BALANCE LEARNING MODEL FOR DEAF CHILDREN

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Abstract. Deaf children have hearing impairments that result in speech impediments. After field observations of several physical education teachers and special school class teachers in Jakarta, there are several problems in deaf children, including fine motor, gross motor and balance disorders caused by hearing loss. The purpose of this research is to make a balance board for deaf children. The method used is Research and Development (R&D) by Borg and Gall method which consists of 10 stages of research. This tool consists of three components, (1) Frame component, (2) Body component and (3) Bluetooth interface based on android application. Consists of 12 indicator lights and 4 piezoelectric sensors that have been programmed in the arduino mega microcontroller, which works automatically and will be connected to android via bluetooth connection. There are 12 stages of the game arranged from easy to difficult. The test results show that the device can issue jump commands randomly or equally well, the jump ordered is displayed on the indicator LED lights and the android application interface simultaneously and in accordance with what is ordered. Piezoelectric sensor can detect the jump of each panel.

Keywords: Balance Board, Modification Board, Deaf Children, Deafness

1. INTRODUCTION

Deafness is a hearing impairment that interferes with the process of recognizing speech through hearing, either with or without an assistive device. Sign languages vary by country, but deaf people use sign language to communicate with others because the finger alphabet has been patented internationally. Soewito, quoted in his book Orto pedagogik [1] explains that deaf people: "A person who has a complete to profound hearing loss cannot hear the conversation without reading other people's lips."

Factors that contribute to hearing loss include heredity, maternal infections such as chickenpox during pregnancy, complications during childbirth, and childhood illnesses such as mumps and chickenpox. Signs of deafness include turning your ear to the speaker, using your ears during a conversation, and being unable to understand speech

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when you cannot see the speaker's face. Other signs include non-compliance with instructions, frequent requests to repeat what has been said, mispronunciation of new words and names, and reluctance to participate in classroom discussions [2]. Deaf students believe that sports can have a significant impact on better socialization. Therefore, these individuals should be involved in sporting activities from an early age [3]. Studies the importance of improving motor skills in deaf children. This may positively impact participation in sports [4].

The human balance system relies on the inner ear, eyes, and muscles and joints to convey reliable information about movement and orientation of the body in space. Vestibular receptors in the inner ear are responsible for maintaining balance. If the inner ear or other elements of the balance system are broken, the position of the body while standing or while moving will become unbalanced. This balance is related to learning, emotions and the social environment, which is the most important thing in every child's development is movement. Through movement will be able to stimulate sensing and vice versa, movement will stimulate the joy and awareness otherwise joy can be expressed by movement, movement allows social contact between people, social contact between people will stimulate movement, movement is the basis of observation and observation stimulates curiosity. Curiosity will produce experience, from experience will be obtained knowledge through observation, where knowledge from experience is the basis of thinking ability or understanding in a broad sense [5]. Balance disorder is one of the disorders that is rarely found in deaf children, but it does not rule out the possibility that there are one or even more deaf children who experience balance problems. Deaf children who have problems with the inner ear organs, where the vestibular (balance) center is located, will be very visible in their attitude and behavior. Hearing and vestibular influence each other because the organs used both use receptors located in the inner ear.

The author developed a tool design model that provides convenience and efficiency for deaf people in helping their balance problems. This tool is intended for physical education teachers to not train manually anymore. In addition to using a balance board, this tool will also be designed using lights to help children focus on their goals.

The development of technology has led us to the era of modernization. Almost every aspect of human life relies heavily on technology, as it was developed to make it easier for humans to act and work [6].

Science and technology are familiar terms that we hear every day. The development of people's lives at this time is inseparable from science and technology. In general, people assume that the mastery and

application of science and technology will guarantee the progress of society. Technology is one of the most important aspects of helping people who are deaf or have any kind of hearing impairment [7].

Indonesia is a developed country, which is still a consumer country for modern technology. Indonesia should be able to create tools that can be used for children with special needs. Not only for athletes but it would be better for children with special needs to develop science and technology and create tools that make it possible to assist development and assist in training and learning.

After researchers conducted a survey of several special school teachers in Jakarta, researchers got the results of 6 out of 7 teachers stating that deaf children have balance disorders. reinforced by research from [8] the balance of students in three special schools in Malang City is in the following categories: out of 58 students, 1 student (1.73%) fell into the fair category and the other 57 students (98.27%) fell into the poor category. Based on the research results, it can be concluded that the balance level of deaf students in special schools in Malang City is low [9].

From the explanation above, the researcher makes a balance board modification tool for deaf children in special needs schools. The balance board will be designed in such a way using lights with sensors that will guide children in doing balance training.

2. METHOD

This research is a research and development (R&D), with the research objective to find a way to develop a balance board modification tool to train balance in deaf children. The method used refers to research and development by Borg and Gall where there are 10 stages of research that are complex and complete, including: "(1) Research and information collecting (2) Planning (3) Developprelminary form of product (4) Preliminary field testing (5) Main product revision (6) Main field testing (7) Operational product revision, (8) Operational field testing, (9) Final product revision (10) Dissemination and implementation [10].

In this step, the researcher collects data based on studies from various literature or literature reviews related to the concepts of developing the model to be developed. The results of this study are developed to create or design a balance board modification tool to train balance in deaf chidren. The tool was tested on 15 low-level deaf children, with each child performing 3 repetitions, so the tool operated 45 times.

3. RESULTS AND DISCUSSION

3.1 Result

This section will present some of the results of the development of a balance modification tool for the deaf.

1. Research and information collecting.

The first stage was carried out by collecting information from SLB teachers in Jakarta "Balance is a problem for deaf students" which ultimately gave the idea for researchers to make the development of a balance board modification tool to train the balance of deaf children.

2. Planning

Planning is made in order to provide a clear guidance in the implementation of the research. After the potential and problems can be shown factually, then it is necessary to collect various information that can be used as material for planning. Field surveys are a way for researchers to gather information, information that can be obtained through physical education teachers and teachers in special need schools. And planning for making tools is presented at this point. This tool is created to assist deaf children in practicing balance.

The main components used in this tool are the arduino mega microcontroller which is needed to accommodate the needs of 4 piezoelectric sensors, and 12 indicator LED lights, HC05 bluetooth module, using an interface on an android tablet in the form of an application that can connect with arduino via bluetooth. To make this tool takes 5 months and uses help from mechanics experts, electronics experts, informatics experts and sports experts. There are 12 stages of the game arranged from easy to difficult.

3. Develop Preliminary from Of Product

Product design is the result of a series of preliminary research, in this study is a modification of a balance tool to train the balance of deaf children called a balance board. The following is the design that has been made:

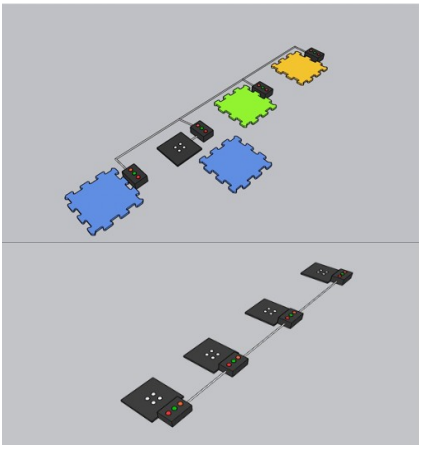

Figure 2: Design of Balance Board (frame component)

4. Preliminary field testing

This preliminary product trial by practicing using a balance board that is assisted by 1 subject to test the operation of the tool. Tested 15 times. There are several revisions:

a. The sensor used is not sensitive enough so the tool does not proceed to the next stage.
b. The tool is still unsafe because there is no anti-slip under the board.
c. Sometimes lights and applications are not synchronized with android applications
d. The contents inside the controller are not organized well.

5. Main Product Revision

After preliminary field testing, we continued to repair the weaknesses of the product.

6. Main field testing

In this test, the tools used have been revised, the tools have used sensors that have added calibration, tools that have been installed anti-slip and system updates in the android application to make synchronization run smoothly. The next step is the same as Preliminary field testing, but this step uses a large scale or more subjects. Doing 30 repetitions with a total of 5 subjects. The results show that the tool is running very well. no obstacles occurred from 30 trials.

7. Operational product revision

Product revision again based on the results of Main field testing. This is the final revision of the product.

8. Operational field testing

In this Operational field testing, the product being tested is the final product that will not be revised again. This tool was tested by 15 subjects with each subject doing 3 repetitions, so this tool operated 45 times. It was found that the tool can send out random jump properly, the ordered jumps are displayed on the indicator LED lights and the android application interface simultaneously and in accordance with what was ordered. The piezoelectric sensor can detect the jump of each panel.

After doing several stages and the process of making the tool. At the following stage is the initial product image:

Figure 3: Final Product (Body component)

The picture below is a picture of the controller that has been packaged in such a good way. The controller is a motor that run the program from this tool.

Figure 4: Controller product
(Bluetooth interface based on android application)

This balance board is equipped with a tablet that displays images to direct the subject to perform the instructed movements. so in addition to the lights that appear on the board there are pictures taken on the tablet to make it easier for the subject to make decisions, here is a picture of the tablet and its contents:

Figure 5: Tablet Displays

The application on the tablet will direct the subject to make movements according to the lights that are on. If the light is red then the subject must jump using two feet, if the light is yellow then the

subject must jump using the right foot, and if the light is green the light uses the left foot. In addition to the board sensor and the application on the tablet this tool also makes a sound. The voice here is intended for researchers or audiences who are watching the course of research.

9. Final product revision

At this point, revisions are made to serve as suggestions for the next researcher. Evaluation of the modification of the tool that has been created. Then, the answers will be analyzed for the benefit of product improvement for future researchers.

10. Dissemination and implementation

Dissemination and implementation of tools is the delivery of the results of research on the development of balance board modification tools from processes, procedures and products to users, especially to special school teachers. While dissemination by participating as a presenter of the international conference of sport science physical education and healt October 2022.

Based on the results of several research steps, this tool was successfully designed and developed. First, researchers make new innovations to train the balance of deaf children with 12 stages of games arranged from easy to difficult. Second, the addition of a sensor reading calibration program on the Arduino so that it can read movements more accurately. Third, after conducting 3 repeated tests and 3 times revising this tool, it has operated very well without any errors in the last test step.

3.2 Discussion

Balance training tools for deaf children are designed to help children with hearing loss develop their motor skills and body balance. Because body balance is often related to hearing function, balance exercises are important for deaf children to support their motor development and coordination. Balance boards have many benefits for deaf children. This tool helps in improving their body coordination, muscle strength, as well as motor ability. Here are some special benefits of balance boards for deaf children:

1. Improves Balance and Posture

Deaf children often experience balance challenges due to disturbances in the vestibular system (the body's balance system associated with hearing). The balance board trains them to control posture and develop body awareness while maintaining balance over unstable surfaces.

2. Developing Motor Coordination

Through exercises on the balance board, deaf children learn to coordinate their hand, foot, and body movements. This is essential to support daily activities and other physical skills, such as walking, running, or climbing stairs.

3. Increases Muscle Strength

When practicing on the balance board, the child will use core muscles such as the abdomen, back, and legs to maintain stability. This helps to strengthen those muscles, which in turn improves posture and mobility.

4. Trains Concentration and Focus

Exercises on the balance board require good concentration to maintain body stability. It helps deaf children develop the ability to stay focused in carrying out physical activity.

5. Increase Body Awareness

Children will learn to feel the position of their bodies in space and how their bodies move to balance themselves. This is important for improving overall body control, especially for children with sensory impairments.

Children with special needs whose physical characteristics are almost the same as normal children are deaf children, except children with hearing impairments or deficiencies in their hearing. Physically deaf children still have the opportunity to be able to develop optimally, especially in the aspect of movement, although it cannot develop as fully as in normal children.

Causes of hearing loss or hearing loss can occur before or after the child is born. According to experts [1] Suggests that the factors that cause hearing loss can be categorized as follows:

1. Factors before the birth of the child
2. Childbirth factors
3. Postpartum Factors

Deafness is a term that refers to a condition in which a child's hearing organs or ears are damaged. This condition creates unique characteristics that set them apart from normal children. Deaf children have the following characteristics:

1. Physical aspect
2. Language
3. Intellectual
4. Social-emotional

Being aggressive most of the time. Deaf children are aggressive because they feel they cannot interpret what others are saying. Deafness can be classified based on several criteria. Based on the degree of hearing loss, these are: (1) Mild Hearing Loss, (2) Moderate Hearing Loss, (3) Moderately Severe Hearing Loss, (3) Severe Hearing Loss,

(4) Profound Hearing Loss. Based on the time of onset, deafness can be classified as: Prelingual Deafness and Post Lingual Deafness. Based on the anatomical location of the hearing loss, deafness can be classified as: (1) Conductive Type Deafness, (2) Sensorineural Type Deafness, (3) Mixed Type Deafness. Based on etiology or origin, deafness is classified as: Endogenous Deafness and Exogenous Deafness [11].

This tool can help deaf children to train their balance using technology. This research must be developed again and the tool must be operated for balance training for deaf children. This tool must be simplified so that it can be produced at a low price so that deaf children can buy and practice at home or school.

4. CONCLUSION

A balance board tool has been created to train the balance of deaf children. where this tool is supported by an android application that helps deaf children in instructions to perform movements. This tool has been tested and can be operated openly to deaf children. There are 12 stages of the game arranged from easy to difficult. Based on the above conclusions, the authors can provide suggestions that can help overcome the problems encountered in making this balance board tool can help overcome the problems encountered in making this balance board tool:

1. Researchers must be able to continue research and development of this tool, researchers realize that there are some weaknesses in the research and development of this tool, where the lack of precision in the detection or reading of jumps so that further development must be carried out until the tool can read jumps with precision and stability.
2. Replacement of a faster microcontroller in the data processing process so that it will be faster and more stable.
3. Enhance the appearance by using good materials such as hight quality plastic and resistant to pressure.
4. Make a guidebook to make it easier for using the tool independently on the tablet can run smoothly, and the sensor will be more sensitive

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