

## Development of Multimedia-Based Worksheets as a Teaching Material on Sub-Material of Invertebrates

(Received 17 March 2019; Revised 31 May 2022; Accepted 31 May 2022)

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**DOI: 10.30870/jppi.v8i1.5139**

### **Abstract**

The purpose of this study is to develop multimedia-based student worksheets in invertebrates sub materials and to describe both the response and scoring result of tenth grade students in Pontianak who learn to use the instructional materials. This research method is Research and Development. The development steps carried out are: 1) potential and problems, 2) information gathering, 3) product design, 4) design validation, 5) product design improvement and 6) product testing. In the product trial phase, a sample of 208 students was used. The validation from both material and media experts on multimedia-based student worksheets in invertebrate sub-materials was confirmed as valid. The student responses at schools with KTSP and curriculum 2013 on the use of multimedia-based student worksheets in Invertebrates sub material were in the fair positive and positive category. The average values obtained by students in schools that applied the KTSP and 2013 curriculum were 40.08 and 54.16 respectively. It was concluded that multimedia-based worksheets were appropriate to be used as teaching material in invertebrates sub material.

**Keywords:** Teaching Material, Student Worksheets, Multimedia, Invertebrate

## INTRODUCTION

The development of information and communication technology (ICT) has had an impact on the world of education, especially in learning (Albirini, 2006; Donnelly & O' Reilly, 2011; Cholifah & Wibawa, 2016; Abadi et al, 2018; Muharram et al, 2018; Bano et al, 2018; Mustadi et al, 2022; Asrizal et al, 2022). The use of technology in learning nowadays has not yet fully developed. Learning technology is still limited to the use of powerpoint, interactive media flash, virtual simulation, and the web usage as additional learning sources (Pinasthika & Muji, 2013; Yusuf, 2010). Meanwhile, there are a lot of computer technology applications available for the teacher, such as Computer Based Learning (CBC), Web- Based Learning (e- learning), Computer Assisted Learning (CAL), and Audio- Visual Based Learning (Rusman, 2012). Technology can also be maximized to develop teaching materials for the teacher (Richards, 2005; Astuti et al, 2018; Lesmono et al, 2018; Fitriyana et al, 2020; Makawawa et al, 2021; Isnaeni et al, 2021). Teaching materials are materials used to help teachers and students in the learning process (Prastowo, 2015; Syamsurizal & Devi, 2017; Wusqo et al, 2021). According to Subhan (2016) in (Elwi et al, 2017)

teaching materials generally consist of knowledge, skills, and attitudes that students must learn to achieve predetermined competency standards. Teaching materials as materials need to be selected by teachers with significant criteria, according to needs, usefulness, human development, and the structure of scientific disciplines. Yet these days most teachers still use the two-dimensional teaching materials like textbooks and student worksheets.

Student worksheets circulating on the market so far have been made in printed form in the sheets of paper containing material and tasks that must be done by students. In addition, student worksheets that are widely circulating in the market generally show more suitability in the nature of material content than the formulation of the objectives (it is difficult to find the composition of worksheets that are suitable with the demands of the learning objectives formulation) (Rosalina & Suhardi 2020). This condition can occur because teachers generally find it difficult to develop these media. The ability of teachers in developing teaching materials is still very low. There are several factors that cause this to happen, one of which is the lack of training on the manufacture/development of teaching materials by the relevant agencies

(Nugraheny et al, 2018; Awe & Ende, 2019). Complaints often heard from students are that the student worksheets only contains practical questions to fill in the empty hours or as a homework (Rohman & Amri, 2013). In addition, the existing teaching materials are felt to be unable to make it easier for students to understand a subject matter (Junaedi et al. 2018; Damopolil & Kurniadi; 2019; Dwipayana et al, 2020). The purpose of using LKS is to help students find their own concepts taught since the student worksheets contains fundamental activities to maximize understanding completed with the achievement indicators from the learning outcomes taken (Syamlan in Pinasthika et al, 2013; Gani et al, 2017).

According to Yusuf (2010) the existence of printed worksheets is still very minimal and not yet effective as a learning tool, in terms of appearance, content and practicality. As a result, worksheets by students becoming less optimal because students work with feelings of compulsion, lack of enthusiasm, and carelessness. In order for the learning objectives to be achieved and learning to be attractive to students, it is necessary to develop the student worksheets to fit the learning objectives or to arrange it differently with the student worksheets that has been circulating in the market both in

terms of appearance and quality. For this reason, it is necessary to optimize worksheets in learning in terms of both appearance and quality. This can be done by transforming the student worksheets through the use of information and communication technology.

The use of information and communication technology in the student worksheets transformation to multimedia-based worksheets can be done by combining the use of text, graphics, audio, video and animation with the support from computers. Multimedia is the use of text, graphics, animation, images, videos, and sound to present information (Najjar, 1996; Ahmad et al, 2021). Interactive multimedia-based worksheets consist of materials and exercises in the form of computer-based questions, students are led to learn independently just by following the instructions for applying the product (Prianto et al, 2017; Arista & Kuswanto, 2018). Mayer (2005) mentions that multimedia is the presentation of words and images simultaneously. The words can either be in printed or spoken text. Meanwhile, the images can either be in static graphics (illustrations, diagrams, maps, or photos) or dynamic graphics (animation or video) . Multimedia-based worksheets have a better role compared

to printed worksheets because they have a complete media that involves utilizing all five senses, so that the imagination, creativity, fantasy, and emotion of students can be developed in a better direction (Rusman, 2012). In addition, Mayer (2005) also suggests that a person will learn better in pictures and words than just words.

Invertebrata sub-material as one of the sub-materials taught in biology requires visualization so the students can understand the concept easier. This visualization is needed because that sub-material learns about morphological characteristics which require a direct observation. Habitat of some invertebrate phyla in the ocean also makes it difficult to be observed easily. Besides, there are phenomena difficult to observe directly by the students, one of them is the breeding process. For this reason, it is necessary to have an alternative learning media so that all objects and phenomena in the Invertebrate sub-material can be presented in the classroom.

To overcome the problems, multimedia worksheets were developed in the invertebrate sub-material. Multimedia-based worksheets in this study is a student guide to carry out activities and it refers to the informative presentation combining the use of text, images, animation, photos, videos, and

sounds in sub-invertebrate material, which includes nine phylum characteristics, its classifications and the roles of phyla in life. The development of multimedia-based worksheets teaching material is in line with the learning process that prioritizes personal experience through the process of observing, questioning, associating, experimenting and networking (forming networks).

Some researchers have conducted tests to determine the effect of using technology in learning on students' learning outcomes and activities. Yusuf (2010) reported an increase in student learning outcomes after being given learning using computer-based interactive worksheets. The average score of 6.33 increased to 6.90. Completeness 73.33% increased to 76.67%, the students' response on the use of interactive student worksheets was also good. Likewise & Neo, 2007; Muller et al, 2008; Rosen, 2009; Wolters & Rosenthal, 2000 also stated that the application of interactive multimedia gained positive responses from students, the use of multimedia in learning process became easier to do and was a good alternative to traditional classes

Based on the explanation above, it is necessary to develop multimedia-based student worksheets teaching materials in invertebrate sub-material for

the tenth grade students. Multimedia-based student worksheets are arranged differently from student worksheets circulating in schools. The instructional material for multimedia-based worksheets developed is expected to help students find their own concept and achieve the expected learning goals.

## **METHOD**

This research is included in research and development (Research and Development / R & D), a research method that is done to produce certain products, and test the effectiveness of these products (Sugiyono, 2010). The development steps taken are: 1) potential and problems, 2) collecting information, 3) product design, 4) design validation, 5) product design improvements and 6) product trials. The stages of making multimedia teaching materials for worksheets were adopted from Sadiman et al in Munadi (2008) include: writing synopsis, making storyboards, writing scripts, making video recordings, making audio recordings for narration, editing, and mastering. This study uses several data collection techniques including interviews and observations that are used to determine potential and problems. Documents for information collection. Questionnaire/questionnaire used for product validation and product testing.

The research carried out includes the stages of determining the potential and problems related to the importance of teaching materials as a support in the biology learning process, the stages of gathering information related to analyzing the syllabus, invertebrate materials and teaching materials used in the learning process, the stages of product design, namely by designing content and components. -the components contained in the multimedia-based student worksheets teaching materials, the product validation stage aims to determine the feasibility of this multimedia-based student worksheets as teaching materials, the product revision stages are carried out as suggested by the validator and the product trial stage is carried out by carrying out the learning process in seven schools with samples as many as 208 students. Subjects in this study were high school students in Pontianak taken from seven senior high schools; Senior High School A, Senior High School B, Senior High School C, Senior High School D, Senior High School E, Senior High School F and Senior High School H. The number of research samples for product trials was 208 students. The sampling technique used is stratified random sampling technique. According to Ulya, et al (2018), the stratified random sampling technique is a

sampling process by dividing the population into strata, then selecting a random sample for each stratum. The distribution of the population is based on schools that use the KTSP and the Curriculum 2013. In each population, schools are then randomly selected that are willing to be the sample in the study.

The instruments for collecting data included expert material validation sheets, media expert validation sheets, student response questionnaires to teaching materials, and evaluation of learning outcomes. Data analysis on teaching materials for multimedia-based worksheets was carried out both qualitatively and quantitatively. Qualitative analysis was obtained in the form of suggestions and comments from material experts and media experts. Quantitative analysis was obtained from media validation sheets, material validation sheets, response questionnaires and student learning outcomes through expert test assessments, field tests, response questionnaires, and learning outcome tests. Before the instrument was used, the validity and reliability tests were carried out. Validation sheets for material experts and media experts were prepared with modifications from Khabibah (2006). Material expert validation criteria consist of aspects of format, content, and language. Media

expert validation criteria consist of aspects of simplicity, integration, emphasis, learning experience, balance, shape and color. Criteria for modified student response questionnaires from Oyelekan & Olorundare (2009) include Clarity and Impact on Learner. Tests of learning outcomes in sub-invertebrate sub-materials are adjusted to the indicators and learning objectives in the tenth grade senior high school syllabus.

The conclusion of the feasibility of multimedia-based worksheets as teaching materials was based on validity criteria according to Khabibah (2006):

$3 \leq RTV \leq 4$ : valid

$2 \leq RTV \leq 3$ : quite valid

$1 \leq RTV \leq 2$ : invalid

RTV = Average total validity

Analysis of student response questionnaire data used a Likert scale. The conclusion of the students' response to the multimedia-based student worksheets teaching material in the invertebrate sub-material was by determining the average of the students' positive response. The next was to determine the response category or responses given by students to a criterion by matching the percentage results with positive criteria according to (Khabibah, 2006) :

$85\% \leq RS$ : Very Positive

$70\% \leq RS < 85\%$ : Positive

$50\% \leq RS < 70$ : Pretty Positive

RS <50%: Not Positive

RS = student response to certain criteria

Analysis of learning outcomes were done by giving a score on the results of student evaluation tests. Data was processed by calculating the number of correct answers to student tests. To change the score to a value used the following formula: Value = ( $\Sigma$  Student's raw score) / (Ideal maximum score) x 100

To change the score to a value, it required a provision that each student's correct answer was given a score of 1 and the wrong answer was given a score of 0.

## RESULTS AND DISCUSSION

This research departs from the problems that occur in the learning process in sub-invertebrate material, both experienced by teachers and students. The problem is the urgency to transform the form of LKS as teaching materials that are currently circulating in the market, in order to produce teaching materials that utilizes technology or to be called as multimedia worksheets. The teaching material for this multimedia-based worksheet is used by students as a guide to conduct sub-invertebrate learning activities in tenth grade senior high school. This student worksheet is composed by combining text, images, animation, photos, videos and sounds. Multimedia includes various

combinations of text, images, graphics, animation and video elements that have been digitally manipulated so as to display a fun projection and having aesthetic value (Khoiriah et al, 2016; Djamas et al, 2018; Widodo et al, 2020).

In this study, to compile the student worksheets, there was a prior analysis to the curriculum 2013 syllabus conducted in the sub-materials of invertebrates, material analysis, and formulation of learning objectives. The Basic Competencies in the sub-invertebrate material are applying the classification principle to classify animals into phyla based on anatomical and morphological observations and linking their roles in life. The learning objectives formulated are: 1) differentiating phyla in groups of Invertebrate animals based on their general characteristics, 2) classifying groups of Invertebrate animals, 3) mentioning how to reproduce phyla in groups of invertebrate animals, 4) explaining the role of Invertebrates animals in everyday life. Furthermore, recording and taking pictures of invertebrate objects in Kabung Island, Lemukutan Island, Randayan Island and Sedau Beach which are located in West Kalimantan Province. From this activity, a design of teaching materials namely multimedia-based worksheets was

produced and will be developed (blue print).

Other designs developed in this study were lesson plan, student response questionnaires, and evaluation tests. Lesson plans were prepared for two meetings, RPP contains elements of (a) introduction, (b) core activities and (c) closing activities. Lesson plans also contain the identity of subjects, standard of competence, Basic Competence,

indicators, learning objectives, learning materials, time allocation, learning approaches and methods, learning steps, tools or materials or learning resources, learning media, and evaluation.

The entire instruments compilation was validated by material experts and media experts. The results of the validation of material experts and media experts are presented in Table 1 and Table 2.

Table 1. Results of Material Expert Validation

Aspect	Average Aspect
Format	3.70
Content	3.62
Language	3.72
Standard deviation	0.05
Total Average	3.68

Table 2. Results of Media Expert Validation

Aspect	Average Aspect
Simplicity	3.60
Integration	3.80
Emphasis	3.40
Interractivity	3.40
Balance	3.70
Form	3.70
Color	3,80
Standard deviation	0.17
Total Average	3.63

Based on the results of the validation data analysis, the material experts and media experts found that the instructional materials for multimedia-based worksheets were arranged in valid categories with grades 3.68 and 3.63. Revisions were made to multimedia-based worksheets on the advice and input from media and material expert validators. Presentation of video

material using multimedia is considered to be able to make most students understand and process the information provided because the video material presented also combines visual and verbal aspects (narration and text) (Doymus et al, 2010; Supsakova, 2016). Mayer (2005) states that students who prefer learning by listening to spoken words will focus more on the narrative



provided, students who prefer to learn by reading the text will focus more on the sentences on the screen, and students who prefer to learn with using pictures will focus more on the visuals presented.

In connection with the media validation, the advice from material experts was the additional information about several important terms related to sub-material invertebrate material such as: bilateral symmetrical, asymmetrical, parazoa, eumetazoa, diploblastic, triploblastic. For this reason, improvements were made by adding glossaries to teaching materials. According to Sugiyono (2010) after the product design was validated through discussions with other experts, it can be

recognized as its weaknesses. The weakness was then trying to be reduced by improving the design.

Teaching materials that have been improved were then tested. The trial was conducted on 7 schools consisting of 4 schools that applied KTSP and 3 schools that implemented the curriculum 2013 with a total number of students was 208 people.

At the trial stage, the learning process is carried out by each tenth grade biology teacher in schools. The next stage was given a question to find out the student learning outcomes and questionnaire to find out the students' response to the student worksheets teaching materials.

Table 3. The Results of Students' Response Questionnaire Analysis

School	Indicator	Interval (%)	Response
Curriculum KTSP	<i>Clarity</i>	64,39	Fair Positive
	<i>Impact on Learner</i>	64,12	Fair Positive
	Students' Response over the worksheets	64,26	Fair Positive
Curriculum 2013	<i>Clarity</i>	74,38	Positive
	<i>Impact on Learner</i>	76,26	Positive
	Students' Response over the worksheets	75,32	Positive

Student's responses in this study consisted of two indicators; clarity and impact on students. From the data analysis it was shown that students whose schools apply the 2013 curriculum had a positive response of 75.32% while students whose schools are still implementing the educational unit level curriculum (KTSP) have a fairly positive response of 64.26% of the use of multimedia-based worksheets.

The students' positive response to the use of multimedia-based student worksheets teaching materials is in line with the Curriculum 2013 application in which students are expected to have competencies in the form of attitudes, knowledge, thinking skills, and psychomotor skills. Learning steps with a scientific approach are considered to be fulfilled by using multimedia-based worksheets. This teaching material is

considered to be able to accommodate three learning domains. This multimedia-based student worksheet not only displays questions that must be done by students, but before answering the student worksheets, students first listen to explanations relating to the material. Each student is in a central position and active in learning, so it can be said that the teacher is only a facilitator.

Although the response of students from schools implementing KTSP is less positive, the learning process carried out has been student-centered. The implementation of learning has led students to be able to seek knowledge and find knowledge by themselves. This is in line with This is in line with the Ministry of National Education (2003) where biological education emphasizes the provision of direct experience to develop competencies so that students are able to explore and understand the natural surroundings in a scientific manner. Biology learning is directed to find out and do so that it can help students to gain an understanding of the natural surroundings. Learning by using multimedia-based teaching materials

make it easier for students to understand the concept (Zahra, 2015; Rubini et al, 2018).

Student learning outcomes in the sub-invertebrate material are obtained after students finish learning by using multimedia-based worksheets. From the observation, it is known that during the learning process by using multimedia learning materials, students are very enthusiastic in observing and active in recording information obtained in learning because of the display of images both original and youtube, the narrator's explanation shows the characteristics of invertebrate animals. A multimedia is said to be practical if users (teachers and students) feel that this multimedia is easy and effective to use (Rodgers & Withrow, 2005; Akbar, 2016; Surjanti et al, 2018). In line with Rusnita & Rodiah research (2010) the use of worksheets in learning can increase student activity. In addition to the compilation of good worksheets, it is one of the requirements to achieve the learning in learning. Student learning outcomes in the invertebrate sub-material are presented in Table 4.

Table 4 Student Learning Outcomes

School	Score Obtained	Value
Curriculum KTSP	10,02	40,08
Curriculum 2013	13,54	54,16

The learning outcomes obtained show that in schools that implement the

2013 curriculum, the average score is higher than schools that apply KTSP.

From the average value obtained, it is known that students from all schools have not achieved classical completeness value because learning by using multimedia learning materials is something new for students so that some new students begin to adapt to the learning process. During this time, students are accustomed to get the explanations from the teacher. On the other hand, with the use of teaching materials for multimedia-based worksheets, students are required to find the concepts. Therefore the teacher needs to change his role in the learning process, no longer as a transformer but as a facilitator and motivator for students. As stated by Harjali, 2016; Fadhilaturrahmi, 2018; Ameliawati et al, 2021 teachers not only play a role in delivering learning material in the form of memorization, but also regulate the environment and learning strategies that enable students to learn. In addition, Usmeldi 2015; Febriani et al, 2017; Gunawan et al, 2019; Aguilera-Hermida, 2020, Listianingsih et al, 2021) stated that in the learning process a situation is conducive to developing creativity, motivation and insight, and the application of technology. The use of worksheets in learning can encourage students to process the material being studied, either independently or in groups (Kopniak, 2018; Fendi et al, 2021).

In connection with student learning outcomes, from interviews with several biology teachers, information was obtained that the low student learning outcomes due to evaluation test questions given in the invertebrate sub-material were mostly in the form of analytical questions (C4). Nonetheless, all the teachers stated that the teaching materials for multimedia-based worksheets were felt to be very helpful and made it easier for teachers to deliver learning material in the invertebrate sub-materials. From the results of the interview it is also known that the examples of invertebrate animals displayed in teaching materials help students in understanding the characteristics of each invertebrate phylum, so that students not only memorize the lesson. The appearance of instructional materials in the form of examples of invertebrate animals which directly recorded from real environments, such as invertebrate animals that live in the sea, can also make time efficient in learning so the teacher does not need to bring students to have a direct observation to the field. Another benefit from the use of multimedia-based worksheets is to increase students' sense of love and care for the environment.

## **CONCLUSION**

Multimedia-based worksheets in the tenth grade senior high school for

sub-invertebrate material is suitable to be implemented as a teaching material.

#### ACKNOWLEDGMENTS

We would like to express our deepest gratitude especially to DIKTI for providing funds to carry out this Competitive Grant research. We also expressed our gratitude to the students, lecturers and all parties who have kindly helped through the process of this research

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