

15 The Design of Recognition System of Children Basic Activities Based on Virtual Reality

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The Design of Recognition System of Children Basic Activities Based on Virtual Reality

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Abstract. An early introduction to children's basic activities, including brushing teeth, washing hands, and eating a meal using a spoon, is deemed important. Many methods can be used to introduce these activities, one of which is by using video. The development of Virtual Reality technology provides a new experience in interacting and using computer-based applications. Users can feel the sensation of being in the real world when using the application. This paper discusses designing a recognition system for children's basic activities through VR technology. The method in the design process used the HCD (Human Center Design) method. System testing was emphasized on the user experience (UX) aspect of the application with the teachers at the early childhood education and kindergarten level as the target respondents. UX testing was conducted by taking the parameters of Attractiveness, Perspicuity, Efficiency, Dependability, Stimulation, and Novelty. The results obtained showed 1.41 points for attractiveness, 1.80 points for perspicuity, 1.28 points for efficiency, 1.80 points for Dependability, 1.49 points for stimulation, and 1.39 points for novelty. So that this application can be used as a medium in introducing basic activities to children.

1. Introduction

Early childhood is children aged 3 to 6 years old. They experience a unique development process at this age due to their growth and development process occurred together with their golden ages. To obtain optimal growth and development for the children, it needs various services that can be used as a proper base for children's growth and development. Early childhood education is one of the attempts that can be done to improve the children's growth and development to reach optimality in each phase. Early childhood development is an attempt done by the society and government to assist early childhood in developing their potentials holistically either in the aspect of education, nutrition, health, or in the psychosocial aspect. Children's learning activities include mental and physical activities divided into some categories, i.e., writing activities, listening activities, oral activities, visual activities, emotional activities, and mental activities. Table 1 illustrates the activities that be done in each category.



Table 1. Categories and Types of Children Learning Activities [1]

Categories of Activity	Activity
Visual Activities	Reading, looking at the picture or watching video, experiment
Oral Activities	Asking, giving suggestion, giving an opinion, formulating
Listening Activities	Listening to the conversation, speech and discussing
Mental Activities	Memorizing, solving the question, analyzing, and responding
Emotional Activities	Taking an interest, being joyful, being excited, feeling bored, being brave, and being calm
Writing Activities	Writing a story, essay or report

The combination and the use of the variance of the learning activity types in Table 1 are very useful in children's learning process. Today, computer technology development offers an outstanding change in which the computer is no longer used only to do the word processing activity or entertaining. Its utilization has been extended into any other domains - particularly on the side of multimedia. One of the recently developed multimedia applications is the use of Virtual Reality (VR) technology that is popular as the entertainment media such as games to the video of 360 degrees. The optimization of Virtual Reality technology as a media for education, however, so far is found very rare. This paper discusses how the design of the VR-based recognition system of children's activities.

Virtual reality (VR) is a simulation on PC or Laptop resulted from the three-dimensional object and environment processing in which if someone attempts to use this VR application, he or she will feel as if he or she were in a real environment. The objective of VR is to make the person feel that he or she were really in the virtual environment [2]. Several visualizations occurred in the virtual world when using virtual reality comprise the visual and audio stimuli or other stimuli [3]. VR has four elements or the important basic parts in the procedure as the builder and the experience of the virtual world users, including:

1. *Virtual World*
The virtual world's main component is formed to resemble the *screenplay* or *script* to create a virtual visualization.
2. *Immersion*
The component gives the users a sensation to feel a virtual environment with a high level of similarities with the real environment. Immersion can be divided into three types:
 - a. *Mental Immersion* – the sensation of making the users' mental feel like they were in the real environment.
 - b. *Physical Immersion* – the sensation of making the physic of the users to feel an atmosphere around the environment created by the virtual reality.
 - c. *Mentally Immersed* – giving a sensation to the users to be involved in the virtual world's environment.
3. *Sensory Feedback*
The useful component to read the needs of the application and the system using several sensory components to deliver the information from the virtual world to the user's senses. The elements include visualization, audio, and touching.
4. *Interactivity*
VR components function as the receiver and transmitter of the response towards the users' actions, later on, enabling the users to directly interact with the fictive field or virtual world [4] [5].

The process of developing a system certainly requires a standardized method. The method used in this paper to design the system was by using the method of Human Center Design (HCD) – an approach for the system development to make the system more interactive and useful. HCD method is focused on the users, needs of the users, ergonomic aspect, science, and technique related to the *usability*. In HCD

approach, several iterations are done to meet the needs of the users. The iterative cycle of HCD includes Observation, Idea Generation, Prototyping, and Testing [6][7].

2. Research Method

The stages carried out in this research can be seen in Figure 1. This stage is made with the aim of helping researchers determine the steps that must be taken.

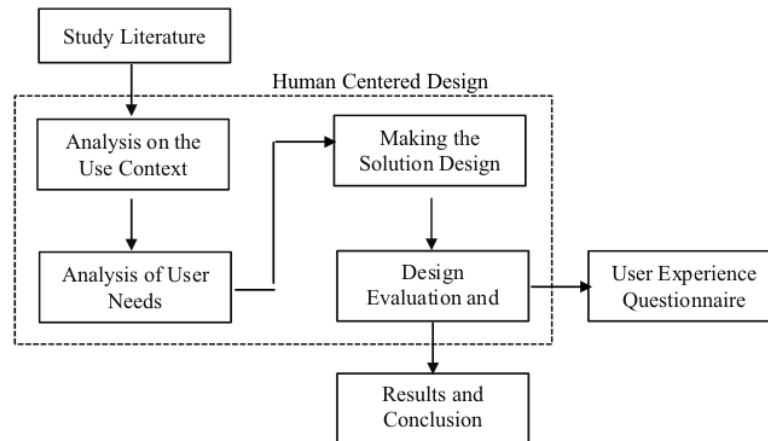


Figure 1. Research Phases

The literature study was conducted to obtain and learn any literature relevant to the User Experience on virtual reality and to observe and document the prospective users. The analysis phase on the use context was done to identify the prospective users and stakeholders from the application system, characteristics of users, purpose, user tasks, and system environment. *Users* on this application were teachers and students. The phase of the analysis on the needs was used to analyze what needs are required by the prospective users on the virtual reality. From the data obtained, the researcher could get the user persona. By using the results of the analysis on the user persona, it was useful to obtain the goals, needs, and requirements needed. The evaluation in this research used the User Experience Questionnaire (UEQ) that made it possible to do the rapid assessment from the User Experience from any interactive products. The questionnaire scale was designed to cover the entire impression of the User Experience. The questionnaires' format supported the user's response to express soon the feeling, impression, and attitude that came out when they used a product. *User Experience Questionnaire* consisted of 6 scales with a total 26 items of question.

1. *Attractiveness*: it is related to the users' impression of the product between like or dislike about the product.
2. *Efficiency*: it is about the efficient use of the product that can be rapidly accomplished.
3. *Perspiciuity*: it is about simplicity in the process of doing the task in a product.
4. *Dependability*: it is about the control of the interaction by the users and system and product.
5. *Stimulation*: it is about how the users are interested in using the product.
6. *Novelty*: it is about the creativity of a product [8][9][10].

The final phases of this research are presenting the research results and drawing conclusions from the research conducted.

3. Result and Discuss

From the interview results, it was found that the users who would use this application were teachers in early childhood education and Kindergarten. The users used as a sample were the school with the normal children and school with the inclusion model. The teachers' or educators' involvement as the users in

this research was purposely to obtain the reference in making the user interface on VR application for the recognition of basic activities of children. Table 2 shows the results of the analysis of the user needs.

Table 2. The User Needs

No	User Needs	Explanation
1	An application that can help for the learning process of children to train the skill in terms of self-treatment	The application system that can display the basic activities of children: Teeth Brushing, Eating a Meal, Hand Washing
2	The learning process with the VR technology can influence the mood	The VR system can display the 3D object with an environment that can be seen from the angle of 360°. With this display, it is expected the mood of the users can be built positively.
3	An application can calm children when they are accessing it	To reduce the level of anxiety, this application can produce instrumental music that can keep the children's mood.

Based on the results from the users' needs, it was continued to the phase, i.e., designing the storyline from the application of introducing the VR-based basic activities for the children. The results of the design of the storyline is shown in Table 3.

Table 3. The storyline of application

<i>Storyboard</i> of the main page	It is the first page when the application is firstly run. It contains the information and directions about the application's use and the selection of the animation scenarios made.
<i>Storyboard</i> of the page about the animation of hand washing	The page is located in a virtual bathroom in which the users can see the animation about the right-hand washing
<i>Storyboard</i> of the page about the animation of eating a meal	The page is located in the virtual dining room in which the users can see the animation of a person who is eating a meal.
<i>Storyboard</i> of the page about the animation of teeth brushing	This page is located in the virtual bathroom in which the users can see the animation about the right teeth brushing

3.1. System Design

On the scene of Main Menu, the display of objects is static and simple. Here, the front house view will be shown to the users in which on this VR application, it takes the setting in the house. For this, the initial display of the scene was made from the Main Menu backgrounded with the house. This could make the children interested in the display as if they were in the comfortable front yard. There are three panels on this scene, i.e., the panel of How to Use, the panel of Activity Menu, and the panel of information. The panel of How to Use contains the instruction about the use of VR. On the panel of Activity Menu, there are four navigation buttons directing the users to the display selected by the users. The navigation buttons include Hand Washing, Eating a Meal, Teeth Brushing, and Out. The navigation button for Hand Washing will lead the user to the scene of Hand Washing. The button of navigation for eating a meal will address the users to the scene of eating a meal. Meanwhile, the navigation button for Teeth Brushing will lead the user to the scene of Teeth Brushing. Finally, the navigation button for Out will lead the user to be out of the VR application. Figure 2 illustrates the design of the main page from VR application.



Figure 2. The display of the main page

The scene of Hand Washing displays the setting or toilet background as a room commonly used for self-cleaning, such as washing the hands. The user will be in front of the sink. This scene also shows the 3D animation in the way of washing the hands step by step. Figure 2 depicts the way of handwashing.



Figure 3. The display of the way of handwashing

The scene of eating a meal shows the setting or kitchen background in which there is a table in it. The user will be in front of the table and this scene illustrates 3D animation about the manner of eating a meal until the food is run out. Figure 4 illustrates the manner of eating a meal.



Figure 4. The display about the way of eating a meal

The scene of Teeth Brushing displays a setting or the background of a toilet. The scene's background is similar to the previous scene that has been discussed, i.e., the scene of Hand Washing. The user will be in front of the sink. This scene will also show the 3D animation about the way of brushing the teeth step by step. Figure 5 presents how a child does the activity of brushing the teeth.

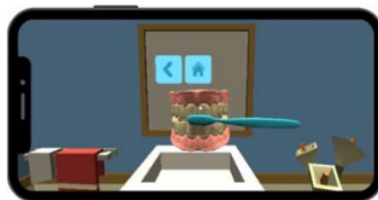


Figure 5. The display about the way to brush the teeth

3.2. Testing

The test for the VR system application as a media for learning basic activities was performed based on the following phases.

1. The test of this application was performed on the users (teachers) as the focus of this research.
2. The users were faced with the android smartphone installed on the VR application as the media of medical rehabilitation connected to VR *headset*.
3. Having used the VR application, the users then tried to control the application via PC integrated with VR application installed on the android smartphone to control the VR application.
4. Then, the researcher did the interview with the users by giving the UEQ questionnaires that have been made to be filled in by the users.
5. The researcher's data were in the form of numerical range of score from 1-7 and continued with the further analysis calculation using UEQ *Data Analysis Tools*.

20 people were involved, as the respondents used in the test using UEQ. Table 4 shows the test results using UEQ in which the results obtained were the mean value from the scale measured for each respondent.

Table 4. The results of the calculation of mean values in each scale
UEQ Scales Means

Attractiveness	1,408
Perspicuity	1,800
Efficiency	1,275
Dependability	1,800
Stimulation	1,488
Novelty	1,388

Having done the mean calculation, as shown in Table 4, it then obtained the benchmark. Benchmark is the graph of the mean scale results to make it simple in seeing the difference between the existing scores. The Benchmark graph consisted of 5 levels, i.e., excellent, good, above average, below average, and bad. Figure 6 shows the results of plotting the mean values of each scale in the graphic form. The mean scales obtained showed 1,41 for Attractiveness, 1,80 for Perspicuity, 1,28 for Efficiency, 1,80 for Dependability, 1,49 for Stimulation, and 1,39 for Novelty. It can be stated that the design, according to the UEQ scale, had a positive user experience as all scales were above 0.8.

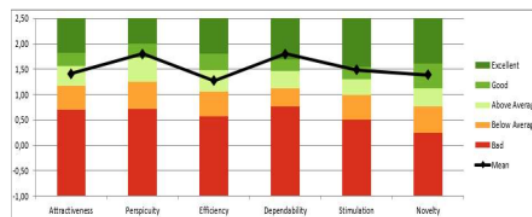


Figure 6. The Results of UEQ Measurement

4. Conclusion

This research showed 1,41 points for attractiveness, 1,80 points for perspicuity, 1,28 points for efficiency, 1,80 points for Dependability, 1,49 points for stimulation, and 1,39 points for novelty. Thus, the UEQ benchmark results with VR application obtained the scores above the average in the categories of attractiveness and efficiency and good scores at three categories, i.e., perspicuity, stimulation, and novelty. Then, the excellent score was found in the Dependability category. This research has successfully designed the user experience on VR with the implementation of the Human-Centered Design (HCD) method proven with the positive value of user experience as all scales were above 0.8 in UEQ. From these results, it can be stated that the system overall can be used to recognize the basic activities of early-age children.

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GRADEMARK REPORT

FINAL GRADE

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GENERAL COMMENTS

Instructor

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