al., 2018; Setiyati, 2016). The development of digital literacy skills can be done by improving several skills, including functional skills, effective communication skills, and critical thinking skills (Sofian et al., 2023). In a study by Zamista et al. (2023), it was stated that the digital literacy of Physics Tadris students had good digital literacy.

In learning, especially hydrocarbons, educators have used various media to improve student literacy, such as e-modules, e-supplements for teaching materials, multimedia. However, it has not succeeded in increasing interest and motivation to learn, this is reinforced by the low learning outcomes. Based on the results of the three-tier diagnostic test, information was obtained that 48.25% of students had misconceptions about the concept of hydrocarbon compound nomenclature (Fatmala et al., 2024).

Therefore, this digital literacy-based game card really needs to be developed to create a fun learning atmosphere and improve students' digital literacy skills through the ability to collaborate and critical thinking skills in solving problems using the concept of hydrocarbons through games.

Method

This research is an ADDIE development model consisting of 5 steps, namely analysis, design, development, implementation and evaluation (Branch, 2009). The steps in the ADDIE model in this study are as shown in Figure 1.

The first stage is analysis. At this stage, a needs analysis is carried out to identify problems and collect data related to what is needed by Chemistry Education students on hydrocarbon material.

The second stage is design. At this stage, it begins with designing a game card design based on the results of the needs analysis obtained from the previous stage. The researcher designs a product design as a solution to the problems found. At this stage, the researcher designs the card model design and the content of the card, and also designs the card usage instructions design. This design is realized in the form of a storyboard which will be the basis for developing card media in the next stage. In addition, at this stage, the researcher also designs a questionnaire instrument that will be used to validate the product and to obtain response data from Chemistry Education students.

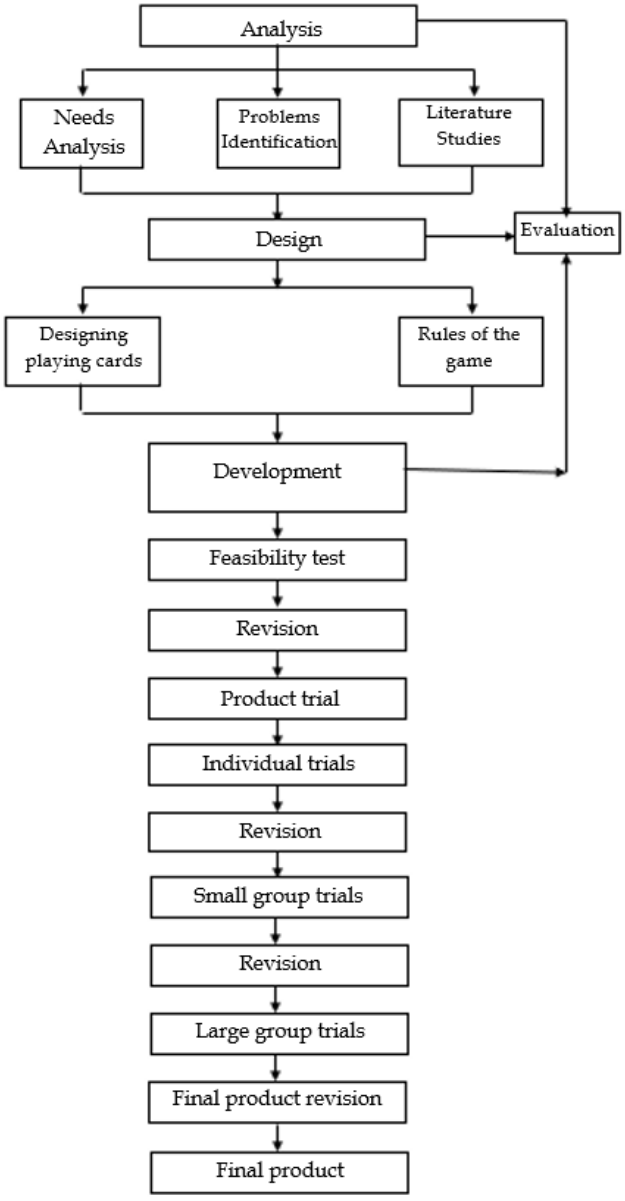


Figure 1. Steps of the ADDIE model

The third stage is development. At this stage, the researcher develops the physical form of the game card based on the results of the design design that has been made in the previous stage. The game card is developed according to the hydrocarbon material studied by Chemistry Education students. In addition, at this stage, the researcher also validates the game card product that

has been developed. Product validation is carried out by 2 experts, namely a chemistry expert and an Indonesian language expert. The aspects assessed on the developed game cards are the content or material content aspects, media aspects and language aspects. If the validator suggests improvements, revisions will be made.

The fourth stage is implementation. Conceptual tests and questionnaires will be given to participants before implementation. Furthermore, the test result data will be analyzed to be used as a reference. Furthermore, the implementation of the resulting learning media is carried out. After the implementation of the test, questionnaires and interviews will be given again to participants.

The fifth stage is evaluation. At this stage, an analysis will be carried out from the results of the data collected in the previous stage. All data will be grouped into two, namely quantitative and qualitative. Before being analyzed, tabulation will be carried out for quantitative data and transcription for qualitative data. After the analysis is complete, data interpretation will be carried out.

The data processing technique uses the percentage of score obtained per item by the Formula 1.

$$P = \frac{\sum x}{\sum xi} \times 100\% \quad (1)$$

Information:
P = Percentage of score obtained
$\sum_x$ = Total score for each item
$\sum_{xi}$ = Ideal score (highest score)

Calculate the overall average percentage of eligibility using the Formula 2.

$$V = \frac{\sum P}{n} \quad (2)$$

Information:
V = Average percentage of validity
∑P = The average percentage score for each aspect
n = Number of aspects assessed

Determining the eligibility criteria for Digital Literacy Based Game Cards on Hydrocarbons with the following interpretation criteria.

Table 1. Card Eligibility Criteria (Riduwan, 2009)

Percentage of Score %	Categories
0-20	Very Low
20-40	Low
40-60	Fair
60-80	High
80-100	Very High

Calculate the total score for each aspect of student response. Convert the score into a percentage using the Formula 3.

$$\%Score = \frac{5n+4n+3n+2n+1n}{5N} x100\% \quad (3)$$

Information:
n = Amount earned
N = Number of items (number of respondents x number of indicators)

The percentage of each aspect obtained is then converted into a media quality category so that conclusions can be drawn regarding the quality of the media. The percentage of media scores is based on the score interpolation criteria.

Table 2. Student Response Score Interpretation Criteria (Riduwan, 2008)

Score (%)	Categories
81 ≤ score ≤10	Very Good
61≤ score <81	Good
41≤ score <61	Fair
21≤ score <41	Not Good
0< score <21	Very Not Good

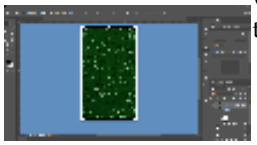
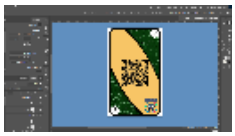
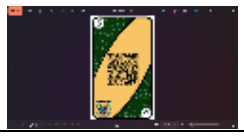
Result and Discussion

This study uses the ADDIE development model (reference) including the steps of Analysis, design, development and Implementation and evaluation. The resulting product is in the form of 12 digital literacy-based game cards. The feasibility of the cards is seen from the material, media and language.

Analysis stage. At this stage, a needs analysis was carried out by interviewing 20 students to find out the learning model that has been carried out by the lecturer and the media used and the learning difficulties they face during learning. The interview results showed that 90% wanted a variety of learning models so that they would not be bored when participating in learning. The media used by the lecturer were ppt, videos and quizzes. Then analyze the CP and CPMk of hydrocarbon material so that researchers can determine fun learning media and which materials will be made. The results of the analysis, the researcher feels that students need to master the basic material of hydrocarbons, namely alkanes, alkenes and alkynes.

Design stage. At this stage, it begins with designing the game card design based on the results of the needs analysis obtained from the previous stage.

Table 3. StoryBoard of Hy-Card Game Cards Based on Digital Literacy

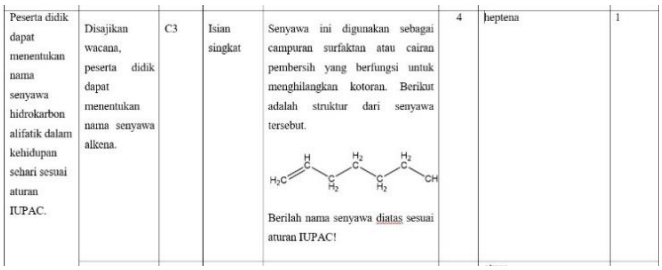
Description	Visual	Information
Cover Soal		Contains the question cover made from canva. The question cover is made in size 4:3
Question Content		Contains questions made by the teacher. The question content is made in size 4:3
New Book		Contains the initial display of BookCreator with a book that has been made from the cover and contents. The size of the book is 4:3
Book Barcode		Contains the display after barcoding the uploaded book containing the book cover and book contents
Question Card Cover		Contains the display of the question card cover measuring 5.5 cm x 8.5 cm. Card components include the card frame and texture
Question Card		Contains the display of the question card design measuring 5.5 cm x 8.5 cm. Card components include the card number; logo; frame; card texture and book barcode
Ready Card		Contains the display of the card design that has been exported and is ready to be printed

Development Stage. At this stage, a product is produced in the form of a digital literacy-based game card that is feasible through expert validation to determine the level of feasibility of the questions reviewed from the aspects of content material, media and language. Each aspect is assessed by two experts through a validation sheet of the feasibility of content material, media and language. The results of the expert feasibility test are presented in the Table 4.

The feasibility test of the questions was validated by experts twice with one revision. Based on the validation results, the content validation was obtained with an average of 98.5%, the language was obtained with an average of 98%, and the media was obtained with an average of 97% with the criteria of being very feasible to use, but the question validator provided suggestions for improving the answer key for question number 4 while the media validator provided suggestions for improving the size and color of the letters.

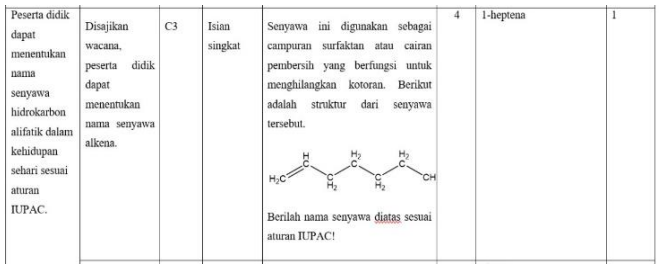
Table 4. Recapitulation of Question Feasibility Test Results

Rated aspect	Assessment Results			
	Validation I (%)	Validation II (%)	Average (%)	Criteria
Contents	99	98	98.5	Very Worthy
Language	96	100	98	Very Worthy
Media	100	94	97	Very Worthy



Peserta didik dapat menentukan nama senyawa hidrokarbon alifatik dalam kehidupan sehari sesuai aturan IUPAC.	Disajikan wacana, peserta didik dapat menentukan nama senyawa alkena.	C3	Isian singkat	Senyawa ini digunakan sebagai campuran surfaktan atau cairan pembersih yang berfungsi untuk menghilangkan kotoran. Berikut adalah struktur dari senyawa tersebut. Berilah nama senyawa diatas sesuai aturan IUPAC!	4	heptena	1

Figure 2. Before correction of answer key number 4



Peserta didik dapat menentukan nama senyawa hidrokarbon alifatik dalam kehidupan sehari sesuai aturan IUPAC.	Disajikan wacana, peserta didik dapat menentukan nama senyawa alkena.	C3	Isian singkat	Senyawa ini digunakan sebagai campuran surfaktan atau cairan pembersih yang berfungsi untuk menghilangkan kotoran. Berikut adalah struktur dari senyawa tersebut. Berilah nama senyawa diatas sesuai aturan IUPAC!	4	1-heptena	1

Figure 3. After correction of answer key number 4

After the validation test is carried out, the next stage is the student responses test. The student response test was conducted three times, namely individual test, small group test and large group test. In the individual test stage, it was conducted on 3 chemistry education students of the 2024 Class who had high, medium and low abilities. The results of the analysis are presented in a graph as seen in Figure 6.

(a) (b)

Figure 4. Display of game card: (a) Card Size Before Repair (5.5 x 8.5 cm); and (b) Card Size After Repair (11 x 7 cm)

(a) (b)

Figure 5. Display of front side of game card: (a) font size and font color before repair; and (b) size and color after repair

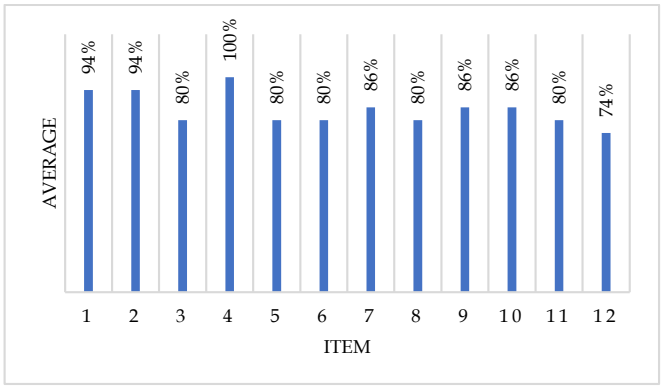


Figure 6. Individual student response questionnaire graph

Information: 1. The instructions for the card game are easy to understand; 2. The game cards are easy to use; 3. The material presented in the cards is clear and easy to understand; 4. Playing with these cards can make the learning process more enjoyable; 5. Through the card game, I can distinguish between various types of hydrocarbons; 6. Through the card game, I can learn the nomenclature of hydrocarbon compounds, the properties of the compounds and their uses in everyday life; 7. Through the card game, I can work together with my teammates; 8. The size and type of letters on the cards are easy to read; 9. The colors used on the cards are attractive; 10. The size of the cards is proportional and comfortable to use; 11. The language used in the game is easy to understand; and 12. The language and sentences used are effective (do not cause double meanings).

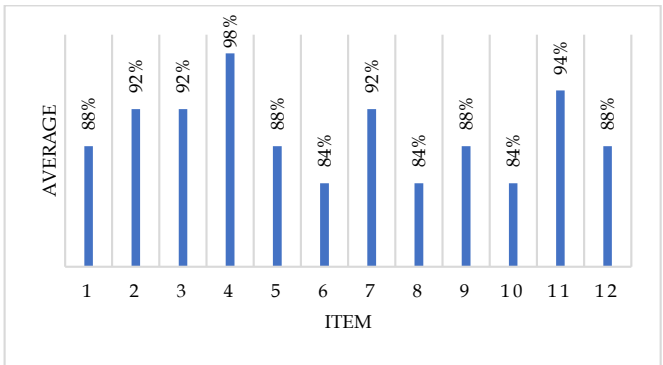


Figure 7. Small group student response questionnaire graph

Students were given a response questionnaire with 12 statements and a scoring range between 1 and 5. Based on the calculation results, an average of 85% was obtained with very good criteria. Based on Figure 8, it can be seen that the instructions for the card game are easy to understand (94%) and playing with Hy-Card cards can make the learning process more enjoyable (100%). However, one student gave a suggestion to improve the size and type of font to make it easy to read. So the researcher made a revision according to the suggestion.

The small group test phase was conducted on 9 chemistry education students of Class of 2024 who had high, medium and low abilities. Based on the calculation results, an average of 89% was obtained. This shows that the Hy-Card card game media is classified as very good. The results can be seen in Figure 8, students are happy with this card game as seen in item 4 (98%).

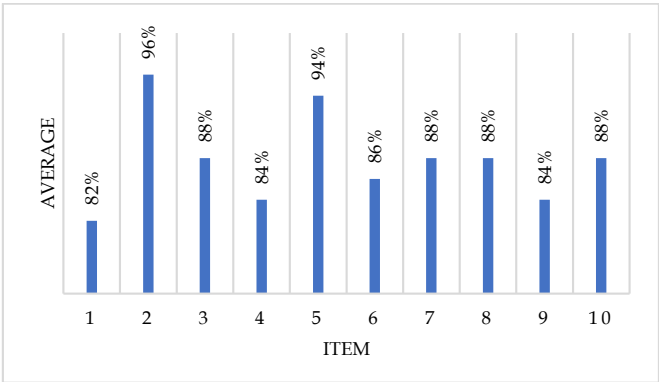


Figure 8. Large group student response questionnaire graph

Based on the results of the large group responses, the item with the highest average in item 2, namely students stated that the game card was easy to use with an average of 96%. Meanwhile, the lowest item was in item 1 with an average of 82% (very good criteria), this means that the 2024 Chemistry Education students felt that the instructions for the card game were easy to understand. The average response of the 2024 Chemistry Education students was 88% (very good). This shows that the response of Chemistry Education students to the Hy-Card game card is very good and they want it to be applied in hydrocarbon learning to make it fun. This is in line with research (Ardyansyah & Rahayu, 2023; Boonpotjanawetchakit et al., 2020; Buendía-Atencio et al., 2022; Chan et al., 2024; Chen et al., 2017; Gomez et al., 2020; Mahardhika et al., 2017; Ong, 2021; Putera & Hadi, 2024; Silva Júnior et al., 2021), which states that learning with card games makes students happy, not bored (Badajos et al., 2023; Hartt et al., 2020) and active (Saithongdee & Sirirat, 2024; Tsay et al., 2020).

Conclusion

Hy-Card game cards are very suitable for use in hydrocarbon learning with the average response trial obtaining very good results and the large group trial obtaining an average of 88% (very good).

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Author Contributions
This research was conducted as a team with Eny Enawaty (chair) coordinating the research, literature review, determining the methodology, creating digital literacy-based media and compiling reports. Ira Lestari (member) compiled the research instrument, implemented the developed learning media, analyzed quantitative and qualitative data. Rizki Furqanul Ichsan (member) inputted the data. Fadhil Alwa Faridy (member) created the media design and Nadila (member) tabulated the questionnaire data and transcribed the interview data.

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Conflicts of Interest
In this study, the author declares no conflict of interest.

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