Indonesian Journal of Educational Review
p-ISSN 2338-2019 | e-ISSN 2335-8407
Vol. 8, No. 1, Juli 2021, p.45-54

Available online at
http://pps.unj.ac.id/journal/ijer

DEVELOPMENT LEARNING MEDIA APPLICATION OF SNAKES ON THE NERVOUS SYSTEM MATERIALS TO INCREASE LEARNING OUTCOMES AND CONCEPTS MASTERY OF HIGH SCHOOL STUDENTS IN THE 2020/2021 ACADEMIC YEAR

Andreansyah [1], Herliani [2], PM Labulan [3]

Mulawarman University Samarinda
Mulawarman University Samarinda
Mulawarman University Samarinda
andreansyahaja55@gmail.com[1]
ellieherliani@gmail.com [2]
pm_labulan@yahoo.co.id [3]

Abstract

The purpose of this study was to examine the validity, practicality, and effectiveness of the snake and ladder application learning media on the nervous system material in improving student learning outcomes and mastery of concepts. The samples in this analysis were Biology teachers and students of SMA Wahidiyah, SMAN 3, SMAN 8 and SMAN 13 Samarinda. The results showed that 78.40% of the validity of the learning media, 90.00% of language validity, 91.11% of the readability aspect, 88.33% of instructions for using the application and 93.17% of the validity of the questions on the application from the validator. The results of the practicality of snake and ladder application media by biology teachers are 89.00% and students 82.87%, the effectiveness value of student learning outcomes on snake and ladder application media is 84.08%, and the results of students' mastery of concepts usingStandard Gain is 0.60 with a medium category. Based on the results of the validity, practicality, and effectiveness of Biology students and teachers at Wahidiyah SMA, SMAN 3, SMAN 8 and SMAN 13 Samarinda, it can be concluded that the application of snakes and ladders to the nervous system material in Biology learning is feasible to be used as a learning medium.

Keywords: *Applications, Snakes and Ladders, Learning Outcomes, and Mastery of Concepts*

The word media comes from the Latin *medius* which literally means middle, intermediary, or introduction. In *Arabic*, the media is an intermediary *(wassail)* or an introduction to messages from the sender to the recipient of the message (Arsyad, 2005). Media, if understood broadly, are humans, materials, or events that build conditions that enable students to acquire knowledge, skills or attitudes. Learning media has several benefits, especially in teaching abstract things to students. There are several benefits of learning media, such as: (1) attracting attention; (2) develop interest; (3) adapting the learning environment and (4) promoting acceptance of ideas (Sukmahidayanti, 2015).

Learning outcomes are changes that occur in students, both concerning cognitive, affective, or psychomotor aspects as a result of learning activities (Susanto, 2013). These results can be seen when students experience changes in behavior. Learning is used to seek behavioral changes in individuals who are learning. This change in behavior is an acquisition that becomes the result of learning (Purwanto, 2013). Wailman in Susanto (2013) states that the learning outcomes achieved by students are the influence of *internal factors* (including: intelligence, interest and attention, learning motivation, perseverance, learning

habits, as well as physical conditions and habits) as well as *external factors* (including: family, school and community).

According to Rosser and Dahar (2006), "a concept is an abstraction that represents a class of objects, events, activities, or relationships that have the same attributes". In line with Sagala (2005), "a concept is the fruit of a person or group of people's thoughts stated in the definition so that it gives birth to knowledge products including principles, laws, and theories". Mastery of concepts can be interpreted as the ability of students to understand the meaning scientifically both in theory and in its application in everyday life (Dahar, 2003). The indicator of concept mastery is that a person can be said to have mastered a concept if the person really understands the concept he is learning so that he is able to explain using his own words according to his knowledge, but does not change the meaning in it.

Game comes from English which means game. The game is an activity in which there are rules. Sadiman et al (2011), describe the game (*games*) is any contest between players who interact with each other. Games as learning media involve students in the experience process and at the same time live up to challenges, get inspired, are encouraged to be creative, and interact with fellow students in playing games (Dananjaya, 2013). Educational games or *games* are game tools specifically designed for educational purposes and to make children or students actively involved (Tedjasaputra, 2005).

According to psychologists, games are an appropriate method for learning social skills because games can create a relaxed and fun atmosphere. So that people can study well and earnestly. In addition, it has been proven that a person's behavior in games is the same as his behavior in everyday life, regarding how to make decisions, solve problems, plan things, and communicate (Saeful et al., 2010).

Snakes and Ladders is a game that uses dice to determine how many steps a pawn must take. The snake board itself is in the form of a grid of 10 rows and 10 columns with numbers 1-100, as well as a picture of a snake and a ladder. Players are drawn in lots to determine who goes first and so on.34 The game of snakes and ladders is a board game for children played by two or more people . The snake and ladder board is divided into small squares and some of the boxes are drawn with a number of “ladders” or “snakes” that connect them to other squares.

Based on research conducted at SMA Negeri 10 Samarinda, SMA Negeri 1 Marangkayu, SMA Negeri 3 Samarinda, SMA Negeri 5 Samarinda, and SMA Negeri 8 Samarinda in using the snake and ladder game, the many questions that arise actually cause student activity to increase. In addition, the concentration of students also increases, so that the cognitive content in the game is absorbed more quickly. The affective aspect can occur due to interactions between students in competing to be the best. Meanwhile, the psychomotor aspect can be shown from the activeness of students in asking, playing and discussing (Yasin et al., 2011).

The nervous system is one of the material discussions in Biology subjects at the XI grade high school education level which can generally be found in odd semesters. The nervous system is a system that works quickly in response to environmental changes that stimulate it. The nervous system is composed of nerve cells (Pratiwi et al., 2015). According to Yusa and Bala (2016), the nervous system is divided into two parts, namely the central nervous system and the peripheral nervous system. The central nervous system consists of the brain and spinal cord, while the peripheral nervous system consists of the craniospinal nervous system and spinal nervous system.

Transmission of impulses in the human nervous system can be divided into two, namely: (1). The sequence of ordinary movements can be written as follows: Stimulus > receptors > sensory neurons > brain > motor neurons > effectors; (2). The order of the reflex action can be written as follows. Stimulus >

receptors > sensory neurons > connector nerve cells in the brain or spinal cord > motor neurons > effectors (Hadi et al., 2017).

This research is expected to minimize and overcome these problems. This development is also intended to make it easier for teachers or instructors to complete existing public resources or supplement learning materials so that teaching and learning activities become innovative and educative, and understanding that was initially biased or gray becomes clear and bright, this is what researchers refer to in carry out this development research.

Based on this description, a study was carried out with the title "Development of Snake Ladder Application Learning Media on Nervous System Material to Improve Learning Outcomes and Mastery of Concepts for High School Students for the 2020/2021 Academic Year"

METHOD

The type of research used is Research and Development (R&D). The model applied in this study is the ADDIE development model (*Analysis, Design, Development, Implementation, Evaluation*) developed by Dick & Carry in (Mulyatiningsih, 2012). This study will test the application of snakes and ladders on nervous system material in improving learning outcomes and mastery of concepts for class XI students at SMA Wahidiyah , SMAN 3, SMAN 8 and SMAN 13 SAMARINDA , which is held for 2 months, starting from October - December 2020.

The purpose of this study was to determine the validity, practicality, and effectiveness of the learning media for the snake and ladder application on nervous system materials for class XI STUDENTS at SMA WAHIDIYAH , SMAN 3, SMAN 8 AND SMAN 13 Samarinda and the teacher's understanding of implementing the game application in the classroom. The technique in this study is the percentage based on the teacher and student response questionnaires, observation sheets, validator questionnaires, *pre-test* questions , and *post-test questions* filled out by the sample.

1. Learning Media Validity Data Analysis

   Calculating the validity score from the results of the expert validation questionnaire using the formula:

   P = x 100%

Table 1. Rules for Weighting Expert Assessment Points

Score	Criteria	Description
5	Very good	Very good quality, easy to understand, according to the context of understanding
4	Good	Good quality, easy to understand, need to improve the context of understanding
3	Enough	Quality is good enough, understandable enough, need to improve the context of understanding
2	Not good	Poor quality, difficult to understand, need to improve the understanding context
1	Not good	Quality is not good, difficult to understand, need to improve understanding context

(Depdikbud, 2017)

Table 2. Criteria for Validity of Learning Media

No	Percentage (%)	Validity Criteria
1	85.01 - 100.00	Very Valid
2	70.01 - 85.00	Valid
3	50.01 - 70.00	Less Valid
4	01, 00 - 50.00	Invalid

(Akbar, 2013)

2. Data Analysis of the Practicality of Learning Media
   Calculating the practicality score from the results of the teacher and student response questionnaires using the formula:

   P = x 100%

Table 3. Criteria for Assessment of Practicality of Learning Media

Value Code	Description
A	Can be used without revision
B	Usable with minor revisions
C	Can be used with multiple revisions
D	Can not be used

(Depdikbud, 2017)

Table 4. Practical Criteria for Learning Media From Student Response Questionnaires

No	Percentage (%)	Criteria
1	85.01 - 100.00	Very Practical
2	70.01 - 85.00	Practical
3	50.01 - 70.00	Less Practical
4	01, 00 - 50.00	Not Practical

(Akbar, 2013)

3. Learning Media Effectiveness Analysis
   The value of the students *' pre-test* and *post-test results was* calculated using the t-test with the statistical formula (tcount) as follows:

Description:
n = Lots of data
D = Difference *between Pre-test* and *Post-test*
n = Number of Samples
= Sample mean 1
= Sample mean 2
= Standard deviation of D

Table 5. Percentage of Effectiveness of Learning Media

Presentation (%)	Category
90-100	Very good
80-90	Good
65-79	Enough
55-64	Not enough
0-54	Not good

(Depdikbud, 2017)

The subjects in this study were class XI students at SMA Wahidiyah Samarinda (subjects for a small class trial of 10 people), class XI students at SMAN 3 Samarinda (MIPA 7 as treatment class 34 students and MIPA 5 as control class 34 students), class XI students SMAN 8 Samarinda (MIPA 3 as treatment class with 33 students and MIPA 1 as control class with 35 students), class XI students at SMAN 13 Samarinda (MIPA 1 as treatment class with 34 students and MIPA 2 as control class with 34 students). The class is taken based on the average value of the Biology subject. The object of this research is the snake and ladder application learning media on the nervous system material to improve learning outcomes and mastery of high school students' concepts.

RESULTS

Media that have gone through the implementation stage, namely small group trials at the Wahidiyah Private High School Samarinda and field trials (large group trials) at SMA Negeri 3 Samarinda, SMA Negeri 8 Samarinda and SMA Negeri 13 Samarinda were then evaluated. At this stage an evaluation is carried out to determine the effectiveness of developing snake and ladder application media on student learning outcomes and mastery of concepts. The achievement of effectiveness is measured based on the cognitive aspect by looking at the minimum completeness criteria (KKM) in biology lessons at school. The KKM score in schools in this study was 80. The evaluation was carried out by giving 10 daily test questions about the nervous system in the form of an essay that will show the effectiveness of using the snake and ladder nervous system learning media.

Development research is more directed at efforts to produce certain products and then tested their effectiveness so that they are ready for real use in the field (Sugiyono, 2013). In other words, products that are ready to be used in the field are products that fall into the "valid" category. The results of the data analysis of validity, practicality, and effectiveness can be seen in the table below.

Table 6. The results of the Snake Ladder Application Media Validity Assessment from the Validator

Assessment Aspect	Validator		Average	Criteria
	V1	V2		
General View	70.00	80.00	75.00	**Valid**
Special View	78.46	80.00	79.23	**Valid**
Application Presentation	80.00	80.00	80.00	**Valid**
Average	76,80	80.00	78,40	**Valid**

The data in Table 6. shows the results of the assessment of the validity of the snake and ladder application from media experts giving an average value of 78.40% with a valid category so that it is suitable for use in learning without revision. With the snake and ladder application learning media that uses an attractive design, in order to increase the attractiveness of students and students' enthusiasm in learning while playing the game of snakes and ladders on the nervous system material.

Table 7. Results of Language Validity Assessment from Validator

Assessment Aspect	Validator		Average	Criteria
	V3	V4		
Aspect of Readability	93.33	88.89	91.11	**Very Valid**
Application Instructions	90.00	86.67	88.33	**Very Valid**
Average	92.00	88.00	90.00	**Very Valid**

The data in Table 7. shows the results of the language validity assessment from the linguist validator providing an average value of 90.00% with a very valid category so that it is suitable for use in learning without revision. With the snake and ladder application learning media that uses simple but precise language with the level of understanding of high school students, thus increasing the attractiveness of students in taking lessons using the snake and ladder application on nervous system material.

Table 8. Results of Question Validity Assessment on Applications from Validators

Assessment Aspect	Validator		Average	Criteria
	P1	P2		
Aspect of Readability	94.67	92.00	93.34	**Very Valid**
Content and Questions	94.00	92.00	93.00	**Very Valid**
Average	94.33	92.00	93.17	**Very Valid**

The data in Table 8. shows the results of legibility validity and questions from biologist teachers (practitioners) giving an average value of 93.17% with a very valid category so that the questions in the snake and ladder application have good quality to be used in learning with little revision. Improvements made to the evaluation questions are that each question must have the same level of difficulty because the probability of getting the question is the same. In addition, the questions are obtained randomly, so the difficulty level must be the same.

Table 9. Analysis of Average Teacher Responses

No	Group	Teacher Response Results (%)
1	Small Class (SMA Wahidiyah Samarinda)	90.67
2	SMA Negeri 3 Samarinda	78.67
3	SMA Negeri 8 Samarinda	94.67
4	SMA Negeri 13 Samarinda	92.00
	Average value	**89.00**
	Category	**Very Practical**

The data in Table 9. shows the results of the biology teacher's response giving an average value of 89.00% with a very practical category so that this snake and ladder application media has good quality to be used in learning. The teacher commented that the snake and ladder application was very attractive for students to use as a companion for teaching and learning activities, and with this snake and ladder learning media students were more active in learning.

Table 10. Analysis of Average Student Responses

No	Group	Student Response Results (%)
1	Small Class (SMA Wahidiyah Samarinda)	85.07
2	SMA Negeri 3 Samarinda	82.25
3	SMA Negeri 8 Samarinda	84.63
4	SMA Negeri 13 Samarinda	79.52
	Average value	**82.87**
	Category	**Very Practical**

The data in Table 10. shows the results of student responses giving an average value of 82.87% with a very practical category so that this snake and ladder application media is practical to use in learning. Students commented that learning to use the snake and ladder application made the learning atmosphere fun, because it was fun interspersed with playing, students felt challenged, students also became easy to understand the subject matter, because it included practice questions that refreshed students' brains.

Table 11. Average Value of Student Learning Outcomes

School	Mark (%)	Category
Wahidiyah High School Samarinda	86.00 %	Effective
SMA Negeri 3 Samarinda	83.68%	Effective
SMA Negeri 8 Samarinda	81.82%	Effective
SMA Negeri 13 Samarinda	84.85%	Effective
Average value	84.08 %	Effective

The data in Table 11. shows the average value of student learning outcomes, which is 84.08% with the effective category so that the snake and ladder application media is good for use in learning.

Learning media can be said to be successful if it can improve student learning outcomes by meeting the medium to high category.

Table 12. Analysis of Student Concept Mastery

No	Group	*N-Gain*
1	Small Class (SMA Wahidiyah Samarinda)	**0.49**
2	SMA Negeri 3 Samarinda	**0.63**
3	SMA Negeri 8 Samarinda	**0.59**
4	SMA Negeri 13 Samarinda	**0.70**
	Average value	**0.60**
	Category	**Currently**

The data in Table 12. shows the average value of student concept mastery with a *Standard Gain of* 0.60 in the medium category so that the snake and ladder application media is good for use in learning. Learning media can be said to be successful if it can increase students' mastery of concepts by meeting the *Gain Standard scores* in the medium to high category.

DISCUSSION

Collecting data in carrying out this research using questionnaires, observation sheets, *pre-test* questions, and *post-test questions* which were conducted on students and teachers who were competent in the subject of Biology. According to research that has been done by Mogari David (2009) that the observation design is intended for students and teachers in filling out questionnaires that aim to show the importance of research in focusing on a condition that is happening in the process of teaching and learning activities.

This study aims to determine the validity of learning media, practicality of learning media, and the effectiveness of learning media in measuring student learning outcomes and mastery of students' concepts . Interviews in schools are more focused on the importance of the ability of teachers in the teaching and learning process, so that they will find a bright spot for the root cause of this problem in accordance with the statement put forward by Natsir (2016).

Observations were made at 5 schools in Samarinda, namely SMAN 18 Samarinda, SMAN 13 Samarinda, SMAN 5 Samarinda, SMAN 3 Samarinda, and SMA Wahidiyah Samarinda. Based on the results of student questionnaires and interviews with biology subject teachers and school staff, they explained several problems in classroom learning activities, including the lack of student motivation, conventional learning (lecture methods, less variety), and decreased mastery of concepts and learning outcomes student. The results of interviews with students were found regarding student problems related to the teaching and learning process in the classroom due to the low interest of students in the learning process, and the lack of student motivation to explore information related to the material being taught, as well as the low level of student concentration.

Facts found in the field regarding teacher problems and obstacles to the delivery of nervous system material, namely the low source of references and driving factors that make teachers only use general learning methods and media from time to time without following technological developments and problems faced by students.

The problems faced by the school have now reached a fairly large and sustainable scale (especially class XI), this is due to the increasing development of technology where students are also adjusting to the era of digital development. However, in schools themselves, they still apply learning by (conventional) methods, so that students feel bored, not interested in the learning given, especially if the material is abstract, one of which is the biology of the nervous system in class XI.

The obstacles that arise are not only from the teacher but also from the students, namely the lack of student interest in the learning process. This occurs due to the lack of interaction between teachers and students because teachers teach with a learning style that is centered and focused on general sources. Not only that, students also lack motivation to explore information related to the material being taught.

The number of obstacles in the world of education should be minimized if teachers have the motivation to develop learning tools, especially the media used in teaching and learning activities. The criteria for good Biology learning in accordance with K13 are not sourced from books, but must be from learning tools and also from the environment around the place where the learning process occurs so that students will be encouraged to develop their skills, this statement is a modification of Widiyatmoko's (2013) statement.

From the results of the research method, it was found that the snake and ladder application learning media on the developed nervous system material had good quality and was able to improve student learning outcomes and mastery of concepts. Based on the results of validity, practicality, and effectiveness, it can be concluded that the snake and ladder application learning media on the nervous system material is suitable for use as a learning medium in the classroom.

Learning activities that focus on the use of IT will be a distinct advantage for students, so that understanding and in-depth understanding of the material being taught becomes more effective and educative, and students are more confident in understanding abstract material (cannot be observed directly). Vasileiadou (2013) states that this activity will trigger students to share experiences and rarely ask the teacher for help. The final stage of this research is that teachers and students will gain an additional understanding of the use of IT in the learning process, as well as innovate new learning that improves science process skills which are the focus of teaching and learning activities.

Suggestions that can be submitted from this research are as follows. *First,* learning using snake and ladder application media as an interactive learning medium is recommended to be applied more often to train students' independence and make learning more interactive. *Second,* teachers are advised to pay attention to the time allocation needed in using snake and ladder application media, good class and time management, and supported by adequate facilities and infrastructure so that students can run the game without rushing. *Third,* it is recommended for teachers to get snake and ladder application learning media on nervous system material as a means of supporting teaching and learning activities, because this media is feasible to use.

CONCLUSION

Based on the research method and problem analysis that has been carried out with the subject of competent biology students and teachers at SMA Wahidiyah Samarinda, SMAN 3 Samarinda, SMAN 8 Samarinda, and SMAN 13 Samarinda, it can be described as follows. *First,* the validity of the snake and ladder application learning media on the developed nervous system material has very good quality in learning outcomes and students' mastery of concepts with an average percentage of 88.20%. *Second,* the practicality of learning media for snake and ladder applications on the developed nervous system material has very good quality in learning outcomes and students' mastery of concepts with an average percentage

of 85.93%. *Third,* the effectiveness of the snake and ladder application learning media on the developed nervous system material has very good quality in learning outcomes and students' mastery of concepts with an average percentage of 84.08%.

Based on the results of validity, practicality, and effectiveness, it can be concluded that the learning media for the snake and ladder application on the nervous system material is suitable for use as a learning medium in the classroom.

REFERENCE

Akbar, S. (2013). *Learning Instrument Instruments* . PT. Rosdakarya Youth: Bandung.

Arief S. Sadiman, et al, (2000). *Media Education: Understanding, Development, and Utilization* . PT. Raja Grafindo Persada, page 2: Jakarta.

Arsyad Azhar. (2005). *Learning Media* . PT. Raja Grafindo Persada: Jakarta.

Dahar, R. (2006). *Learning Strategies* . *Bandung* . PT. Rosdakarya Youth: Bandung.

Hadi, WO, Sukoco, T. (2017). *Seconds* . PT Intan Pariwara: Klaten.

Mulyatiningsih, E. (2016). *Development of Learning Models. (On line). from (http://staff.uny.ac.id/sites/default/files/pengabdian/draendangmulyatiningsih-mpd/7cpengembangan-model-pembelajaran.pdf).* Retrieved January 30, 2020.

Pratiwi, DA, Maryati, S., Srikini, Suharto, Bmbang S., et al. (2015). *Biology of SMA volume 2 for class XI based on the 2013 curriculum.* Erlangga: Jakarta.

Purwanto. (2009). *Evaluation of Learning Outcomes* . Student Library: Yogyakarta.

Ratna Wilis Dahar. (2011). *Learning and Learning Theories.* Erlangga: Jakarta.

Sugiyono. (2015). *Educational Research Methods: Quantitative and Qualitative Approaches and R n D. CV.* Alphabeta: Bandung.

Tedjasaputra, MS (2005). *Play, Toys and Games for Early Childhood Education.* Grasindo: Jakarta.

Vasileiadou, Pinelopi D. (2013). *An Analysis of Students' Communication during Group Work in Mathematics* .Electronic Journal of Vocational Colleges-June (Special Issue) 2013

Widiyatmoko, A. (2013). *Development of Characterized Integrated Science Learning Tools Using a Humanistic Approach Aided by Cheap Teaching Aids.* JPII (online),Vol 2 (1) (2013) pages 76-82

Yusa, Manickam Bala. (2016). *Books for active and creative students studying biology 2 for SMA/MA class XI specialization in mathematics and natural sciences.* Grafindo Media Pratama: Bandung.

Zaman, Saeful , *et.al.* (2010). *Creative Games Choices To Increase Self and Group Potential.* Gagasmedia: Jakarta.