

## ***I-INVETEBRATA AS AN ANDROID-BASED LEARNING MEDIA FOR MOLLUSCS, ARTHROPODS, AND ECHINODERMS IDENTIFICATION AND ITS INFLUENCE ON STUDENTS' MOTIVATION***

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### **ABSTRACT**

*In Zoology course, students often have difficulty to identify several invertebrates. Android-based learning media is currently an alternative way of solving some problems during the learning process. Therefore, android-based learning media that assist students to identify invertebrates was developed in this study. This research method used to research and development model (R&D) developed by Borg and Gall (1983) that consisting 10 steps, that are research and data collection; planning the educational product; developing the product's preliminary form; initial field testing; the first revision of main product; main field testing; operational product revision; operational field testing; final product revision; and dissemination. The validation results from the material expert I, material expert II, and media experts were 96.6%; 94.3%; and 94.7%, respectively. That results concluded I-Invertebrata was feasible for use in learning but requires minor revision. Furthermore, the results of quasi-experimental research that was analyzed by using analysis of covariance test showed the learning motivation of students who use I-Invertebrata is significantly higher than students who do not use I-Invertebrata.*

**Keywords:** *I-Invertebrata, Invertebrate Zoology, learning motivation*

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### **INTRODUCTION**

Biology is one branch of science that learns all about life (Reece, Urry, Cain, Wasserman, Minowsky, & Jackson, 2011). The learning objects in biology include all organisms, including invertebrates. Invertebrates are animals that do not have the vertebral column (Wijayanti et al., 2015). In university, invertebrate is studied in the Invertebrate Zoology course. The object of Invertebrate Zoology study includes the characteristics of morphology, anatomy, physiology, habitat and the role of invertebrates in the ecosystem. In addition, in the course, students are required to be able to identify and classify the various types

of invertebrates that they found in the environment.

The tool that could be used to identify invertebrates is dichotomous keys, the tool that presents a series of statements consisting of two lines of description of the characteristics of an organism with opposite features (Randler, 2008). To understand the dichotomous keys, somebody must understand the nature and the diversity of animal shapes being identified.

To understand the principles of invertebrate identification, sometimes, course held a field study that could facilitate a contextual learning process. Contextual learning is a learning that links learning materials to real-world contexts (Fraser, Tobin, & McRobbie, 2012). Through this learning, students are empowered to think

critically and effectively in understanding a surrounding phenomenon (Nasution & Rezeqi, 2015). However, sometimes, these activities require adequate learning media, time and cost.

The information obtained from interviews with Biology Laborans and Zoology Invertebrate course lecturer at the University of Muhammadiyah Malang (UMM) in February 2016, during the field study, students had difficulty focusing on complex invertebrate materials, thus making learning a bit saturated. One of the causes is the media used by students in assisting invertebrate identification during field study were only general maritime books and journal articles. Those learning sources just contain the description of invertebrates and the research results. This condition made teach less relevant, causing students to be less confident and less satisfied with their invertebrate identification results. This fact shows that students' learning motivation, as well as the utilization of instructional media in Invertebrate Zoology course at the UMM, has not developed optimally.

The learning motivation is very important in the learning process (Filak & Sheldon, 2008; Kusurkar, Cate, Vos, Westers, & Croiset, 2013). Motivation also affects how many students participate in a learning activity, or how many students absorb the information/concepts taught by the lecturer. In addition, learning motivation also affects life skills (Kiswoyowati, 2011). A person who has good life skills will be able to overcome various problems of life.

Related to the interview results, it needs improvement in the learning process that involves invertebrate identification activities at the UMM. One of the efforts that could be done is to utilize innovative and contextual learning media that is able to improve the invertebrate learning process and could increase student learning motivation. One of that is a media that is able to identify invertebrates by utilizing android-based smartphone devices.

The utilization of android to support the learning process is called mobile learning or m-learning (Mehdipour & Zerehkafi, 2013). Implementation of m-learning is an attempt to overcome a number of educational problems as it allows the creation of innovation and could help students and teachers in obtaining information (West, 2013). In addition, the use of android-based applications in learning-known as blended learning-could help users

(students) understand the material being studied (Husamah, 2015a, 2015b; Purwanti, 2013). Estimated, with ease of access, there is the acceleration in the use of android to overcome obstacles in the learning process (Indriwati & Dedi, 2013).

The results of further observations, through 31 questionnaires distributed by researchers in the second-semester students majoring in Department of Biology Education at the UMM who are taking the course of invertebrate courses; it is known that 84% of students have smartphone devices based on android. However, this smartphone device is mostly used for SMS, phone, or chat. This indicates that most students still use their smartphones just for social media. In addition, with so many android users, there is great potential to apply android-based learning media to those students.

Based on the information, it is proposed a research that develops the "*Identifikasi Invertebrata*" (*I-Invertebrata*) or invertebrate identification as an android-based learning media to identify Molluscs, Arthropods, and Echinoderms and its effect on students' learning motivation. The development of *I-Invertebrata* is an essential study because it provides various benefits, both theoretical and practical. The theoretical use of this present study is to describe and develop the repertoire of science education and learning, especially on the development of learning media. The practical uses of this study are: 1) for students, the results of the *I-Invertebrata* implementation is to have a positive effect on student motivation and 2) for lecturers, the results of the study can be used as input material and one of the references for lecturers in choosing learning media.

## METHOD

The development of *I-Invertebrata* based on android used a research and development (R&D) development model developed by Borg & Gall (1983) consisting of 10 steps.

### Research and Data Collection

At this step, the information related to human resources with skills, knowledge, and media development experiences were collected as well as the research for content on the media were conducted. At this step, an inventory of Molluscs, Arthropods, and Echinoderms species in the tidal zone of Gatra Beach, Malang

District, East Java province, Indonesia was conducted.

### Planning The Educational Product

Research and development (R&D) planning includes: 1) estimating funding, personnel and time; 2) formulate validator qualification; and 3) compiling research instrument consisting of student motivation questionnaire, student motivation observation sheet, expert material questionnaire and media expert and student response questionnaire.

### Developing the Product's Preliminary Form

At this step, preliminary media was developed. The preliminary media was in the form of draft or storyboard.

### Initial Field Testing

Initial field testing was conducted by presenting several experts including media expert and material experts to assess the designed media. Each expert was asked to assess the design, so, it could be known about the weaknesses and the advantages of the designed media.

### The First Revision of Main Product

Once the media design was validated through discussion with the experts, it could be known the weakness of the media. The weakness was then tried to be reduced by revising the design.

### Main Field Testing

The test was conducted on a small scale by involving 9-second semester students of Department of Biology Education, at the UMM which were taken based on students' ability (high achievement, middle and low achievement). The reason for choosing students with different ability level was to know the evaluation of the media from the different student who has different ability level. After implemented *I-Invertebrata*, students were given a questionnaire to find out the students' response to the learning media.

### Operational product revision

After conducting a main field testing and have known the weakness, next step was to revise *I-Invertebrata* in order to design the media that more perfect.

### Operational field testing

*I-Invertebrata* was tested on a wider scale. In this step, a quasi-experimental research was conducted to find out whether the *I-Invertebrata* could significantly be motivated students or not. The data obtained from this step was then tested using analysis of covariance (ANCOVA). The designs at this step are presented in Table 1.

**Table 1.** A quasi-experimental research design in operational field testing step

Group	Pretest	Treatment	Posttest
Experiment Class	T <sub>1</sub>	using <i>I-Invertebrata</i>	T <sub>2</sub>
Control Class	T <sub>1</sub>	without <i>I-Invertebrata</i>	T <sub>2</sub>

### Final Product Revision

The final media revision was conducted after operational field testing and if there were still the weakness of *I-Invertebrata*.

### Dissemination

The dissemination was conducted if the learning media that has been tested was declared as an effective media and feasible for mass production. Dissemination conducted by presenting the learning media in research seminar and dissemination the learning media to several students from several universities.

## RESULTS AND DISCUSSION

### Research and Data Collection

At this step, it has been found a person who has the skills, knowledge, and experiences were willing to create a media application based on android and web server. In addition, from the inventory of Molluscs, Arthropods, and Echinoderms in the tidal zone of Gatra Beach, it was found 42 species from six classes, those were Gastropoda, Malacostraca, Asteroidea, Ophiuroidea, and Echinoidea.

### Planning the Educational Product

The results of this step were: 1) the time required for the research was 6 months, the activity starts from initial observation until final media revision; 2) the material experts were senior lecturers i.e. Atok Miftachul Hudha and Agus Dharmawan, and the learning media expert was Henry Praherdiono; and 3) the instruments were student motivation questionnaire and observation sheets, material

validation questionnaire and learning media validation questionnaire.

**Developing the Product's Preliminary Form**

*a) I-Invertebrata*

“Identifikasi Invertebrata” (abbreviated to I-Invertebrata) is the name of the media that has

been developed in this study. *I-Invertebrata* is an android application that serves to identify the types of Molluscs, Arthropods, and Echinoderms. The *I-Invertebrata* displays could be seen in Figure 1.



**Figure 1.** The displays of *I-Invertebrata*

*b) Web Server*

Web server is a website that serves to process and store data used by *I-Invertebrata* applications. When the database on the web server changes then the data on the *I-Invertebrata* application also changed automatically. The web server displays could be seen in Figure 2.

**Initial Field Testing**

The validation score from the material expert I and II was 96.6% and 94.3%, respectively, which means the material was feasible for use in learning but required minor revision. The advice from the material experts was: 1) the images should not be just black and white; and ) all images need to have the description.

The media expert's validation score is 94.7%, which means the media is eligible for use in learning but required minor revision. The

suggestion from the media expert was: 1) direct usage instructions need to be provided on the main page; 2) hardware usage instructions (smartphone screen type) and android versions (Android 4.0, Android 4.1, etc.) need to be provided; and 3) the media needs to be uploaded to the play store so that it could be downloaded en masse.

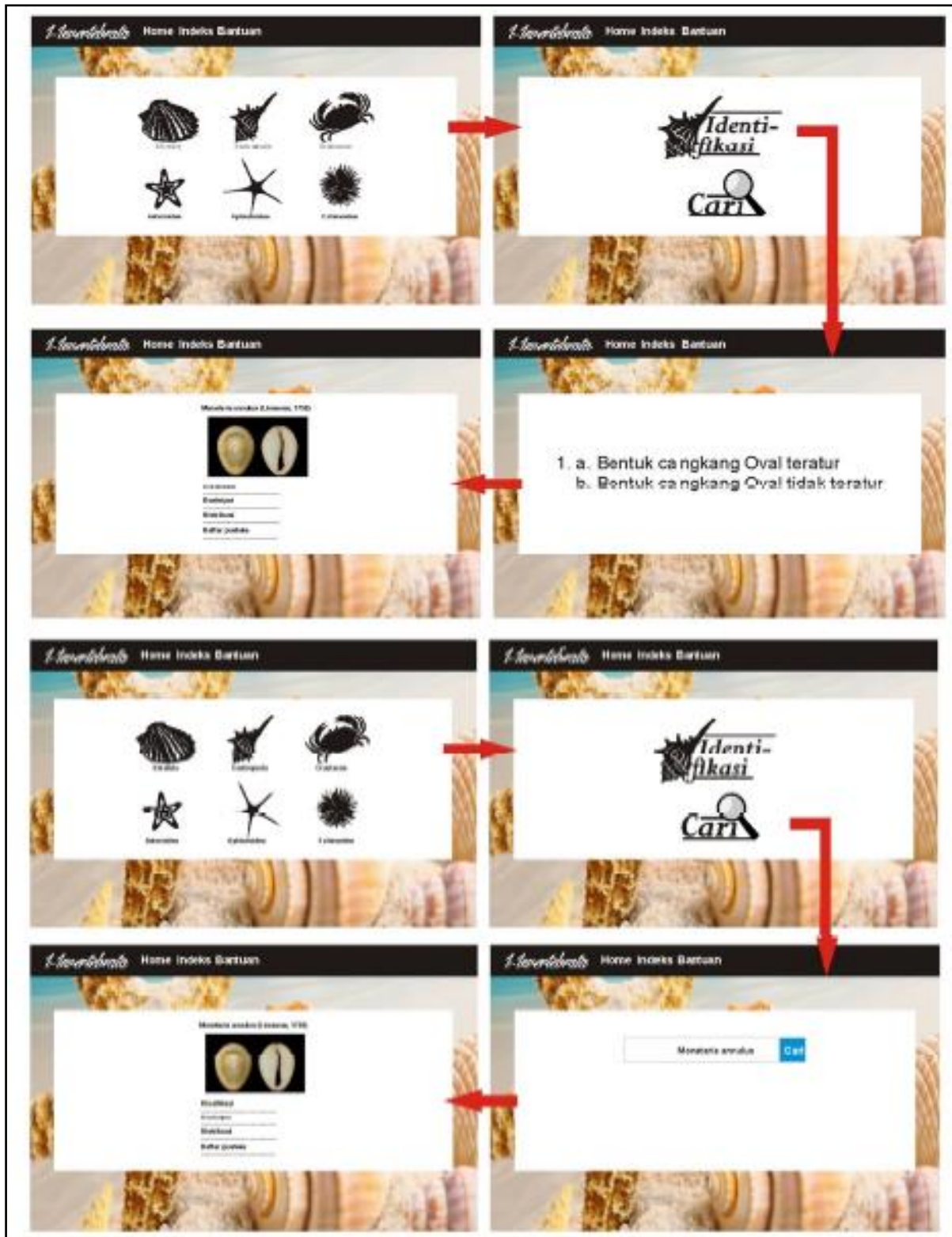
**The First Revision of Main Product**

In this step, the main product was revised. At the revision step, not all images were full colored due to there are several morphologies of invertebrates that look more contrast and clearer when the image of these invertebrates is black and white. In this step, the description has been added to all images. The usage instruction has been also added to the main page. However, the suggestion from media expert that advice to upload the media to the play store was not conducted due to limited of funds and time.

**Main Field Testing**

The score of student responses to *I-Invertebrata* was 88.3% which means media

has been feasible and can be used in learning but required little revision. The total students' responses to the *I-Invertebrata* are shown in Table 2.



**Figure 2.** The displays of the web server

Students' comments on *I-Invertebrata* were generally said that *I-Invertebrata* was an

interesting media and helpful in identifying Molluscs, Arthropods, and Echinoderms. But,

there was some point that needs to be improved, such as the need to add an explanatory image to each key determination in order to enable the student to understand every key determination. Figure 3 is the documentation of the main field testing step.

**Table 2.** Results of student responses to learning media

No.	Aspects	Percentage (%)	Category
1	Attractiveness	89	Feasible
2	Clarity of material presentation	85	Feasible
3	Efficiency	91	Quite Feasible
4	Interactivity	88	Quite Feasible
<b>Average</b>		<b>88.3</b>	<b>Feasible</b>



**Figure 3.** The main field testing step (Source: Authors' research documentation)

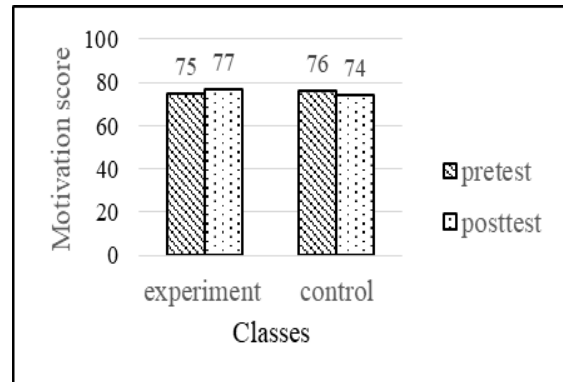
**Operational Product Revision**

At this step, an explanatory image of the determination key to enable the student to understand every key determination were added.

**Operational Field Testing**

Based on students' learning motivation from observation sheet, the students' learning mean score in experimental class was 74%, whereas in control class was 64%. From the data, it could be seen that during the learning process, students who use *I-Invertebrata* appear more motivated in following the learning process when compared with students who do not use *I-Invertebrata*.

Beside from the observation sheet, the students' learning motivation data was also obtained through pretest and posttest. The mean pretest score of students' learning motivation in the control class was 76 whereas the post-test score was 74. The mean score of students' learning motivation in the experimental class was 75 whereas posttest score was 77. The graph of students' motivation mean score is shown in Figure 4.



**Figure 4.** The graph of pretest and posttest score in experimental and control class

Then, the data were analyzed using ANCOVA. The result of ANCOVA test could be seen in Table 3.

**Table 3.** The summary of ANCOVA test result

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	789.3	2	394.7	11.2	0.000
Intercept	294.1	1	294.1	8.4	0.006
Pretest Motivation	650.4	1	650.4	18.5	0.000
Class	195.7	1	195.7	5.6	0.022
Error	1863.1	53	35.2		
Total	320471.2	56			
Corrected Total	2652.4	55			

Based on the result, F value was 5.567 with p-value was 0.022, p-value <  $\alpha$  ( $\alpha = 0.05$ ). Thus, H0 was rejected and the research hypothesis that states there are significant differences between students' learning motivation in the experimental class with students in the control class was accepted. The adjusted mean score in experimental class was 77.212 whereas control class was 73.458. Thus, the learning motivation of students who use *I-*

*Invertebrata* is significantly higher than students who do not use *I-Invertebrata*.

The student response score on *I-Invertebrata* was 80% which means media was feasible and could be used in learning but still required minor revision. Students' comments generally stated that *I-Invertebrata* were attractive, innovative, and useful for identifying invertebrates. Furthermore, students stated *I-Invertebrata* were more reliable. However, there were some notes that need to be fixed, such as the visual displays were less interesting, the menu was not directly displayed on the main page, and need to be added a share menu with the aims the students could share the identification information to the other friends. Figure 4 is the documentation of the operational field testing step.



(a)



(b)

**Figure 4.** The operational field testing step in experimental class: (a) identification process and (b) identification results presentation (Source: Authors' research documentation)

### Final Product Revision

In this step, several revision have been conducted, such as revising the display of icons, backgrounds, menus that directly displayed on the main page, and adding the share menu that aims to enable students to share their identification results to social media (email, Facebook, Twitter, and the other social media), as well as adding the contact menu so that students could give a criticism or suggestions to developers.

### Dissemination

This step was conducted through national research seminar and dissemination the learning media to several students at the UMM and Universitas Negeri Malang (UM). In this research, *I-Invertebrata* as a learning media that could improve students' learning motivation in Zoology Course has been developed. The findings obtained in this study is *I-Invertebrata* able to improve student's motivation to learn. This finding is in line with some previous researchers who conducted research on the positive impact of learning media on the learning process (Alqahtani & Mohammad, 2015; Lee, 2015). Alqahtani and Mohammad (2015) research show that the use of Say Quran which is an android-based learning media has a relationship with the appearance, satisfaction, and behavior of students, whereas, in Lee's research, the use of mobile phone can increase the academic motivation of learners.

The characteristics of *I-Invertebrata* that use original images made *I-Invertebrata* as an interesting learning media. Furthermore, *I-Invertebrata* is an easy operation media. Those two factors contribute to improving students' attention.

This explanation is in line with Nugrahani (2007) that stated the use of the image in learning media is an effective way to improve students' absorptive capacity and improve the students' understanding of the lessons. Moreover, the use of the image as a learning media is more effective to convey information or messages as well as more facilitate students during learning something (Arguel & Jamet, 2009). Pan and Pan (2009) also reported the presence of images can make it easier for students to understand what they are reading.

In addition, the use of key determination using *Bahasa Indonesia* led learning to more effective. This condition also led the confidence of the students to increase. Students were more understanding of the material and were more confident with their invertebrate identification results. This self-confidence is one of the important characteristics to achieve optimal learning achievement (Salirawati, 2012). Students who are more confident about a subject generate more motivation during the learning process.

Based on this study, *I-Invertebrata* is the learning media that useful for improving Invertebrate Zoology Course process. In addition, in the future, the presence of *I-Invertebrata* could also facilitate the practice of Zoology practical activity based on authentic-based research. The idea to design Zoology Course based on authentic-based research is necessary due to in the last few decades, various research has recommended lecturing activities that facilitate students to do authentic-based research (Fauzi, Corebima, & Zubaidah, 2016; Fauzi & Ramadani, 2017; Widowati, Nurohman, & Anjarsari, 2017). In these learning, students will design and conduct their own research, meanwhile, the lecturer only provides the basic themes for their research. With the presence of *I-Invertebrata*, students will more easily perform their research activities when their research procedure require identifying of various invertebrates.

## CONCLUSION

Students' motivation is one factor that plays an important role in the success of the learning process. When a lesson becomes tedious or matter becomes increasingly difficult to understand, the motivation of students tends to decrease. One alternative solution to handle the condition is by presenting learning media into the learning process.

*I-Invertebrata* is an android-based media that has been developed in this study. The validation results from material and media experts concluded *I-Invertebrata* was feasible for use in learning. Moreover, based on quasi-experimental research that has been conducted at operational field testing test, *I-Invertebrata* has been proved could improve students' learning motivation in Invertebrate Zoology Course at the UMM. *I-Invertebrata* could be the

alternative way to improve the learning process of Zoology course.

It is recommended for lecturers to use *I-Invertebrata* as the solution of the obstacle when student face difficulty in identify invertebrates. However, *I-Invertebrata* still needs to be refined to be more perfect. Related to that, The database on the web server needs to be added by conducting an inventory study on the other beach or collecting data generated by the other inventory reports from other researchers.

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