

Making Chemical Snakes and ladders Game as Learning Media on Hydrocarbon Compound Material for Senior High School

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Abstract – One alternative of instructional media that can be used as a practical model for hydrocarbon compound material is a chemical snakes and ladders game. The media consists of a board that contains facts, concepts, and principles of hydrocarbon compound material, questions about the hydrocarbon compound material and answer keys of the questions, pawns, and dice. These media can improve students' learning activities and students' comprehension of the hydrocarbon compound material. The research aimed to produce instructional media in the form of a chemical snakes and ladders game on hydrocarbon compound material. The type of this research is the Research and Development (R&D) by applying 4D models, namely (1) define, (2) design, (3) develop, and (4) disseminate. This research was conducted until develop phase. The feasibility test was conducted on XI MIPA 1 students of SMAN 7 Sijunjung, in the form of the instructional quality and technical quality of the media. The instrument used was questionnaires that analyzed by using kappa moment and rating scale technique. The result of the analysis determines that the average score of the feasibility test of the media is 93.90%. It indicates that the chemical snakes and ladders game is highly feasible and very fit for use as an instructional media in the hydrocarbon compound material for SMA.

Keywords – Chemical Snakes And Ladders Game, Hydrocarbon Compounds, Learning Media, 4-D Model, Feasibility Test.

I. INTRODUCTION

Hydrocarbon compound is one of the chemical materials taught in Senior High School. Hydrocarbon compound material contain many facts, concepts, principles, and procedures. The material of hydrocarbon compound discusses the uniqueness of carbon atoms, types of carbon atoms, the grouping of hydrocarbons, nomenclature of hydrocarbon compounds, isomers, physical properties, and reactions of hydrocarbon compounds. To understand the facts, concepts, principles, and procedures, students must read this material repeatedly and practice answering questions.

Based on the results of observations, hydrocarbon compound material is taught by teachers and group discussion methods. Learning media used in the form of PowerPoint slides, teaching materials, and student worksheets. While the training model given by the teacher is in the form of giving questions from printed books and questions in the student worksheet. The provision of training to students serves to improve students' understanding of the material. However, the provision of exercises in the form of questions from printed books and worksheets constantly has weaknesses including students becoming bored and lacking enthusiasm. For this reason, we need a learning media that

can make students excited and able to do the exercises independently. One of the learning media that can be used is game media.

From the results of observation, training for hydrocarbon compound material has not been found using game media. Whereas game media have many advantages including preventing boredom, active students in learning, and increasing competitive spirit. This is certainly very helpful especially for material that contains many facts, concepts, principles, and procedures such as hydrocarbon compound material. Games have several aspects that are superior to conventional learning methods and can generate motivation (Vogel et al., 2006). Game media are chosen based on the characteristics of Senior High School students who are in adolescence who enjoy playing and group work. There are several specifics of adolescent social behavior, one of which is enjoy in the group (Mudjiran, 2007).

Educational games are good for learning (Kurt et.al, 2005). Games are influential in the learning of abstract concepts, are enjoyable, and allow the students to benefit from the experience of other classmates. Chemistry instructors could consider integrating games into their course plans (Rastegarpour and Marashi, 2012). Educational game media can increase student motivation (Garris et.al, 2002). Game media can make learning atmosphere enjoyable. Educative, productive, and fun games are all educational tools that are educational and can be used in learning, produce more value for its users, and make fun when using it (Yusuf and Auliya, 2011). The use of game media as a training model is expected to increase students' interest in doing the exercises and make the learning atmosphere more enjoyable.

One of the advantages of game media is that it can break through boredom. Also, game media can be used repeatedly so that students can play while learning (Haryono, 2013). Game media is suitable for use as a learning media or training model for a material that contains many facts, concepts, principles, and procedures such as hydrocarbon compound material.

Game media used as a training model in learning are the snakes and ladders game media which have been modified so that it becomes an educational and communicative chemical snakes and ladders game. This game is modified by adding a general description of the material, facts, concepts, and principles contained in the material so that it can help students to remember the facts, concepts, and principles contained in the hydrocarbon compound material that has been learned.

This chemical snakes and ladders game is equipped with practice questions so that it can be used as a substitute for the

training model that is usually given by the teacher in the form of questions from printed books or worksheets. The use of game media as a training model will increase students' interest in doing the exercises because students can learn while playing and make the learning atmosphere more enjoyable. Snakes and ladders game was chosen because this game is liked by all ages ranging from children, adolescents, and even adults. Snakes and ladders game is one form of the popular game from the age of children, adolescents, and even adults (Haryono, 2013). Snakes and ladders game can be used for students with an age range of 7-18 years (UNESCO, 1988).

Based on the above, the writer is interested in designing an alternative learning media in the form of snakes and ladders game. This study aims to make the chemical snakes and ladders game as a learning media on hydrocarbon compound material for Senior High School and determine the feasibility level.

II. METHODS

This type of research is research and development (R&D) that is research used to produce certain products and test the effectiveness of these products. This research was conducted in class XI MIPA 1 in SMA 7 Sijunjung. The object of this research is the chemical snakes and ladders game as a learning media on hydrocarbon compound material for Senior High School.

The development model used is a 4-D model. This 4-D model consists of 4 main stages, namely: (1) define, (2) design, (3) develop, and (4) disseminate (Trianto, 2014). This research is limited to the develop stage.

At the define stage, front end analysis, student analysis, task analysis, concept analysis, and learning objectives analysis are carried out. At the design stage, the design of the chemical snakes and ladders game is made of the hydrocarbon compound material consisting of the board of snakes and ladders game equipped with facts, concepts, and principles contained in the hydrocarbon compound material, a collection of questions consisting of 4 series of questions (A, B, C, and D), pawns and dice.

The final stage of this research is the develop phase. This stage aims to produce learning media in the form of a revised chemical snakes and ladders game based on input from the validator. The revised media will then be tested to determine the feasibility of the media.

The instrument used in testing the level of media validity was a validation sheet that was filled in by validators namely 3 Chemistry lecturers at Universitas Negeri Padang. The

instrument used to test the feasibility of the chemical snakes and ladders game as a learning media of hydrocarbon compound material was a questionnaire filled out by students and teacher suggestion sheets. Media validity was analyzed using kappa moments, while student questionnaires to determine the feasibility of the media in terms of instructional quality and technical quality were analyzed using rating scales.

$$\text{moment kappa } (k) = \frac{Po - Pe}{1 - Pe}$$

Information:

k = kappa moment

Po = Realized proportion, calculated in a way the number of values given by the validator is divided the maximum number of values

Pe = Unrealized proportion, calculated by the maximum number of ways minus the amount the value given by the validator divided by the amount maximum value.

Table 1. Interpretation of kappa moment values (k) (Boslaugh & Watters, 2008).

Interval	Category
0.81 – 1.00	Very high
0.61 – 0.80	High
0.41 – 0.60	Medium
0.21 – 0.40	Low
0.01 – 0.20	Very low
≤ 0.00	Invalid

III. RESULTS AND DISCUSSION

3.1. Research Results

The results of this study are in the form of products, namely the chemical snakes and ladders game on hydrocarbon compound material. This study uses a 4-D development model. At the development stage, the validity assessment and the level of media feasibility data were obtained. The results of the validity test and the feasibility study were obtained as follows.

3.1.1. Validity Test

The aspects assessed in the media validity test are content eligibility, instructional feasibility, linguistic component, and graphic component.

Table 2. Validity values of the chemical ladder snake game

No	Rated aspect	Average kappa moment (k)	Validity
1	Content eligibility:		
	a. Facts, concepts and principles	0.80	High
	b. The questions	0.81	Very high
2	Instructional feasibility	0.86	Very high
3	Linguistic component	0.80	High
4	Graphics component	0.86	Very high

3.1.2. Media Feasibility Test

Data on the level of media feasibility were obtained from student questionnaires and teacher suggestion sheets.

Table 3. Results of Analysis of Student Questionnaire Data for Instructional Feasibility

No	Statement for Instructional Feasibility	Score	Data Interpretation
1	The chemical snakes and ladders game provides learning opportunities whenever and wherever	97.86%	Very decent
2	Chemical snakes and ladders game can be used repeatedly	90.00%	Very decent
3	The use of the chemical snakes and ladders game can help me strengthen the material that has been taught	98.57%	Very decent

4	My motivation in understanding hydrocarbon compound material is increasing by using chemical ladder snake game	92.86%	Very decent
5	I am interested in using chemical snakes and ladders game because the learning process becomes fun	99.29%	Very decent
6	The chemical snakes and ladders game can make me more able to interact socially with friends	94.29%	Very decent
7	By using the chemical snakes and ladders game, I can better recall the hydrocarbon compound material that has been taught	95.00%	Very decent
Score average		95.41%	Very decent

Table 4. Results of Analysis of Student Questionnaire Data for Technical Feasibility

No	Statement for Technical Feasibility	Score	Data Interpretation
8	The use of letters or symbols on the board of chemical snakes and ladders game is clear.	89.29%	Very decent
9	The size of the writing on the set of chemical snakes and ladders game problems is correct	89.29%	Very decent
10	The language used in a collection of questions is simple and easy to understand	90.00%	Very decent

11	This chemical snakes and ladders game is easy to use	93.57%	Very decent
12	The overall appearance of the chemical snakes and ladders game is already interesting	92.86%	Very decent
13	Questions given in the chemical snakes and ladders game are already equipped with answer keys	97.86%	Very decent
Score average		92.14%	Very decent

Table 5. Eligibility values based on Eligibility Criteria

No	Eligibility Criteria	Item Number	Eligibility Value	Data Interpretation
1	Instructional Feasibility	1,2,3,4,5,6,7	95.41%	Very decent
2	Technical Feasibility	8,9,10,11,12,13	92.14%	Very decent
Score average			93.90%	Very decent

Table 6. Teacher's suggestion / response data for content eligibility

No Item	Statement for Eligibility of Purpose	Suggestions / Responses
1	Regarding the accuracy of the media with Basic Competence (KD) on hydrocarbon compound material.	Respondent 1: Right Respondent 2: Right Respondent 3: Right
2	Regarding the accuracy of the media with indicators on hydrocarbon compound material.	Respondent 1: Right Respondent 2: Right Respondent 3: Right
3	Regarding the accuracy of the media with the aim of learning hydrocarbon compound material.	Respondent 1: Right Respondent 2: Right Respondent 3: right
4	Regarding the accuracy of facts, concepts,	Respondent 1: Right Respondent 2: Right

principles and procedures that exist in the media with hydrocarbon compound material.	Respondent 3: Appropriate
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9	Regarding the use of media in making students interact socially with their friends.	Respondent 1: can increase student interaction with peers. Respondent 2: can make students interact socially with their friends. Respondent 3: can establish social relationships with friends
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Table 7 . Teacher suggestion / response data for feasibility of objectives

No Item	Statement for Eligibility of Purpose	Suggestions / Responses
5	Regarding the suitability of the media with the level of student personality development.	Respondent 1: still appropriate Respondent 2: appropriate Respondent 3: appropriate
6	Regarding the use of media in increasing student interest and attention.	Respondent 1: can increase student interest and attention Respondent 2: can increase student interest Respondent 3: can increase student interest and attention
7	Regarding the use of media in increasing student learning activities.	Respondent 1: can increase student learning activities Respondent 2: can increase student learning activities Respondent 3: can increase student learning activities
8	Regarding the use of media in making it easier for students to strengthen and remember the material that has been taught.	Respondent 1: can facilitate students in establishing and recalling material that has been taught Respondent 2: can facilitate students in recalling material that has been taught Respondent 3: can facilitate students in establishing and recalling material that has been taught

3.2. Discussion

The validation sheet contains 4 aspects of assessment namely the appropriateness of the contents which includes the suitability of facts, concepts, and principles on the board of snakes and ladders game questions on a collection of questions, instructional eligibility, linguistic component, and graphic component. Based on the validation sheet, the three validators provide an assessment of the chemical snakes and ladders game as a learning media on hydrocarbon compounds material.

The third validator's assessment of the content component about the suitability of facts, concepts, and principles on the game board and the language component of the chemical snakes and ladders game media both have an average kappa moment of 0.80 with a high validity category. The feasibility of the contents of the suitability of the questions in the collection of questions with indicators and learning objectives, instructional feasibility, and components of this media graphics have a very high category of validity with an average kappa moment 0.81, 0.86 and 0.86.

The results of the validity test of the game of the chemical snakes and ladders game as a learning media on hydrocarbon compounds material by the validators show that the media made are valid. A product is said to be valid if the instrument can measure what should be measured. Based on the analysis of the questionnaire data for students of class XI MIPA 1 of SMA Negeri 7 Sijunjung, the average value of the feasibility of the chemical snakes and ladders game on hydrocarbon compound material was 93.90%. This value is interpreted as very feasible.

The chemical snakes and ladders game as a learning media must pay attention to the content or scope of the material and learning objectives. The content in question is the compatibility of the media with the material hydrocarbon compounds. Based on the responses given by the teachers regarding the accuracy of the snakes and ladders game media

with Core Competencies (KI), Basic Competence (KD), indicators, and learning objectives, all respondents stated that the chemical snakes and ladders game media is appropriate with KI, KD, indicators, and learning objectives, as well as facts, concepts, principles and procedures contained in the hydrocarbon compounds. If the media used by the teacher matches the learning objectives and learning material, then the media can be used to teach students. Media is not only used to facilitate teachers in delivering materials but can be used to help students learn by the objectives to be achieved (Sanjaya, 2006).

This chemical snakes and ladders game is by the level of development of Senior High School students who are in their teens with 16-18 years of age. This is because the snakes and ladders game media can be used for students with a range of 7-18 years (UNESCO, 1988). Senior High School students are in their teens who love play and group work. There are several specifics of adolescent social behavior, one of which is enjoy in the group (Mudjiran, 2007).

The use of the chemical snakes and ladders game as a learning media can also increase students' interest and attention in learning and doing exercises. This is because students are actively involved in fun activities. Students can learn while playing so students do not feel bored. According to Davis, Shepherd, and Zwiefelho in Rakhmadhani (2013) games that are used as learning media can directly stimulate student interest and become good motivating techniques. According to Haryono (2013), if students can focus their attention fully on learning, this can improve learning outcomes. The chemical snakes and ladders game made contains images related to hydrocarbon compound material and the game board is designed with attractive colors. Colorful designs/drawings attract more students' attention (Sudjana and Rivai, 2011).

Playing had a significant role in the learning of abstract concepts and the understanding of chemistry concepts was facilitated through creating excitement and joy, also interaction amongst students (Rastegarpour dan Marashi, 2012). The chemical snakes and ladders game can make it easier for students to establish and remember material that has been taught in a fun way. This is because students work on exercises and repeat learning while playing. By playing students feel more relaxed in the learning process so that the learning atmosphere becomes fun. According to Djaali (2011), a pleasant atmosphere can make students always want to learn.

The instructional quality meant is that this chemical snakes and ladders game can teach students. Teaching is done

to facilitate learning so that the communication process occurs. With the communication process, the message can be conveyed well (Amri, 2013). Based on the analysis of student questionnaires obtained the value of the instructional quality is 95.41%. This indicates that the chemical snakes and ladders game on hydrocarbon compound material is very feasible in terms of instructional quality.

Chemical snakes and ladders game media can provide learning opportunities anytime and anywhere because this media is collected in one small box so that it is easy to carry and can be used repeatedly as student training material. The repetition of the exercise will make learning information or messages last long in students' memories so that information is not easily forgotten.

Snakes and ladders game media can also make it easier for students to learn and help solidify the material that has been taught in a more fun way. The students found it helpful to understand the material after using the chemical snakes and ladders game media showing that the process of delivering messages went well. This is because there are pictures on the game board and a collection of questions. The existence of image stimuli in the media will provide better results in remembering, recognizing, recalling, and linking facts with concepts (Arsyad, 2013). Visual media can facilitate understanding and strengthen memory (Djamarah and Zain, 2002).

The use of the chemical snakes and ladders game as a learning media especially exercise media can increase student motivation in understanding hydrocarbon compound material. This is because students learn in a pleasant atmosphere. A pleasant atmosphere will arouse interest in learning, joy, full involvement, and the attention of students (Haryono, 2013). Motivation also plays a role in clarifying the learning objectives to be achieved which are related to the significance of learning objectives (Jalius, 2009). The learning media in the form of chemical snakes and ladders game is very good criteria in terms of student motivation (Nugroho, 2013).

The media of this chemical snakes and ladders game allows students to interact socially with their friends. In playing games, students sit in groups. The question and answer process in the game makes students discuss each other, correct, remind, and respect each other when they get their turn. The interaction will provide opportunities for students to express according to their respective abilities. This will make the potential of students develop due to the dynamic actualization that continues to be developed (Haryono, 2013). Games provide acceleration for children to

practice physical skills, social skills, get emotional satisfaction, and intellectual training (Hamalik, 2000).

The technical qualities are legibility, the appearance of the snakes and ladders game, and the practicality of using media. Based on the analysis of student questionnaires, a technical quality feasibility score is 92.14%. This indicates that the game media of chemical snakes and ladders game on hydrocarbon compound material is very feasible in terms of technical quality.

The use of letters and symbols on the game board is clear. The size and type of letters in the set of questions are correct and legible. The language used in a collection of questions is also simple and easy to understand.

Based on students' responses regarding media appearance, 25 out of 28 students stated that the snakes and ladders game media was very good and interesting, the colors used were very good and clear, and the language used in the games was easy to understand. The media appearance is readable, easy to understand, and attracts attention making the media able to convey the message desired by its users (Arsyad, 2013). This media makes learning more interesting and enjoyable because it is presented in an easy-to-play form and attractive colors (Rosyana, 2014).

Based on the description it can be seen that the snakes and ladders game media overall has a very high feasibility value both in terms of instructional quality and technical quality. This can be seen from the results of the overall student questionnaire analysis is 93.90%. Based on the questionnaire data, the chemical snakes and ladders game on hydrocarbon compound material can be used as a learning media especially as a training model for hydrocarbon compound material.

The limitation of using this chemical snakes and ladders game in the learning process is in terms of time. Based on research that has been done, students use the chemical snakes and ladders game in the learning process at school and require a long time to reach the finish. Therefore, this chemical snakes and ladders game should not only be used during school hours but can also be used outside school hours for independent training. If this game is used during school learning hours, the game time should be limited. If no player reaches the finish until the end of the game, the winner is determined by adding up the points of each player. The player with the highest points is declared the winner.

IV. CONCLUSION

Based on the results of research and the data analysis that has been done it can be concluded that the chemical snakes

and ladders game as a learning media on hydrocarbon compounds material can be made and is very feasible to be used for chemistry learning in Senior High School.

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