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Beyond Sight: Developing Inclusive Health-related Exercise for Visually Challenged Learners

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Abstract. This study aimed to develop an exercise routine for Visually Challenged (VC) learners and investigate their previous experiences and background in the field of Physical Education (PE in the Special Education (SPED) schools of Iligan City. In this study, qualitative and quantitative methods were applied utilizing Input, Process, and Output framework. This study employed qualitative and quantitative research designs. The researcher utilized Likert Scale to evaluate the exercise routine and semi-structured questionnaire to gather information about the previous experiences of SPED teachers and VC learners in the field of PE. Findings indicate a strong positive validation from the five experts. The material or instrument being evaluated is perceived as clear, relevant, understandable, well- worded, concise, comprehensive in its coverage of study variables, and utilizes an appropriate measurement scale. The consistent "Agree" or "Strongly Agree" interpretations across all indicators suggest that the experts found the evaluated material or instrument to be of high quality in terms of clarity, relevance, understandability, wording, conciseness, coverage of variables, and appropriateness of the scale. The study concluded that the development of an exercise routine for visually challenged learners is a feasible and promising approach to address the accessibility gap in physical education. A systematic, iterative design process, incorporating stakeholder feedback, is essential for creating effective and relevant educational tools for VC learners. The exercise routine format has the potential to enhance the learning experience of VC learners by providing accessible and engaging auditory instruction.

Keywords: Health-related exercises, Physical Education, Visually Challenged Learners, Inclusive Education, Special Education

1. Introduction

Inclusive education in the Philippines has been growing a priority in the recent years. The Department of Education (DepEd) recognizes the need to address the problem of lack of inclusivity in education in the country and thus ensures that the rights of the children are guaranteed. DepEd Order No. 72, series of 2009, is a comprehensive inclusive program for children with special needs. Physical education teaches students the significance of maintaining physical health; however physical health status in the Philippines has noticeably diminished due to the rise of technology and the evolving youth culture shaped by social media (Parantar, 2019). Many public schools in the Philippines struggle with limited resources, including inadequate facilities, equipment, and trained personnel for teaching physical education effectively (Aguilar,2019).

When it comes to teaching Physical Education to visually challenged learners in the Philippines, several challenges are also encountered. Many teachers in the Philippines may have not received specialized training on how to effectively teach PE to visually challenged learners. The lack of training can spring to uncertainty and difficulty in implementing instructional methods and activities to meet these students (Echevarria & Lopez, 2017).

Limited access to adaptive equipment and resources has been one of the challenges of teaching PE to visually challenged learners. Visually challenged learners require adaptive equipment, tactile markings, and audio-based guidance systems (Darcy & Smith, 2012). Designing an inclusive PE curriculum that addresses the diverse needs and abilities of visually challenged learners can be challenging. Educators may struggle to create activities and lesson plans that are accessible, meaningful, and engaging for all students, regardless of their visual abilities (Echevarria & Lopez, 2017). Ensuring the safety of visually challenged learners during PE activities is paramount. Educators must carefully plan and supervise activities to minimize the risk of injury, considering factors such as environmental hazards, communication barriers, and the need for clear instructions and guidance (Darcy & Smith, 2012). Students who are visually challenged encounter both challenges and successes when participating in physical education classes. Challenges include difficulties accessing learning materials, following physical activities, and adjusting to a new environment (Estrada, 2023). Visually Challenged learners may face social barriers and feelings of isolation in PE settings. Educators must actively promote social inclusion and facilitate positive peer interactions to ensure that visually impaired students feel welcomed, respected, and supported by their peers (Echevarria & Lopez, 2017). These challenges are important and addressing them requires a collaborative effort from educators, administrators, policymakers, and the community to ensure that visually challenged learners have equal access to quality Physical Education.

Effective teaching requires effort and creativity from the teacher to ensure students benefit. The teacher plays a crucial role in successful teaching. Resources like equipment and administrative support are essential for high-quality instruction. Both teachers and students need positive attitudes. Well-planned activities with suitable equipment can help visually impaired individuals maximize their abilities and overcome challenges (Jakinda, et.al., 2022).

While there are several studies conducted on how to effectively teach PE to the students, there have been a need for more studies and intervention on how to effectively teach PE to visually challenged learners since they are also recipients of quality Physical Education. Addressing this gap, the current study aims to assess the background and history of VC learners in the field of physical education and develop a learning material to aid teachers and VC learners in teaching and learning physical education. This study focuses on creating a suitable exercise routine that is safe and suitable for the needs of the VC learners through assessing the history and background of the VC learners in the context of Physical Education. The creation of the exercise routine is anchored on the Input, Process, and Output framework.

2. Methods

This study aims to assess the VC learners PE background and develop an exercise routine tailored for visually challenged learners in teaching physical education hence anchored in IPO stands for Input, Process, and Output framework. The IPO framework is a conceptual tool that helps visualize the flow of information and the relationship between different components of a study. IPO in this study is composed of the following:

Input

Data collected through interviews from the visually challenged learners, the SPED teachers, field experts regarding their experiences in teaching physical education.

Process.

This refers to the course of action that will be taken to transform input into outputs. This study's process includes: (1) Choosing a topic: This study will focus on the health-related Exercises. Health related exercises play a crucial role in maintaining overall and well-being and preventing chronic diseases (WHO, 2020). (2) Create exercise routine. (2) The exercise routine will then be evaluated by field experts.

Output.

This refers to the final exercise routine for the VC learners.

2.1 Research Design

In this study, qualitative and quantitative methods were applied utilizing Input, Process, and Output framework. In the Quantitative Research Design, the researcher utilized Likert Scale to evaluate the exercise routine. In the Qualitative Research Design, the researcher conducted interview with SPED Teachers to explore their experiences and history in the context of Physical Education. Research activities were primarily conducted in the entire Schools Division of Iligan City, particularly the following schools:

1. Iligan City SPED Center
2. Tambo Central School
3. Sgt. Miguel Canoy Memorial Central School

The respondents of this research were (5) field experts; and (3) SPED teachers. The researcher of this study utilized a purposive sampling approach. The aim is to accommodate diversity among the participants including different age groups, educational levels, and backgrounds. By including a diverse sample, the study can gather a range of perspectives and experiences related to the implementation of the exercise routine.

In the selection of SPED teachers, below are the criteria:

1. He/she is a SPED teacher for at least 1 to 3 years.
2. He/she has experience teaching visually challenged learners.

2.2 Research Instruments

A Likert Scale to evaluate the health-related Exercises Routine and Semi-structured Interviews: The researcher conducted interviews with SPED Teachers, and field experts to explore their experiences in the field of Physical Education.

2.3 Data Gathering Procedure

The present study follows the Successive Approximation Model (SAM). The researcher followed three stages of the development process of the exercise routine. Preparation Phase: the researcher gathered information and background of the visually challenged learners, their PE class settings, PE class experiences and their fitness status. Iterative Design Phase: the researcher created a prototype exercise routine tailored to the needs of the visually challenged learners. Then the researcher met the SPED teachers and reviewed the prototype of the routine, recreating and make changes if needed.

Iterative Development Phase: The researcher who made exercise routine was evaluated by the field experts, gather insights and feedback. Redesign was needed to ensure the efficiency of the exercise routine in the execution of health-related exercises.

2.4 Statistical Tools

The data gathered were carefully classified, tabulated, and subjected to statistical treatment for analysis and interpretation of the findings.

Descriptive Statistics. Mean and percentage will be used for the quantitative date during the assessments. Thematic Analysis. This method helps in organizing and interpreting participants' experiences, perceptions, and challenges in teaching PE.

2.5 Ethical Considerations

The researcher is aware of ethical principles to consider in conducting the study. The first principle that was applied in the study is the principle of beneficence, the right not to harm the participants.

The participants in this survey were assured of their safety. The survey forms and the interview methods were drafted in a very clear and concise manner to prevent conflict among respondents. The researcher also ensured that the participants participate voluntarily and that nothing is forced. Informed consents were given to the respondents.

The second principle that was observed in the study is respect for human dignity or the right to full disclosure. The participants were informed about the nature and purpose of the research, the procedure to be used, and the expected benefits of the participants. The researcher ensured that each individual must be able to understand what they are being asked to do, and what are the effects, risks, and benefits to them. They were given enough time to decide whether to participate in the study. The issues of the study were identified in advance to prevent future problems during the research process.

To mitigate risks and ensure the safety of participants, the program implemented: Supervised Sessions, having a trained facilitator assist during exercises. Safe Environment, exercises were conducted in hazard-free spaces with supportive surfaces. Emergency Protocols were established, a first-aid response plan in case of accidents. Informed Consent was explained thoroughly to the parents and visually challenged learners.

Additionally, it is essential to ensure that the development and implementation of the exercise routine for teaching health-related exercises address their unique needs and vulnerabilities. The researcher implemented the following: audio descriptions to guide learners through exercises, ensure informed consent is obtained in an accessible, risk assessments for exercises to prevent injuries, considering balance and coordination challenges, trained facilitators or guardians to assist learners during exercise sessions, ensure progressive difficulty levels in exercises to match individual capabilities.

Lastly, the principle of justice or the right to privacy and anonymity. Anonymity means not letting the respondents write their names in the questionnaire if they do not want to. The respondents in this study were given a waiver regarding the confidentiality of their identity. Rest assured that the data gathered from them would be treated with the strictest confidentiality so that they would be more open. All digital data, including responses, recordings, and documents, should be encrypted both during transfer and storage to prevent unauthorized access. Limit access to personal data to authorized personnel only. Provide clear instructions and training to all individuals who will have access to personal data (e.g., research assistants, transcribers, or translators) on the importance of privacy and the specific steps they must take to safeguard it.

3. Results and Discussion

This chapter outlines the development process of the exercise routine for visually challenged learners in teaching health-related exercises. Utilizing the Input-Process-Output (IPO) model and the Successive Approximation Model (SAM) as frameworks, the program was developed through three key phases, Input, Process – (SAM was embedded to follow the preparation, iterative design and iterative development phases in developing the exercise routine to make it tailored to the needs of the VC learners) and lastly the Output. The input phase presents the initial investigations based on the initial interview from SPED teachers who handles the VC learners. The information gathered was used to

outline the content of the exercise routine. The process phase describes the prototype creation, refinement through experts and the finalization of the exercise routine. Lastly, the output phase details the developed exercise routine tailored to the needs of the VC learners.

3.1 Input Phase: Pre-Assessment for Sped Teachers Handling VC Learners

The Input Phase presents the initial stage of the development of exercise routine for VC learners. It focuses on gathering initial information and to establish baseline and get a clear picture of the current situation of VC learners in the context of Physical Education, to learn about the typical daily routines and educational approaches used with VC learners before outlining and creating the first prototype of the exercise routine.

Table 1 Descriptive Statistics Pre-Assessment interview guide for Sped Teachers Handling VC Learners

Category	Variable / Finding	Frequency / Count	Percentage (%)
Visually Challenged (VC) Learners	Total VC learners across 3 teachers	5 learners	-
	Teacher 1	2 learners	(40% of total learners)
	Teacher 2	2 learners	(40% of total learners)
	Teacher 3	1 learner	(20% of total learners)
Types of Visual Impairments (across 5 learners)	Totally blind	3 learners	60.00%
	Blind with multiple disability	1 learner	20.00%
	Low vision	1 learner	20.00%
Attendance Patterns (N=3 Teachers)	Learners do not regularly/often attend	2 teachers	66.70%
	Learner rarely attends	1 teacher	33.30%
Available Resources (Mentions by N=3 Teachers)	Audio materials (educational songs)	3 teachers	100%
	Audio materials (stories)	1 teacher	33.30%
	Tactile materials	1 teacher	33.30%
Participation in Regular PE (N=3 Teachers)	Visually challenged learners do not participate in regular PE classes	3 teachers	100%
Other Physical Activity Engagement (N=3 Teachers)	Engage in physical activities only during school-based sports fest (once a year)	3 teachers	100%

Across the three teachers surveyed, a total of 5 visually challenged learners were being handled. The distribution per teacher was even, with 2 teachers each managing 2 VC learners, and 1 teacher managing 1 VC learner.

Regarding the types of visual impairments among these 5 students, total blindness was the most common, affecting 3 out of 5 learners (60%). Each teacher reported having blindness accompanied by multiple disabilities (20% of the total) and 1 learner with low vision (20% of the total). A significant concern highlighted by the survey was student attendance. 2 out of 3 teachers (66.7%) reported that their VC learners do not regularly or often attend classes. The third teacher (33.3%) noted that their student rarely attends, citing

moodiness as a factor. This indicates a prevalent challenge in ensuring consistent school participation for these learners.

In terms of resources available to support VC learners in their academic subjects, audio materials, specifically educational songs, were universally available, with all three teachers (100%) mentioning them. One teacher (33.3%) also had access to audio materials in the form of stories, and another teacher (33.3%) reported the availability of tactile materials. This suggests a primary reliance on auditory resources. This finding underscored the lack of instructional materials and skills when including children with visual impairments in Physical Education (Lieberman et al., 2023).

A key finding was complete lack of participation of these VC learners in regular PE classes. All three teachers (100%) confirmed that their VC learners do not typically participate in regular PE. Furthermore, opportunities for other forms of physical activity appear highly restricted. All three teachers (100%) stated that their students only engage in physical activities during a school-based sports fest that occurs just once a year. In a study conducted by McMahon et.al. (2019), noted that children with visual impairments experience limited chances and incentives to engage in general physical activity, leading to delays physical activity levels. These findings highlight potential areas for intervention and support to enhance the educational experience and physical well-being of these students.

3.2 Process Phase Development

The Process Phase marks the core development of the exercise routine guided by the IPO and SAM model. It translates initial assessments to develop an initial prototype and refines it through iterative feedback from experts. The following sections outline the evidence- informed steps taken to ensure contextual relevance and effectiveness.

3.2.1 Preparation Phase: Creating Topic Outline and Script

This phase outlines content of the exercise routine based on the initial assessment, this includes choosing which exercises best suited to the VC learners and script writing. Table 2 presents the first draft of health-related exercises.

Table 2 First draft of the exercise routine (Alpha Prototype)

Exercise Title	Instruction	Number of Repetitions
Warm-up Exercises (Episode 2)		
Arm Circle	Stand tall with your feet shoulder-width apart. Extend your arms out to the sides at shoulder height. Begin to circle your arms forward, gradually increasing the size of the circles.	10 circles in each direction
Leg Swings	Stand tall with your feet slightly apart. Swing your right leg forward and back, keeping your knee straight. Repeat with your left leg.	10 swings on each leg
Light Jog in Place	Stand tall and lift your knees up towards your chest as quickly as you can. Keep your arms pumping at your sides.	Jog in place for 30 seconds
Forward Fold	Stand tall with your feet slightly apart. Bend forward at the waist, reaching towards your toes. If you can't reach your toes, bend your knees slightly.	Hold for 30 seconds
Arm Circles with Leg Kicks	Stand tall and extend your arms out to the sides at shoulder height. Circle your arms forward while kicking your legs alternately.	Do 10 circles in each direction
Cardio Exercises (Episode 3)		
Jumping Jacks	Stand with your feet together and your arms at your sides. Jump your feet out to the sides while raising your arms overhead. Jump your feet back together and bring your arms back to your sides.	Repeat for 30 seconds

Table 2 (Cont')

Exercise Title	Instruction	Number of Repetitions
High Knees	Stand with your feet shoulder-width apart. Bring your knees up towards your chest as quickly as you can. Alternate legs and keep your core engaged.	Aim for 30 seconds
Butt Kicks	Stand with your feet shoulder-width apart. Kick your heels up towards your glutes as quickly as you can. Alternate legs and keep your core engaged.	Do 30 seconds
Jumping Jacks with Arm Circles	Perform jumping jacks as discussed earlier but add arm circles by moving your arms in a circular motion.	Do 30 seconds
Strength Training Exercises (Episode 4)		
Push-ups	Begin by lying on your stomach with your hands placed directly under your shoulders. Push up into a plank position, keeping your body straight from your head to your heels. Lower back down to the starting position. (Can be modified by doing them on your knees).	10-12 repetitions
Squats	Stand with your feet shoulder-width apart and your toes slightly pointed out. Lower your body as if you're sitting down on a chair. Keep your back straight and your knees aligned with your ankles. Push back up to a standing position.	10-12 repetitions
Lunges	Start by standing with your feet shoulder-width apart. Step forward with one leg, lowering your body until both knees are bent at a 90-degree angle. Push back up to a standing position and repeat with the other leg.	10-12 lunges on each leg
Bicep Curls (with dumbbells)	Stand with your feet shoulder-width apart and hold a dumbbell in each hand with your palms facing forward. Bend your elbows and bring the dumbbells up towards your shoulders, curling your wrists slightly inward. Pause at the top of the movement, then slowly lower the dumbbells back to the starting position. Keep upper arms stationary.	Repetitions not specified (general recommendation: 10-12)
Shoulder Presses (with dumbbells)	Stand with your feet shoulder-width apart and hold a dumbbell in each hand at shoulder height with your palms facing forward. Press the dumbbells straight up overhead, extending your arms fully. Pause at the top, then slowly lower the dumbbells back to the starting position. Keep back straight, engage core.	Repetitions not specified (general recommendation: 10-12)
Triceps Extensions (with dumbbell)	Stand with your feet shoulder-width apart and hold a dumbbell in one hand behind your head with your palm facing forward. Extend your arm upward, straightening your elbow. Pause at the top, then slowly lower the dumbbell back to the starting position. Keep upper arm stationary.	Repetitions not specified (general recommendation: 10-12)
Flexibility Exercises (Episode 5)		
Hamstring Stretches	Stand tall with your feet shoulder-width apart. Reach down towards your toes, keeping your legs straight. If you can't reach your toes, bend your knees slightly.	Hold for 30 seconds, then switch legs
Quadriceps Stretch	Stand tall and lift one leg behind you, grasping your ankle with your hand. Gently pull your heel towards your buttocks until you feel a stretch in the front of your thigh.	Hold for 30 seconds, then switch legs
Child's Pose	Start on your hands and knees. Spread your knees wider than your hips and sit back on your heels. Lower your chest to the floor and extend your arms out in front of you.	Hold for 30 seconds
Seated Shoulder Stretch	Sit tall with your back straight. Bring one arm behind your back and reach up with the other hand to grasp your wrist. Gently pull your arm upward until you feel a stretch in your shoulder.	Hold for 30 seconds, then switch arms
Seated Hip Flexor Stretch	Sit on the floor with your legs extended in front of you. Bend one leg and bring the foot closer to your buttocks. Lean forward slightly until you feel a stretch in the front of your hip.	Hold for 30 seconds, then switch legs

Table 2 (Cont')

Exercise Title	Instruction	Number of Repetitions
Cool-Down Exercises (Episode 6)		
Standing Quadriceps Stretch	Stand tall with your feet shoulder-width apart. Lift one leg behind you, grasping your ankle with your hand. Gently pull your heel towards your buttocks until you feel a stretch in the front of your thigh.	Hold for 30 seconds, then switch legs
Seated Hamstring Stretch	Sit on the floor with your legs extended in front of you. Reach forward towards your toes, keeping your legs straight. If you can't reach your toes, bend your knees slightly.	Hold for 30 seconds
Seated Shoulder Stretch	Sit tall with your back straight. Bring one arm behind your back and reach up with the other hand to grasp your wrist. Gently pull your arm upward until you feel a stretch in your shoulder.	Hold for 30 seconds, then switch arms
Deep Breathing	Find a comfortable position, either sitting or lying down. Close your eyes and take slow, deep breaths. Inhale through your nose, filling your lungs with air. Exhale slowly through your mouth, releasing the tension in your body.	Not specified (technique)

The exercise routine was carefully crafted to ensure that the VC learners can safely execute the exercises given considering their safety and background. The VC learners who were the main respondents of this study have little to no background in physical education classes and physical activities. Therefore, intensity, time and type of exercise should be considered as well. Applying the FITT principle to an exercise routine is an efficient and a safe method for goal attainment (American College of Sports Medicine, 2018).

3.2.2 Iterative Design Phase

Cycle 1(Alpha Prototype).

This is where the actual creation and refinement of the exercise routine happen through repeated cycles. In this phase, development of basic draft structure and flow. Tables 3 presents the assessment of the experts of the alpha prototype.

Table 3 Evaluation of the content of the exercise by the experts (Alpha Prototype)

Indicator	Mean Score	Median Score	Mode(s)	Score Distribution (1:SD, 2:D, 3:FA, 4:A, 5:SA)	General Perception
1. The instructions are clear and adequate.	3.4	3	3, 4	FA: 3, A: 2	Fairly Agree to Agree
2. The content is relevant to the objective of the study.	3.4	3	3, 4	FA: 3, A: 2	Fairly Agree to Agree
3. The content is clearly stated and understandable.	4.2	4	4	A: 4, SA: 1	Agree
4. Wording is within the level of understanding of the respondents.	4.6	5	5	A: 2, SA: 3	Agree to Strongly Agree
5. There is no duplication and redundancy.	4.2	4	5	FA: 1, A: 2, SA: 2	Fairly Agree to Strongly Agree
6. The instrument covers the variables of the study.	3.2	3	3	FA: 4, A: 1	Fairly Agree
7. The scale used is appropriate for the study.	3.4	3	3	FA: 4, SA: 1	Fairly Agree

Experts generally found the instructions for the instrument to be between "Fairly agreeable" and "agreeable' in terms of clarity and adequacy (average score of 3.4 out of 5). Similarly, the relevance of the exercise routine content to the study's objective received an average 3.4, also indicating fair agreement to agreement. For both these indicators, three experts rated them as "fairly agree" and two rated them as "agree".

The clarity and understandability of the content itself were rated favorable, with an average score of 4.2 ("agree"). The content was perceived to be largely free of duplication and redundancy with an average score of 4.2 (ranging from "fairly agree to strongly agree"). In a study conducted by Wakefield et.al., 2022, it suggested that podcast creation can lead to deeper learning and potentially better knowledge retention due to the active engagement of the learners. While focused on creation, it implies that engaging with the material in an active way, which should be influenced by clear descriptions and well-structured content, supports retention.

Cycle 2. Refined Prototype (Beta Prototype).

Based on the alpha feedback, revision on the structure, script/outline were done. Table 6 presents a brief overview of the learners who participated in the study.

Table 4 Brief overview of the VC learners under the supervision of the SPED teachers

Name	Age	Type Of Visual Impairment	Duration Of Visual Impairment	Prior Pe Class Experience	Familiarity With exercise routine	Prior Experience with Digital Learning Materials for Exercise
Sabrina	6	Totally Blind	Since Birth	No	No	No
Jared	10	Totally Blind	Since Birth	No	No	No
Stephen	17	Totally Blind	Since Birth	No	No	No

All 3 participants (100%) were totally blind since birth. None had prior formal PE class experience (3 of them had minimal exposure only during sports fests that happens once a year), no prior familiarity with exercise routine, and no prior experience using digital learning materials for exercise instruction. In a literature review by Haegele and Poretta, 2015., key results suggested that the low physical activity levels among school-aged individuals with visual impairments are more likely linked to a scarcity of appropriate opportunities to engage in physical activity, rather than their specific level of vision or the educational environment they are in.

Table 5 Second Draft of the Exercise Routine

Exercise Title	Instruction	Number of Repetitions
Warm-Ups		
Arm Circles (Forward)	Make big circles with your arms going forward, like you're stirring a giant pot!	10 circles
Arm Circles (Backward)	Make big circles with your arms going backward.	10 circles
Leg Swings (Right Leg)	Stand tall, feet slightly apart. (Hold onto a stable chair or wall if needed). Swing your right leg gently forward and then gently backward, like a quiet clock ticking.	10 gentle swings
Leg Swings (Left Leg)	Stand tall, feet slightly apart. (Hold onto a stable chair or wall if needed). Swing your left leg gently forward and then gently backward.	10 gentle swings
Shoulder Shrugs	Sit or stand tall. Lift your shoulders up towards your ears, like you're saying, "I don't know." Then let them drop back down.	5-8 repetitions
Ankle circles (Seated)	Sit on a chair or the floor. Lift one foot just a little off the ground. Gently make circles with your ankles. Repeat with the other foot.	5 each direction, each foot

Table 5 (Cont')

Exercise Title	Instruction	Number of Repetitions
Wrist Circles	Hold your arms out in front of you or by your sides. Make gentle circles with your hands, like you are waving slowly in a circle.	5-8 circles each direction
High Knees (Warm-up)	Stand tall. March in place, trying to lift your knees up high, as if you are marching in a parade. You can touch your knees with your hands each time they come up.	30 seconds
Cardio		
Jumping Jacks	Start with feet together, arms by sides. Jump to spread feet a little wide, while bringing arms out to the sides like airplane wings (or up towards the sky). Jump back to starting position. (Ensure clear space).	Perform for a guided duration (e.g., 15-20 seconds, or 5-8 repetitions)
High Knees (Cardio)	Stand tall. March or jog in place quickly, lifting your knees up high one after the other.	Perform for a guided duration (e.g., 20-30 seconds)
Strength		
Wall Push-ups	Stand facing a clear wall, about one big step away. Place your hands flat on the wall at shoulder height. Gently bend your elbows and lean your body towards the wall, then push back until your arms are straight.	5-10 repetitions
Squats	Stand with feet about shoulder-width apart (like your feet are under your shoulders). Pretend you're going to sit down in a small chair that's behind you. Keep your back straight. Then stand back up tall. (A real low, stable chair can be placed behind for safety/guidance initially).	5-10 repetitions
Flexibility		
Hamstring Stretch (Standing)	Stand tall (hold onto a chair if needed). Keep your legs mostly straight and gently try to reach your hands down towards your feet. Stop when you feel a little stretch in the back of your legs. Don't bounce.	Hold for 10-15 seconds
Child's Pose	Start on your hands and knees, like a little table. Gently sit your bottom back towards your heels. You can reach your arms out in front of you on the floor, or rest them by your sides. Let your head be heavy.	Hold for 15-20 seconds
Knee Hugs (Lying Down)	Lie on your back on a comfortable surface. Gently bend one knee and pull it towards your chest with your hands. Hold for a moment. Lower it. Then do the other knee. You can also hug both knees at the same time.	Hold each knee for 10-15 seconds, 2-3 times; or both knees for 15-20 seconds
Cat-Cow Stretch	Get on your hands and knees, like a table. Slowly round your back up towards the sky, like a scared cat, letting your head drop down. Then, slowly let your tummy sink down towards the floor and look up a little, like a sleepy cow stretching.	5-8 slow repetitions (1 cat + 1 cow = 1 rep)
Butterfly Stretch (Seated)	Sit on the floor. Bring the bottoms of your feet together in front of you, letting your knees drop out to the sides like butterfly wings. You can hold your feet or ankles. Sit up tall. (No need to push knees down, just let them relax).	Hold for 15-20 seconds
Balance		
Marching with Arm Swings	March in place, lifting your knees. As your right knee comes up, swing your left arm forward. As your left knee comes up, swing your right arm forward. Like a marching soldier!	20-30 seconds
"Airplane" Balance (One Leg)	Stand tall. Slowly lift one foot just a tiny bit off the floor behind you. Stretch your arms out to the sides like airplane wings. Try to balance for a few seconds. Put your foot down. Try the other leg. (Hold onto support if needed).	Hold for 3-5 seconds each leg, 2-3 times each leg

Table 5 (Cont')

Exercise Title	Instruction	Number of Repetitions
Standing Quadriceps Stretch (Right Leg)	Stand tall, hold onto a wall or stable chair with one hand. Bend your right knee and bring your right foot up towards your bottom. Gently hold your right foot or ankle with your right hand. Feel a stretch in the front of your leg.	Hold for 10-15 seconds
Standing Quadriceps Stretch (Left Leg)	Stand tall, hold onto a wall or stable chair. Bend your left knee and bring your left foot up towards your bottom. Gently hold your left foot or ankle with your left hand.	Hold for 10-15 seconds
Cool down		
Seated Hamstring Stretch	Sit on the floor with your legs straight out in front of you. Gently reach your hands towards your toes. Keep your back comfortable. Stop when you feel a little stretch.	Hold for 10-15 seconds
Seated Shoulder Stretch (Right Arm)	Sit up tall. Reach your right arm across your body, like you're giving yourself a hug with one arm. Use your left hand to gently press on your right arm to feel a stretch in your shoulder.	Hold for 10-15 seconds
Seated Shoulder Stretch (Left Arm)	Sit up tall. Reach your left arm across your body. Use your right hand to gently press on your left arm to feel a stretch in your shoulder.	Hold for 10-15 seconds
Deep Breathing	Find a comfy spot (sit or lie down). Place your hands on your tummy. Breathe slowly through your nose, feel your tummy go up like a balloon. Breathe out slowly through your mouth, feel your tummy go down.	5-10 breaths

Table 5 presents the second draft of the exercise routine. Some exercises were replaced by easier and doable exercises for the VC learners. All 5 experts noted that health related issues and intensity should be considered in designing an exercise routine especially to VC learners with no history of PE class or physical activities in a regular basis. These findings support the principles of progression for different fitness levels, including specific recommendations for "novice" trainees. It recommends starting with loads corresponding to 8–12 repetition maximum (RM) for initial resistances in novice training, which is a moderate intensity designed to allow for proper form and adaptation before increasing the challenge (American College of Sports Medicine, 2002).

Cycle 3. Prototype 3.

Prototype 3 was created based on the feedback of the experts. In prototype 3, no further changes are needed.

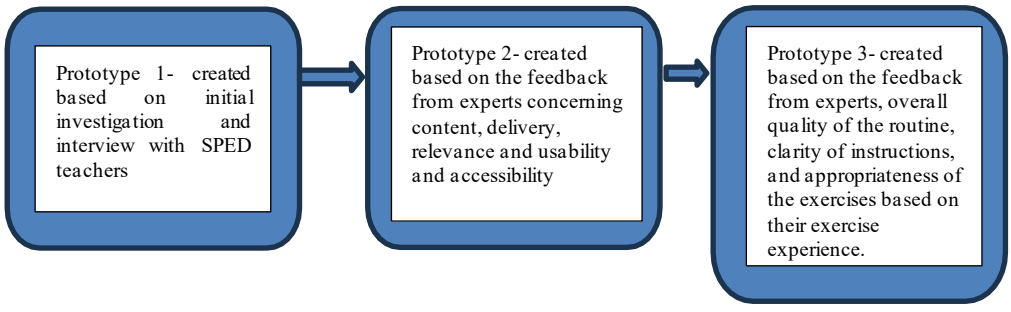

Figure 2 Changes in the exercise routine from prototype 1, 2 & 3.

3.2.3Output Phase: Finalized exercise routine for Visually Challenged Learners

This section outlines the finalized version of the exercise routine. After two rounds of refinement based on expert feedback, the final outputs are now ready for implementation. The routine is composed of 6 components of health-related exercises: Warm-up, cardiovascular exercises, muscular strength/endurance exercises, balance, flexibility, and Cool down exercises.

Table 6 Final Exercise Routines (Prototype 3)

Exercise Title	Instruction	Number of Repetitions
Warm-Ups		
Arm Circles (Forward)	Make big circles with your arms going forward, like you're stirring a giant pot!	10 circles
Arm Circles (Backward)	Make big circles with your arms going backward.	10 circles
Leg Swings (Right Leg)	Stand tall, feet slightly apart. (Hold onto a stable chair or wall if needed). Swing your right leg gently forward and then gently backward, like a quiet clock ticking.	10 gentle swings
Leg Swings (Left Leg)	Stand tall, feet slightly apart. (Hold onto a stable chair or wall if needed). Swing your left leg gently forward and then gently backward.	10 gentle swings
Shoulder Shrugs	Sit or stand tall. Lift your shoulders up towards your ears, like you're saying, "I don't know." Then let them drop back down.	5-8 repetitions
Ankle up and down (Seated)	Sit on a chair or the floor. Lift one foot just a little off the ground. Gently move your ankles up and down Repeat with the other foot.	5 each direction, each foot
Wrist Circles	Hold your arms out in front of you or by your sides. Make gentle circles with your hands, like you are waving slowly in a circle.	5-8 circles each direction
High Knees (Warm-up)	Stand tall. March in place, trying to lift your knees up high, as if you are marching in a parade. You can touch your knees with your hands each time they come up.	30 seconds
Cardio		
Vertical Jumps	Start with feet together, arms on your side. Jump and keep your hands on your side.	Perform for a guided duration (e.g., 15-20 seconds, or 5-8 repetitions)
High Knees (Cardio)	Stand tall. March or jog in place quickly, lifting your knees up high one after the other.	Perform for a guided duration (e.g., 20-30 seconds)
Strength		
Wall Push-ups	Stand facing a clear wall, about one big step away. Place your hands flat on the wall at shoulder height. Gently bend your elbows and lean your body towards the wall, then push back until your arms are straight.	5-10 repetitions
Squats	Stand with feet about shoulder-width apart (like your feet are under your shoulders). Pretend you're going to sit down in a small chair that's behind you. Keep your back straight. Then stand back up tall. (A real low, stable chair can be placed behind for safety/guidance initially).	5-10 repetitions
Flexibility		
Hamstring Stretch (Standing)	Stand tall (hold onto a chair if needed). Keep your legs mostly straight and gently try to reach your hands down towards your feet. Stop when you feel a little stretch in the back of your legs. Don't bounce.	Hold for 10-15 seconds

Table 6 (Cont')

Exercise Title	Instruction	Number of Repetitions
Child's Pose	Start on your hands and knees, like a little table. Gently sit your bottom back towards your heels. You can reach your arms out in front of you on the floor or rest them by your sides. Let your head be heavy.	Hold for 15-20 seconds
Knee Hugs (Lying Down)	Lie on your back on a comfortable surface. Gently bend one knee and pull it towards your chest with your hands. Hold for a moment. Lower it. Then do the other knee. You can also hug both knees at the same time.	Hold each knee for 10-15 seconds, 2-3 times; or both knees for 15-20 seconds
Cat-Cow Stretch	Get on your hands and knees, like a table. Slowly round your back up towards the sky, like a scared cat, letting your head drop down. Then, slowly let your tummy sink down towards the floor and look up a little, like a sleepy cow stretching.	5-8 slow repetitions (1 cat + 1 cow = 1 rep)
Butterfly Stretch (Seated)	Sit on the floor. Bring the bottoms of your feet together in front of you, letting your knees drop out to the sides like butterfly wings. You can hold your feet or ankles. Sit up tall. (No need to push knees down, just let them relax).	Hold for 15-20 seconds
Balance		
Marching with Arm Swings	March in place, lifting your knees. As your right knee comes up, swing your left arm forward. As your left knee comes up, swing your right arm forward. Like a marching soldier!	20-30 seconds
"Airplane" Balance (One Leg)	Stand tall. Slowly lift one foot just a tiny bit off the floor behind you. Stretch your arms out to the sides like airplane wings. Try to balance for a few seconds. Put your foot down. Try the other leg. (Hold onto support if needed).	Hold for 3-5 seconds each leg, 2-3 times each leg
Standing Quadriceps Stretch (Right Leg)	Stand tall, hold onto a wall or stable chair with one hand. Bend your right knee and bring your right foot up towards your bottom. Gently hold your right foot or ankle with your right hand. Feel a stretch in the front of your leg.	Hold for 10-15 seconds
Standing Quadriceps Stretch (Left Leg)	Stand tall, hold onto a wall or stable chair. Bend your left knee and bring your left foot up towards your bottom. Gently hold your left foot or ankle with your left hand.	Hold for 10-15 seconds
Cool down		
Seated Hamstring Stretch	Sit on the floor with your legs straight out in front of you. Gently reach your hands towards your toes. Keep your back comfortable. Stop when you feel a little stretch.	Hold for 10-15 seconds
Seated Shoulder Stretch (Right Arm)	Sit up tall. Reach your right arm across your body, like you're giving yourself a hug with one arm. Use your left hand to gently press on your right arm to feel a stretch in your shoulder.	Hold for 10-15 seconds
Seated Shoulder Stretch (Left Arm)	Sit up tall. Reach your left arm across your body. Use your right hand to gently press on your left arm to feel a stretch in your shoulder.	Hold for 10-15 seconds
Deep Breathing	Find a comfy spot (sit or lie down). Place your hands on your tummy. Breathe slowly through your nose, feel your tummy go up like a balloon. Breathe out slowly through your mouth, feel your tummy go down.	5-10 breaths

This exercise routine follows the FITT principle in crafting a safe and efficient routine. To create a successful fitness plan, it's essential to apply fundamental exercise guidelines. These principles are relevant for everyone, regardless of their fitness level, from elite athletes to recreational exercisers. A simple way to recall these core guidelines is by using the acronym FITT, which represents the key elements of Frequency, Intensity, Time, and the Type of activity (American College of Sports Medicine. 2017).

Table 7 Experts' Evaluation of the content of the exercise routine

Indicator	Expert					Mean Score	Median Score	Mode	Qualitative Interpretation (Mean)
	1	2	3	4	5				
1. The instructions are clear and adequate.	5	5	5	5	5	5	5	5	Strongly Agree
2. The content is relevant to the objective of the study.	5	5	5	5	5	5	5	5	Strongly Agree
3. The content is clearly stated and understandable.	4	4	5	5	5	4.6	5	5	Agree to Strongly Agree
4. Wording is within the level of understanding of the respondents.	4	4	4	4	4	4	4	4	Agree
5. There is no duplication and redundancy.	4	4	4	4	5	4.2	4	4	Agree
6. The instrument covers the variables of the study.	5	4	5	4	4	4.4	4	4	Agree to Strongly Agree
7. The scale used is appropriate for the study.	5	5	5	5	5	5	5	5	Strongly Agree

Table 7 indicates a strong positive validation from the five experts. The material or instrument being evaluated is perceived as clear, relevant, understandable, well-worded, concise, comprehensive in its coverage of study variables, and utilizes an appropriate measurement scale. The consistent "Agree" or "Strongly Agree" interpretations across all indicators suggest that the experts found the evaluated material or instrument to be of high quality in terms of clarity, relevance, understandability, wording, conciseness, coverage of variables, and appropriateness of the scale.

A study conducted by McNamara et al. (2021) investigated the effectiveness of "Content Acquisition Podcasts (CAPs)" podcasts designed with instructional principles and expert-developed content—to improve preservice physical educators' knowledge and self- efficacy for teaching students with visual impairments supports the strong validation from experts and learners in crafting the exercise routine.

Table 8 VC learners Prototype 3 Performance Data

Exercise	Unit	Mean	Median	Range
Warm-Ups				
Arm Circles (Forward)	circles	10	10	0
Arm Circles (Backward)	circles	10	10	0
Leg Swings (Right Leg)	swings	10	10	0
Leg Swings (Left Leg)	swings	10	10	0
Shoulder Shrugs	repetitions	8	8	0
Ankle Circles (Seated)	circles	5	5	0
Wrist Circles	circles	8	8	0
High Knees (Warm-up)	seconds	30	30	0
Cardio				
Jumping Jacks	repetitions	10	10	0
High Knees (Cardio)	seconds	30	30	0
Strength				
Wall Push-ups	repetitions	4.33	5	2
Squats	repetitions	8.33	10	5
Flexibility				

Table 8 (Cont')

Exercise	Unit	Mean	Median	Range
Hamstring Stretch (Standing)	seconds	15	15	0
Child's Pose	seconds	20	20	0
Knee Hugs (Lying Down)	seconds	20	20	0
Cat-Cow Stretch	repetitions	8	8	0
Butterfly Stretch (Seated)	seconds	20	20	0
Balance				
Marching with Arm Swings	seconds	30	30	0
""Airplane"" Balance (One Leg)	seconds	5	5	0
Standing Quadriceps Stretch (Right Leg)	seconds	15	15	0
Standing Quadriceps Stretch (Left Leg)	seconds	15	15	0
Cool down				
Seated Hamstring Stretch	seconds	13.33	15	5
Seated Shoulder Stretch (Right Arm)	seconds	15	15	0
Seated Shoulder Stretch (Left Arm)	seconds	15	15	0
Deep Breathing	breaths	10	10	0

For many exercises, Stephen, Jared and Sabrina show identical performance. This is reflected in a range of 0 for those exercises. These include most of the warm-up, cardio, flexibility, balance and cool down exercises. The largest differences in performance are seen in the strength exercises. Wall push-ups mean 4.33, the median is 5, and the range is 2. Sabrina performed fewer push-ups than Stephen and Jared. Squats have 8.33 mean, median of 10 and the range is 5. Sabrina performed fewer squats than Stephen and Jared. Stephen, Jaren and Sabrina performed similarly across most exercises, particularly in the warm-up, cardio, flexibility, balance and cool down categories. The most notable difference in performance is observed in the strength exercises, where Sabrina performed fewer wall push-ups and squats compared to Stephen and Jared. Table 8 indicates generally consistent performance across most exercises, particularly in warm-up, cardio, and flexibility components. The strength exercises showed more variability, potentially reflecting differences in strength levels or exercise difficulty. Students' age, ethnicity, self-concept are the biggest individual factors affecting their participation in physical activity. Support from friends, parents and teachers also positively influenced their involvement. At the community level, having accessible facilities and safe places to be active were crucial (Hu et al. 2021).

4. Conclusions

The study yielded the following key findings: Input Phase:

1. SPED teachers reported significant challenges, including irregular school attendance and a lack of VC learner participation in regular PE classes.

2. The predominant resources used by teachers were audio materials (educational songs and stories) and tactile materials, highlighting a reliance on auditory-based learning.

Process Phase:

1. The exercise routine development process, refined through expert feedback, was crucial in producing a relevant and engaging tool. Experts positively evaluated the exercise routine's relevance, inclusivity, variety, quality, and information accuracy. They also identified areas for improvement, specifically: Enhancing accessibility features

(transcripts, audio descriptions), improving the clarity and conciseness of instructions, ensuring the currency of the information, and improving overall quality.

2. The development of the exercise routine involved repeated trials and refinements based on feedback from both experts and learners. This process inherently included evaluating how well learners were able to follow and execute the exercises, which directly relates to evaluating their performance. Specifically, the modifications made to the exercise routine content and structure based on experts' feedback.

Output Phase:

The finalized exercise routine comprised six components of health-related exercises, specifically: warm-up, cardiovascular exercises, muscular strength/endurance exercises, balance exercises, flexibility exercises and cool-down exercises.

The study concluded that the development of an exercise routine for visually challenged learners is a feasible and promising approach to address the accessibility gap in physical education. A systematic, iterative design process, incorporating stakeholder feedback, is essential for creating effective and relevant educational tools for VC learners. The exercise routine format has the potential to enhance the learning experience of VC learners by providing accessible and engaging auditory instruction. While the exercise routine was generally well- received, ongoing refinement is necessary to optimize its accessibility, clarity and usability for diverse learners.

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