

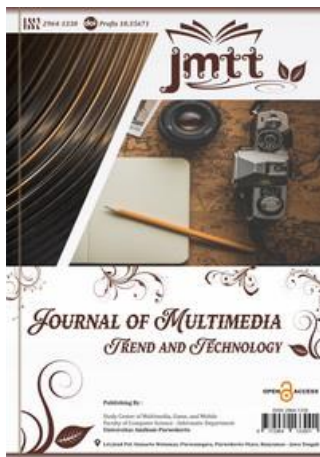
English Educational Game Modeling Using Goal Directed Design Method

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ARTICLE INFO



History :

Submit on 21 April 2024

Review on 15 May 2024

Accepted on 2 June 2024

Keyword :

Education,
Game,
Human Computer Interaction,
Children Application.

ABSTRACT

Language and Communication Development. Through play, children engage in conversation, listen to stories, and communicate with others. This enriches their vocabulary and helps them understand the structure of language. Early literacy is essential to early childhood learning. Playing with letters, words, and picture books helps children develop early literacy skills that are essential for later academic success. A learning aid in the media is an educational game. In this study, we developed an English vocabulary learning application for fruit and animal names. The application is used by kids between the ages of 4 and 6. The goal of this research is to create an application that will help kids recall things better and expand their vocabulary. We employ the Goal Directed Design Method for the design of the user interface. The research, modelling, requirements, definition, framework definition, refinement, and support are the eight primary stages of this method. Eighteen youngsters between the ages of four and six participated in this study. According to the application's evaluation, all participants were able to recall fruit and animal names with an approximate 10% increase.

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INTRODUCTION

Learning through play plays a very important role in early childhood development. At this stage, children are in a critical period of cognitive, social, emotional and physical development[1][2]. Play is not only a fun activity for children, but it is also a natural way for them to learn and understand the world around them[3]. Through play, children explore basic concepts such as cause and effect, numbers, shapes and language. This helps develop critical thinking and problem-solving skills. Role-play and creative play allow children to use their imagination, which is important for cognitive development and abstract thinking skills[4]. Playing with peers helps children learn to share, take turns, communicate and cooperate. This is important for building social skills that will be useful throughout their lives[2][5]. Through play, children learn to recognise, express and regulate their emotions. Play can also help them cope with fear or anxiety, and develop self-confidence[6]. Physical play, such as running, jumping or climbing, helps children develop gross motor skills. Activities such as drawing or building blocks help with fine motor skills. Active play helps children stay healthy and fit, which is important for optimal physical growth[7].

Language and Communication Development. Through play, children engage in conversation, listen to stories, and communicate with others. This enriches their vocabulary and helps them understand the structure of language. Early literacy is essential to early childhood learning. Playing with letters, words, and picture books helps children develop early literacy skills that are essential for later academic success[8].

English is a foreign language that is important for the public to master in order to communicate in this global world[9]. There are many ways to introduce English to children, for example through books, films, or educational games[10]. Educational games are a popular medium today. Not only as a medium of entertainment, but also as an alternative learning medium[11]. Educational games can help the educational process for children to form a new image that learning is so fun[7][6].

Play allows children to learn through their multiple senses—seeing, hearing, touching, and feeling. This multisensory learning helps strengthen understanding and memory[12]. Learning while playing is a natural and effective learning method for young children. It not only teaches new skills and concepts, but also helps in the child's holistic development, including cognitive, social, emotional, physical, and language[13]. By encouraging rich and varied play, parents and educators can support children's overall growth and development, preparing them for success in school and life[14].

In making educational games, especially for children, it is necessary to pay attention to the interface design so that it is attractive such as visual forms, colors, audio. In this study, the Goal Directed Design method will be used for designing in making educational games. The concept of Goal Directed Design is to emphasize the user's goals in designing an interface, so that it is hoped that the system created can be used easily by children[2].

The purpose of this study is to design an educational game that can increase the number of animal and fruit names in English that can be remembered by users. The Goal Directed Design method was developed by Alan Cooper, the concept of Goal Directed Design is to emphasize the user's goals in designing an interface, so that the system created is expected to be easy to use[15].

In designing the interface design of the educational game that was built, the Goal Directed Design method was used. This research was conducted at TK Kanisius Wirobrajan at Yogyakarta. At the research stage, interviews were conducted with English teachers at TK Kanisius and psychologists, while respondents from the questionnaires distributed were parents of TK anisius students totaling 30 respondents. At the time of testing, participants were 18 students at TK Kanisius aged 4-6 years.

METHOD

Goal Directed Design (GDD) is an approach used in interaction design and product development to ensure that the resulting product truly meets the needs and goals of the user[16]. This method was developed by Alan Cooper and his team and is the basis of the persona-based approach. Here are the main stages in Goal Directed Design:

1. Research

This stage involves gathering information about users, their needs, usage context, and business objectives. Methods used include interviews, observations, case studies, and surveys. Understand the needs, goals, and constraints of the various stakeholders involved in the project.

2. Modeling

Based on the data collected, personas are developed to represent different types of users. These personas are fictional characters that represent groups of users with similar goals, behaviors, and needs. Scenarios are stories that describe how personas will interact with the product to achieve a specific goal. This helps in understanding the user workflow and determining the features needed.

3. Requirements Definition

Identifying User and Business Needs, user needs that have been identified through personas and scenarios are used to outline the features and functions needed in the product. Needs and features are ranked by priority, focusing on the features that are most important to meet user and business goals.

4. Framework Definition

This is the stage where the overall architecture of the product or system is designed, including navigation, key workflows, and information hierarchies. At this stage, initial wireframes or sketches are often created to visualize ideas. Designing how users will interact with the product, including the user interface (UI) and user interaction (UX).

5. Refinement

The design is refined and improved by adding more visual details, interactions, and system responses. This includes the development of high-resolution mockups and interactive prototypes. User testing is conducted with the prototypes to identify usability issues and obtain user feedback. Based on the test results, the design is adjusted to ensure that user goals are met.

6. Development Support

The design team works closely with the development team to ensure that the design vision is properly translated into the final product. This includes providing design guidance, assets, and collaborating to resolve technical issues. Feedback from development and user testing may require additional iterations to refine the design before product launch.

7. Deployment

The refined and validated design is implemented into a final product that is ready to be launched to users. After the product is launched, an evaluation is conducted to measure whether the product is achieving its stated goals, and to identify areas for future improvement.

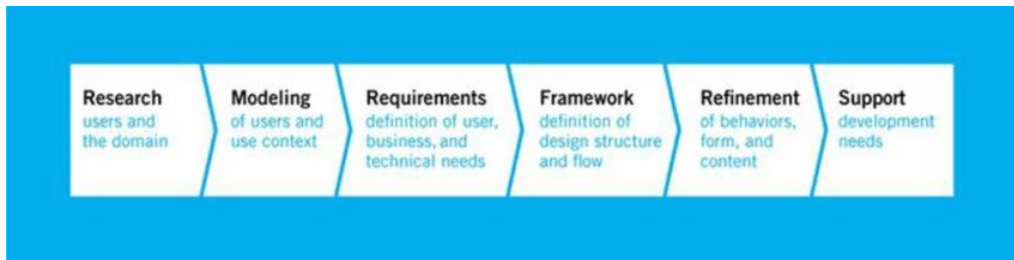


Figure 1, Goal Directed Design (GDD) Framework

Goal Directed Design is an iterative process that ensures that each stage of product development is driven by user needs and goals[17]. By following these stages, designers can create products that are not only functional but also provide an optimal user experience.

RESULT

In the first stage of Goal Directed Design, Experience Goals and End Goals are produced. Experience Goals in this study are applications that are easy to use and make learning English vocabulary more enjoyable. While the End Goal in this study is to increase the number of animal and fruit names in English that can be remembered by users.

At the Modeling stage, a persona is produced, which aims to increase the number of animal and fruit name vocabulary in the language. The characteristics of the persona are as follows:

- Kindergarten B students
- Use gadgets for 1-2 hours per day
- Use the gadget to play Angry Bird
- Can't read English words yet
- Can't write English words yet

At the Requirement Definition stage, problem statements were obtained, namely that users can understand the vocabulary of animal and fruit names in English. And vision statements, namely creating a fun application so that they can learn the vocabulary of animal and fruit names in English.

At the Framework Definition stage, the overall product concept is created, defining the basic framework for product behavior and visual design. At this stage, the application hierarchy that will be built is compiled, as shown in Figure 2.

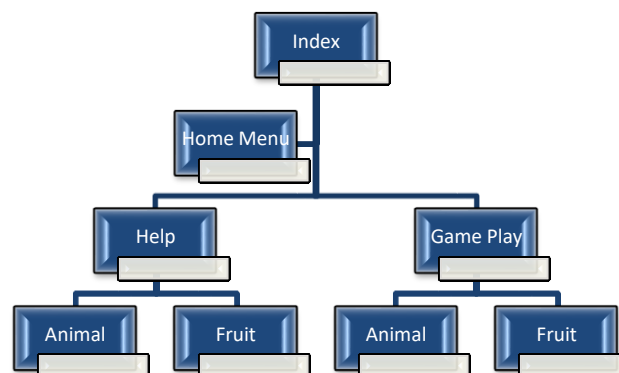


Figure 2, The concept of the application hierarchy to be built.

The Refinement stage is the implementation of the Framework Definition stage in real form. From what has been compiled, a translation will be carried out through a design form made using game design tools. The designs in the parts of this application are as follows:



Figure 3, Home Page Design.

When the user first opens this application, the home page will appear as in Figure 3. On this page there is one button, namely 'start', which functions to start this application and will go to the menu page. On the menu page there are options 'Let's Learn' and 'Let's Play'. If the user selects 'Let's Learn', there will be a choice of topics 'Animal' and 'Fruit'. Both of these material topics contain pictures of animals or fruits as in Figure 4, which when selected will display information about the selected object.



Figure 4, Page when starting the game.

When the user selects the desired object, an animal or fruit animation will appear (as in Figure 4) according to the object selected by the user, accompanied by audio of the animal/fruit name in Indonesian and English, accompanied by the animal's sound. On this page there are 3 buttons, the 'previous', 'repeat' and 'next' buttons. The 'previous' button will take the user to the previous object, the 'repeat' button to repeat the object currently displayed, and the 'next' button to go to the next object.

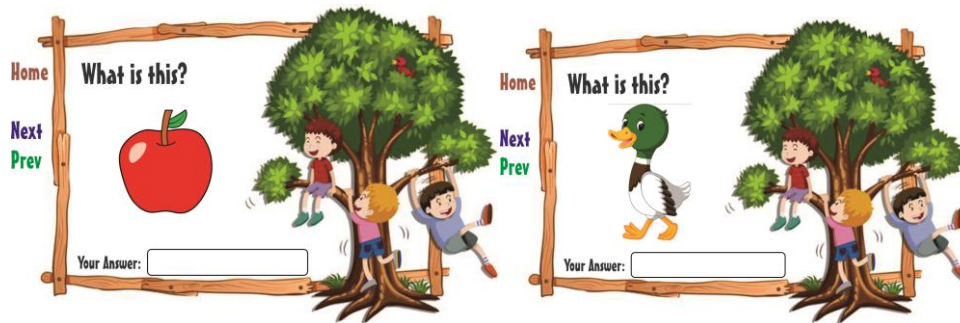


Figure 5, 'Animal' and 'Fruit' Pages

In the 'Let's Play' menu, there are 2 types of games on each topic (animals and fruits), namely 'Find Animal/Fruit Name' and 'Find Animal/Fruit'. On the 'Find Animal/Fruit Name' page as shown in Figure 5, users are asked to find the name of the animal/fruit displayed in each question given in the form of audio "what is this animal/fruit name?". Users can press the play button located below the answer choices. The play button will produce audio of the animal name choices in English. Users simply select the word above the play button that is considered correct. On the 'Find Animal/Fruit' page as shown in Figure 5, users are asked to find the animal/fruit requested by the system in the form of audio, for example "let's find Sheep". Users select the answer that is considered correct by selecting the animal. On this game page there is a score that displays the points that the user has obtained. If the user wants to repeat the question, the user can press the 'repeat' button. If the user successfully answers the question correctly, the score will increase.

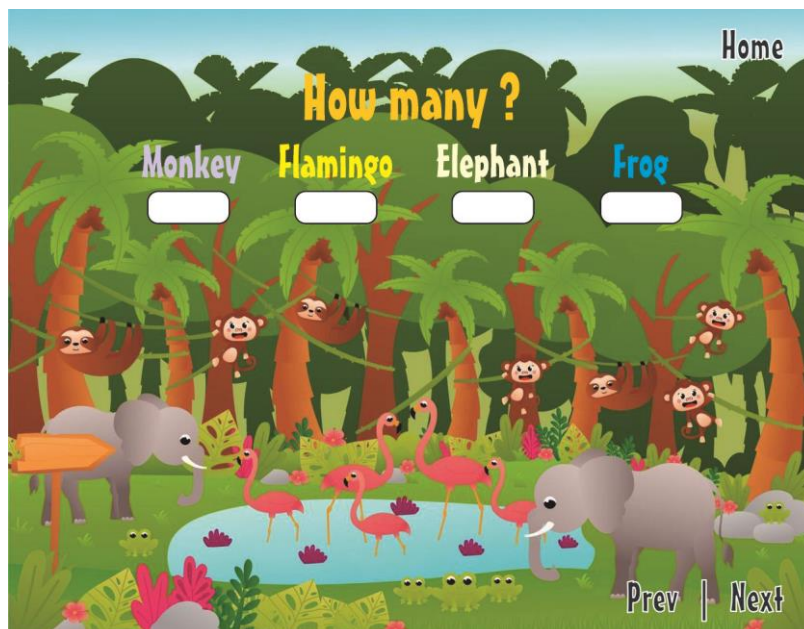


Figure 6, Finding the object animal / fruits pages

If the user answers with their mind, the display 'CORRECT! VERY GOOD' as in Figure 6, on the other hand, if the user answers the question incorrectly, the score will not

increase and the display 'WRONG!' will appear and the application will show the correct answer as in Figure 7.



Figure 7, Wrong Page and Correct Page

If the user has answer 10 questions, then the game is over and the final score the user has achieved will be displayed. On this page there is also a button to repeat this game again.



Figure 8, Page when the game is finished (Game Over)

Participants in this test, amounted to 18 students. Participants were divided into 2 groups, the first used the application 3 times and the second used the application 1 time. Both groups of participants were first given 20 questions by showing 10 pictures of animals and 10 pictures of fruits and participants were asked to answer English from the pictures shown.

Based on the test results data, there was no decrease in English vocabulary knowledge tested on all participants in group 1. In the first experiment, only Ishak did not experience an increase in vocabulary knowledge, while the other participants, namely Student 1 - 9 experienced an increase.

From the results of the 3 experiments that have been conducted in group 1, participants experienced an average increase of 2 questions that could be answered in each experiment. This means that after using the application, participants increased their knowledge of animal and fruit names in English by 2 words.

Table 1, Recapitulation of the Difference in Correct Answers from Group 1 in 3 Trials.

No.	Participant	Difference between Correct Answer and Previous Trial		
		1	2	3
1.	Student 1	1	4	4
2.	Student 2	2	3	2
3.	Student 3	3	2	1
4.	Student 4	0	1	2
5.	Student 5	2	2	2
6.	Student 6	2	3	3
7.	Student 7	2	2	4
8.	Student 8	3	1	0
9.	Student 9	3	4	3
	Average	2	2,44	2,33

Similar to group 1, group 2 was also asked to answer 20 questions on animal and fruit vocabulary names that were the same as group 1. In group 2, participants only used the application once for 10 minutes. After using the application, participants were given the same questions again.

Table 2. Recapitulation of the Difference in Correct Answers Before and After Using the Application from Group 2.

No.	Participant	Difference in Correct Answers
1.	Student 9	3
2.	Student 10	1
3.	Student 11	3
4.	Student 12	3
5.	Student 13	4
6.	Student 14	1
7.	Student 15	3
8.	Student 16	1
9.	Student 17	1
	Average	2,22

The assessment of the Learnability aspect is obtained by comparing the results before participants use the application with after using the application. As in Figure 8, from each trial to the next, the average participant experienced an increase. The average increase in questions that participants could answer from before using the application to using the application as many as in each trial was 2 questions.

In the test conducted on group 1, which had used the application 3 times, the results of the increase were obtained as follows:

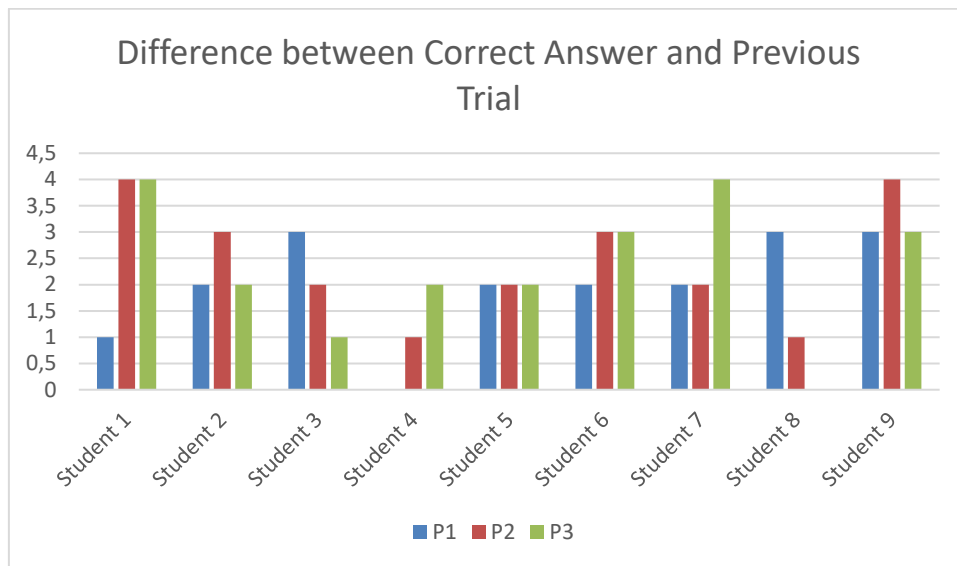


Figure 9, Increase After Using the Application in Group 1.

In testing the Task Success and Time on Task aspects, 6 different types of scenarios were given that participants used when using the learning application. The test was conducted on 9 participants who had used the application 3 times. Participants were asked to use the learning application according to the existing scenario.

The following are the scenarios given to the 9 participants:

- Task 1: showing animal material (horse)
- Task 2: going to the next animal material
- Task 3: going to the previous animal material
- Task 4: repeating animal material
- Task 5: selecting the let's find fruit game menu
- Task 6: selecting the let's find animal name game menu

In measuring task success, binary values are used, namely 1 for successful tasks and 0 for tasks that fail or exceed the specified time size. By using binary values, it is easier to set numeric values so that the average can be easily calculated. The results of the scenario test in group 1 can be seen in table 3.

Table 3, Scenario Testing Results.

Participant	Task Number						Succesed (%)
	1	2	3	4	5	6	
Student 1	1	1	1	1	1	0	83,33
Student 2	1	1	1	1	0	1	83,33
Student 3	1	1	1	1	1	1	100
Student 4	1	1	1	1	1	1	100
Student 5	1	1	1	1	0	0	66,67
Student 6	1	1	1	1	0	0	66,67
Student 7	1	1	1	0	1	1	83,33

Student 8	1	1	1	1	1	1	100
Student 9	1	1	1	1	1	1	100
Usability System(%)	100	100	100	88,89	66,67	66,67	87,03

Usability testing was conducted using the USE Questionnaire technique, the aspects measured were ease of use of the system (Easy of use) and user satisfaction (Satisfaction). The questions given to the participants were as follows:

1. Easy of use

P1. Is this application easy to use?

P2. Can you use this application without your help?

P3. Do you know the meaning of these buttons?

2. Satisfaction

P1. Do you think this application is fun?

P2. Is this application not boring?

P3. Do you want to have this application at home?

Table 4, Likert Scale Results of Easy of Use and Satisfaction Aspects.

Participant	Easy of Use			Satisfaction		
	P1	P2	P3	P1	P2	P3
Student 1	1	4	4	3	3	3
Student 2	2	3	2	3	3	3
Student 3	3	2	1	3	3	3
Student 4	0	1	2	3	3	3
Student 5	2	2	2	3	3	3
Student 6	2	3	3	3	3	3
Student 7	2	2	4	3	3	3
Student 8	3	1	0	3	3	3
Student 9	3	4	3	3	3	3

Table 5, Results based on aspects tested.

Aspect Testing:	Average:
<i>Easy of Use</i>	2,63
Satisfaction	3

In the interview result table, it contains values 1 to 3 which means 1 = disagree, 2 = so-so, 3 = agree. To calculate the participant's assessment of the application on the aspects tested. Then the calculation is done by calculating the average of each aspect. The results of the average value that has been obtained are then mapped to the scale range with the following intervals:

$$interval = \frac{\text{high score} - \text{low score}}{\text{count of class}} = \frac{3-1}{3} = 0,67 \quad (1)$$

After the interval size is known, then a scale range is created so that the average participant assessment of the application can be known. The scale range is as follows:

- ✓ – 1.66: Bad
- ✓ 1.67 – 2.33: Average
- ✓ 2.34 – 3: Good

CONCLUTIONS

Based on the comparison of the results of the experiment before and after using the application with 18 children as participants, an average increase of 2 questions were answered correctly out of a total of 20 questions after the participants used the application. This shows that the educational game created helps users to increase the number of animal and fruit names in English that can be remembered.

Based on the usability test using the USE Questionnaire with 9 children as participants, in the Easy of Use aspect, the results showed that participants considered this application to be in the good category, with an average of 2.63 (range 2.34 - 3). This indicates that the application created is easy to use. In the Satisfaction aspect, the results showed that participants considered this application to be in the good category, with an average of 3 (range 2.34 - 3). This indicates that the application created is fun.

Based on the performance test using performance metrics with 9 children as participants, the results obtained in the task success aspect were 87.03%. In tasks 1, 2, and 3, the results were 100%, in task 3 the results were 88.89%, in tasks 5 and 6 the results were 66.67%. In the aspect of task on time in the first task, an average of 16 seconds was obtained to complete the first scenario. In the second task, an average of 1 second was obtained to complete the second scenario. In the third task, an average of 1 second was obtained to complete the third scenario. In the fourth task, an average of 2 seconds was obtained to complete the fourth scenario. In the fifth task, an average of 28 seconds was obtained to complete the fifth scenario. In the sixth task, an average of 26 seconds was obtained to complete the sixth scenario.

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