

Development Of Problem Based Learning Multimedia In Sma Negeri 1 Kotamobagu

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Abstract

This research was conducted at SMA Negeri 1 Kotamobagu, Kec. North Kotamobagu, Kotamobagu City in class XI IPA G. The time of this development research was carried out in the even semester in January – February of the 2021-2022 academic year at SMA Negeri 1 Kotamobagu.

The object of this research is the development of multimedia learning based on PBL (Problem Based Learning) on the material of the reproductive system as a media to support student learning. Research Procedures The ADDIE Model (Analysis, Design, Development, Implementation, and Evaluation) is a development research model that researchers take. The resulting product is in the form of linear learning multimedia based on PBL (Problem Based Learning) on the material of the reproductive system whose contents are in the form of anatomy and physiology of human reproduction, human development, and abnormalities that occur due to reproductive problems and others that can be used for teachers as a reference in teaching and for students in increasing interest and learning outcomes which have implications for the achievement of learning objectives. After developing and validating multimedia, the final results of the assessment of media experts are 86.6% and material experts are 95.33% with very valid criteria, and the results of the assessment of biology subject teachers are 96.66% with very valid criteria and final results the response of students as much as 90.4% with very good criteria. So that the resulting multimedia product is very feasible to be used as a learning medium for reproductive system material in high school.

Keywords: learning multimedia, biology, from based learning

Introduction

Gametogenesis or the process of gamete formation is the process for the formation of sperm (spermatozoa) and the formation of eggs (ova) in both parents to form new individuals.

The process of spermatogenesis occurs in the seminiferous tubules in several stages followed by maturation in the epidymis and this process starts from mitotic division and the growth of sperm stem cells or spermatogonia into primary spermatocyte cells. The end result of this process is spermatids (spermatozoa) which are haploid (n) with 23 chromosomes.

Hormones that affect this process are gonadotropin hormone, FSH (follicle stimulating hormone), LH (luteinizing hormone), and testosterone hormone.

The process of oogenesis occurs in the ovaries (ovaries). Primordial germ cells in the embryo undergo mitosis to produce diploid oogonia ($2n$), each oogonia develop into diploid primary oocytes. The primary oocyte then undergoes meiosis I division to form cells of different sizes, namely the secondary oocyte and the first polar body. The secondary oocyte then undergoes a second meiotic division to produce an ovum and a second polar body. The ovum is larger than the second polar body. The first polar body splits into two polar bodies called the plain. The second polar body and the plain then degenerate. In oogenesis, one functional ovum or egg cell and three non-functional polar bodies are produced and decay along with the menstrual process.

Menstruation, Fertilization and Pregnancy

In women, if fertilization does not occur, the endometrium will shed out of the body. In general, the menstrual cycle occurs every 28 days. On the first to the fourteenth day there is growth and development of primary follicles stimulated by FSH. In this development, the oogonia cells will divide by meiosis and produce one haploid egg. When the follicle develops into a mature Graafian follicle (follicle de Graaf), this follicle also produces the hormone estrogen which stimulates the release of LH from the pituitary. This period of follicular growth is called the follicular phase.

Fertilization

Fertilization (fertilization) is the process of union of gametes between male gametes (sperm) and female gametes (ovum). Fertilization is the activity of the egg cell and the unification of genetic material through the fusion of the sperm nucleus with the egg nucleus which produces a zygote (Ferial, 2013).

Pregnancy

Pregnancy and childbirth involve the development of the zygote accompanied by hormonal cooperation from conception to birth. After ovulation or the release of an egg, the egg will enter the fallopian tube (oviduct). The ovum will be surrounded by many sperm, but only one sperm can fertilize the egg. Then, there is a union of the egg nucleus with the sperm nucleus to form a zygote containing half the mother's traits and half the father's traits. The zygote divides by mitosis until the final form when the embryo consists of 32 cells and is called a morula. This morula then immediately forms the blastosol cavity and is called a blastocyte. The outermost layer of the blastocyst is called the trophoblast. These blastocytes move towards the uterus for implantation (attachment to the uterine wall).

The uterine wall becomes thick, soft, and tender, and secretes milk-like secretions (uterine milk) as food for the embryo. The embryo eventually becomes a fetus that gets food from the mother's body through the placenta. The membrane covering the embryo consists of the amnion, chorion, vitelline sac and allantois. When the growth and development of the fetus has been perfect, the fetus will come out through the vagina. The fetal sheath will rupture, followed by expulsion of the placenta. During pregnancy, progesterone and estrogen stimulate the growth of the mammary glands, but after giving birth, the hormone prolactin stimulates milk. Evaluation (evaluate). The evaluation stage is the final stage of the ADDIE development model. In this last stage, the results of the assessment of the products developed are discussed.

The evaluation stage of the ADDIE development model consists of two types of evaluation, namely formative evaluation and summative evaluation. Formative evaluation is an evaluation that is used to determine the quality of the product produced and as a result, improvements or revisions will be made to the media products made. This formative evaluation has actually been carried out at the development stage. Summative evaluation is an evaluation used to determine students' mastery of the competencies to be taught, this evaluation is usually equipped with a pretest and posttest (Tung, 2017).

Methods

This research was conducted at SMA Negeri 1 Kotamobagu, Kec. North Kotamobagu, Kotamobagu City in class XI IPA G. The time of this development research was carried out in the even semester in January - February of the 2021-2022 academic year at SMA Negeri 1 Kotamobagu.

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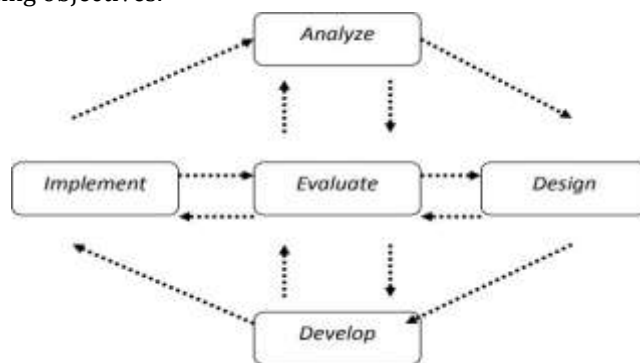


Figure 1 ADDIE Development Stage(Tung, 2017)

The following are the steps of development research using the ADDIE model:

Analysis

The analysis phase was conducted to determine the need for the development of PBL-based biology learning multimedia (Problem Based Learning). At this stage, a preliminary study was carried out, namely observations of the condition of teacher and student learning facilities and interviews with biology subject teachers. This preliminary study is expected to obtain several aspects of needs analysis, namely:

- a. Curriculum analysis, which is to analyze the curriculum used in SMA N 1 Kotamobagu by looking at the syllabus used by the class XI subject teachers for the even semester. After knowing the applicable curriculum, it can be seen what competencies to be achieved in learning.
- b. Analysis of Student Needs and Learning Media, aims to determine what type of media will be used in the development that is suitable for students.
- c. Material analysis was carried out by identifying the main material of the reproductive system in the syllabus of biology class XI even semester. The subject matter is then arranged systematically to be displayed in PBL-based learning multimedia (Problem Based Learning).

The results obtained from the calculation of the questionnaire assessment using the equation formula above, will be matched with the eligibility criteria or validity criteria as well as responses or responses to multimedia. From the match of these criteria, it will be known whether the learning media that the researcher developed is feasible or not. To be able to give meaning from decision making whether or not the media is feasible by using the conversion level of achievement and can be processed by presenting a percentage using a Likert scale as a measurement scale.

The expert validators are two media expert lecturers and two material expert lecturers, as well as a biology subject teacher who will assess the validity of the developed multimedia. Assessment is done by filling out a questionnaire containing statement items and using a Likert scale. This scale is in the form of a statement and is followed by five responses, for the need for data analysis in the form of media expert validators, material experts and biology subject teachers, the answers can be given a score as table 3.5 below:

Table 1 Rating Scale on Answer Choices

No	Qualification	Score
1.	Very good	5
2.	Well	4
3.	Enough	3
4.	Not enough	2
5.	Very less	1

(Riduwan, 2014)

Table 2. Interpretation of Media Validity Score

Level Achievement	Validity Level	Information
85.01%-100.00%	Very Valid	Can be used without revision
70.01%-85.00%	Quite Valid	Could used, but necessary little revision
50.01%-70.00%	Less Valid	Recommended not to use because it needs a major revision
01.00%-50.00%	Invalid	Cannot be used

Adaptation from (Akbar, 2013)

Analysis of student response data

Student responses at SMA Negeri 1 Kotamobagu are small group trial data that will assess the feasibility of the developed multimedia. Assessment is done by filling out a questionnaire containing statement items and using a Likert scale. This scale is in the form of a statement and is followed by five responses, for the purposes of data analysis in the form of student responses, the answers can be given a score as table 3.7 below:

Table 3. Student Response Assessment Score

No	Evaluation	Score
1	Strongly agree	5
2	Agree	4
3	Enough	3
4	Don't agree	2
5	Strongly Disagree	1

Sugiyono in (Kartini & Putra, 2020)

After students evaluate the questionnaire, quantitative data will be obtained and then it will be accumulated based on the

following formula (Riduwan, 2014):

Information :

Q: Earning percentage

=0

$f0$: Total score obtained N : Total score / maximum score

Table 4. Interpretation of Student Response Scores

No	Score Interval	Category
1	81 - 100	Very good
2	61 - 80	Well
3	41 - 60	Enough
4	21 - 40	Not enough
5	0 - 20	Very less

Sugiyono in (Kartini & Putra, 2020)

Results and Discussion

The product produced in this study is a learning media packaged in multimedia based on a learning model, namely PBL (Problem Based Learning) which has student center characteristics so that it can assist students in learning the material of the Reproductive System. This multimedia development uses the stages of the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation) developed by Dick and Carey. The following are the stages of ADDIE in research: The analysis stage is carried out to obtain field facts, at this stage the researcher conducts a preliminary study during the KKN (Real Work Class) Merdeka Learning Teaching Assistance Program at SMA Negeri 1 Kotamobagu on May 5, 2021. Teacher 1 interviews are carried out face-to-face, while teacher interviews 2 conducted via online via WhatsApp in the preliminary study obtained the following results:

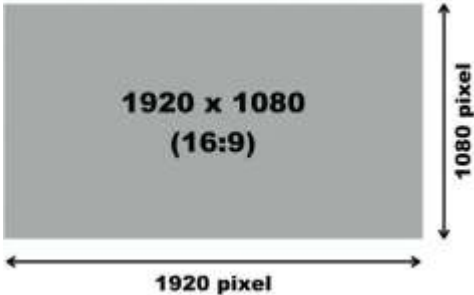
The second stage, namely design, is the stage of designing the multimedia product that will be developed. At this stage the researcher designs the design, formulates the KD (Basic Competence), the learning objectives that will be pursued and displayed in the learning multimedia, and makes learning scenarios starting from the initial display and the final display by paying attention to other supporting components.

- Multimedia Design Draft:

Table 5. Multimedia Design Design

Aspect	Information
Title	Development of Biology-based Learning Multimedia PBL (Problem Based Learning) at SMA Negeri 1 Kotamobagu

Development (develop)

	<p>While the ratio is 16:9 as shown below</p>  <p>So as to produce multimedia products with the best conditions or results with HD resolution of 1080p (pixels).</p>
Frame Rate	25fps

development stage is the advanced stage or realization of the design stage. This stage includes the creation of multimedia, multimedia reviews or validating multimedia by experts and revision of multimedia products. The stages of researchers in developing multimedia are as follows:

Multimedia Creation

Researchers make learning multimedia based on the results of the multimedia learning scenario design from the initial view to the end. The development of this learning multimedia cannot be separated from using a variety of main applications and supporting applications. The main applications used are Wondershare Filmora, Canva, and Power Point; in order to create content and material content in the form of video animations, insertion of supporting elements, insertion of reference images, interesting slides, and transitions, while for supporting applications used are SuperMe to create characters, the default application of Apple i-Phone Recording and WhatsApp to record or dubbing to produce audio narration in (Mp3) format. Making multimedia is made based on the design aspect or design, in terms of indicators or learning objectives and in terms of material. At the stage of making multimedia there is a process of editing, mixing, cutting and packaging content. The editing process using the Canva application, PowerPoint to create material content and the addition of supporting elements in this process is the unification of the multimedia aspects and the material that will be included in the multimedia.

The editing process using the SuperMe application aims to create characters, and is packaged in classroom nuances for visualizing the classroom background. Based on the data in the table above, it shows that the overall results obtained based on the validators of the two material experts are 95.33% with very valid criteria. The feasibility of this multimedia product as a learning multimedia was obtained from the results of material expert validation which was validated by a Biology Education Lecturer, Faculty of Mathematics and Natural Sciences, Manado State University.

Implementation The aspects assessed on the biology subject teacher assessment sheet consist of two aspects, namely the suitability of the content of the material and the suitability of the learning media.

Table 4.8 Validation Results of Biology Subject Teachers

No	Aspect	Percentage	Criteria
1	Conformity of Content	96.66%	Very Valid

2	Appropriateness of Learning Media	96.66%	Very Valid
Average		96.66%	Very Valid

**Complete questionnaire data in the attachment*

Based on the data in the table above, it shows that the overall results of the aspects obtained based on the validator of biology subject teachers are 96.66% with very valid criteria. The feasibility of this multimedia product as a learning multimedia was obtained from the results of material expert validation which was validated by a biology subject teacher at SMA Negeri 1 Kotamobagu.

The aspects assessed on the student response assessment sheet consist of two aspects, namely the content of the material and formative tests and multimedia presentation. The following is the result of the recapitulation of the response assessment of SMA Negeri 1 Kotamobagu students to multimedia in table 4.8.

Table 4.9 Recapitulation of Student Response Assessment Results

No	Respondent Name	Percentage	Criteria
1.	Inayah Haris (IH)	90%	Very good
2.	Hasrianti Mokoagow (HM)	92%	Very good
3.	Adinda Andrea P. Mokoginta (AM)	90%	Very good
4.	Dicky Karundeng (DK)	92%	Very good
5.	Gabriela AJ Salunusa (GS)	94%	Very good
6.	Dehlia Natalia Paat (DP)	100%	Very good
7.	Ebenheazer Anugrah Kuhu (EK)	94%	Very good
8.	Gusti Abdullah Ramadhan (GR)	94%	Very good
9.	Aidia Toluhu (AT)	92%	Very good
10.	Ganezza Putri W. Laoh (GL)	86%	Very good
11.	Inayah Nurhasana Wonggo (IW)	82%	Very good
12.	Gerald Bastian Gamalangit (GG)	88%	Very good
13.	Gladis Pricilya Mamonto (GM)	82%	Very good
14.	Halfanandra Ake (HA)	92%	Very good
15.	Elis Fajriah Mamonto (EM)	88%	Very good
Average		90.4%	Very good

**Complete questionnaire data in the attachment*

Based on the data in the table above, it shows that the overall results obtained are based on the assessment of student responses as much as 90.4% with very good criteria. The percentage of the results of the assessment of student responses to multimedia is presented in the bar chart in Figure 4.42.

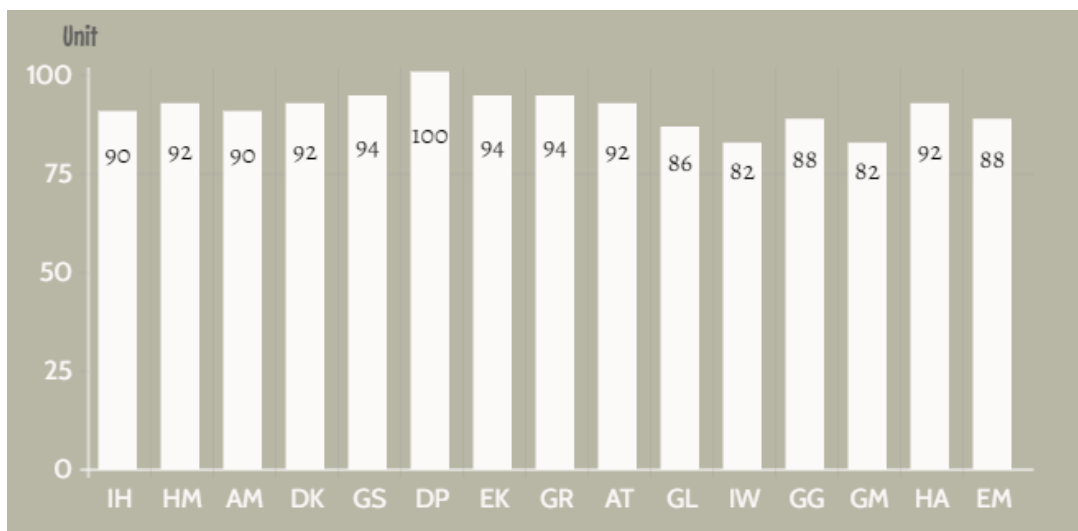


Figure 4.42 Percentage of Student Response Results

Evaluation (evaluate)

The evaluation stage is the final stage of the ADDIE development model. In this last stage, the results of the assessment of the products developed are discussed. The evaluation results come from the assessment of comments and suggestions from validators, subject teachers and students.

The evaluation stage of the ADDIE development model consists of two types of evaluation, namely formative evaluation and summative evaluation. Formative evaluation is an evaluation that is used to determine the quality of the product produced and as a result, improvements or revisions will be made to the media products made. This formative evaluation has actually been carried out at the development stage. Summative evaluation is an evaluation used to determine students' mastery of the competencies to be taught, this evaluation is usually equipped with a pretest and posttest (Tung, 2017).

In this study using only formative evaluation, this is adjusted to the research objective, namely to develop learning multimedia in order to obtain the feasibility of the developed multimedia product, so that it is not to determine the effectiveness of the multimedia product. The evaluation stage carried out by this researcher refers to the revisions in the previous stage from the validators of media experts and material experts in the form of suggestions and input to improve the multimedia developed so that it becomes good or suitable for use as teaching materials or learning media tools. Based on the results of the feasibility test of multimedia development, it can be seen and concluded that it is like this multimedia for use from media experts with a percentage of 86.6%, so from the percentage that multimedia is very valid and can be used without revision. From the material experts, they get a percentage of 95.33%, so from the presentations that multimedia is very valid and can be used without revision in terms of material. After being validated by media and material experts, it is continued with implementation to determine the feasibility of multimedia before it is disseminated. The implementation process with the percentage of biology subject teachers is 96.66% with a very valid conclusion and can be used without revision and the percentage of student responses is 90.4% with a very good conclusion. Then the final results of research data will be obtained collectively both from media expert validators, material expert validators,

If the score for the multimedia assessment shows the criteria are very valid or valid and the response is very good or good, then it can be declared feasible to be used as learning. So it can be concluded that the PBL-based biology learning multimedia (Problem Based Learning) is very valid and very feasible to be used as a learning medium with an assessment score that has been achieved.

Learning media is an important component for students and teachers in carrying out the learning process. According to Latuheru in (Hasan, 2021) suggests that media are materials, tools, methods, or techniques used in learning activities, with the intention that the process of educative communication interaction between teachers and students can take place appropriately and usefully. Therefore, learning media is a tool that can be used by teachers as intermediaries to build

educative communication interactions to students which aims to stimulate students to be motivated and be able to participate in full and meaningful learning. One class of learning media is Multimedia, Multimedia is a tool to convey messages that combine two or more elements of a variety of learning media such as, sound (audio), images, graphics, text, photos, films, and animations in an integrated manner (Kustandi & Sutjipto, 2011), where this multimedia is a combination of several media and integrated into one product, such as research products (Rengkuan, 2020) which uses a variety of media and applications such as Autoplay Media Studio, Camtasia v8, Photoshop and Microsoft PowerPoint in creating multimedia at UNIMA. Multimedia has a main function, namely the learning process becomes more interesting, there is an interactive process, the amount of teaching time can be reduced and the learning process by teachers and students can be carried out anytime and anywhere because of its flexibility (Kustandi & Sutjipto, 2011). The use of multimedia in the classroom provides benefits during learning such as in research (Hasbiyanti, 2020) students are more enthusiastic and active during learning by using multimedia, students tend to be more active in reading, actively asking questions, observing pictures and videos presented via smartphones. In this research, multimedia development is carried out which contains animated videos, audio, text, reference images, and contains interesting transitions. The role of animation in learning can attract students' attention and strengthen motivation (Utami, 2011) usually this type of animation is in the form of writing or pictures that move uniquely. The role of the video transition also has a function for students' interest in watching the learning multimedia that is made and making the resulting video even better such as cinematic videos. Transition itself is a transition from one situation/place/action to the next action (Sutrisno, 2020). The transition used is a transition from one video media to another with interesting effects. In making multimedia using 3 default Canva transitions, 1 Wondershare Filmora transition and 1 PowerPoint transition which is a default transition. The duration in this multimedia at the first meeting is 16 minutes and the second meeting is 15 minutes which in the article (Firmansyah, 2020) human endurance in watching non-interactive videos is only 15 minutes in conditioned situations. So there is no need to make material that is too long, it takes about 15 minutes of solid learning videos and also contains complete material that has been planned in the narrative before making. As a complement to multimedia learning is equipped with evaluation questions, according to (Asrul, Ananda, & Rosnita, 2014) the function of the evaluation is to determine the effectiveness and efficiency of the broad learning system including learning media. So when using multimedia learning students understand more quickly seen from the evaluation of these students. Students remember the material they are learning better and it is easier to answer the questions that have been given to students. In addition, the multimedia produced is based on the PBL (Problem Based Learning) model which is a problem-based model with student center characteristics (student-centered learning) which presents a stimulus for real-life problems so as to increase student activity and achievement and motivation to learn. According to Slavin in (Syamsidah & Suryani, 2018) the PBL learning model aims to make participants strong and independent, accustomed to taking initiative and skilled in using critical thinking to solve problems. In research (Noer & Gunowibowo, 2018) it was proven that the use of the PBL model is effective in learning, especially for mathematical critical thinking compared to conventional ones, seen from the percentage value of students by 60% in good categories and also in research (Bujung, Tanor, & Ogi, 2021) using PBL learning models and using multimedia applications makes learning more interesting and makes students find and solve problems themselves so as to train students to think creatively in the problem solving process. This is in line with field events that make students active in learning after being presented with multimedia which is developed based on a problem-based learning model.

Conclusion

After developing and validating multimedia, the final results of the assessment of media experts are 86.6% and material experts are 95.33% with very valid criteria, and the results of the assessment of biology subject teachers are 96.66% with very valid criteria and final results the response of students as much as 90.4% with very good criteria. So that the resulting multimedia product is very feasible to be used as a learning medium for reproductive system material in high school.

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