Increasing Independence of Cerebral Palsy Children using Virtual Reality based on Mlearning

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Abstract. This research is a classroom action research that aims to determine the impact of using Virtual Reality (VR) Technology by measuring the level of courage of cerebral palsy (CP) students after using Android-based VR on the dreaded object by comparing pre-action and past action behavior in Dilaraf Islamic School Tangerang – Banten. The study was conducted in three cycles with 12 students CP. Data analysis uses descriptive quantitative data analysis. The results showed the average results of motor sensor tests of students in pre cycle I of 4 graduated students increased by 7 out of 12 students. 91.67% of students have reached the Minimum Completeness Criteria (MCC) in the third cycle. This shows the indicator set is that 60% of students reach the MCC has been achieved. Thus the VR technology learning method can improve the motor sensor skills of cp students.

1. Introduction

Cerebral Palsy (CP) is a neurological disorder that occurs due to injury to brain tissue when the child is developing, brain tissue injury is caused due to illness or without illness and the child has a seizure that results in damaged brain nerve cells. CP causes motor function in children experiencing disturbances in the form of movement control, muscle strength, body posture, muscle coordination, and body balance which will affect fine and gross motor movements in children. Types of cerebral palsy:

- Spastic cerebral palsy is characterized by stiffness or muscle tension and is difficult to move
- Athetoid cerebral palsy is characterized by frequent uncontrolled movements.
- Ataxic cerebral palsy has the characteristics or symptoms of lack of balance and coordination as a result the sufferer is often shaken, trembling and even falling.
- Cerebral palsy combination is a combination of more than one type of cerebral palsy.

Sensory integration therapy emphasizes stimulation in three main senses, namely tactile, vestibular, and proprioceptive. This sensory system is very important because it helps the child's interpretation and response to the environment[1,13,14].

Based on the results of observations at the Dilaraf Islamic School in Tangerang - Banten that the therapeutic process is done conventionally by involving children with CP and traffic in one therapy room with the help of props such as puzzles, rides, up and down stairs and so forth. Learning techniques that are varied and fun help CP children to study. In this research, VR technology can be an alternative
media for sensory integration therapy by stimulating the motor sensation of Cerebral Palsy children using an Android-based Google CardBoard device. The application of VR technology helps increase competence both cognitive and psychomotor, and supports practical, dynamic, animative and interactive practical activities[2,4,7]

2. Method

2.1 Classroom Action Research (CAR)
In this study using Classroom Action Research (CAR) by collaborating with Early Starter TK A class instructors at the Tangerang-Banten Islamic School Neuroscience, which was carried out over two cycles through a process consisting of 4 (four) interrelated and continuous basic stages: planning, action implementation, observation and reflection as shown in Figure 1.

![Figure 1. CAR Cycle Kemmis and McTaggart[5]](image)

The results of the research data were analyzed with the help of descriptive statistics[6]. Then classified into 5 categories as shown in Table 1.

| Table 1. Motor Sensory Categories |
|----------------------------------|
| No  | Grades | Category  |
|-----|--------|-----------|
| 1   | 86 - 100| Very good |
| 2   | 71 - 85 | Good      |
| 3   | 60 - 70 | Enough    |
| 4   | 41-59   | Less      |
| 5   | <= 40   | Very little |

Indicators of success in Classroom Action Research (CAR) using the Minimum Mastery Criteria (MMC) have been set by the school, while the MMC, meaning that students have been declared to exceed mastery learning if they have achieved a value of 60. If the value obtained by students is below 60, then it has not can be declared complete. The application of virtual reality technology is said to be a classic success if 60% of students get a value above or equal to 60 for subjects on motor skills.

2.2 Virtual Reality Technology
Virtual reality is an environment that is simulated by a computer, which can stimulate physical sensations such as the real world or the world of imagination. Virtual reality can mimic or re-create experiences that are sensory felt by humans. Most virtual realities provide a virtual environment utilizing the sense of sight. It was displayed either using a monitor screen or by using other vision aids. In addition to the sense of sight, the sense of hearing can also be influenced by virtual reality with the help of loudspeakers. Virtual reality is different from animation and video whose image is played or
repeated in a set sequence, virtual reality can be seen, interact and see from various perspectives. Thus providing greater flexibility than usual[3]. Application of Educational Virtual Reality Technology can be seen in Figure 2.

![Figure 2. Application of Educational VR Technology](image)

3. Results and Discussion

This study wanted to determine the impact of using virtual reality technology by measuring the level of courage of students after using virtual reality technology on the feared object. The main focus is to find out the impact of using virtual reality on Cerebral Palsy (CP) students by comparing pre-action and past-action behavior. The study was conducted in three cycles with 12 research subjects CP at Dilaraf Islamic School Tangerang - Banten. Analysis of the data used by descriptive quantitative data analysis. Data obtained from learning outcomes will be obtained in the form of grades and percentage of completeness. To process the data the formula is used:

\[ \text{MoL} = \frac{S}{TS} \]  

Information:
- MoL = Mastery of Learning
- \( S \) = Score
- \( TS \) = Total Score

To see the percentage of students’ mastery learning using the percentage formula, namely:

\[ \% = \frac{A}{B} \]  

Information:
- \( \% \) = Percentage of students
- \( A \) = Students Graduate
- \( B \) = Total Students

The ability of motor sensor scores of students in the three cycles namely pre cycle where students do not use virtual reality technology, in cycle 1 and cycle 2 students use virtual reality technology are classified in five categories as shown in Table 2 (ex=exam and avg=average) and for a recapitulation of motor sensor values can be seen in the table 3.

| No | Name | Pre Cycle | Cycle -1 | Cycle -2 |
|----|------|-----------|----------|----------|
|    |      | \( ex1 \) | \( ex2 \) | avg \( ex1 \) | avg \( ex2 \) | avg \( ex1 \) | avg \( ex2 \) | avg \( ex1 \) | avg \( ex2 \) | avg |
| 1  | Naufal | 62 | 76 | 69 | 70 | 74 | 72 | 71 | 75 | 73 |
| 2  | Idel H | 34 | 60 | 47 | 35 | 67 | 51 | 63 | 65 | 64 |
| 3  | Fhanum | 48 | 60 | 54 | 41 | 69 | 55 | 65 | 71 | 68 |
| 4  | Satria | 38 | 36 | 37 | 34 | 20 | 27 | 60 | 64 | 62 |
| 5  | Althaf | 83 | 75 | 79 | 85 | 91 | 88 | 86 | 92 | 89 |
| 6  | Fakhri | 51 | 55 | 53 | 63 | 69 | 66 | 70 | 80 | 75 |
Table 3. Recapitulation of Motor Sensory Values

| No | Grades | Pre Cycle | Cycle -1 | Cycle -2 |
|----|--------|-----------|-----------|-----------|
|    |        | Freq      | Percent   | Freq      | Percent   | Freq      | Percent   |
| 1  | 86 - 100 | 0        | 0         | 1         | 8.33      | 3         | 25        |
| 2  | 71 - 85  | 2        | 16.67     | 3         | 25.00     | 3         | 25.00     |
| 3  | 60 - 70  | 2        | 16.67     | 2         | 16.67     | 5         | 41.67     |
| 4  | 41 - 59  | 6        | 50.00     | 4         | 33.33     | 1         | 8.33      |
| 5  | < 41     | 2        | 16.67     | 2         | 16.67     | 0         | 0.00      |
|    | Total    | 12       | 100       | 12        | 100       | 12        | 100       |

If the results of the students' sensory ability tests for the three cycles are categorized in the MCC applicable at the school research location for motor subjects, the percentage of students' classical learning completeness in the three cycles can be seen in Table 4.

Table 4. Categories of student learning completeness

| Grades | Category | Frequency |
|--------|----------|-----------|
|        |          | Pre cycle | Percent | Cycle -1 | Percent | Cycle -2 | Percent |
| >= 60  | Complete | 4         | 33.33   | 6        | 50      | 11       | 91.67   |
| < 60   | Incomple | 8         | 66.67   | 6        | 50      | 1        | 8.33    |
| Total  |          | 12        | 100     | 12       | 100     | 12       | 100     |

In order to compare the students' sensory abilities through virtual reality technology, the comparison of the average motor test results in the pre cycle, cycle I and cycle II stages is illustrated in Figure 4.

Figure 3. Comparison of students' motor sensory completeness

Based on the results of motor sensory abilities tests conducted in the three cycles, data obtained that classical completeness based on MCC in pre-cycle (theory) had a tendency. Average score =
33.33 of eight students did not complete, which means that they had not reached the specified indicator, namely 60% so that it continues on cycle 1. Furthermore, researchers try to make a scenario with Visual reality technology. This is intended so that students experience an increase in the value of motor sensors. The results of action 1 indicate that the learning outcomes obtained have increased and the learning process has undergone many changes and is better than before that is 50% with 6 students incomplete. Based on the results of the evaluation, the study continued by giving direction as well as mental guidance to students. Then it is repeated again in the next two weeks, the second cycle. The results obtained are 1 student not graduating with an average level of 91.67%. The agreement between the researcher and the teacher of fine motor subjects in the Dilaraf Islamic School of Tangerang, then the learning cycle with VR Technology can be applied.

4. Conclusion
Based on the results of research by testing the assessment through the learning cycle it can be seen that the application of VR technology can increase both cognitive and psychomotor competencies, supporting practicum activities dynamically, animatively and interactively so that it is not boring and attracts ABK students to learn, students can learn to express what which he saw through virtual reality. The teacher acts as the listener of the child's story and provides an explanation of the child's knowledge. Students are stimulated to direct emotions towards learning. The application presented using Virtual Reality Technology will visualize 3D objects that have been arranged in such a way as to form a Virtual environment that is very interesting for students. However, in its use teachers are expected to help.

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