

## DEVELOPMENT OF BIOLOGY EDUCATIONAL GAME FOR LEARNING INTEGRATED PEST CONTROL

**Adisti Yuliastrin<sup>1</sup>, Raflen Aril Gerungan<sup>2</sup>, Einstivina Nuryandani<sup>3</sup>, Candra Wibawa<sup>4</sup>**

*<sup>1, 2, 3, 4</sup>Universitas Terbuka (INDONESIA)*

### **Abstract**

Games are a technology that is favored by many groups and can be a medium that can convey a message. Education games can be used as an effective, innovative and informative educational medium. Biology has many concepts that can be used as a game application so that the process of sending messages in the material is more interactive. This study aims to develop an android-based game application on the concept of integrated pest control by utilizing biological agents such as pest predators and refugia plants, instead of using pesticides. The development research method consisted of three stages, analysis of game needs, multimedia development, and making game programs. The results of the development of this android-based game application were successfully created and called "Pelindung Dele", this game application can be played properly.

Keywords: Educational Games, Biology, Learning, Integrated Pest Control.

### **1 INTRODUCTION**

The use of technology in the era of society 5.0 is a characteristic that cannot be separated from the behavior of modern society, technology in that era is the basis of all human activity in various fields, even in the field of education, it cannot be separated from the use of technology. In addition, the Covid-19 pandemic that has occurred has encouraged the creation of disruptive innovations in a learning process (Virtič, Dolenc, & Šorgo, 2021). Online learning is a learning mode whose use trend has increased significantly in the current era (Anderson & Dron, 2011). The application of online learning in distance education has its own challenges and problems, so a learning strategy is needed that can make students feel comfortable participating in the learning process (Leontyeva, 2018). The use of game technology as an addition to the diversity of online learning media will certainly provide a special attraction to the distance education process. This of course can encourage the birth of creativity in students in participating in online learning. (Diki, 2015) states that creativity has an indirect relationship with student learning outcomes. The application of game applications as learning media will not be separated from the development process, because game application-based learning media must have special material which is certainly in accordance with the topics in the learning process. Game is an activity that has goals and achievements that involve players in it so as to create an interaction. Furthermore (Crawford, 2003) in his book states that games are activities that are centered on an achievement in which there are active actors and

interactive opponents. To utilize games as learning media, we must understand several classifications in games, namely: 1) game as game, this is a game designed to create fun or fun, 2) game as media, aims to convey messages to its users, 3) game beyond game, known as gamification, where gamification is the application of a game design concept or way of thinking to a non-game environment (Martono, 2015). Game as media is a suitable classification in that we want to apply the use of games as learning media. The development of a game for learning must create a process of sending a message of a material concept to students. In general, Biology learning at the Open University (UT) is implemented in an online learning mode, although there are other learning modes. Learning Biology has a lot of material that can be used as a concept for the development of game applications as learning media. Integrated pest control (IPM) is the scope of material in Biology learning. IPM is a method of controlling plant pests (OPT) with a multidisciplinary ecological approach. The simple concept in IPM is how pests on plants can be controlled by using biological agents. The efforts that can be made to increase the diversity of biology learning media in distance education with online learning mode are by developing a biology learning media game application with integrated pest control material. The hope is that with this game application students can have high learning motivation and creativity.

## **2 METHODOLOGY**

This research is a research and development (R&D) study (Samsu, 2017; Sugiyono, 2013, van den Akker, 1999). This research method consists of three stages, starting with the game needs analysis stage, the multimedia game development stage, and the game program development stage. Analysis of game needs is needed to adjust the concept of the game that is developed with the suitability of the material and theory contained in the course so that it can become a support for interactive learning media. Multimedia game development: 1) game concept that contains the purpose of making the game, who is the target to play the game, and the benefits of the game. 2) game design that contains storyboards or scenarios, hardware specifications, views, and materials needed in the game. 3) material collection, this stage is carried out to collect material or supporting objects in game development. Making game programs at this stage is the process of making all game concepts and designs that have been made into an application. The game development stage will always be followed by a game trial process, for trials carried out on UT Biology students.

### 3 FINDINGS AND DISCUSSION

#### 3.1 “Pelindung Dele” Game Application

##### 3.1.1 Display Game Icon

The appearance of the game icon (Figure 1) has the characteristics of the game and is interesting to look at, this is important because it will make it easier for game application users to find it on the user's smartphone.



Figure 2. Initial Display

##### 3.1.2 Initial Menu Display

The display below (Figure 2) is the initial display before playing the Pelindung Dele game. In this view the user is directed to be able to click the play icon.



Figure 2. Initial Display

##### 3.1.3 Display Instruction Menu

The display below (Figure 3) shows instructions for playing the Pelindung Dele game. This display provides brief information about how to play to the user.



Figure 3. Instruction Menu

### 3.1.4 Display Gameplay

Game play in the Pelindung Dele game (Figure 4), where the user has to water the soybean plants and then protect the plants from pests such as whitefly and pod borer. Protecting soybean plants from user pest attacks in the game there are already two biological agents that game players can use to deal with the attacks of these two pests. Apart from that, there is also an option to use chemical pesticides, but if the user uses it, it will reduce the player's health points. At the end of the game, the score obtained by the player will be displayed.



Figure 4. Gameplay

### 3.1.5 Info Box Display

The info menu (Figure 5) will provide information about what types of pests will attack soybean plants and what types of biological agents can overcome these pest attacks.



Figure 5. Info Menu

### 3.1.6 Game Display Failed

This display (Figure 6) will show when the player fails which is caused by the loss of life due to pest attacks that we cannot stop.



Figure 6. Game Display Failed

### 3.1.7 Complete Game Display and Score

This display (Figure 7) indicates the end of the game and displays the total score obtained by the players.



Figure 7. Complete Game Display and Score

## 3.2 Blackbox Testing

3.2.1 *At this stage testing is carried out using blackbox testing techniques or behavioral testing with the aim of knowing deficiencies in the game's protective game. Testing of the protective game was carried out on four UT Biology students and one expert who provided information and input about this game.*

Table 1. Blackbox Testing Game Pelindung Dele

<b>Feature</b>	<b>Expeted Result</b>	<b>Met Expectation</b>	<b>Proof</b>	<b>Comment</b>
Icon Game	Eye catching	Yes	Picture 1	-
Play Game	User can play the game	Yes	Picture 2	-
Game Instruction	Giving information to play the game	Yes	Picture 3	-
Information Box	User get information about pest and biological pest control	Yes	Picture 5	-
Game Level	Users will find the game more challenging when the level goes up	Yes	-	Could be developed further
3D Object	Users can understand well the appearance of each object in the game	Yes	Picture 4	-
Home Button	Users can return to the main menu	Yes	Picture 7	-
Replay Button	Users can play back the game	Yes	-	-
Object Button (Water)	Users can control and move objects	Yes	-	Features work
Object Button (Pesticides)	Users can control and move objects	Yes	Picture 4	Features work
Object Button	Users can control and move objects	Yes	Picture 4	Features work, players need

(Biological Agents)				time to adjust how to play
Pop Up (Information)	Users can receive information via pop ups	No	-	Pop Up on refugia plant object not working, need to fix
Score System	Users can see the score at the end of the game	Yes	Picture 7	The score can be seen at the end of the game, but it needs to be increased so that the score can be saved at least 10 players with the highest score can be seen.

#### 4 CONCLUSION

An Android-based game application with the name Pelindung Dele game has been successfully built and can be played. Some of the core features of the game are running well although there are features that need to be improved and developed. The gameplay in this game has succeeded in providing educational information about the concept of integrated pest control to users.

#### ACKNOWLEDGEMENTS

We thank the research team for the Open University LPPM for helping in funding this research so that it can run well until it is finished. We also thank all those who have contributed to this research.

## REFERENCES

- Anderson, T., & Dron, J. (2011). Three Generations of Distance Education Pedagogy. *International Review of Research in Open and Distance Learning*, 12(3), 80–97. <https://doi.org/10.19173/irrodl.v12i3.890>
- Crawford, C. (2003). *Chris crawford on game design* (First). Indianapolis: New Riders Publishing. Retrieved from [https://books.google.co.id/books?hl=id&lr=&id=USBb11Dyw4sC&oi=fnd&pg=PA1&dq=Chris+crawford+on+game+design.+Peachpit&ots=7ViBPTtLSn&sig=x88PPpolwyrGwHrDVtL17F7wQBo&redir\\_esc=y#v=onepage&q&f=false](https://books.google.co.id/books?hl=id&lr=&id=USBb11Dyw4sC&oi=fnd&pg=PA1&dq=Chris+crawford+on+game+design.+Peachpit&ots=7ViBPTtLSn&sig=x88PPpolwyrGwHrDVtL17F7wQBo&redir_esc=y#v=onepage&q&f=false)
- Diki, D. (2015). Creativity of Biology Students in Online Learning: Case Study of Universitas Terbuka, Indonesia. *Researchgate*, (August 2015). Retrieved from [https://www.researchgate.net/publication/311345570\\_Creativity\\_of\\_Biology\\_Students\\_in\\_Online\\_Learning\\_Case\\_Study\\_of\\_Universitas\\_Terbuka\\_Indonesia](https://www.researchgate.net/publication/311345570_Creativity_of_Biology_Students_in_Online_Learning_Case_Study_of_Universitas_Terbuka_Indonesia)
- Leontyeva, I. A. (2018). Modern Distance Learning Technologies in Higher Education: Introduction Problems. *EURASIA Journal of Mathematics, Science and Technology Education*, 14(10), 1–8. <https://doi.org/https://doi.org/10.29333/ejmste/92284>
- Martono, K. T. (2015). Pengembangan Game Dengan Menggunakan Game Engine Game Maker. *Jurnal Sistem Komputer*, 5(1), 23–30.
- Virtič, M. P., Dolenc, K., & Šorgo, A. (2021). Changes in Online Distance Learning Behaviour of University Students during the Coronavirus Disease 2019 Outbreak, and Development of the Model of Forced Distance Online Learning Preferences. *European Journal of Educational Research*, 10(1), 393–411. <https://doi.org/10.12973/EU-JER.10.1.393>



