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Hidden Chem Card to Improve Students' Motivation and Learning Outcomes

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Abstract: One of the causes of low student motivation is due to the lack of learning media support in learning activities. The purpose of this research is to obtain a hidden chem card game media that is feasible to increase students' motivation and learning outcomes in stoichiometry material. This research uses the type of Research & Development (R&D) research that was tested limited to 30 students grade 10 in senior high school. Data collection techniques used questionnaire method for students' response and motivation, observation method to observe students' activities, and test method for students' learning outcomes. The results showed that students' learning motivation increased, all statement items obtained high criteria, namely students' enthusiasm (increased by 12%), students' pleasure with chemistry subjects (increased by 9%), and a sense of wanting to study chemistry diligently (increased by 11%). The paired t-test results based on pretest-posttest scores showed a significant increase with the acquisition of moderate (44%) and high (23%) n-gain scores more than the low category (33%). This shows that the hidden chem card game media can increase students' motivation and learning outcomes.

Keywords: hidden chem card, stoichiometry, learning motivation, learning outcomes.

▪ INTRODUCTION

In the world of education today, there are many cases of students being less interested in learning in the classroom, so this causes students to be more lazy to learn and less able to understand the material well. Stoichiometry in chemistry is the most difficult subject matter (Depdikbud, 2018). This difficulty can be overcome by increasing students' learning motivation, especially externally (Emda, 2017). Motivation is the drive and interest of a person to get certain goals (Sabrina, et., al., 2017). Of course, when a learner feels that they want to be more competitive in a group, then they will have the urge to get better things than their friends.

The application of game media during offline learning allows learners to be more interactive. This can also support students' interest in stoichiometry material (Diah, et. al., 2019). Offline game media that is trending in the current era is cards, this game is played in various circles ranging from children to adults. Through games that integrate with learning, students are trained to be confident, communication, and sportsmanship and form a fun and not boring atmosphere in the classroom (Saefullah, 2012). In addition, there is evidence that research has been conducted showing that students currently use android phones for approximately 8 hours per day (Nabila, 2021). This can certainly make a reference for creating semi-online game media that can complement the game media to be developed, for example using the QR Code feature. The use of QR Code-assisted card game media can improve students' cognitive outcomes (Riyanti, et., al., 2021).

The hidden chem card game media is a QR Code-assisted offline card game media that trains students to solve questions by discussing with fellow group members in pairs and can support interactive power between students. The mechanism in this game is that all 20 cards are put into a box containing styrofoam granules and then students take them randomly. After they take the card, they scan it and do the multiple choice questions in it,

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then after they finish working, the score will appear at the end to be accumulated with the second round.

▪ METHOD

This type of research is research and development (R&D) version of Borg and Gall modified by Sukmadinata (2006). This research aims to obtain a hidden chem card game media that is feasible to increase students' motivation and learning outcomes in stoichiometry material. This research was conducted at Senior High School 1 Kedamean, Gresik, on 30 grade 10 students. Figure 1 shows the research design used in this study.

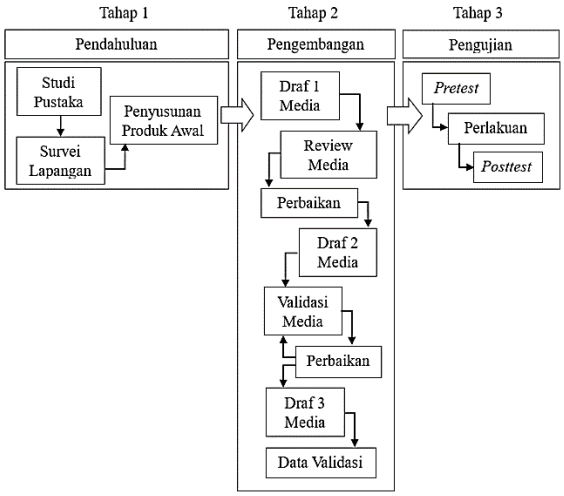


Figure 1. Sukmadinata's development steps

The data collection technique used is a non-test for the questionnaire method. This questionnaire method is used to obtain data on the results of students' learning motivation towards hidden chem card game media. Indicators of student learning motivation include attention, relevance, confidence, and satisfaction. In addition to using non-test data collection techniques, this study also used a test method to obtain student learning outcomes, namely the pretest-posttest. The pretest-posttest indicators include learning objectives in accordance with the concept of mole stoichiometry. The results of learning motivation were analyzed using quantitative descriptive analysis, namely using the average percentage on each aspect, then the average acquisition score was interpreted into Table 1.

Table 1. Score interpretation criteria

Percentage	Criteria
$0\% < x \leq 20\%$	Very low
$20\% < x \leq 40\%$	Low
$40\% < x \leq 60\%$	Enough
$60\% < x \leq 80\%$	High
$80\% < x \leq 100\%$	Very High

Meanwhile, the learning outcomes of students were analyzed using the n-gain test to determine the increase in scores obtained by students, and using a paired t-test to

determine the difference between two related data. The results of the n-gain test for each learner are then interpreted into the following table.

Table 2. N-gain criteria

Interval	Criteria
$(g) \geq 0.7$	High
$0.7 > (g) \geq 0.3$	Medium
$(g) < 0.3$	Low

After doing the percentage of learning motivation results and knowing learning outcomes through the n-gain test and paired t-test, the effectiveness of the hidden chem card game media can be concluded according to the results obtained.

▪ RESULT AND DISSCUSSION

Result

The results of the analysis obtained at the preliminary stage are that the curriculum used by grade 10 is an independent curriculum. The learning material used is stoichiometry part of the mole concept, because the curriculum used in the independent curriculum school, it uses learning outcomes as a reference material in formulating learning objectives. The results of the preparation of the initial draft are the creation of storyboards, flowcharts, and media drafts of hidden chem card games. The components of the hidden chem card game media include cards, styrofoam boxes, instructions and game rules. This component consists of subcomponents, in the card there is a QR Code which after being scanned will appear questions about the concept of stoichiometry. If the students' answers are wrong, they will be redirected to brief material, and if the students' answers are correct, they will be redirected to the next question. In addition, there is also an answer key link and material in the link listed on the card. Assessment of students' learning motivation towards hidden chem card game media based on ARCS questionnaire obtained the following results.

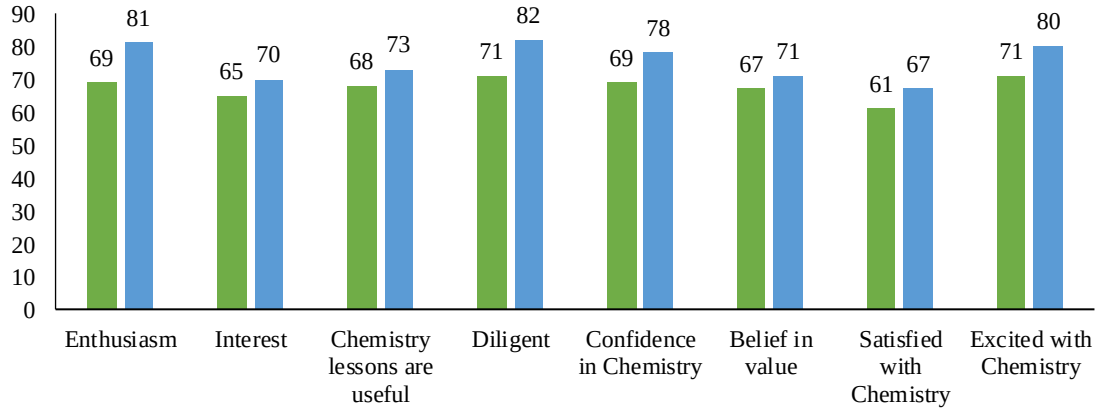
Table 3. Recapitulation of learner motivation results

Aspect	Statement	Percentage of Motivation on each Aspect (%)	
		First	Last
Attention	The use of hidden chem card games can make me enthusiastic about chemistry subject matter	69	81
	The use of the hidden chem card game is an unusual way of teaching, and it caught my attention.	65	70
Relevance	I find chemistry useful for my life	68	73
	To get the targeted chemistry learning outcomes, I have to do all the assignments given to me.	71	82
Confidence	In chemistry, I am confident that I can achieve the target score that I have set.	69	78
	I am confident that I will get good grades in chemistry.	67	71
Satisfaction	I feel studying chemistry gives me a lot of satisfaction	61	67
	I feel excited about chemistry lessons	71	80

Table 3 shows the assessment of the results of students' learning motivation after using the hidden chem card game media at the 1st meeting and 2nd meeting. Students' learning motivation increased after using the hidden chem card game media. Of the 8 statement items, 3 statements experienced a fairly high increase, namely the enthusiasm of students (increased by 12%), the students' pleasure with chemistry subjects (increased by 9%), and a sense of wanting to study chemistry diligently (increased by 11%) after using the hidden chem card game media. This can be seen in the following graph.

Figure 2. Graph of increased learner motivation

This increase shows that more students feel that the hidden chem card game increases their learning motivation, so this learning media can be used by teachers as a



reference tool in developing students' learning motivation in the classroom.

The results of the pretest and posttest can be analyzed using individual and classical completeness first to determine the percentage of students who achieved learning outcomes after playing the hidden chem card game. The individual completeness obtained is that there are individuals who get learning outcomes in the range of 80-100, this value is a value above the school's completeness value of 75, so that the individual can be said to be complete. While this classical completeness is the overall result of individual completeness. A total of 80% of students get a complete score from 30 students who implement the hidden chem card game media. Figure 11 shows that there is a high increase of 23%, a moderate increase of 44% and a low increase or even no increase of 33%.

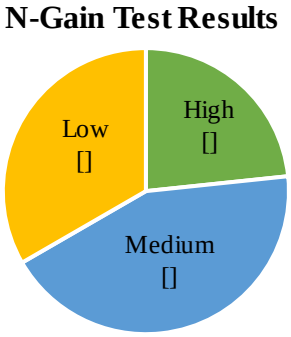


Figure 3. Graph of n-gain test results

Table 4. Pretest-posttest normality test results

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.156	30	.059	.934	30	.063
Posttest	.153	30	.073	.934	30	.061

After the n-gain test is carried out, a normality test is carried out to determine whether the pretest-posttest data is normally distributed or not. Based on Table 4, the significance level of the pretest and posttest using the Kolmogorov-Smirnov and Shapiro-Wilk tests obtained a significance value > 0.05, so it can be concluded that H0 is accepted and the data from the pretest and posttest results are normally distributed.

Next is the hypothesis test, this test aims to determine if there is a significant difference between the two groups, this test uses a paired t-test with the following hypothesis formulation.

H0 : The hidden chem card game media cannot improve learning, $\mu 0 \geq 0{,}05$
Ha : The hidden chem card game media can improve learning, $\mu 0 < 0{,}05$

This test uses a one-party test, namely the left party test, because the null hypothesis states greater than or equal to (≥). Table 4 below will present the results of the paired t-test of pretest and posttest scores through SPSS.

Table 4. Paired T-test results

Paired Samples Test									
		Paired Differences					t	df	Significance
					95% Confidence Interval of the Difference				One-Sided p / Two-Sided p
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pretest - Posttest	-9.767	7.802	1.424	-12.680	-6.853	-6.856	29	<,001 / <,001

Table 4 shows that the data obtained a significance value of <0.001 on one-sided p. It means that the significance value <0.05. then Ha is accepted. In addition, the calculated

t value is -6.856. In the left party test, the provision applies that if the calculated t price is smaller (<) than the t table price, Ha is accepted and H0 is rejected.

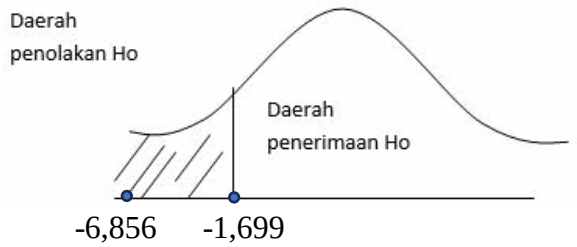


Figure 4. Left sided test

The result of t count is in the H0 rejection area because the value is smaller than t table. So it can be concluded that the hidden chem card game media on stoichiometry material can improve student learning outcomes. Both tests of effectiveness between motivation and learning outcomes show that the hidden chem card game media is said to be effective. This means that increased learning motivation shows increased learning outcomes as well. This is also in accordance with research studies which state that learning motivation is the basis for obtaining maximum learning outcomes (Rahman, 2021).

Discussion

The use of technology in education has a positive impact on the learning process. The involvement of technology in learning media is a means of improving the quality of learning and student interaction (Alkadri & Fauzi, 2021). The development of innovative game media is carried out in supporting chemistry learning. The game media developed is a QR Code-assisted card game that is operated using a smartphone. The QR Code presented in it contains questions related to stoichiometry material as well as features such as discussion if you get an incorrect answer and score on the final display. This game technique uses a box containing styrofoam into which the cards are inserted, then students take them randomly so that this media is called hidden chem card game media. The development of hidden chem card game media is done by paying attention to visual appearance, material, and learning content. Learners who use card game learning media show high levels of motivation and interactive power compared to learners involved in traditional learning (Rahman, et., al., 2020). This shows that hidden chem card game media can increase students' learning motivation as well.

The QR Code-assisted game media was validated by expert lecturers and chemistry teachers. This media validation aims to assess the extent to which the media being developed can be valid for testing on students. The assessment results showed that the hidden chem card game media obtained a score of 4 on content validity and a score of 5 on construct validity. The feasibility assessment was also carried out using a learner response questionnaire and an implementation observation. The assessment results show that the hidden chem card game media is included in the practical category used to increase students' motivation and learning outcomes. The new card game mechanism brings new experiences for students so that students are more interested and curious in learning chemistry. Technology in education can influence students to learn more actively

and can motivate students to learn (Saidin, et., al., 2015). The use of QR Code can improve students' cognitive outcomes (Riyanti, et., al., 2021). The use of game media assisted by QR Code can improve student learning outcomes by helping learn stoichiometry material from mistakes when answering questions incorrectly and helping students to learn from these mistakes. Learners gave positive responses and activities during the implementation of the hidden chem card game media.

The use of hidden chem card game media in this learning has an influence on learning activities. The results showed that the use of hidden chem card game media in learning sotikiometry material can affect students' learning motivation in learning chemistry. Students' learning motivation at the 2nd meeting was better than at the 1st meeting. The increase was caused by interesting learning resources and integrated with technology in learning (Mundilarto & Ismoyo, 2017). The learning outcomes of students also show an increase, the similarity of the results that both increase in motivation and learning outcomes is what proves that student motivation can improve student learning outcomes. Based on the results of learning motivation, students are more enthusiastic in learning chemistry after implementing the hidden chem card game media. Learning motivation has a positive and significant effect on improving student learning outcomes (Romadhoni, et., al., 2019).

▪ CONCLUSION

The hidden chem card game media is feasible to use in learning based on the results of validation (media assessment by experts), practicality (student response questionnaire and implementation observation), and effectiveness (motivation and learning outcomes). The hidden chem card game media is able to increase student learning motivation and improve student learning outcomes as evidenced by the results of an increase that increases in each aspect or indicator of the statement and has an increase above 10% in several aspects, while learning outcomes show an increase through the n-gain results obtained by 67% of students whose learning outcomes have increased. The results of both show that motivation and learning outcomes are very influential and can help students in realizing technology-integrated learning.

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