DIGITAL TRANSFORMATION OF PHYSICAL EXERCISES TO ENHANCE REFLEXES AND SPATIAL AWARENESS FOR BLIND AND VISUALLY IMPAIRED CHILDREN

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Summary

Through applying conventional research methodologies in physical education and sports, this study has developed a systematic digital transformation process, accompanied by four digital product sets demonstrating significant positive effects on 7-year-old blind and visually impaired children. Empirical trials have validated the efficacy of 66 digital-transformed exercises. Among these innovations, the newly developed "Training for the Blind" application stands out as it successfully meets the training needs and fosters enthusiasm among participants, while also accelerating the community reintegration process for blind and visually impaired children.

Keywords: blind and visually impaired children, blindness, severe visual impairment, SOS Children's Village Hanoi.

INTRODUCTION

In Vietnam, blind individuals make up a significant portion of the disabled population, with children being a particularly vulnerable group that requires greater societal attention. The rapid progression of digital transformation in recent years has had a profound influence across all sectors, including sports, which is increasingly adapting to align with these technological advancements. We are now in an era of extensive digital integration, making the application of digital technologies to physical exercise programs for blind and visually impaired children both timely and essential. These interventions are designed to improve reflexive abilities and spatial awareness, aiding in the early reintegration of blind and visually impaired children into society. However, this sector remains limited in Vietnam. Consequently, selecting digital-transformed exercises, which enhance the reflexes and spatial awareness of children living at the SOS Children Village in Hanoi, plays an important role to the weak in society. Therefore, it boosts the process of reintegrating into the normal society of blind and visually impaired children.

RESEARCH METHODS

This study employed a comprehensive array of research methods, including Document Analysis and Synthesis, Pedagogical Observation, Interview Method, Expert Consultation, Pedagogical Experiment, Pedagogical Testing, and Statistical Analysis.

RESULTS AND DISCUSSION

Through various research methods, the study selected 66 out of 68 exercises, categorized into four groups: Basic warm-up exercises group (3 exercises), Exercises to enhance reflexive abilities group (29 exercises), Exercises to improve spatial awareness group (27 exercises), Cool-down exercises group (7 exercises)

The process of digital transformation for exercises to enhance reflexive abilities and spatial awareness for blind and visually impaired children at the SOS Children's Village is illustrated in Diagram 1. The results of interviews about selecting digital technologies for these exercises are presented in Table 1.

The data presented in Table 1 indicates a strong consensus among experts regarding the selection of three technological tools, with total scores ranging from 58 to 66 points. The

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Step 1	Step 2	Step 3	Step 4	Step 5
Situation assessment and planning	Strategy development	Data and process digitization	Organizational preparation	Evaluation and improvement

Diagram 1. Process of digital transformation for exercises to enhance reflexive abilities and spatial awareness for blind and visually impaired children

average Likert values (on a 3-point scale) were between 2.94 and 3.0. These results confirm the validity of the established processes and provide a basis for implementing the subsequent steps to digitize exercises aimed at enhancing reflexive abilities and spatial awareness for blind and visually impaired children at the SOS Children's Village in Hanoi and surrounding facilities in Hanoi and Bac Ninh. At the same time, experts unanimously emphasized the attention to the newly programmed technological product, which applies digital transformation: the app Training for the Blind. The established process for using the Training for the Blind app is as follows:

- Step 1 (with assistance): Download the "Training for the Blind" app and install the software on the device. Make sure to select the appropriate platform (iOS or Android) based on the device being used.

- Step 2 (with assistance): Open the software on the installed device.

+ Option 1: A volunteer assists in entering the child's information into the app in text form.

+ Option 2: A volunteer lets the child enter information into the app by saying the information.

- Step 3 (with or without assistance): Implement the lesson plan using the digitized voice exercises that the app's artificial intelligence platform has set up for training. In the initial training stages, children will require assistance to help them understand reflexive responses and basic exercise routines, which will take about two lesson plans. Afterward, children can practice independently at this stage. The app allows adjustments to the reading speed - either faster or slower - and enables users to return to previous lesson plans if training outcomes are unsatisfactory; however, lesson plans cannot be accessed out of order, as this would cause the app to malfunction.

- Step 4 (with or without assistance): Exit the software by pressing the "stop" button, pressing "Back" twice, or using the power button to exit.

• Note: After Step 4, the volunteer can record training information, noting strengths and weaknesses, as well as evaluating the lesson plan. If the child practices independently, they should describe their personal feelings and the degree of adherence to the lesson plan to the volunteer to collaboratively find appropriate solutions for the next lesson.

The experimental organization process lasted for three months, with 2 to 4 sessions each week (not including additional voluntary practice time). The experimental subjects consisted of 120 blind and visually impaired children, both male and female, aged 7, from 9 clubs, special schools, and care centers for blind and visually impaired children located in Hanoi and Bac Ninh. The results were recorded before the experiment and after three months of practice through selected tests. The results are presented in Figure 1, Table 2, and Diagram 2.

The results in Table 2 indicate that both the experimental and control groups of 7-year-old children, regardless of gender, showed significant differences in most tests, with t-calculated exceeding the t-table at a probability level of $P < 0.05$. This demonstrates that the implementation of the selected digitized exercise programs positively impacts the development of reflex and spatial awareness skills in blind and visually impaired children at the SOS Children's Village in Hanoi and nearby facilities in Hanoi and Bac Ninh. However, in the group of Girls Aged 7 – Visually Impaired,

Table 1. Interview Results on Selecting Technologies for Digitizing Exercises to Enhance Reflexive Abilities and Spatial Awareness for Blind Children (n=22)

No.	Content	Total points	Likert
1	**Big Data Application (Online Storage Application):** *Advantages:* Offer a free sponsorship to the project for research implementation with a total upload capacity of 120GB, valid for 2 years (valued at 3,500,000 VND per year)	58	2.94
2	**Vbee AI Voice Studio (Artificial Intelligence Voice Application):** **Advantages*:** Free text-to-voice conversion for the project with a total upload capacity of 10,000 documents, expanded storage for voice files in MP3 format, valid for 1 year. Logo image	66	3
3	**Developing Open-Source Code and Creating an App (Mobile Application for iOS and Android Platforms):** - Logo Design Concept: + The stylized letter "S" represents the shape of Vietnam and forms an eye. + Three white dots in different colors represent the three regions of Vietnam, symbolizing the blind. - The colors gray, yellow, and green represent mountains, plains, and seas. Green symbolizes hope; orange signifies determination to overcome personal challenges; and gray represents resilience and the drive to progress with the nation. - App Logo Name: **Training for the Blind** -**Advantages:* +The app is newly developed, free, and can store data in text or voice format (MP3). It functions both offline and online, supporting users with operations akin to Artificial Intelligence.	66	3

Figure 1. Process for downloading the app/installation/inputting information data and practicing reflex and spatial awareness skills for blind and visually impaired children

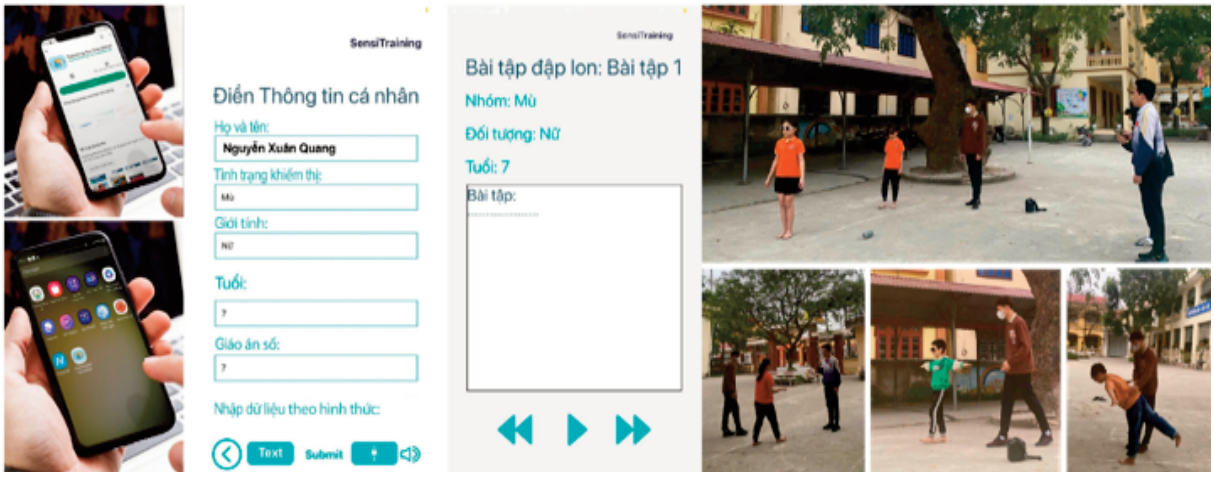

Table 2. Comparison of results from the use of digitized exercise programs through assessment tests for enhancing reflex and spatial awareness skills in 7-year-old blind and visually impaired girls (n=120)

No	Tests	Comparison of Results between Control and Experimental Groups							
		Girls Aged 7 (n=60) – Blind				Girls Aged 7 (n=60) – Visually Impaired			
		Control Group (n=30)	Experimental Group (n=30))	t	P	Control Group (n=30)	Experimental Group (n=30)	t	P
1	Identify Sound Signals (s)	18.0 ± 1.14	17.88± 1.11	2.51	<0.05	17.9 ±1.03	15.6 ±1.07	2.51	<0.05
2	Identify Reflex Signal in Four Directions (points)	7.2 ±0.42	7.9 ± 0.37	2.39	<0.05	7.5 ±0.37	7.8 ±0.33	1.11	>0.05
3	Follow a Straight Line (cm)	166 ±2.50	148 ±2.44	3.38	<0.05	145 ±2.50	125 ±2.60	2.42	<0.05
4	Determine Hand Angle (degrees)	44.0 ± 1.19	36.5 ±1.54	2.37	<0.05	43.01 ±1.19	35.1 ±1.29	2.49	<0.05
5	Determine Body Angle (degrees)	47.01 ±1.66	41.05 ±1.68	2.34	<0.05	46.04 ±1.50	45.1 ±1.74	1.6	>0.05
6	Evaluate Interest Level in Participating and Practicing Digital Exercise Programs (points)	5.5 ±0.62	8.19 ±0.41	2.36	<0.05	7.78 ±0.35	9.8 ±0.24	6.38	<0.05

Diagram 4: Digital conversion products for exercises for blind and visually impaired children aged 7 & 8	1) Lesson preparation, selection, and detailed observation of each exercise, then describing it in digital text file format: ***Advantages:** No need for speakers or headphones, helping volunteers have a system of text-based exercises for reference, reading, and guiding the participants to ensure expertise.
	2) Converting text files into voice files, in MP3 format with 66 exercises: ***Advantages:** Volunteers do not need to read the text; they can actively and adaptively play the MP3 files (these files are suitable for children who have developed basic motor skills).
	3) Set of 8 offline data files, including 240 exercise methods aimed at specific condition of different visually impaired participants: ***Advantages:** Files are arranged according to training programs that are recommended by experts, and follow AI-approached orientation.
	4) Brand-new software: app named "Training for the Blind" (includes the full set of products in items 1, 2, and 3): ***Advantages:** Smart, easy access (only requires internet and a smart device).

Diagram 2. Advantages of digitized exercise programs for enhancing reflex and spatial awareness skills in blind and visually impared children

there were still two tests where, despite the experimental group's mean values being higher than those of the control group, they did not show statistically significant differences at the probability level of $P > 0.05$.

CONCLUSION

The research process has established a digital transformation process, along with four digital product sets that have a positive impact on 7-year-old blind and visually impaired children, including those who are totally blind. The practical application results have proven the effectiveness of the 66 digitized exercise programs, comprising 120 specific training lesson plans for four target groups. Notably, the newly created product, the app "Training for the Blind," has met the needs and interests of participants, facilitating the reintegration process into the community for blind and visually impaired children.

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