

IMPLEMENTATION OF *HYDROCARBON ADVENTURES* GAME AS AN ONLINE LEARNING MEDIA DURING COVID-19 PANDEMIC

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Abstract. *The purpose of this study was to obtain the successful application of the game Hydrocarbon Adventures as an online learning media for hydrocarbon compounds in the covid-19 pandemic. The design of this study used the one-group-pretest-posttest experimental method. The target of this research is online learning using Hydrocarbon Adventures media games conducted by 27 grade XI students of Senior High School 1 Sampang. The students will be given pretest before using game. After using the game, students will be given posttest. The students also answered the questionnaire about online learning using game. The results showed that student learning outcomes after using the learning media Hydrocarbon Adventures game had increased with classical completeness for values reaching 92.59%, and an increase in student learning outcomes at a pretest value of 44,19 into a posttest value of 83,41, and shows the improvement tested with a gain score of 0.7 being in the medium category. Based on these results that is also supported by the results of the questionnaire responses, where 79.2% of the students giving a positive responses to the learning media after using it. Based on the results of the research, it can be concluded that the Hydrocarbon Adventures learning media on the material of hydrocarbon compounds through online learning during the covid-19 pandemic succeeded in being able improve student learning outcomes.*

Keywords: *Learning media, Hydrocarbon Adventures game, covid-19 pandemic*

INTRODUCTIONS

The Novel Coronavirus Disease 2019 (Covid-19) is a disease caused by the onslaught of a virus that originated in Wuhan, Hubei Province, China, and rapidly spread worldwide. On March 11, 2020, the World Health Organization (WHO) officially declared it a global pandemic. [1]. The pandemic occurs when a contagious disease easily spreads across various locations globally. In the past two weeks, Covid-19 cases outside China have increased thirteenfold, causing global concern [2].

Various countries have implemented policies to break the chain of the Covid-19 virus, including Indonesia. Indonesia has enforced social distancing, also known as physical distancing (to maintain physical

distance), as an effort to minimize and prevent the spread of the virus. The World Health Organization uses terms such as social distancing, physical distancing, and self-isolation. Additionally, Indonesia has implemented Large-Scale Social Restrictions (PSBB) [3].

Due to the current situation, leaders of higher education institutions and school principals are compelled to make prompt decisions and policies in response to directives from the Ministry of Education and Culture. These directives require educational services or "learning from home" from early childhood education to higher education [4].

During the implementation of online learning, several obstacles have been identified by various researchers. Based on

the latest data, (1) an analysis of online learning during the Work From Home (WFH) period of the Covid-19 pandemic as a challenge in pioneering the digital era of the 21st century; (2) an examination of 21 reflections on online learning during the Covid-19 emergency; and (3) an exploration of the utilization of the Ministry of Education and Culture's home learning portal as an online learning media from elementary school to higher education [5,6,7]. Building on the obstacles identified by several researchers, this study provides solutions focusing on the utilization of home learning portals through the use of the Hydrocarbon Adventures game as a learning media. The challenges and solutions in online learning are essential aspects that need to be thoroughly examined. Barriers in the learning process can decrease the interest of students [8]. According to recent research, key factors for the success of online learning include the readiness of facilities and infrastructure [9].

The creativity of a teacher in the process of online learning indeed seems to have a significant impact on the success of a learning target. For instance, in the chemistry teaching method adopted in several schools, it appears to be less attractive, leading students to feel bored during the chemistry learning process, making the classroom environment tend to be passive. Especially in a learning process like this, students may perceive it as if they are pressured to learn, creating a sense of being pushed. Such conditions give rise to feelings of boredom and irritation, consequently diminishing the interest, attention, and motivation of students in the learning process [10].

The characteristics of chemistry as a subject involve abstract concepts and are laden with mathematical principles, making it challenging for students to grasp easily. Therefore, the use of media is necessary to alleviate students' understanding of these concepts [11]. Research conducted by Fauzia et al. [12] indicates that approximately 70.37% of students at SMAN 1 Mojokerto express that chemistry is a complex subject. One aspect contributing to the lack of appeal in chemistry is the uninteresting learning process (61.11%), attributed to the use of practical methods such as PowerPoint presentations, worksheets, and

guidebooks.

In chemistry subjects at the high school level, there are numerous theories that prove to be quite challenging for students to comprehend. This difficulty arises because the material involves chemical reactions, calculations, and incorporates an abstract and microscopic theory [13]. Additionally, supported by research conducted by Amilia & Agustini [14], it is stated that 66.67% of students express the difficulty of understanding hydrocarbon compound materials, citing various factors such as an excessive amount of memorization required. The characteristic of hydrocarbon compound materials lies in specific subtopics, particularly the nomenclature of alkanes, alkenes, and alkynes. There exists a hierarchy that students must grasp, as failure to understand the basics from the beginning can make it challenging to comprehend subsequent nomenclature [14].

According to the results of an interview with a chemistry teacher at SMA Negeri 1 Sampang on April 29, 2020, conducted online, it was stated that there are several obstacles in the process of online learning. One of the challenges is in delivering the material, as many students complain about the difficulty in understanding the content. This issue arises due to the lack of online teaching resources. With the current technological advancements, teaching methods have started to evolve, especially during the ongoing pandemic, which requires students to learn from home. The creativity of teachers becomes crucial in this context. One example of technological advancement is the use of game-based learning through Android-based smartphones.

In using Android-based smartphone games, it can create a unique impression in the memory of students and provide a comfortable and entertaining learning environment without neglecting the learning objectives [15]. Android-based smartphones can also be utilized in teaching chemistry materials because they can encourage students to actively participate in the learning process.

Based on the research conducted by Freitas [16], the advantages of educational games include the ability to enhance the knowledge level of students. The benefits of

using Android-based gaming media include providing motivation for students to develop and improve their learning levels.

Games are used as a learning media with the intention of making it easier for students to practice freely and creating a reactive learning environment, making learning more enjoyable [17]. Furthermore, with the presence of Android-based games as a learning media, the hope is to make the teaching and learning process engaging and build a spirit of enjoyable learning. The approach aims to be relaxed while maintaining a serious element in education so that feelings of boredom and monotony can be eliminated, especially during the current pandemic where learning is required to take place at home [18].

Hydrocarbon Adventures game has been developed and deemed suitable as a learning media for hydrocarbon compound materials. It has been proven to meet the criteria of media feasibility, including validity, practicality, and effectiveness. Each game has received an interpretation score of more than or equal to 61%, and an assessment score of more than or equal to 3 for each evaluated aspect.

This game includes tournaments, instructional videos, and questions related to hydrocarbon materials. In the game, there are three levels that participants must complete. Each level contains obstacles in the form of monsters, and players must avoid touching these monsters as it will reduce their life points. With this gaming medium, it is hoped to be an alternative for learning during the COVID-19 pandemic, which requires students to study at home. This medium can be utilized by students during both in-class and extracurricular learning processes, making it highly flexible. This approach aligns with the idea that the presence of educational media in the teaching and learning mechanism can enhance students' motivation, prevent boredom, allow learning through play during the learning process, and contribute to theoretical knowledge [19].

The objective of this research is to achieve success in implementing Hydrocarbon Adventures game as an online learning media for hydrocarbon compound materials during the COVID-19 pandemic. By utilizing the game as a learning tool, it is

hoped to provide a solution to the challenges posed by online teaching and learning, ultimately improving the academic performance of students, particularly in the field of chemistry and the topic of hydrocarbon compounds.

METHODS

The method utilized in this study involves implementing a one-group pretest-posttest design [20]. The objective of this research is to target online learning using Hydrocarbon Adventures as an instructional game, conducted with 27 students in the 11th grade at SMA Negeri 1 Sampang. Before commencing the learning process, the students were given a pretest to assess their initial capabilities. After the use of the game, they were also presented with a posttest. The results from the pretest and posttest serve to observe the improvement in the students' learning achievement regarding hydrocarbon compounds, utilizing Hydrocarbon Adventures as an instructional game during the online learning process. The data used to achieve the learning objectives include learning outcomes and questionnaire responses from the students.

From the gathered data, each is analyzed. For the analysis of the participants' learning outcomes test, it is done by calculating the percentage of participants' learning mastery. Participants are considered to have mastered the hydrocarbon compound material if individual mastery reaches $\geq 75\%$, while the Hydrocarbon Adventures game as a learning media is considered effective if the classical mastery reaches $\geq 80\%$. Learning mastery can be utilized as a parameter for the level of participants' understanding; if participants have achieved learning mastery, then they can be considered to have mastered the material to be provided. According to [21], pretest and posttest scores obtained are further analyzed using the method:

$$\text{individual mastery: } \frac{\text{total score obtained}}{\text{total number of students}} \times 100\%$$

$$\text{ketuntasan klasikal: } \frac{\text{number of students who have mastered}}{\text{total number of students}} \times 100\%$$

The results of the learning test will be further analyzed by measuring the percentage

of participants' learning mastery. To test the difference in the average scores of pretest and posttest, an analysis will be conducted by first testing normality, which is used for testing pretest and posttest data. Then, in the paired t-test, the calculation of normalized gain is carried out. For the normalization test, paired t-test, and calculation of normalized gain scores, the SPSS program will be used.

Then, after learning using the game media, participants are given a response questionnaire. For the data from the response questionnaire, the analysis is conducted by calculating the percentage based on Riduwan's [21] criteria, which use the statement conditions Very Disagree "STS" = 1, Disagree "TS" = 2, Agree "S" = 3, and Strongly Agree "SS" = 4. The percentage is calculated using the following formula:

$$P(\%) = \frac{\text{total score of the collected data}}{\text{score criteria}} \times 100\%$$

According to those criteria, the response from participants after using Hydrocarbon Adventures as a learning media is considered to have a positive response if the percentage of the response questionnaire scores is $\geq 61\%$.

RESULTS AND DISCUSSION

The results of the conducted research obtained the learning outcomes of the participants from the pretest and posttest.

Table 1. Learning Outcomes of Students

Test	Average Score	Classical Mastery (%)	Total Students
Pretest	44,19	0.00	27
Posttest	83,41	92,59	27

Based on Table 1, it is evident that there is a very significant improvement in the learning process of the participants. In the pretest condition, the average score of students was 44.19, and for the posttest, there was an increase, with an average score of 83.41. The classical mastery between the pretest and posttest scores yielded highly significant results, indicating that the classical mastery for the posttest reached 92.59%, while for the pretest, it was 0.00%.

In the process of examining the collected data to determine whether there is a noticeable difference between the average pretest and posttest scores during learning using Hydrocarbon Adventures as a learning media, a paired-sample t-test was employed using the SPSS program. However, before conducting the paired-sample t-test, a Kolmogorov-Smirnov normality test was performed. The results of the normality test will be presented in Table 2 below.

Table 2. Normality Test Results

One-Sample Kolmogorov-Smirnov Test		
	Score pretest	Score posttest
N	27	27
Kolmogorov-Smirnov Z	1.293	1.053
Asymp. Sig. (2-tailed)	.071	.218

Based on the normality test table, the significant values are greater than 0.05 for both pretest and posttest scores, indicating that the scores obtained are normally distributed. Therefore, a paired t-test can be conducted to determine if there is a significant difference between the average pretest and posttest scores. The results of the paired-sample t-test are presented in Table 3.

Table 3. Paired-sample t-test Results

Conditions	t	df	Sig (2-tailed)
Pretest and Posttest Score	-21,713	26	0,000

Based on the data in Table 3, a test was conducted with the null hypothesis $H_0: \mu_1 = \mu_2$: indicating no difference between the average pretest and posttest scores. The alternative hypothesis (H_1): $\mu_1 \neq \mu_2$ suggests a significant difference between the average pretest and posttest scores. To determine the extent of the improvement in the participants' learning outcomes, the calculation of gain scores is then carried out.

Table 4. Gain Score Results

Gain Score	Criteria	Total Students	Percentage (%)
$g > 0,7$	High	11	41%
$0,7 \geq g > 0,3$	Middle	16	59%
$g > 0,3$	Low		

Based on Table 4, it is evident that the average gain score of the participants falls into the moderate category, demonstrating that the use of Hydrocarbon Adventures game as a learning media has achieved a significant improvement in the participants' learning outcomes. The increase in learning outcomes is attributed to the presence of materials and questions in the Hydrocarbon Adventures game that participants are required to earnestly engage with.

Looking at Tables 1 to 4, it is evident that utilizing Hydrocarbon Adventures as a learning media has led to an increase in the participants' learning outcomes in online settings during the COVID-19 pandemic, which necessitated remote learning. This aligns with the findings of research conducted by Rohmawati [22], indicating that the use of educational games, both theoretically and empirically, can enhance learning outcomes and student engagement, especially in the field of science. Additionally, it is consistent with research results demonstrating an improvement in learning outcomes after the use of games [23].

Following the use of Hydrocarbon Adventures as a learning media, a questionnaire was distributed to the participants to gather their responses and assess the utilization of Hydrocarbon Adventures as an online learning tool during the COVID-19 pandemic. The following are the responses obtained from the participant questionnaire.

Table 4. Results of Student Response Questionnaire After Using Hydrocarbon Adventures Game Media

No	Statement	Respond Percentage
1.	I can play the Hydrocarbon Adventures game smoothly.	82,4%

No	Statement	Respond Percentage
2.	I did not encounter difficulties in installing this game.	75%
3.	I understand the rules in the Hydrocarbon Adventure game.	76,5%
4.	I do not feel bored when learning using game media.	82,4%
5.	I would like to play Hydrocarbon Adventures continuously during the Covid-19 pandemic.	73,8%
6.	The Hydrocarbon Adventures game is enjoyable and interesting to play during the Covid-19 pandemic.	83,3%
7.	Learning chemistry using game media motivates me to continue learning at home.	82,4%
8.	The Hydrocarbon Adventures game makes it easier for me to understand the hydrocarbon compound material.	81,4%
9.	This game really helps me to comprehend and understand chemistry, especially the hydrocarbon compound material.	79,6%

Based on the data from student responses, the next step is to discuss each objective within the questionnaire regarding the use of the Hydrocarbon Adventures game as a learning media for the hydrocarbon compound material.

1) To determine the ease of using the game

Based on the statements in Table 4, positive responses were obtained. This can be observed from statements 1, 2, and 3 in the students' responses, indicating that the ability to play Hydrocarbon Adventures smoothly received positive responses within the range of 75% to 83%. This demonstrates that students did not face difficulties in playing the game remotely while using Hydrocarbon Adventures as a learning media. This is supported by research stating that in a game, there are instructions or rules for students to achieve the expected learning objectives [24].

Additionally, multimedia should be designed as simple as possible so that students can delve into it without complicated knowledge about multimedia [25]. Similarly, games as learning media should be designed simply so that students can play them smoothly. Therefore, it can be said that Hydrocarbon Adventures, as a learning media, can be used because it is easy to play or use in the teaching and learning process.

2) To determine interest in the game as a learning media

Based on the statements in Table 4, very positive responses were obtained. This is evident from statements 4, 5, 6, and 7 in the students' responses, indicating that Hydrocarbon Adventures, as a learning media, is enjoyable and interesting to play during the Covid-19 pandemic. The responses obtained fall within the percentage range of 73.3% to 83.3%. This proves that the attractiveness of the game as a learning media can boost students' motivation and interest in learning chemistry during the Covid-19 pandemic, thus enhancing their learning outcomes.

This situation aligns with the theory presented by Vygotsky, which emphasizes the direct impact of play on the intellectual development of children [26]. Additionally, games as a learning media have several advantages, including being enjoyable for students, providing entertainment, and being engaging to implement. Games allow active participation from students in the learning process [14]. Therefore, it can be concluded that Hydrocarbon Adventures, as a learning media, is enjoyable and engaging for use during the Covid-19 pandemic.

3) Clarity of the material in the game media:

Based on the statements in Table 4, students provided very positive responses. This is evident from statements 8 and 9 in the students' responses, indicating that the Hydrocarbon Adventures game media makes it easier for them to understand the hydrocarbon compound material, and positive responses were obtained within the range of 79.6% to 81.4%. This suggests that the clarity of the material in the game media can enhance the learning outcomes of students in studying chemistry, particularly in the topic of hydrocarbon compounds.

This is supported by research revealing that the presence of learning media in the teaching and learning process can enhance students' learning motivation, prevent boredom during the learning process, and contribute to the understanding of a concept by students [27]. Therefore, this means that Hydrocarbon Adventures, as a learning media, can assist students in understanding lessons, especially in the hydrocarbon compound material.

In summary, students overall provided positive responses regarding Hydrocarbon Adventures as a learning media for the hydrocarbon compound material during the Covid-19 pandemic.

CONCLUSION & RECOMMENDATIONS

Conclusion

Based on the results of the research data analysis, it can be concluded that the Hydrocarbon Adventures game, as a learning media for hydrocarbon compound material through online learning during the COVID-19 pandemic, has successfully influenced the learning outcomes of students. There was a significant improvement from the pretest score of 44.19 to the posttest score of 83.41, indicating an increase tested by a gain score of 0.7 falling into the moderate category. Meanwhile, the classical completeness reached 92.59%, supported by a positive response from the students at 79.2%.

Recommendations

Based on the conducted research, the researcher provides recommendations for future studies. (1) During the trial of Hydrocarbon Adventures game as a learning media, it took a considerable amount of time. This resulted in the learning process not aligning with the initial plan. Due to varying capacities among students, depending on their willingness and abilities to complete the game-based learning, it is recommended to establish a clear time limit by teachers during the online learning process. (2) In the process of installing Hydrocarbon Adventures game as a learning media, some students encountered difficulties. Among them were students without Android devices and had limited internet access during the game download via Google Drive. (3) The results of

this research can be used as an evaluation and reference in the teaching-learning process.

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