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Research paper

Design and Implementation of Motion Expression Activity Program Applying LMA to Children with Intellectual Disabilities Using ICT

SungHee Hong[1]*, EunHye Kim[2]

[1, 2] *Shinhan University, Korea*
** Corresponding author E-mail:hongsungh22@hanmail.net*

Abstract

The purpose of this study is to design and implement a movement expression activity program through ICT using Laban's LMA in recognizing movements of children with intellectual disabilities. Kinect and Laban's movements were used to construct a motion expression activity program. In this research method, screen image screen and theme music were used as contents of musical work <Les Miserable>. The motions of randomly set to 40 kinds, and when the movement of the screen coincided with each other, the score was displayed with the ringing tone. The experimental design was conducted for 13 children with disabilities for 4 days (12. 21 ~ 12. 25. 2016). In addition the willingness to match the motion of the screen in kinetic expression activities using Kinect, repetitive exercises gradually improved the completeness of the movements and the final score of the game. This study, it has been observed that curiosity, interest, and immersion in movement expression activity are designed and implemented by using Kinect for the movement expression activity program with a new education game approach that can eliminate the fear of physical activity it was tried.

Keywords: *Movement Expression Activity, Laban Movement* Analysis *(LMA), Kinect, Children with Intellectual Disabilities*

1. Introduction

1.1. Characteristics of Children with Intellectual Disabilities

Children with intellectual disabilities are less likely to undergo physical changes such as height and weight compared to non-disabled children, but they become similar when they are fully mature, or the difference is relatively small [1].

However, children with mild intellectual disabilities have physical differences with non-disabled children and may be delayed for 1-4 years [2]. These children with intellectual disabilities tend to have more physical differences because they tend not to have leisure activities or physical activities [3].

The purpose of movement activities of the body is to promote healthy growth and development of body and soul, social development, improvement of physical ability, leisure, interest in own health and body, improvement of confidence in social life, relieving stress, it is a major guideline for conducting a happy life [4]. Physical activity includes all the elements of the emotional, social, and physical aspects, and these factors can help to learn the interactions In addition, physical activity during childhood promotes physical, emotional, and social development through repeated use of multiple sensory organs [5, 6]. Most of the disabilities of children with intellectual disabilities have complex disorders (developmental disorders, autism, etc.) caused by a lack of sensory and perceptual abilities.

In particular, when students fail to perform tasks due to their inadequate intellectual abilities in school life, they also hinder social and psychological development [7, 8, 9, and 10]. This physical development requires a sense integration movement for children, and this effect is more effective at an early stage [11].

In the case of children with intellectual disabilities, hyperactivity appears in the creative expression activities of behavior when performing unfamiliar behavior [12], and it is evaluated as excessive motivation, excitement, and tension [13]. But because they do not know the sequence of action and how to enforce it, they are seen to be hyperactive behaviors due to impulsive and accidental lack of action [13, 14]. This hyperactivity is a simple behavior due to cognitive cause, but is due to a lack of clarity on how to perform the action for low cognitive abilities. They do not know the order of actions and practices rather than psychological burden [14]. Hyperactivity is assessed as excessive motivation, excitement, and tension during exercise [13]. It is because of the cognitive cause view rather than the mental cause. It is a simple operation but it is not clear how to perform the action due to low cognitive ability [14]. In the case of lack of experience in expressive activity, it is claimed that repetitive learning about various forms improves expressiveness [15].

1.2. Laban Movement Analysis (LMA) theory

Rudolf von Laban[16, 17] who describes the movement as the source of creation, was interested in how all the movements of the human being seen in dance, theater, sports, etc. are expressed in the space in which we live, then he observed and analyzed the movement that were performed by us. It has been very comprehensive and universal about the movements of the body from the actual habitual movement to the artistically creative movement. Laban Movement Analysis (LMA) [18] is an analysis system of motion based on Laban's theory. It is used for human and animal movements and movement of objects as well as various move-

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ments expressed in virtual space. And all natural and artificial movements of the human body. The application of LMA which emphasizes the ability of body to recognize the movement, is to help the recognition of the body part that is the basic means of movement for the subjects who have restriction on the natural motion due to lack of recognition of the body part. Laban movement analysis helps to assert the psychological state and assertion in the body's unconscious or conscious movements such as BESS, body, effort, space, shape, and weight (e.g. Figure 1). In each of the four categories, Body refers to what moves, Effort moves, and Shape refers to how it relates to the environment. ? ', And the space is the question' where does it move? 'Each of the four elements of Body, Effort (qualitative or dynamic), Shape, and Space are equally important in human motion [18, 19, and 20].

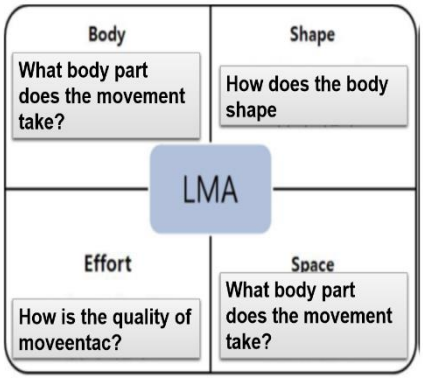

Fig. 1: LMA component

The four categories of Laban Motion Analysis (LMA), BESS, are also closely linked to each other, as various elements are intricately intertwined, whether intended or not. In other words, mutual affinity means that the Effort factors have mutually related characteristics with the space and shape of motion

2. Main body

2.1. Kinect Camera

Fig. 2 the Kinect, developed by Microsoft, is a peripheral device connected to the XBoX360. It is equipped with a camera module and recognizes the motion of the user with motion capture. The Kinect camera supports not only real time depth information but also provide RGB image and joint tracking information [21].



Fig. 2: http://www.XboX.com

2.2. Principle Kinect Camera

The principle of the Kinect camera is to use infrared rays to scan the user, and the infrared rays that reach the body are reflected and transmitted to the Kinect. The equipped sensor then captures the distance per pixel according to the reflected infrared rays, and the image processing software recognizes the play in real time. When the user in the recognized state moves, the software displays the screen according to user's movement.

2.2. Skeleton Recognition

The principle of the Kinect camera is to use infrared rays to scan the user, and the infrared rays that reach the body are reflected and transmitted to the Kinect. The equipped sensor then captures the distance per pixel according to the reflected infrared rays, and the image processing software recognizes the play in real time. When the user in the recognized state moves, the software displays the screen according to user's movement [22].

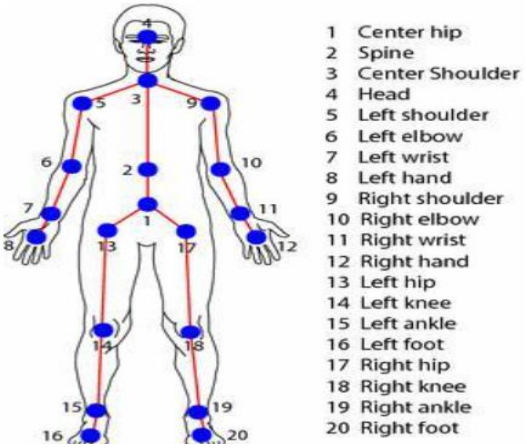

Fig. 3: Joint points of the Kinect skeleton http://patents.google.com

Fig. 3 in order to obtain joint information for the whole body of the user, it is possible to apply the game using all parts of the body such as arms, legs, waist, and buttocks. It should be within the field of view of the Kinect camera sensor. When the user stands in front of the Kinect camera, the image is analyzed to separate the background and the user.

3. Design and Implementation

3.1. Target and Design

The educational sports games designed in this study were used for 4 days (12. 21~12. 24. 2016), for the intellectual disability education program of the local government in South Korea and participated in ages 8 to 18 years. The subjects were selected from 13 children with mild handicaps among the 32 children with intellectual disabilities and they were able to recognize the words for 20 hours a day for 5 hours.

In this study, we used Mat Lab to recognize the user's joints and display them on the screen using the Kinect camera (e.g. Figure 4).



Fig. 4: Participant's place and process.

3.2. Musical 'Les Miserable' Choreography and Image Production for Kinect Game Production



Fig. 5: Choreography and image creation for Kinect game creation

Fig, 5 'Les Miserable' for Kinect game production was designed for 40 choreographies and motion analysis (except for 8 motion movements in repeat motion).

3.3. Design and Implementation

The beginning scene of musical and the user's image along with the joint position for motion recognition are shown as (e.g. Figure 6). If you keep this posture for a while, the whole body recognition process will end. Once recognized, you can see that the mapped joint moves with the user's movement as the user's behaviour changes. Keeping this posture for a while will end the whole body recognition process. Once recognized, as the user's motion changes, the mapped joints can be seen to move along with the movement of the user.

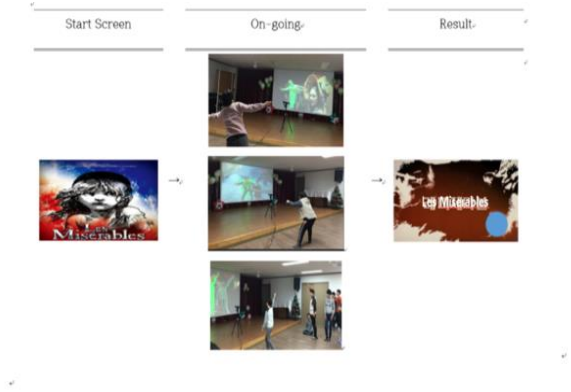

Fig. 6: Experimental program configuration

4. Conclusion

In this study, children with intellectual disabilities were more awkward on the screen when they encountered programs with Kinect, but the time was shortened by following the gradually moving movements. As the scores of the motions were increased, self - confidence increased. We can observe that the movement can be expressed differently even if the movement is the same. When the movement from the center of the body is started for which the representative movement is observed in the motion expressing activities of the children with intellectual disabilities, the body recognition of the center of body is concentrated, and the motion of the body freely appears in the actual life.

The behavior of children with intellectual disabilities in the study, on the contrary, showed that Kinect moves from the fingertip and toe, which is the farthest part of the body, to meet the movement image. These movements have been shown to be more difficult as they continue to the next consecutive motion.

Therefore, the program should be developed so that the movement of children with intellectual disabilities can be expressed naturally in which leads to the movement of the natural body in real life. These motions appear to be self-confident behavior for children with intellectual disabilities and this study suggests that ICT program should be developed continuously through body movements

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