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Kinect Sensor- based LMA Motion Recognition Model Development

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Abstract

The purpose of this study is to suggest that the movement expression activity of intellectually disabled people is effective in the learning process of LMA motion recognition based on Kinect sensor. We performed an ICT motion recognition games for intellectually disabled based on movement learning of LMA. The characteristics of the movement through Laban's LMA include the change of time in which movement occurs through the human body that recognizes space and the tension or relaxation of emotion expression. The design and implementation of the motion recognition model will be described, and the possibility of using the proposed motion recognition model is verified through a simple experiment. As a result of the experiment, 24 movement expression activities conducted through 10 learning sessions of 5 participants showed a concordance rate of 53.4% or more of the total average. Learning motion games that appear in response to changes in motion had a good effect on positive learning emotions. As a result of study, learning motion games that appear in response to changes in motion had a good effect on positive learning emotions

Keywords: *Azure Kinect, Laban Motion Analysis, Movement activity*

1. INTRODUCTION

The educational field is also changing a lot as we face the unintended era of un-tact due to Corona 19. In particular, living in group facilities and experiencing unforeseen society has made it more difficult for people with disabilities who are vulnerable to infectious diseases to do outside activities. As they cannot attend school or spend less time with people around them, they are becoming increasingly isolated. It is very important to provide a new learning experience in the educational field for the disabled. Therefore, this study needs a new learning experience while experiencing a motion expression activity program based on the Kinect sensor. It intends to present various content case studies of motion recognition model development by experiencing the motion recognition learning process. In this study, as a convergence and complex study using ICT, motion recognition games were conducted for the disabled, using LMA movement activities as a basis. The quality of movement through Laban's LMA is that movement occurs through the human body that recognizes space [1, 2, 3]. These movements appear differently according to changes in weight, including changes in time and tension or relaxation in emotional expression. In this study, we set the iterative learning process as the basic motion for expressing emotions [4, 5]. Learning effect through repetitive vocational training for intellectually disabled people functional game content proposal for diagnosing and improving cognitive function playing digital textbooks for special education for the disabled developed as the significance of character education in elementary physical education using games [6, 7]. The research was presented only as an educational game.

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2. EXPERIMENTS

2.1 Research Design

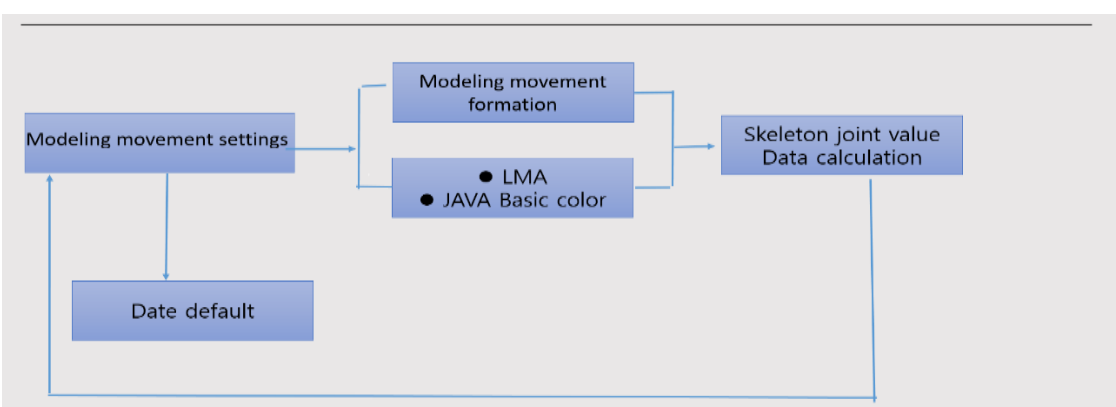
Table 1 shows subjects of this study were 5 persons with intellectual disabilities and were conducted 2-3 times a week for 10 weeks.

Table 1. Research subject characteristics

Age(name, gender)	Degree of disability	Disability characteristics
28(Ma, Male)	Mild	Communication is possible, lack of expressiveness and a lot of desire
25(Kim, Female)	Mild	Communication is possible and tend to do only what you went
19(Go, Male)	Mild	Communication is possible and have a willingness to actively participate favorite in programs
24(Choi, Male)	Mildly severe	Receiving language is possible but expressive language difficult and sincere
24(Go, Female)	Mild	Communication is possible some introspective and passible

Table 2 shows he progress of the program design was set as the concept of the game. 3 dance doctors (1 Korean dance major, 2 modern dance majors), game program technician, and dance therapist participated in the Laban movement setting. Participants were asked to follow the motion of the silhouette appearing on the game screen. At the same time as the appearance of the motion silhouette, the figure of the participant was also projected on the screen, and if it was adjusted to a certain level of motion (6 equal points in 12 joint values), the score was raised with the sound of 'ding-dong'. This was set to give the game adaptability and motivation, and the skeleton's joint value was assigned to each motion according to motion recognition. At this time, the default value of the joint was set based on the silhouette of the demonstrator's motion.

Table 2. Research design model



2.2 Azure Kinect

Figure 1 shows Azure Kinect is a developer with advanced AI sensors that provide visual and audio models with sophisticated computer vision, with more sophisticated sensor functionality than the existing Kinect1 and Kinect360. Azure Kinect includes a depth sensor, an array of spatial microphones with video cameras, and a direction sensor, an all-in-one compact device with multiple modes, options, and SDK (Software Development Kinect).

Figure 1. Main components of the frame (http:szure.microsoft.com)

2.3 Motion Recognition Program Progress

Figure 2 shows the first scene of the motion game, the individual's simple name, gender, and date of birth were recorded to calculate the joint value of each individual skeleton.

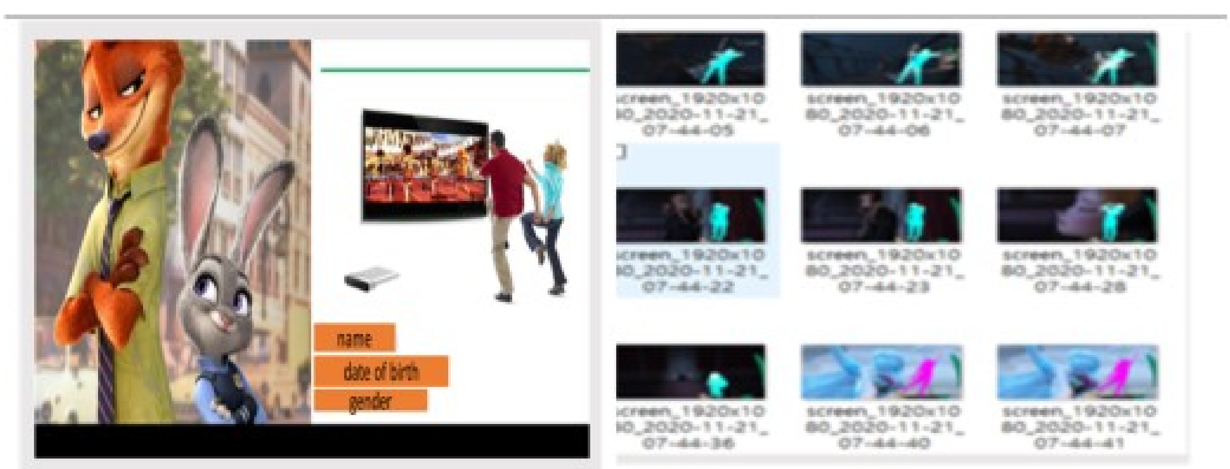


Figure 2. Program start and motion recognition progress

2.4 LMA Motion Recognition Model

Figure 3 shows in order to have time to communicate with Kinect, the movement was performed after practicing the three-scene movement at the same time as the start. In this study, in the motion game content setting, four basic emotions of humans (Joy, anger, sadness, happiness). The set to move, expressive activity. The rhythm of music and animation images that change according to emotions were set. The motion movement of the movement was connected to the video and the music. All motion movements were produced as videos. Selected music, video, and motion were mapped.

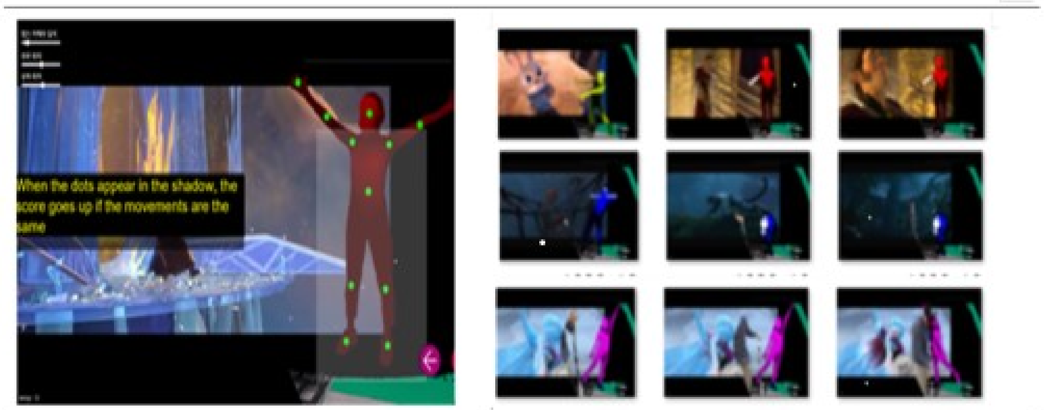


Figure 3. LMA motion recognition model

3. RESULTS

Figure 4 shows motion scores the elements of motion according to the motion performance ability of the game participant. If the picture and movement of the Kinect skeleton provided on the screen match correctly, a bell sound and a score have been added. The data were evaluated for the timing of participation in the movement game and the ability to perform movements after participation. The perfect skeleton value for each movement (head, right-left shoulder, right-left elbow, right-left hand, pelvis, right-left knee, and right- left foot with 12 joint values) was scored. A visual effect on the screen appeared so that participants could recognize the change in score.

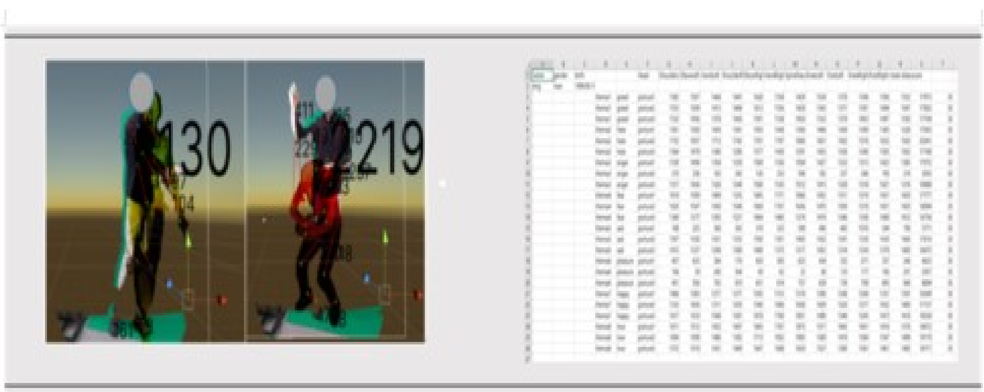


Figure 4. Motion skeleton joint values

3.1 Movement Individual Game Score

Figure 5 shows the time given to an action that appears on the screen was set to 20 seconds, and in this study, eight actions were selected as a case study and the score was measured. The test time required by one participant for the game was set within 2 minutes 40 seconds to 3 minutes. In order to organize the data, it was suggested that the data is collected through the posture of the movements according to the game movement, and the score increases by giving the feedback of the bell sound when the movements matched the movement program. On the other hand, no points were given for the scenes expressing inconsistent motions of the participant's posture, and they rendered their own appearance on the screen and checked their movements through them. Analysis of these data calculated the average of the highest and lowest scores after the performance of movement activity and 10 times participation.

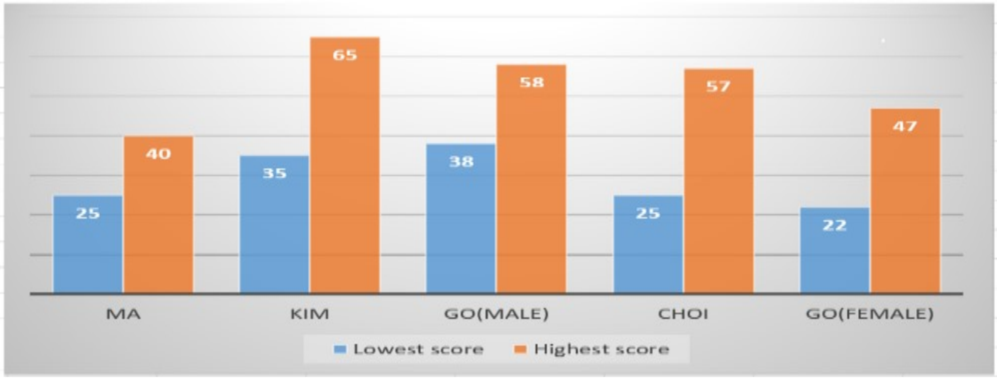


Figure 5. Movement individual game score

4. CONCLUSION

Figure 6 shows in this study, Laban's LMA was constructed by using Azure Kinect for the intellectually disabled. The motion recognition program content re cognizes the user's motion information and provides it to the kit sensor. A motion recognition model method generated from each vector was proposed by extracting the feature points of the skeletal model. The design and implementation of the motion recognition model will be described, and the possibility of using the proposed motion recognition model is verified through a simple experiment. As a result of the experiment, 24 movement expression activities conducted through 10 learning sessions of 5 participants showed a concordance rate of 53.4% or more of the total average. After the end of the motion work, the score display was set to give the participant the motivation to do better through the recognition of their performance ability and comparison with other participants. After participating in the Kinect sensor-based LMA movement program, the score continued to increase statistically and significantly.

Figure 6. Participating in a motion recognition game

It was found that it can effectively change the learning time of motion expression activities of intellectually disabled people who participated in the motion recognized model program using ICT. Therefore, it is necessary to develop a program so that the movements of children with intellectual disabilities that lead to the movements of natural objects in real life can be expressed naturally [8].

In particular, continuous and systematic development and management of programs provided to intellectually disabled persons residing in facilities can improve the quality of learning about movement activities and contribute to increasing the satisfaction of living in group facilities.

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REFERENCES

[1] S. H. Hong and E. H. Kim, "Design and Implementation of Motion Expression Activity Program Applying LMA to Children with Intellectual Disabilities Using ICT," *International Journal of Engineering & Technology,* vol.7, No. 3.33, pp. 191-193. Dec. 2018.

[2] S. H. Hong, "A Study on the Effects of Physical Activity Expression Activity on Self-Expression Ability and Self-Esteem of Students with Intellectual Disabilities," *Korean Journal of Arts Education,* Vol. 15, No. 1, pp. 127-140. Sep. 2017.

[3] S. H. Hong, "Children with Intellectual Disabilities Movement Expression Activity: A Study on Functional Game Contents Using Motion Graphics and Kinect," *Korean Journal of Arts Education*, Vol. 7, No. 3, pp. 121-136. Sep. 2019.

[4] J. M. Kwon and M. Y. Kim, "Job Training for the Intellectually Handicapped Using Functional Games: A Study on Contents for Game Use of Vocational Skills Textbook," *Korea Computer Game Society,* Vol. 25, No. 4, pp. 35-46. Dec. 2012

[5] S. W. Ji, J. B. Jung, K. C. Nam, and M. G. Choi, "Design and Implementation of Cognitive Enhancement Games for rehabilitation of old mans," *Journal of the Korean Computer Game Society*, Vol. 14, pp. 239-246, Sep. 2008.

[6] I. S. Kim, Development of digital textbooks for special education for the disabled with games. *http://www.etnws.co.kr*, 2009

[7] S. J. Park and H. J. Lm, "The Significance of Elementary Physical Education Class Using Games as Character Education," *The Korean Journal of Elementary Physical Education*, Vol. 17, No. 3, pp. 179-190. Oct. 2011.

[8] S. H. Hong and T. W. KIM, "A Study on the Use of Motion Graphics and Kinect in LMA (Laban Movement Analysis) Expression Activities for Children with Intellectual Disabilities." *International Conference on Human-Computer Interaction*, CCIS, Vol. 1088, pp. 149-154. Sep. 2019.