HYDROGEN
JURNAL KEPENDIDIKAN KIMIA
https://e-journal.undikma.ac.id/index.php/hydrogen/index

December 2023. 11(6)
e-ISSN: 2656-3061
p-ISSN: 2338-6487
pp. 983-994

Development of Android-Based Marbles Chem Hydrocarbon Mobile Game Media to Improve Motivation and Learning Outcomes of 11th Grade Science Students

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Article History
Received: 06-08-2023
Revised: 09-12-2023
Published: 20-12-2023

Keywords: game media, hydrocarbon, motivation, learning outcomes

Abstract

One of the uses of ICT in the world of education can be in the form of game media because students are actively involved in learning so that it can increase motivation. Learning outcomes are related to motivation, if the motivation given is more appropriate, the more successful the learning will be. This study aims to obtain feasible Marbles Chem Hydrocarbon media to increase student motivation and learning outcomes based on three aspects, namely validity, practicality, and effectiveness. The research method used is research and development / Research and Development (R&D) adaptation from Plomp (2013), consisting of three phases, namely the Preliminer Phase, the Prototype Making Phase, and the Evaluation Phase. Limited trials were conducted in 11th Grade Science (MIPA) of State Senior High School (SMAN) 20 Surabaya. Validity is obtained from three validators. Practicality is obtained from the results of response questionnaires, observation of student activities, and the implementation of learning. effectiveness is obtained from ARCS motivation questionnaire sheets and student learning outcomes. Media validity on content validity and construct validity barada in the range of scores 4 and 5 with valid and very valid criteria. Practicality is reviewed based on observations of learning implementation, student response questionnaires, and observations of student activities with an average percentage of 98.47%, 96.98%, and the results of observations of relevant activities are greater than irrelevant activities, namely 205.16 > 6.43. The effectiveness of the media obtained pretest-posttest increased from 60 incomplete categories to 87.69 complete categories and the ARCS motivational questionnaire increased from 55.32 with the moderately effective category to 95.85 very effective categories. Based on the results of validity, practicality and effectiveness, Marbles Chem Hydrocarbon media is suitable to be used as a learning medium on Hydrocarbon material.

How to Cite: Muhidah, I., & Agustini, R. (2023). Development of Android-Based Marbles Chem Hydrocarbon Mobile Game Media to Improve Motivation and Learning Outcomes of 11th Grade Science Students. Hydrogen: Jurnal Kependidikan Kimia, 11(6), 983-994. doi:https://doi.org/10.33394/hjkk.v11i6.8728

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INTRODUCTION

Motivation to learn is a change in energy within a person characterized by effective encouragement and reactions in an effort to achieve goals (Soemanto, 2006). Motivation has an important position in achieving predetermined learning goals, motivation will give rise to a drive and business reactions caused by the need to achieve in life (Arianty & Watini, 2022). This makes individuals have the effort, desire and drive to achieve high learning outcomes, that learning outcomes are a reflection of a person's mastery ability of the subjects taught. High learning outcomes are a symbol of a student's success in his studies (Muhammad, 2016).

In learning, the motivational factor has an important influence. Motivation is one of the factors that greatly determines the learning outcomes of students, in this case what makes the behavior to work or learn with full initiative, creativity and direction (Muhammad, 2016). But until now there are still many students who have low motivation to learn, resulting in the learning outcomes obtained also going down. One of the chemistry materials that makes students lack motivation to learn is hydrocarbon material because this material is memorized so that students find it difficult to remember and understand (Supriadi et al., 2022). Based on pre-research data, 78.7% of students stated that chemistry was a difficult lesson, 67.2% of students had difficulty understanding hydrocarbon material. In addition, 63.9% stated that chemistry was a boring subject, this could occur due to the lack of utilization of innovative and creative media when learning in class so that learning became monotonous and boring as evidenced by a percentage of 65.6%. Monotonous learning can be caused by the lack of active participation of students in learning so that students become unfocused in learning such as sleeping, playing games, disturbing friends, and other things. As many as 85.2% of students want the learning process to be interspersed with games and 93.4% of students are interested if chemistry learning uses game media. Based on an interview with one of the chemistry teachers, it was stated that the completeness of students in hydrocarbon material was 40% in one class. Learning outcomes are related to motivation, if the motivation given is more appropriate, the more successful the learning will be (Tukan & Komisia, 2020).

Based on this problem, it is necessary to have a strategy that can drive learning motivation, namely the Attention, Relevance, Confidence, Satisfaction (ARCS) motivation strategy developed by John M. Keller which can be used by teachers to increase student motivation and activity in learning (Tukan & Komisia, 2020). ARCS is a very flexible motivation method and can be used in various interests. In learning, the ARCS method has a syntax that can be combined with any learning strategy that the teacher has chosen (Susanti, 2020). The ARCS motivation model cannot stand alone in learning but can function when combined with learning strategies used by teachers in the classroom supported by suitable learning media to increase learning motivation (Susanti, 2020).

Learning media that are suitable for increasing learning motivation are those that involve information technology (Akbar & Noviani, 2019), it is in accordance with Permendikbud Number 22 of 2016 that one of the learning principles is the utilization of information technology to improve the efficiency and effectiveness of learning. One of the media that can be combined is making games because game-based learning media will make the learning atmosphere fun because students can learn while playing (Uyun & Lutfi, 2022). Because according to Hartanti (2019), states that through game media can increase student learning motivation so that the learning outcomes achieved are also high. This is also supported by pre-research data which states that 90.2% of students are happy when using game media so that they are easily motivated to learn and enjoy learning more (Rahmawati & Lutfi, 2018).

METHOD

This research uses a type of development research with Research and Development (R&D) methods. In this study, an Android-based game development design was used which was adapted from the Plomp & Nieveen (2013) development model. This research and development model is used because it is more clear and structured. This research and development was carried out to produce Android-based Marbles Chem Hydrocarbon Mobile Game media to increase motivation and learning outcomes of 11th Grade Science students. In this development, there are 3 phases, namely the first preliminary research phase, the second phase of prototyping, and the assessment phase shown in the following flow figure.

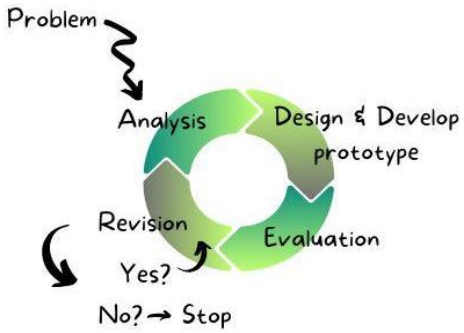

Figure 1. Plomp Research Flow

In the picture, it can be explained that the preliminer phase is in the form of data analysis, the prototype manufacturing phase is carried out by making design and prototype development, and the assessment phase is in the form of evaluation and validation (content and construct).

The data used in this research method is reviewed from the aspects of validity, practicality, and effectiveness. Validity comes from the validation of content and constructs. Practicality comes from student activity observation sheets and student response questionnaires. effectiveness comes from test results and ARCS motivational questionnaires

Validity Test

The instrument used to measure the variables of this study used a 5-point Likert scale. Respondents' answers were choices from five alternatives (Table 1).

Table 1. Likert Scale Points

Indicators	Score
Excellent	5
Good	4
Good enough	3
Not Good	2
Bad	1

(Riduwan & Sunarto, 2017)

This validation data is determined by mode or decision making at the largest number (Lutfi, 2021). Marbles Chem hydrocarbon mobile game media is said to be valid if the results of the score criteria obtained are ≥ 3 or the category is good enough.

Practicality Test

The practicality test is reviewed from student response questionnaires and observations of student activities

Student Response Questionnaire

The results of student responses were analyzed using the guttman scale (Table 2).

Table 2. Guttman Scale Criteria

Answer	Positive Statement Score	Negative Statement Score
Yes	1	0
Not	0	1

(Riduwan & Sunarto, 2017)

The data will be obtained in percentage form with the following formula.

$$Persentage\ \% = \frac{\sum Skor\ hasil\ pengumpulan\ data}{\sum Skor\ kriteria}\ x\ 100\%$$

The criteria score is obtained from the following formula:
Criteria score = highest score x number of aspects x number of respondents

The percentage results obtained will then be converted according to the criteria (Table 3).

Table 3 Practicality Score Interpretation

Percentage %	Category
0-20	Impractical
21-40	Less practical
41-60	Quite practical
61-80	Practical
81-100	Very practical

Based on these criteria, *Marbles Chem* Hydrocarbon game media is said to be practical if the score ≥ 61%

Observation of Student Activities

Data analysis of observation sheets / student activities is carried out by researchers during learning activities. Data in the form of aspects of assessment of student activities are analyzed using the following formula:

$$\%\ activity = \frac{\sum existing\ frequency}{\sum total\ frequency}\ x\ 100\%$$

Based on the results of this percentage, the Marbles Chem Hydrocarbon game media is said to be practical if the percentage of relevant student activities is greater than the activities of irrelevant students.

Effectiveness Test

The effectiveness test was reviewed from the pretest-posttest sheet and the student ARCS motivation questionnaire

Pretest and Posttest

Student learning outcomes are used to measure the effectiveness of *Marbles Chem* Hydrocarbon game media. Students are said to experience completeness in learning assessed based on the test results that have been provided. According to the results of interviews with chemistry teachers, the value of students is said to be complete if the value at the KKM value is 75, below the KKM students are said to be incomplete. The calculation of student scores during the *pretest-posttest* is used as follows:

$$Score = \frac{correct\ answer}{number\ of\ item}$$

The learning outcomes were analyzed by ranges of knowledge competency scores according table 4.

Table 4 Competency Value Range Learning Outcomes

No.	Curriculum 2013		Curriculum 2006	
	Number range	Predicate	Number range	Predikat
1.	3,85-4,00	A	94-100	A
2.	3,51-3,84	A-	86-93	A-
3.	3,18-3,50	B+	78-85	B+
4.	2,85-3,17	B	70-77	B
5.	2,51-2,84	B-	62-69	B-
6.	2,18-2,50	C+	54-61	C+
7.	1,85-2,17	C	47-55	C
8.	1,51-1,84	C-	38-46	C-
9.	1,18-1,50	D+	29-37	D+
10.	1,00-1,17	D	0-28	D

(Kemendikbud, 2014)

The calculation of the completeness of achieving student learning outcomes is used as follows.

$$\% = \frac{\sum number\ of\ student\ with\ c\text{completeness}}{\sum Total\ number\ of\ student}\ x\ 100$$

Media can be said to be effective if the value of the percentage of calculation of completeness of achieving student learning outcomes is obtained ≥61%. Based on the analysis of learning outcomes can be categorized as follows.

Table 5 Likert Scale Learning Outcomes Criteria

Persentage %	Category
0-20	Ineffective
21-40	Less effective
41-60	Effective enough
61-80	Effective
81-100	Highly effective

The improvement in learning outcomes can be calculated using the following formula.

$$< g >= \frac{S_{posttest} - S_{pretest}}{100 - S_{pretest}}$$

Information:
Sposttest = posttest score
Spretest = pretest score

Based on the gain score, it will be adjusted to the criteria on the table 6.

Table 6 Gain Score Criteria

Score Gain	Category
g>0,7	High
0,7>g ≥0,3	Medium
g<0,3	Low

(Hake, 1999)

Based on the gain score, the media is said to be effective if the gain score is >0.7 with high criteria or ≥0.3 with medium criteria.

Student ARCS Motivation Questionnaire

The motivation questionnaire used is a questionnaire aimed at students to determine student learning motivation during the learning process. This questionnaire was made based on the ARCS motivation theory according to Keller & Suzuki (2004), The results of student responses were analyzed using the Guttman scale.

Table 7. Guttman Scale Criteria

Answer	Positive Statement Score	Negative Statement Score
Yes	1	0
Not	0	1

(Riduwan & Sunarto, 2017)

The ARCS model was developed by John Keller which consists of four aspects of motivation, namely attention, relevance, *confidence*, and satisfaction (Satisfication) (Keller & Suzuki, 2004). After obtaining the overall score of each question, it can be calculated using the formula

$$Persentase\% = \frac{\sum skor\ hasil\ pengumpulan\ data}{\sum skor\ kriteria}\ x\ 100\%$$

The criteria score is obtained by the following formula.
Criteria score= highest score x number of aspects x number of respondents.

Table 8. Media Effectiveness Interpretation Criteria

Persentage %	Category
0-20	Ineffective
21-40	Less effective
41-60	Effective enough
61-80	Effective
81-100	Highly effective

(Riduwan & Sunarto, 2017)

Based on these criteria, the Android-based Marbles Chem hydrocarbon mobile game media can be said to be feasible if the score is ≥61%.

RESULTS AND DISCUSSION

Validity Test

In the validity of the content, there are two aspects, namely the truth of the material and conformity with the learning objectives. The results of the validity of the contents are recapitulated in the table as follows.

Table 9**.** Results of Validity of Marbles Chem Content

No	Quality Standard Aspects/Indicators	Score	Criteria
1.	The truth of the material	5	Very valid
2.	Compliance with learning objectives	4	Valid

Learning media can be categorized as external factors that affect the learning process in the classroom, both in teachers and learners. Learning media is an activity that can create conditions so as to allow students to gain new knowledge, skills and attitudes. In addition, the use of learning media is very important because it can shorten time. This means that learning using media can simplify problems, especially in conveying things that are new and unfamiliar to students (Siregar & Nara, 2015).

In aspects one and two have scores of 5 and 4 with very valid and valid criteria. This means that the media is in accordance with the applicable curriculum and is in accordance with the learning objectives (Lutfi, 2021). This is in accordance with Arifah & Fernando (2022), opinion that games make students feel happy and comfortable in participating in learning. Not only avoiding boredom, excited learning activities using game media will leave a long impression in the memory of students and provide opportunities for students to learn with a more pleasant atmosphere without leaving the learning objectives.

The construct validity contains internal consistency in the product developed such as, the characteristics of science, conformity with the characteristics of students, language suitability with the age of students, having rules, having elements of guidance, feedback, and others which are as shon in Table 10.

The first aspect has a score of 4 with valid criteria. This shows that Marbles Chem game media has IPA characteristics. The material that has been compiled on this medium is associated with real life. This is in accordance with an interview that has been conducted on one of the teachers of State Senior High School (SMAN) 20 Surabaya that chemistry is very close to everyday life so that it can attract students' interest in learning. Learning outcomes will be optimal if there is motivation, the more appropriate the motivation given, the more successful the learning will be (Tukan & Komisia, 2020).

Table 10 Results of Construct Validity of *Marbles Chem* Hydrocarbons

No	Quality Standard Aspects	Score	Criteria
1.	IPA characteristics	4	Valid
2.	Conformity to the characteristics of learners	4	Valid
3.	Language Suitability to the age of students	4	Valid
4.	Has rules	5	Very valid
5.	Presence of feedback	5	Very valid
6.	There are requirements and strategies in playing	4	Valid
7.	There is a standard of student success	4	Valid
8.	Challenge and engage learners	4	Valid
9.	Graphic elements	4	Valid
10.	Audio visual communication	4	Valid
11.	Software engineering	4	Valid

The second aspect has a score of 4 with valid criteria. The assessment indicators are based on the analysis of learners at the time of conducting pre-research that students have learning styles of 45.9% visual, 27.9% kinesthetic and 26.2% auditory. In this media, the visual learning style is more dominant, as evidenced by Marbles Chem Hydrocarbon media having a bright background with a *hand writing* style so that students are not saturated. In addition, 80.3% of students stated that games are more interesting than classroom learning so that Marbles Chem Hydrocarbon media is structured so that students can learn and play. This is in accordance with the statement by Pramita & Agustini (2016), that the purpose of the game is to eliminate or monotony so that it can create a learning atmosphere that seems relaxed. In addition, according to Vygotsky's social theory play is a selfhelp tool or a tool to bridge children to think because at the time of thinking children will give their attention to the game, so that play can be used a means to learn (Slavin, 2011).

The third aspect has a score of 4 with valid criteria. This is supported by the opinion of Siregar et al (2022) that there are several ways to design effective and efficient media in achieving learning objectives, one of which is that the media must be designed as simple as possible so that it is clear and easy to understand by students (Prastowo, 2015). The fourth and fifth aspects have a score of 5 with very valid criteria. In the fourth assessment indicator, Marble Chem Hydrocarbon media is equipped with a guidebook to facilitate teachers and students as well as display the rules of the game. The fifth assessment indicator is based on feedback so that students know whether what is done is wrong or not and profitable or not so that there are instructions for use so that students are easy to use (Prastowo, 2015).

The sixth, seventh, and eighth aspects have a score of 4 with valid criteria, students when playing are given the choice to continue, stop or return to play, and answer or not, if students want to leave the game then students click the cross button, if students want to play again choose the level to play. Learners must push marbles before starting the game which serves to obtain the compounds needed for preparation in the next challenge, after which learners are asked to arrange hydrocarbon compounds according to a predetermined time of 120 seconds. Students who succeed in compiling hydrocarbon compounds within a predetermined time can continue at the next level while if students exceed the predetermined time limit, the display will automatically move to the next level so that students cannot return to the previous level. The higher the level, the more difficulty the level will increase.

The ninth, tenth, and eleventh aspects have a score of 4 with valid criteria Media Marbles Chem Hydrocarbon can be installed on all versions of android. The selection of android base is based on student analysis where 90.2% of students of SMAN 20 Surabaya are android smartphone users. Android is one of the operating systems that can be used on cellular phones and touch screen tablet computers (touch screen) with Linux-based. The basis of the Android operating

system is the inux Kernel which is open source so that the Android operating system allows developers to always create their own Android applications that can be used for various kinds of mobile tools (Sulistyowati et al., 2022). This Marbles Chem Hydrocarbon media can be installed on all android without a minimum version so that this media is easy to maintain, install, and use on each student's smartphone. According to Putra et al. (2022), stated that android-based learning can improve learning outcomes because through android-based learning can access lessons and assignments anywhere and anytime.

Practicality Test

Student Response Questionnaire

The student response questionnaire is an instrument used to review the practicality of Marbles Chem Hydrocarbon media. The student response questionnaire is intended for grade XI MIPA 2 students at SMAN 20 Surabaya. Students fill out this response questionnaire after using the media and working on the *posttest sheet*. The student response questionnaire contains "Yes" and "No" answer choices, there are questions with negative and positive statements, for questions with positive statements, the answer "Yes" is given a score of one, while for non-zero answers, for negative statement questions, the answer "Yes" is given a score of zero and "No" is given a score of one. The function of positive and negative statements is so that in the work students provide answers to every question seriously and not mechanistic.

Each question in the response questionnaire has the purpose of knowing the ease of students in using Marbles Chem Hydrocarbon media, students' interest in Marbles Chem hydrocarbon game media, the usefulness of Marbles Chem hydrocarbon game media, and the quality of language in Marbles Chem hydrocarbon game media. Learning motivation is the driving force that exists in a person both intrinsically and extrinsically which can cause learning activities, give direction and ensure the continuity of learning and play a role in the growth of several positive attitudes, such as enthusiasm for students, a sense of pleasure in learning so as to increase knowledge and skills. low learning motivation. Lack of motivation can be seen from the lack of interest of students to listen to the teacher during teaching and learning activities, the lack of interest of students to teach the tasks given by the teacher, and the enthusiasm of students in learning is low (Ramadhani & Muhroji, 2022). Based on the results of the study, an average percentage of 96.98% was obtained so that Marbles Chem media is practical to increase student motivation and learning outcomes.

Observation of Student Activities

Student activity observation sheets are sheets used for observation of students at intervals of five minutes. Each activity observed has the aim of knowing the ease of use of Marbles Chem Hydrocarbon media, the activeness of students when using the Marbles Chem Hydrocarbon game, the interest of students using the Marbles Chem Hydrocarbon game, and irrelevant activities when using the Marbles Chem Hydrocarbon game. Based on the data from the observation of student activities, relevant activities are obtained greater than irrelevant activities. These irrelevant activities are, playing mobile phones, chatting with friends, and sleeping. This relevant activity may occur because chemistry learning that is in the hour after sports learning makes learners exhausted.

Effectiveness Test

Pretest-posttest results

According to Soemanto (2006), the initial process of human life development begins with learning. This learning depends on need and motivation. Learning is a process of behavior change due to interaction with the environment and individuals that is realized instead of collecting knowledge. The process of individual change cannot be witnessed but can be seen

from the movement of behavior change (Arianty &; Watini, 2022). Changes in the learning process can be measured from knowledge, knowledge measurement can be measured using *pretest-posttest* sheets. *Pretest-posttest* sheets are instruments used to measure students' knowledge. Pretest sheets are used to measure students' initial knowledge before the use of *Marbles Chem* Hydrocarbon media. Posttest sheets are used to measure knowledge after the use of *Marbles Chem* Hydrocarbon media. The pretest-posttest sheet is intended for 26 11th Grade Science (MIPA) student of SMAN 20 Surabaya. This sheet is analyzed using individual and classical completeness to see the completeness of students before or after the use of media then analyzed using N-gain to see if there is an influence on student learning outcomes after the use of Marbles Chem Hydrocarbon media shown in the table as follows.

Table 11. Student Pretest-posttest Results

No	Name	Pre	Completeness	Post	Completeness	*N-Gain*	Criteria
1	AAA	50	Incomplete	90	Complete	0.8	High
2	AFAGB	60	Incomplete	90	Complete	0.75	High
3	AA	60	Incomplete	80	Complete	0.5	Medium
4	ARN	60	Incomplete	80	Complete	0.5	Medium
5	AAS	60	Incomplete	80	Complete	0.5	Medium
6	DHAR	70	Incomplete	100	Complete	1	High
7	DML	60	Incomplete	100	Complete	1	High
8	DLH	70	Incomplete	90	Complete	0.67	Medium
9	EJ	70	Incomplete	100	Complete	1	High
10	FC	70	Incomplete	100	Complete	1	High
11	FAR	60	Incomplete	90	Complete	0.75	High
12	HADS	60	Incomplete	80	Complete	0.5	Medium
13	HHN	70	Incomplete	90	Complete	0.67	Medium
14	IMH	60	Incomplete	80	Complete	0.5	Medium
15	IBM	60	Incomplete	90	Complete	0.75	High
16	KZR	50	Incomplete	100	Complete	1	High
17	LMQ	60	Incomplete	80	Complete	0.5	Medium
18	LH	60	Incomplete	80	Complete	0.5	Medium
19	MK	70	Incomplete	90	Complete	0.67	Medium
20	PASM	60	Incomplete	80	Complete	0.5	Medium
21	RMTES	50	Incomplete	90	Complete	0.8	High
22	RA	50	Incomplete	90	Complete	0.8	High
23	RLMW	50	Incomplete	90	Complete	0.8	High
24	RANZ	50	Incomplete	80	Complete	0.6	Medium
25	SAR	50	Incomplete	80	Complete	0.6	Medium
26	SDM	50	Incomplete	80	Complete	0.6	Medium
Average		60	Incomplete	87.69	Complete	0.70	High

The completeness of students can be seen that the pretest score of students is below the KKM score applicable at SMAN 20 Surabaya, which is 75. In the pretest score, a score range of 50-70 is obtained so that students are declared incomplete on the pretest, while the posttest score is obtained in the score range of 80-100, which means that students are above the applicable KKM score so that it is declared complete. Classical completeness in the posttest 11th Grade Science 2 is 100, meaning that the completeness of achieving student learning outcomes is obtained ≥61% so that the media can be said to be very effective (Riduwan, 2015).

The average calculation of *N-gain* is obtained 0.70 with the high category. A total of 12 students got the very high category while the rest were moderate. Students who get the medium category, when viewed based on pretest-posttest scores, still increase. Based on the high category N-gain score, it can be stated that Marbles Chem Hydrocarbon media is a medium that can be declared effective (Hake, 1999).

ARCS Motivation Questionnaire

The ARCS motivation questionnaire sheet is an instrument used to measure student motivation. ARCS motivation has advantages in the learning process, namely: 1) can increase student attention to learning material, 2) connect the material with its benefits in daily student life, 3) can increase student confidence in the material provided by the teacher, and 4) can realize student satisfaction in the learning process and the material they learn. Therefore, researchers are interested in using the ARCS motivation strategy in this research because of its advantages (Tukan & Komisia, 2020).

ARCS is a very flexible motivation method and can be used in a variety of interests. In learning, the ARCS method has a syntax that can be combined with any learning strategy that the teacher has chosen (Susanti, 2020) The ARCS motivational model cannot stand alone in learning but can function when combined with the learning strategies teachers use in the classroom. The ARCS motivation sheet is intended for 26 students of 11th Grade Science SMAN 20 Surabaya. This sheet is analyzed using scores that will be interpreted according to the criteria. The following are the results of the student motivation questionnaire.

Based on the data from the ARCS motivation questionnaire, students found that the average percentage before was 55.32 with the category of quite effective and after of 95.85 with the category of very effective.

CONCLUSION

Based on the analysis and discussion data, Marbles Chem Hydrocarbon Mobile Game Media was obtained which is feasible to be used to increase the motivation and learning outcomes of 11^{th} grade science (MIPA) students with the following eligibility criteria.

Marbles Chem Hidrocarbon Mobile Game Media is said to be valid as a learning medium for 11th Grade Science students in terms of content validity and construct validity obtained from the assessment of the three validators. Validity is in the range of scores 4 and 5 with valid and very valid criteria.

Marbles Chem Hydrocarbon Mobile Game Media is said to be practical as a learning medium for 11th Grade Science students in terms of student activity observation sheets, learning implementation observations, and student response questionnaires with each obtained the average percentage of learning implementation and student response questionnaires are, 98.47%, and 96.98% with very effective criteria while relevant activities obtained are greater than the activities obtained irrelevant i.e. 205.16 is greater than 6.43.

Marbles Chem Hidrocarbon Mobile Game Media is said to be effective as a learning medium for 11th Grade Science students in terms of pretest-posttest sheets and student ARCS motivation questionnaires with each obtaining an increase in the average percentage of pretest-posttest sheets from 60 with the incomplete category to 87.69 with the complete category and the student ARCS motivation questionnaire from 55.32 with the moderately effective category to 95.85 with the very effective category.

RECOMMENDATIONS

Based on the analysis and discussion data obtained by Marbles Chem Hydrocarbon Mobile Game Media, there are several suggestions in future research, namely that the game should be tested individually so that more accurate information will be obtained.

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