

5. METHODS

5.1 PARTICIPANTS

5.1.1 SOURCE OF SUBJECTS

The participants for this study were children attending schools for intellectually disabled individuals in Pune, Maharashtra. In fact, the researcher of the present investigation approached *Kamayani Praśikśan and Sanśodhan* Society. Since 1964, *Kamayani* has been in forefront of education welfare, vocational training, rehabilitation and research in the field of intellectually disabled children. The main object of “*Kamayani*” is to help the intellectually disabled from all sections of the society in their all-round development. Other objective is to make them self-reliant, self-sufficient, worthy citizen of the society and to rehabilitate them. As the objective of the present research was to impart yoga training to children with intellectual disability, the authorities of the school readily accepted the proposal and also convinced the parents of the children.

The participants were classified into categories of mild to moderate intellectual disability on the basis of their IQ scores. The participants ages ranged from 10 to 15 years.

5.1.2 SAMPLE SIZE

On a conservative estimate, considering moderate effect size, according to Cohen (1988), the sample size was calculated. To achieve minimum power of 0.80, with $\alpha=0.05$, for two groups, the required sample size was calculated as 29 subjects per group. However, to protect against the effects of attrition on power, a minimum number

of 35 subjects in each group was established. For all the above calculations, G*Power 3.0 was used, and alpha was fixed at 0.05, power at 0.95, and assuming two-tailed condition. The subjects were selected from Sai Sanskar School for intellectual disability students and Kamayani intellectual disability School situated in Chinchwad PCMC and Pune respectively.

5.1.3 INCLUSION CRITERIA

- Students with mild to moderate intellectual disability
- Both genders
- Age ranging from 10 to 15 years
- Normal health status
- IQ level between 40 to 68

5.1.4 EXCLUSION CRITERIA

- Major mental or physical disability
- Severe intellectual disability
- Students unable to do yoga practice
- History of psychiatric episodes
- Students visually or hearing impaired
- IQ level below 40

5.1.5 ETHICAL CONSIDERATION

A signed informed consent was obtained from parents or guardians of the intellectual disability children with at the time of registration, after they had read the proposal that involved noninvasive data collection methods and risks-free intervention. All the procedures were reviewed and accepted by the institutional ethical committee of S-

VYASA University. Participation in this project was voluntary of nature and the participants were not provided with any incentives for their participation. The participants were free to discontinue their participation at any point in time without any consequence. This was stated verbally to both the control and intervention groups during a presentation to the parents of the participants and school authorities. It was also restated in the consent forms.

5.2 DESIGN AND PROCEDURE

A completely randomized group design (Rothstein, 1985) of two groups of equal numbers was adopted for this study.

Groups	Test	Training	Test
Experimental Group	Pre-test	Yoga training for 3 months, sixty minutes per day	Post-test
Control Group	Pre-test	No special training for 3 months	Post-test

Making use of the table random numbers, 70 subjects were divided randomly into two groups viz; Group –A (Yoga) and Group – B (Control) with equal numbers. A blue print of the subject’s distribution is presented in Table 5.1 along with a flow chart.

Table 5.1
Blue print of the subject’s distribution

Groups	No. of Subjects
Group A– Yoga Group	35 (24 Male+11 Female, age group mean \pm SD; 12.5 \pm 1.3 years)
Group B – Control Group	35 (19 Male+16 Female, age group mean \pm SD; 13.0 \pm 1.9 years)
Total	70

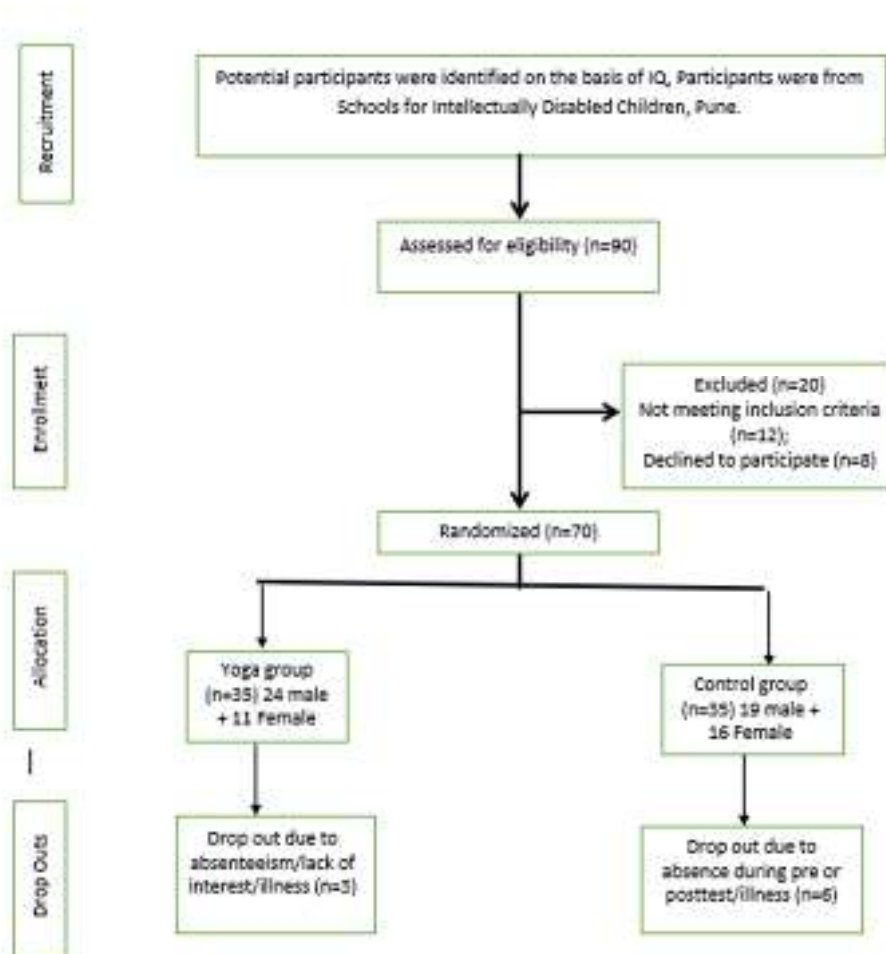


Figure 1: The CONSORT Flow chart illustrating recruitment, enrollment, allocation and drop-outs, of the research study.

The design of the experiment was planned in three phases as follows:

- Phase – I Pre-test
- Phase – II Training or Treatment, and
- Phase – III Post-test

Pre – Test (Phase – I)

All the subjects of the experimental and control groups were exposed to the selected health related physical fitness and motor function ability tests to record pre-test data.

Treatment Stimuli (Phase – II)

After the pre-test was administered, all the subjects of Group A were exposed to specially designed yoga training with their regular school schedule every day in the evening for one hour except Sundays and holidays for a total period of twelve weeks. The subjects of the control group, although did not receive the yoga training, were kept busy with some recreational and physical activities every day for hour in the evening except Saturdays, Sundays and holidays during the total period of the experiment. A yoga teacher was given a responsibility to organize a daily training programme for a total period of twelve weeks.

An orientation programme was conducted separately for two teachers teaching children with intellectual disability, and who were to assist the researcher during the conduct of this experiment giving details of the entire intervention (administering pre-test, training intervention, post-test, monitoring activities of the control group, setting up of the testing stations, location of the experimental group for performing yoga intervention, location of the control group performing clay modeling activity, time schedules and order of tests to be taken, and any other eventuality that may arise during the conduct of the experiment).

Post-test (Phase III)

Finally, when the treatment or training period of twelve weeks was over, a post-test on the selected physical fitness and motor function variables was conducted for all the subjects of the two groups.

The scores in each criterion measure were taken before and after the experimental period of twelve weeks.

5.3 INTERVENTION

5.3.1 Development of Yoga Training Intervention

The research method for the development of yoga intervention considered standard steps generally used in a developmental research. Initially, according to the aims and objectives of the present study, the common limitation of bodily movement generally faced by the intellectually disabled children was identified. On the basis of traditional texts in yoga, certain yoga practices useful to improve health related physical fitness and psycho-motor performance were identified. The content validity of a yoga module for children with intellectual disability was assessed by a panel of 22 experienced yoga experts. The YM for children with intellectual disability was developed in the form of a tailor-made yoga practices that were supported by classical texts and research evidence. A total of 32 practices were included in the YM, and each practice was discussed and rated as (i) not essential, (ii) useful but not essential, and (iii) essential. The content validity ratio (CVR) was calculated using Lawshe's formula. The steps followed to execute the above-mentioned methods are presented in a flow chart as well as in the steps given below:

Step 1 (compilation of literary research on intellectual disability): Exhaustive literary search from the Vedas, textbooks and research papers/theses available in yoga was carried out for intellectually disabled and it was combined with a modern scientific view on intellectual disability.

Step 2 (sorting of literary research on intellectual disability): Compiled literature has been put together in a tabular form to get common and unique features described in each text. The studies were carried out on different practices and published in journals

as a scientific background was extracted. This gave a scientific back up to the literary search.

Step-3 (preparing treatment protocol based on the literary research on intellectual disability): A minute-wise treatment protocol was developed in the form of a tailor-made practice which was supported by classical texts and research evidence.

Step-4 (Validation by experts): This complete module was presented for validation in front of yoga experts with clinical experience (≥ 5 years). These experts were requested to participate in evaluating the content validity for the proposed instrument on a three-point scale (i) not essential, (ii) useful, but not essential, (iii) essential.

An expert panel including 22 health educationists, mental health specialists and physical educationalists with ≥ 5 years of yoga therapy experience examined the content validity. In this study, experts with yoga therapy and clinical experience (≥ 5 years) were considered as yoga experts. The experts selected for the present study (males as well as females) were all Indians with ages ranging from 36 to 63 years and following different yoga traditions like *Kaivalyadhām* Yoga, *Sivānanda* Yoga, *Satyānanda* Yoga and *Vivekānanda* Yoga including Physical Educational institutes and universities. The expert panel was asked to comment on the necessity and relevance of the items to calculate the Content Validity Ratio (CVR) and the Content Validity Index (CVI) respectively. The necessity of an item was assessed using a three-point rating scale: (i) not essential, (ii) useful but not essential, and (iii) essential. In this way, ratings were made blinded. Following the experts' assessments, the CVR for a total scale was computed. According to Lawshe, if more than half of the panelists indicate that an item

is essential, then that item has the least content validity. Here, CVR for the scale equal or greater than 0.42 was considered satisfactory. CVI was estimated by experts' ratings of the items of relevance, simplicity, and clarity on a 3-point Likert scale.

FLOW CHART OF DEVELOPMENT OF YOGA MODULE FOR CHILDREN WITH ID



Pilot Study

To check the feasibility of the yoga module, thirteen children with intellectual disability (6 male and 7 female) with the age of 12.53 ± 1.45 were enrolled to a pilot study. The participants were classified into the categories of mild to moderate intellectual disability on the basis of their IQ scores. All the participants were children attending schools for intellectually disabled individuals in Pune, Maharashtra. The inclusion criteria were (a) mild to moderate intellectual disability, (b) age between 11-15 years, and (c) normal health status. Exclusion criteria were (a) major mental or physical disability, (b) severe intellectual disability, (c) children unable to do yoga practice, (d) history of psychiatric episodes. The study was approved by the institutional review board and ethical committee of S-VYASA University. A signed informed consent was obtained from parents. Further, permission from school authorities was also obtained to conduct the study. The objective of the study was to see effects of a yoga module on health-related physical fitness among children with intellectual disability. The subjects were intervened with the validated yoga module for six weeks (1hr/day, 5 days week). All the subjects were assessed for flexibility (sit and reach test), abdominal muscles strength (sit ups) and balance (standing stork test) at the baseline and after the completion of six weeks of the yoga training. All the 13 subjects completed the intervention. There were no adverse effects observed during the study period.

5.3.2 Experimental Session

The validated yoga training consisted of loosening exercises, *Asana Prānāyāma* and meditation. All the practices were introduced in a slow and progressive manner. The yoga training was for an hour, five days a week for a total period of 12 weeks. The

experimental group practiced yoga *asanas* (postures) and *Prānāyāma* (breathing techniques). Each *asana* pose was held for 15-30 seconds initially, and for one minute in later stages. The duration of *Prānāyāma* was 2-3 minutes initially and was gradually increased to 5 minutes. The loosening exercises included were hand rotation front and back, twisting, side arch hand right and left, forward and backward bending and side bending. Each exercise was performed for two minutes with 10 rounds each. Standing *Asanas* included *Ardhakaṭīcākṛāsana* (Half Waist Wheel Pose), *Ardhacākṛāsana* (Half Moon Pose), *Pādahasthāsana* (Hand under Foot Pose), *Trikonāsana* (Triangle Pose), *Tāḍāsana* (Mountain Pose) and *Adhomukhaśvānāsana* (downward Facing Dog Pose). The sitting position *Asanas* were *Vajrāsana* (Thunderbolt Pose), *Jānuśīrāsana* (Head to Knee Pose), *Uṣṭrāsana* (Camel Pose) and *Vakrāsana* (Half Spinal Twist Pose). The supine pose *Asanas* practiced were *Vīparitakarṇī* (*Inverted pose*), *Halāsana* (Plough Pose), *Pavanamuktāsana* (Wind Releasing Pose), *Setubandhāsana* (Bridge Pose) and *Savāsana* (Corpse Pose). The prone position *Asanas* included were *Bhujāṅgāsana* (Cobra Pose), *Salabhāsana* (Grossoper pose), *Dhanurāsana* (Bow Pose) and *Makarāsana* (Crocodile Pose). The breathing exercises for the experimental group participants were *Bhastrīkā*, *Dīrgha Svāsana*, *Nāḍīśudhiprānāyāma* *Bhrāmārī prānāyāma*. The schedule of the yoga training is presented in Table 5.2.

Table 5.2
Yoga Training Intervention

Sr. No.	Name of Practice	Round	Time
Loosening Exercises			
1.	Hand rotation front and back	10	2 minutes
2.	Twisting	10	2 minutes
3.	Side arch hand right and left	10	2 minutes
4.	Forward and backward bending	10	2 minutes
5.	Side bending	10	2 minutes
Standing Asanaja			
1.	<i>Ardhakaṭicakrāsana</i>	1 round each side	1 minute
2.	<i>Ardhacakrāsana</i>	1	2 minutes
3.	<i>Pādahasthāsana</i>	1	1 minute
4.	<i>Trikonāsana</i>	1 round each side	2 minutes
5.	<i>Tāḍāsana</i>	1	1 minute
6.	<i>Adhomukhaśvānāsana</i>	1	1 minute
Sitting Asanaja			
1.	<i>Vajrāsana</i>	1	2 minutes
2.	<i>Jānuśirāsana</i>	1	2 minutes
3.	<i>Uṣṭrāsana</i>	1	1 minute
4.	<i>Vakrāsana</i>	1 round each side	2 minutes
Supine Asanaja			
1.	<i>Viparitakarṇī</i>	1	1 minute
2.	<i>Halāsana</i>	1	1 minute
3.	<i>Pavanamuktāsana</i>	1	1 minute
4.	<i>Setubandhāsana</i>	1	1 minute
5.	<i>Savāsana</i>	1	2 minutes
Prone Asanaja			
1.	<i>Bhujāṅgāsana</i>	1	1 minute
2.	<i>Salabhāsana</i>	1	1 minute
3.	<i>Dhanurāsana</i>	1	1 minute
4.	<i>Makarāsana</i>	1	2 minutes
Breathing Exercises			
	<i>Bhastrikā</i>	3 rounds	2 minutes
	<i>Dīrgha Svasana</i>	1.5 Min 2round	3 minutes
	<i>Nāḍīśudhi Prānāyāma</i>	6 rounds	3 minutes
	<i>Bhrāmarī Prānāyāma</i>	6 rounds	3 minutes
Meditation			
	<i>Nadānusandhana</i>	9 rounds	5 minutes
	<i>OM Chanting</i>	3 rounds	3 minutes
	<i>Music</i>	1 round	5 minutes

5.3.3 Control Session

The participants of the control group were not given any specific training; however, they were kept busy with some recreational and physical activities for an hour at the same time of the day as the yoga training session. The subjects as well as their guardians were promised that they would be offered yoga training after the completion of the experimental period.

5.4 ASSESSMENT

At the baseline and after training intervention, the following dependent variables were assessed considering standard tests (Table 5.3).

Table 5.3
Dependent Variables

Sr. No.	Variables	Tools Used
Demographic Variables		
1.	Age	
2.	Height	Stadiometer
3.	Weight	Weighing Scale
4.	BMI	Weight/Height in m ²
Health Related Physical Fitness		
1.	Cardiovascular Efficiency	Harvard Step Test
2.	Flexibility	Sit & Reach
3.	Strength & Endurance of Abdominal Muscles	Sit Ups
4.	Body Fat Percentage	Body Fat Monitor
Psycho-Motor Abilities		
1.	Static Balance	Balance rail test
2.	Eye Hand Coordination	Alternate Hand Wall Toss Test
3.	Agility	Shuttle Run
4.	Reaction Time	Ruler Test

5.4.1 Cardiovascular Efficiency

Cardiovascular efficiency was assessed through Harvard Step Test.

A modified version of the Harvard Step Test was used. Gallagher and Brouha used two heights (18” and 20”) of benches on boys in the age group of 12 – 14 years. The stepping rate was 30 steps a minute for two minutes. This test was modified by the investigator to a bench having a height of 15 inches. The stepping rate was also increased to 40 steps for a minute. The faster pace to perform was the reason to reduce the height of the bench.



A modified test battery was administered as per the instruction manual (AAHPER, 1984).

Limitations in administering each test-item were recorded for further improvements in the test. After a gap of 30 days, the test was administered for a ‘second try – out’. The test retest reliability coefficient was assessed for each test item and also for the test as a whole. The significant reliability coefficient ($r = 0.81$) assured the ‘Preliminary form’ of the test.

5.4.2 Flexibility

Purpose

The objective of this test was to reach a specified distance on the right and the left sides. It measured flexibility of the lower back and hamstrings. Proper hamstrings flexibility helped to avoid lower back pain.



Equipment

The test apparatus consisted of a specially constructed box with a measuring scale where 23-cm was at the level of the feet.

Procedure

Sit and Reach test was administered to assess the flexibility of low back and posterior thighs. A standard sit and reach box were used as described in the AAHPERTD Physical Fitness Test Manual. The subjects were instructed to sit with legs extended fully against the end of the box. With arms extended forward, one hand on the top of the other with palms down, the subjects were instructed to bend forward from waist. Fingers were extended forward as far as possible along the ruler on the top of the box. The score was the distance in centimeters passed (+) the edge of the box against which the feet were positioned or the distance short (-) of reaching the box. Three trials were given with the best score recorded to the nearest centimeter. The validity of the test was reported by logic and the reliability coefficients ranged from 0.84 to 0.98.

Scoring

The score is the most distant point reached on the fourth trial, measured to the nearest centimeter. The test administrator should remain closed to the scale and note the most distance line touched by the fingertips of both hands. If the hand reaches unevenly, the test should be administered again. The tester should place one hand on the subject's knees to ensure that they remain extended. Three trials were given.

5.4.3 Strength and Endurance of Abdominal Muscles**Purpose:**

The objective of this test was to complete as many partial curl-ups as possible at a rhythmic pace. Abdominal fitness was important to good health because low levels were associated with bad posture and lower back pain.

**Equipment:**

Stopwatch, mat, evolution sheet, and pencil

Procedure:

To assume the starting position, the subject lies on his/her back with knees flexed, feet on a floor, with the heels between 12 and 18 inches from the buttocks. Arms are interlocked and placed under the head. Feet are held by the partner to keep them in touch with the testing surface. The subject, by tightening his/her abdominal muscles, curls to the sitting position. The sit-up is completed when the head touches knees. To complete the sit-up, the student returns to a down position until the back makes contact with the testing surface.

The timer gives a signal, 'Ready, go' and the sit-up performance is started at the word "go". The performance is stopped at the word "stop". The number of correctly executed sit-ups performed in 60 seconds are scored. Rest between sit-ups is allowed, and the student should be aware of this before the initiation of the test. However, the objective is to perform as many correctly executed sit-ups as possible in 60-second period.

Scoring:

Record the number of correctly executed sit-ups that are completed in 60 seconds.

5.4.4 Body Fat Percentage

Purpose:

This test is used to assess the body composition, or more specifically the level of fatness in an individual.

Equipment:

Omron fat monitor (HBF-402) is used for direct measurement. The instrument has two handles to catch hold of the instrument and a monitor which displays score digitally.



Procedure:

The trainees were instructed to stand in a normal standing position of legs with 8 to 10 inches apart. (Eyes towards front, spine straight, and hand by the side of the body) Then, every trainee's age in years, height in centimeters, body weight in kilograms and gender of the trainee was entered through the available keyboard. When the instrument indicated its readiness, the trainee was

directed to hold the handles of the instrument with two hands. The hands were kept straight in the front at the shoulder level so that the eyes could easily read the monitor display. The finger grip should be very firm in such a way that the instruments sensor could easily sense the skin voltage. Generally, within 30-40 seconds the monitor displayed the body fat percentage score. If there was any display with error signal, the data on age, height, body weight, gender (M/F) were to be entered again through the keyboard and the process would be repeated till the monitor displayed the score in body fat percentage.

A proper method for measuring body fat percentage with this instrument plays a very important role. The following points are to be remembered:

- Check the battery before making it ready for measurement.
- Get adjusted to this instrument and its functional procedure.
- Keep ready the data such as age, height, weight, and gender of each volunteer before measuring the volunteers' body fat percentage.
- Take care of the alignment of each body parts for an ideal standing posture. Finger grips should be checked so that they are kept with a proper alignment as available in the handles of the instrument.
- Read the monitor's display for recording the score.

Score:

The percentage of the body fat as registered on the dial of the instruments monitor is the score. Each measurement is taken three consecutive times and the average of the three scores is the final score.

5.4.5 Static Balance

Objective:

The objective of the test *Standing Stork Test- Blind* is to record the balance time in the static position.

Material:

Stopwatch

Procedure:

- At the beginning of an actual test, the subjects were instructed to warm up for ten minutes.
- The subject stands comfortably with hands on hips.
- The subject is asked to lift the right leg and place the sole of the right foot against the side of the left kneecap and close both the eyes.
- Next, command “GO”, start the stopwatch and the subject is instructed to raise the heel of the left foot to stand on the toes.
- The subject has to hold this position as long as possible.
- When the subject touches the left heel to the ground or the right foot moves away from the left knee, the time is recorded.



5.4.6 Eye Hand Co-ordination

Purpose:

To measure hand-eye co-ordination

Equipment required:

Tennis ball or baseball, smooth and solid wall, marking tape and stopwatch

Procedure:

A mark was placed at a certain distance from the wall (e.g. 2 meters, 3 feet). The person stands behind the line facing the wall. The ball was thrown from one hand in underarm action against the wall, and attempted to be caught with the opposite hand.



The ball was then thrown back against the wall and caught with the initial hand. The test could continue for a nominated number of attempts or for a set time period (e.g. 30 seconds). By adding the constraint of a set time period, you would add the factor of working under pressure.

Scoring:

This table lists general ratings for the Wall Toss Test, based on the score of the number of successful catches in a period of 30 seconds.

5.4.7 Agility

Purpose:

To measure and agility

Facilities and equipment:

Two lines parallel to each other are placed on floor 30 ft. apart, 2 blocks of wood, 2 x 2 x 4 inches and a stopwatch are needed.



Procedure:

The subjects were asked to stand at one of the lines with 2 blocks on the other line. On the signal ‘to start’, the subject started running to the block which he carried across the starting line and placed the block which he carried across the starting line on his way back.

Instructions:

On the signal ‘go’, the subjects were told to run as fast as possible to the next line and pick up the block. They were also instructed to place the block instead of throwing it on floor.

Scoring:

The score was the time recorded in seconds.

5.4.8 Reaction Time**Required Resource:**

Meter ruler

Procedure:

- To begin the test, a ruler was held by the experimenter between the outstretched index finger and the thumb of the subject’s dominant hand. The ruler was held in such a way that the top of the subject’s thumb was at a zero-centimeter line.



- The experimenter instructed the subject to catch the ruler as soon as possible after it is released.
- The experimenter released the ruler and the subject caught the ruler between his index finger and thumb as quickly as possible.
- The experimenter recorded the distance between the bottom of the ruler and the top of the subject's thumb where the ruler had been caught.

Calculations:

The algorithm to calculate the reaction speed is $d = vt + \frac{1}{2}at^2$ where

- d = distance in meters
- v = initial velocity = 0
- a = acceleration due to gravity = 9.81m/s^2
- t = time in seconds

We need to manipulate $d = vt + \frac{1}{2}at^2$ to give us an algorithm for t as $v = 0$ then $vt = 0$ therefore the algorithm is $t = \text{Sqrt}(2d/a)$

Example:

- $d = 9 \text{ cm}$
- $t = \text{sqrt}(2 \times 0.09 \div 9.81)$
- $t = \text{sqrt}(0.01835)$
- $t = 0.135 \text{ seconds.}$

5.5 DATA EXTRACTION AND ANALYSIS

The data was collected using standardized tests. All statistical analyses were performed using R software. Independent-samples t-tests and paired sample t-tests were for statistical analyses.