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IMPLEMENTING CONTEXTUAL BIOLOGY GAME LEARNING (CBGL) IN DIGITAL ERA WITHPTERODOVELA IN SMARTPHONE TO IMPROVING SENIOR HIGH SCHOOL STUDENT'S ABILITIES IN LEARNING DIVERSITY OF BRYOPHYTA AND PTERODOPHYTAIN INDONESIA

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Abstract

The aim of this study are (1) Developing Pterodovela Digital media the diversity of bryophyta and pterodophyta for senior high school students (2) to analyze the feasibility of Pterodovela as learning media. (3) determine the effectivity of contextual biology games learning (CBGL) using Pterodovela to improve student's achievement and students activity. Methods: This research combines between the educational research and development and experimental research. R&D consists of ten steps: (1) research and information collecting, (2) planning, (3) develop a preliminary form of product, (4) preliminary field testing, (5) main product revision, (6) main field testing. (7) operational product revision, (8) operational field testing, (9) final product revision. (10) implementation. Field testing conducted at 2 senior high schools in Indonesia as many as 96 students. Experimental research design that used was"Randomized Control group pretest-posttest design. Methods of data analysis using percentages description and statistical test with t-test. Conclution: Digital pterodovela very feasible to use in contextual biology game learning (CGBL), received positive response from students and teachers, and effective to improve student's achievement and learning activities in biology. T-test results of student's achievement t count = 3.531> t table = 1.645 and learning activities is t=2.25 > t table = 1.645.

Keywords

Contextual Biology Game Learning, Pterodovela, Senior High School Student, Diversity of Bryophyta and Pterodophyta

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1. Introduction

Biology is one of the science subjects that help students to understand the environments, and has an objects of learning which can be found immediately around the student (Rohwati et al., 2012; Idris et al., 2008). But some of the material have very complex diversity and not available in nature around the students or in very limited number. One of the examples is the diversity of bryophyta and pterodophyta. Therefore it is necessary to facilitate with learning media for students to studying Biology. According to Prasetya et al (2008) and Warsita et al (2008) learning media are tools that helps teacher in providing students' understanding of a concept. Along with the global changes in the development of knowledge and technology, related to education in the school system, teachers are required to develop a learning media but

learning media currently get less attention from teachers (Sutjiono et al., 2005). When students open biology textbooks, students will see a page that full of text, sometimes pictures that is so small and unclear. The more thick book that they read, the more small words that students will get. This problems make them so bored and not motivated to learn.

Based on the results of the media needs analysis in five senior high schools in Indonesia, instructional media that had been used less varied. The teachers use instructional media on the material of mosses and fern diversity such as textbooks and modules, but students are lessly interested in the media so that students feel tiredly and sleepy. Many students want more diverse of learning media that used by the teacher in mosses and fern which has an attractive appearance, practical and easy to understand, convenient for viewing, can stimulate students to learn, easy to use, and based on modern technology. So, it need for the development of instructional media on the material of fern and mosses in the form of pterodovela. Pterodovela or Pterodophyta Photonovela. Photonovela is the form of photographs that made as real as possible which is applied in the form of a story, but the story is created in digital form based on Android smartphone, which can be operated in the mobile media. Based on the report of Aji e al (2011) More than 75% of middle school students in the world have mobile phones, and this number will continue to increase along with the development of information and communication technology. Mobile phone is an important tool for communicating, but the developments are very rapid currently create mobile phone with android application (Wahyu et al., 2008). Android-based smartphones can be used not only to communicate but also for learning, one of the examples is the application of interesting learning media. Most of students realize android application as a form of entertainment, but as a way of learning that is challenging and fun. If Android can be used as a means to convey a compelling story fotovovela shaped, of course, can also be used to deliver learning materials. Based on this potential used of smartphone it is necessary to apply contextual biology games learning (CBGL) in digital era based on android application.

Contextual learning is a learning based on everyday life phenomena (Wardani, 2008). In this case photonovela to be developed that is based on local potention the diversity of bryophyta and pterodophyta in Medini forest kendal districts Indonesia. Based on the results of preliminary observations showed that bryophyta and pterodophyta in Medini forests had greatly variation. This is because the habitat of bryophyta and pterodophyta are moist areas, so that forest sites are located in the area that has a high humidity that is very suitable for bryophyta and pterodophyta

life. Plants that studied are the type of liverworts (hepaticopsida), hornwort (antheropsida) and mosses. It also conducted research the types of ferns such as horsetail (Equisetum) and true fern (pterophyta). Based on the Results of the study need to develop an instructional media in the form of photonovela that innovative and interesting. The aim of this study are (1) Developing Pterodovela Digital android Media based on diversity of bryophyta and pterodophyta for senior high school students. (2) To analyze the feasibility of Pterodovela as learning media. (3) Determine the effectivity of contextual biology games learning (CBGL) using Pterodovela to improve student's achievement and student activity in teaching and learning process.

2. Methods

2.1 Research Approach

This study combines Educational Research and development and experimental research. Stages of the research process of R & D based on Brog and Gall (1983) consist of ten steps: (1) Research and information collecting, (2) Planning, (3) Develop a preliminary form of the product, (4) Prelimina1y field testing, (5) Main product revision, (6) Main field testing. (7) Operational product revision, (8) Operational field testing, (9) The final product revision. And (10) dissemination and implementation.

2.2 Time and place

Bryophyta and pterodophytadiversity research carried out in the Medini forest, that located in Kendal, Central Java, Indonesia. Time of research conducted in the second semester of academic year 2014/2015, on March until September 2015. The product testing conducted in 2 secondary schools on Indonesia: Senior high School 1 Jepon and Senior high School 1 Kendal.

2.3 Stages of research

Research and information collecting is done by conducting research of bryophyta and pterodophytadiversity in Medini forest the location used is in the area of the river flow. Then the identification is done with parallel keys, recording of data in the form of descriptions and classifications, create of herbarium, at this stage also conducted a media needs analysis study at 2 schools in Indonesia.

- Planning and develop preliminary form of product, Planning consists of a flowchart compilation, making draft media, Outlines of Contents and storyboard of Pterodovela. (1) create a flowchart media and make outlines of media content. (2) The manufacture of a

derived materials that discuss the content of the material. (3) the preparation of the story board that discusses more details about the object such as display, text, audio, narration, animation, color, the design of media content and other aspects that should be included in Pterodovela. (4) The media creation with Adobe air with finding and selecting a variety of scripts to be used. Minimal hardware used in developing multimedia is a personal computer (PC) with these specs: Intel Pentium Dual core 2.0 GHz or higher, 128 MB RAM, hard drive 150 MB Monitor SVGA with a resolution of 1024 x 768, the operating system Windows 7 (5) finishing manufacture program. After making the media completed compiled into the application form.

- Prelimenary Field Testing / feasibility of Pterodovela is taken using eligibility criteria of instructional media by used a questionnaire to the media expert and material expert.

2.4 Data Analysis Method

- The data analysis of Pterodovela feasibility

Analysis of the questionnaire data on media experts and material expert response is used descriptive percentage techniques. The scale of measurement variables in this study refers to the Likert Scale 1-4 (Arikunto et al., 2006). Scores were then calculated using the formula below:

$$PV = R/MS \text{ X } 100\% \quad (1)$$

Which is PV = the percent value, R = score that obtained, and MS = maximum score. Criteria for eligibility level media according to Sugiyono et al (2006) are presented in (Table 1).

Table 1: *Criteria for eligibility level of Pterodovela media*

Interval Criteria	Criteria
81% ≤ PV< 100%	Very Well
62% ≤ PV < 81%	Good
43% ≤ PV < 62%	Enough
33% ≤ PV < 43%	Less
PV < 33%	Bad

2.5 The Design of Research

The design of study for product testing` used is "Randomized Control group pretest-posttest design". The design of the study are presented in (Table 2).

Table 2: *The Design of "Randomized Control group pretest-posttest design"*

Group	Pretest	Treatment	Posttest
Experiment	Y1	Xa	Y2
Control	Z1	Xb	Z2

Experimental method involving research samples in the form of two groups of students, which is experimental group and a control group consisting of 1 grade in 1 school to field testing and 2 classes of 2 schools to operation field testing. Biology subject to the experimental class learning using pterodovela, while the subject to a control class is teached using conventional methods.

3. Result and Disscussion

3.1 The Results of Research and information collecting

The observation made in the Medini Forest, Kendal discovered 21 species of ferns, consisting of one class (leptosporangiate fern) and 14 families. While data mosses show that found 9 Order of mosses: Metzgeriales, marchantiales, Jungermanniales, Anthocerotales, Notothyladales, Bryales, Hypnales, Leucodontales, Politricales. Where the order is divided into 11 families that are: Aneuraceae, marchantiaceae, Metzgeriaceae, Plagiochelaceae, Ricciaceae, Anthoceritaceae, Notothyladaceae, Brakeage, Hypnaceae, Leucodontaceae, Polytricaceae.

3.2 Develop prelimenary form of Product

Applications of Pterodovela size is 15.2 MB (Mega Byte), with named Medini. This application use Indonesian. This innovative product can be operated in all types of smartphone multimedia phone that have IOS or Android application, such as samsung, nokia, and others. Pterodovela publishing the results presented in (Figure 1).

Figure 1: *Results of Pterodovela published that is ready to use at smartphone multimedia phone.*

The menu tha had been made are 6, with 3 main menu consists of competence, materials, and plant diversity in Medini forest, and additionals ie evaluation, profile, and references. Display menu of Bryophyta pterodophyta diversity is presented in (Figure 2).

Figure 2: *The preview of Pterodovela before revision*

3.3 Eligibility of Pterodovela (Prelimenary Field Testing)

Pterodovela feasibility tested by two experts whom are media experts and material expert (prelimenary field testing), as well as through trial use by students and teachers in learning. Testing carried out in two phases thay are field testing and operation field testing. A teaching material is said to be feasible if the assessment by experts on teaching materials in accordance with the standards of eligibility, have a high degree of acceptability, and effectively applied in learning. Assessment of teaching materials include a feasibility component of content, language and presentation. With the standard of this assessment, it is expected that all instructional materials including pterodovela that had been developed in this study meet the standards teaching materials to produce a quality instructional materials.

Feasibility of Pterodovela material based on validation results are presented in (Table 3).

Based on data in (Table 3) can be seen that the Pterodovela feasible to be used as learning media, the level of material in classical eligibility is 95.62% in very well criteria.

Table 3: *Eligibility of Pterodovela according to matter expert*

Assessed aspects	Percentage
Complete Material	95%
Linkage between core competencies and base competency in curriculum	94,67%
The material accuracy	100%
Presentation of material	90%
Communicative and interactive	91,6%
Aspects of language	100%
The average in the overall material feasibility	95,62 %
Eligibility criteria Pterodovela material that is very Well	

The results of validation in terms of media are presented in (Table 4). Based on the validation results in (Table 2) it can be seen that Pterodovela reach very well criteria. Pterodovela validated the feasibility of the four main aspects. Classically percentage of feasibility Pterodovela obtained 94.17%.

Table 4: *Feasibility of Pterodovela according to media experts*

Assessed Aspects	Percentage
Engineering software (usability)	100%
Audio and visual communication	92,36%
Other aspects: the design of games	95,50%
The average of overall media feasibility	94,17%
The eligibility criteria in terms of media is Very Well	

3.4 Main product revision of Pterodovela

Based on the revised design of media expert and material expert, the design of materials and quizzes made more attractive to the adventure game in the Medini forest, with a character named Velo as presented in (Figure 3).

Figure 3: *Display one of the games of pterodovela (mosses and fern exploration in Medini Forest) after revised*

Based on the revised learning media, the first design are the pieces of plants images separately. At this quiz players will pair the pieces of the picture in the box that is provided to form the correct image. After a successful pairing player will identify the name of the plant species. While the True or False Quiz, players will be faced with a statement on mosses and fern. Players asked to choose between true or false about the revelation.

3.5 Field Testing

Based on field testing results is known that most of the students assess Pterodovela very feasible. Feasibility Pterodovela on field testing are presented in (Table 5).

Table 5: *Results of student responses to Pterodovela on field testing*

Response Criteria	Percentage
Very Well	87.38%
Good	10.50%
Enough	2.12%
Less	0.00%

3.6 Operation Product revision

Revisions of Pterodovela were made based on the comments of the students on field testing is made to the full adventure in the Medini forest, as presented in (Figure 4).

Figure 4: *Display adventure games in the forest after a revised Medini pterodovela*

3.7 Operation Field Testing

The students' responses of Pterodovela that had been revised are presented in (Table 6).

Table 6: *The response of students to Pterodovela on operation field testing*

Response Criteria	Percentage
Very Well	92,19%
Good	7,81%
Enough	0.00%
Less	0.00%
Bad	0.00%

Based on data in (Table 6) Pterodovela had better condition than was before the revision. According to the students, Pterodovela easier for the students to classify ferns and mosses. The media make students more enthusiastic about learning, so that learning becomes fun.

3.9 The effectivity of Pterodovela to improve student's achievement and student activity

3.9.1 Student's achievement data

Analysis of the student's pretest and post test. The results of the student's pretest and post test are presented in (Table 7).

Table 7: *Data of pretest and posttest student in experiment class and control class*

Variation	Control class		Experiment Class	
	Pretest	*Posttest*	*Pretest*	*Posttest*

The highest score	40	73,5	50,5	88,5
The Lowest score	27,5	45	35	52,5
Average	36,2	62,3	45,2	80,3
Different average	26,1		35,1	

Based on the data in (Table 7) it can be seen the results of student's achievement (the difference between pretest and posttest) in the experimental class and the control class. Student's achievement as well as the pretest and post test were found to be higher in the experimental class students. Results of analysis using the t test showed that there is a significant difference between the student's achievement of students in control group and an experimental group with t count= 3.531> t table = 1.645. More t test results are presented in (Table 9).

3.9.2 Data of student activity

Activity of students during the learning process takes place is obtained through observation. The percentage of student activity during learning in the experimental class and control class is presented in (Table 8).

Table 8: *Data of student activity in experimental class and control class during the learning process.*

No	Activities category	Percentage of students of class	
		Experiments	*Control*
		%	*%*
1	Very Active	15,1	0
2	Active	81,8	50,0
3	Active Enough	3,1	43,75
4	Less active	0	6,25
5	Passive	0	0

From the data in Table 8 it can be seen that most of the experimental class students achieve active category and very active of activity, while the majority of students in control group only reach the level of active and active enough, there are even students who are less active. Results of analysis using the t test showed that there is a significant difference between students' activity control group and the experimental group of t-count is 2.25 and a value table

1.645. More results are presented in (Table 9).

3.9.3 Effectivity test the Pterodovela

Pterodovela effectivity is known from the student's achievement (pretest postes difference) and student activity of experiment are higher (better) than control group. t-tests were performed with SPSS version 16. If the price t count <t table Ho is accepted and if t count> t table H0. t-test results on the right side of student learning outcome data shows the price t count on learning achievement of = 3.531> t table = 1.645. Thus student student's achievement experimental class is higher than the control class student (Table 9). T test results of the student's achievement showed t-count price of 2.25 and table value 1.645. So the activity of the experimental class students is higher than the activity control class. Based on the above it can be concluded that the pterodovela digital media effectively to improve student's achievement and student activity. T test results are presented in (Table 9).

Table 9: *Results of analysis using the t test for student's achievement and student activity in experimental class and control class.*

No	t-test group	Difference mean between the value of posttest-pretest	T value
1	Student's achievement in Experiment class	35,1	t-count: 3,531 t-tab: 1,645
2	Student's achievement in control class	26,1	
3	Experiment Class activities	2,662	t-count: 2,25 t-tab: 1,645
4	Control class activity	1,886	

The reason that cause an increase the activity of students is the challenge in the form of games in Pterodovela. The challenge is an important to create problem-solving skills (Istianda et al., 2009). In this case the games created an atmosphere of competition between groups of student to winning the competition, so that they become more active, higher passion, and focus on learning to solving the problems. The game unconsciously make students more excited, more motivated and do self-learning activities, because the learning atmosphere was nice. Students who basically like the game can carry out the learning challenges with enthusiasm and actively

participate in the learning although they formed small groups (Ismail et al., 2006).

Pleasant learning atmosphere is also supported by the media that had interest appearance, especially mosses and fern adventure in the Medini forest. According to some students of adventure games is very helpful to them in understanding the diversity of mosses and fern. Learning environment is attractive and fun that facilitate students in learning, so the achievement of students is increase (Sutijono et al., 2005). This is consistent with the statement of Dani et al., (2008) which reveals that education game is one of the tool in teaching and learning both students and teachers are quite effective in assisting teachers in learning organizing, but it also causes the absorption of students is higher than in a conventional group (Arsyad, 2011).

According to Purnomo et al., (2011) the effectivity of multimedia occur because of the following reasons: (1) students quickly absorb information and knowledge of the material that had been presented, (2) pictures, videos, and animations in the media more attractive than the text, (4) interactive, and (5) oriented towards problem solving. According to teacher Pterodovela facilitate them to in organizing learning in order to achieve the goal of learning, because there is complete material and interesting material.

The research of Sadiman et al., (2010) reported that a computer can accommodate students who are slow to accept the lesson, because the use of multimedia involves various organs of the body begin to ear (audio), and eyes (visual). The involvement of this various organs makes the information easier to understand. According to (Adri et al., 2007), students were only able to retain 20% of the they see, 30% of which are heard, but can remember 50% of what they heard and seen, even they be able to remember up to 80% of the material that being seen, heard and do at once. This is also suported by the use of digital media in the form androit smartphone that practice and easy to carry anywhere.

Media communications are easy to carry and preferred by the younger generation in particular android-based digital media in today's digital era, rather than the use of conventional methods. This is reinforced by the opinion Haryanto et al, (2010) and Purwanto et al., (2009) that the implementation of multimedia based learning is clearly more attractive, more interactive, the amount of teaching and learning time can be reduced, the quality of student learning better and the learning process can be done anywhere and anytime (flexible), as well as students' attitudes and attention can be improved. The ability of students is also increase especially in using technology in digital era.

4. Conclusion

The results of the overall study shows that digital multimedia pterodovela very feasible to use in contextual biology game learning (CGBL) in the digital era. Pterodovela smartphone based aslo received a positive response from students and teachers, and effective to improve student's achievement and students activities in biology, especially in the matter of Bryophyta and pterodophyta diversity. This innovative media is expected to be aplicated in schools around the world to improve the quality of biology learning.

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