

**EFFECT OF SPECIFIED TRAINING WITH SIGN LANGUAGE
AND VIBRATOR AIDS ON SELECTED PSYCHO MOTOR
VARIABLES AND SKILLS IN HANDBALL AMONG
DEAF AND DUMB COLLEGE STUDENTS**

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Submitted by

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CERTIFICATE BY THE SUPERVISOR

This is to certify that the thesis entitled “**EFFECT OF SPECIFIED TRAINING WITH SIGN LANGUAGE AND VIBRATOR AIDS ON SELECTED PSYCHO MOTOR VARIABLES AND SKILLS IN HANDBALL AMONG DEAF AND DUMB COLLEGE STUDENTS**” is a record of research work done by **R. SIGAMANI**, a part time scholar of Doctor of Philosophy, in Department of Physical Education, Gandhigram Rural University, Gandhigram, Dindigul during the year 2011 – 2015.

This thesis is his original work and it has not previously formed the basis for the award to any candidate, for any degree, diploma, associateship or other similar titles. This thesis represents, entirely an independent work on the part of the candidate but for the general guidance by me.

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DECLARATION BY THE SCHOLAR

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DEDICATED TO

MY

BELOVED PARENTS

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CHAPTER I

INTRODUCTION

Among the living organisms, human being is considered as the supreme creation in the world. It is because human being only has the potential skills such as thinking and intellectual ability. The Tamil Sangam poetess **Avvaiyar** speaks about the greatness of human being with her phrase “born as a human being is a rarity that to getting a birth without any problems such as handicapped, blind, deaf and dumb on transgender is the rarest of the rarity. Such a rare group shines well with survival skills such as education and experience. So, getting a birth of human being and enriching with education are being considered as a boon in the world. So, most of the Government in the world spend covetable amount of money to educate the children of their country. In general, education is considered as a tool for bread and butter purpose but it provides scope for all strata of society to uplift their life style.

In the brim of 20th century, our society has been facing and reporting the issues related to the special children such as physically handicapped, visually challenged, hearing impaired, deaf and dumb, and learning difficulty such as Dyslexia. The type of education designed for these people is called ‘Special Education’. Tamil Nadu Government created a Ministry for Differently Abled people (**Matruththiranaligal in Tamil**) exclusively for these children. They should try their level best to utilize these facilities to share all opportunities made available for their normal counterparts.

1.1. OVERALL PERCENTAGE

The issue of special need people has got a considerable attention in recent years, globally and locally, where **Al-Rousan (2007)** pointed that the

disability has negative repercussions on the disabled person personality and counter effect on the community. The disabled person is considered as an economical burden on his family and community. The duty of the society is to interact positively with various categories of disability on solid foundations and constructive objectives and help in the development of disabled persons and reflect his improvement in all physical, psychological, mental and social well-being, as well as to produce a personality capable of adapting to the surrounding community standards.

Alqoraity (2001) mentioned that the deafness disability has a particular importance because of the importance of the sense of hearing to the individuals and the problems caused by losing it. The result of losing the basic means of communication among the members of the community leads to great loss for the individuals. **Rateb (2007)** said that the proportion of people who suffer from weak to full hearing loss reached between 4 to 5% of individuals worldwide. This deficit does not mean that disabled hearing person has lost his ability to work and satisfy his psychological and physical needs, but by training and care, he can perform a high level of performance and achievement in various fields.

1.2. CAPACITY OF HEARING DISABLED

Alkrioti (1995) insisted that the hearing-disabled are capable of performing most if not all activities that suit other ordinary people with the same orientation and mental level. It also stresses by **Canon (2002)** that the hearing-disabled have super power in game, play and physical achievement of some motor skills more than their ordinary peers, as they are distinguished from all other disabilities, that their organs are sound and their senses are correct, and will enjoy high fitness with the regular training, if they were guided correctly to reach a level

similar to the level of ordinary peers with similar orientation and mental level. That is why the psychological factors are considered an important element of success in all games and sports events, where **Allawi (1992)** pointed that when the Supreme sports level players are similar in physical aspects, skills, and planning, the psychological factor is that which determines the result of competition. One of the important psychological factors in progressing and achieving are motivation, anxiety and tension, and thus by knowing the level of these features, one can answer some important questions concerning the deaf exercising a certain sports activities, or their reluctance about playing with fellow peers and their participation in their activities.

Based on the foregoing researchers who try to identify the motivations of worry and anxiety among deaf players and specifically in the skills of aiming in the game of basketball in Jordan, because of its importance at all levels. It was seen that concern and tension in the area of sports for the deaf, and their achievements and behaviors reflecting all aspects of personality, and these sports accomplishments for hearing handicapped, is not dependent only on the physical and skillful evolution but also influenced by many psychological factors such as their motivations, desires, satisfactions, cognition, psychological preparedness, thinking, fear and anxiety ... etc, It was observed that the feel roundness and happiness of the deaf player when succeed, and his disappointment and despair when he fails, affect his performance efforts strongly.

The deaf player can be encouraged or discouraged, he could be tired on sometimes paralyzed, he might get initially fever symptoms or indifference. It is a double-edged sword to engage them in sports.

1.3. EDUCATIONAL METHODS

Afifi (1998) pointed that there are a lot of educational methods in the teaching of deaf players the basic skills in games, and till used as the percentage of success varied in their skill and physical performance, and in this regard **Mahrous (2000)** recalls that the basketball game contains basic offensive and defensive skills that makes the team win, if it is performed nicely and quickly, basic skills are necessary to raise the level of the group towards excellence, any player should master the basic skills, since there are no skill that are more important than others, as it is the movements that each player should be implemented in accordance with the conditions required by the game, in order to reach positive results and saving effort and delay case of fatigue.

Ammons (2008) deaf people, since time immemorial, have always found a way to find each other and share their commonality and, in particular, their need for visual communication through sign language. Since the first schools for the Deaf were established in **Paris, 1755**, deaf people began congregating in more formal situations, primarily for social and cultural reasons. Most Deaf people are (and still are) born into hearing families.

They have experienced difficulties with communication and especially the misunderstanding of how Deafness affects the ability to participate in society. This, in turn, has led to negative stereotypical attitudes towards them. A classic example is the term “Deaf and dumb” which describes Deaf people as “dumb”, “stupid” or “incompetent.” Societies everywhere have viewed Deaf people as intellectually inferior, linguistically impoverished and often have been treated as marginalized citizens.

The first Games, known as the International Silent Games, were held in Paris in 1924. The Silent Games were the first ever sports event for any group of people with disabilities. In deaf Olympics, athletes competed in fifteen (15) different sports competitions including swimming, athletics, tennis, ten-pin bowling, basketball, indoor volleyball, beach volleyball, table tennis, handball, wrestling, cycling, football, orienteering, shooting and badminton. Assistive visual devices were used in swimming, water polo, athletics, shooting and basketball. These devices were flashing lights that replaced the starter's gun or referee's whistle (**Ammons, 2008**).

1.4. VIBRATOR TRAINING

All information about the world is perceived by human through five senses: sight, hearing, touch, smell, and taste. Tactile perception is associated with the sense of touch. Touch is perceived through the skin which contains receptors for pressure, pain, temperature, and kinetic receptors. The band width for each sense, the rate at which the brain can process information from the sensory receptors, is largest for sight and decreases rapidly for each sense in an order of vision 106 bits/s, hearing 104 bits/s, touches 102 bits/s (**Goldishand and Taylor, 1974**).

Human brain receives and understands vibration stimuli. Vibrotactile sensation generally means the stimulation of skin surface at certain frequency using vibrating contactors. Pacinian Corpuscles are considered performing a major role in vibrotactile perception with maximum sensitivity at higher frequencies, i.e., 200–300 Hz. The phenomenon of vibrotactile sensation was first introduced by **Geldard, 1960**.

There are four different parameters through which vibrotactile information coding can be studied, namely, frequency, amplitude, timing and location. A vibrotactile stimulus is only detected when the amplitude exceeds a certain threshold, known as detection threshold (DT). In general, DT depends on several different parameters (**Van-Doren (1990)**) but mainly on the frequency (~20-500 Hz) and location (fingers are most sensitive 250-300 Hz). Vibrating stimulus up to 200 Hz results in synchronized firing of afferent nerve fibers and considered capable of great physiological information flow, i.e., due to presence of large number of mechanoreceptor esp. PC's (**Kaczmarek and Rita, 1995**). By using single detectable stimulus simple messages can be encoded **Rehman, et al., (2008)**. **Van Erp, et al., (2006)** has given detailed information for the use of vibrotactile displays in human computer interaction.

While presenting tactile coding information, a designer should consider the following principals (**Kaaresoja and Linjama, 2005**). No more than four intensity (magnitude) levels should be used. No more than nine frequency levels should be used for coding information and the difference between adjacent levels should be at least 20%. The time interval between adjacent signals should be more than 10 milli-seconds to prevent the “saltation effect”. The vibration on the hand should be carefully dealt with and long durations might make users irritated. Vibration intensity can be used to control threshold detection and sensory irritation problem; similar to volume control in audio stimuli (**Rehman, 2010**).

Vibration offers many potential benefits for the use of mobile phones. A mobile phone is “synchronized” with the ball in the real field. By holding the phone, users are able to experience dynamic movements of the ball, to know attacking

directions and which team is leading the attack. The usability test of the system shows that vibrotactile display is suitable for rendering live football information on mobile phones by adopting designed coding schemes with a right training process **(Rehman, et al., 2008)**.

Sport technologies use embedded and wearable sensors for measuring physiological aspects and muscle movements that can help coaches understand and improve the performance of athletes. **Chi, et al., (2005)** described that these technologies could help to improve sports performance and learning, to encourage more exercises, and to make sports more entertaining. Besides assisting coaches, sport technologies could also support athletes with real-time instructions on how to move the body or with immediate feedback on their performance. This information could be presented as artificial tactile stimuli, as sound, or visually on a display.

For acquiring motor skills, such as in sports training, it is important that the learner frequently receives instructions on how to perform the skill and feedback on the performance. Coaches typically give instructions and feedback before and after a trial, and concurrently during the execution of the movements. Yet in many sports, the coach cannot correct the learner during an exercise. A good case in point is snowboarding. Snowboarders receive instructions before descending the slope and delayed feedback after the ride. During the ride, they are spatially separated from their coach. They have to rely on their own perception of what is right or wrong **(Van, et al., 2006)**.

For instructing snowboarders during the ride, the coach could descend alongside the student to call out instructions. Even so, snowboarders could miss

these spoken messages in the noisy environment. Spoken messages could also block environmental audio cues on which snowboarders rely on. Artificial tactile stimuli are an alternative means to give real-time instructions or feedback without these drawbacks. These stimuli can be generated by actuators, such as vibration motors that are sewn into the sportswear.

Tactile stimuli have been proposed as application in sports for instructing athletes where to move to, how to move, and when to move (**Van, et al., 2006**). Their advantage is that they directly stimulate the body, like a coach who guides the student's movements. When the athlete needs only a hint at how to adjust the posture, a tactile stimulus can nudge the body in the right direction. **Van Erp, et al., (2006)** described that tactile stimuli could signal to athletes where to move to, how to move and when to move. **Van Erp, et al., (2006)** also reported that the first two application scenarios where and how to move—were tested with elite athletes in soccer training, cycling, and speed skating.

Furthermore, **Van Erp, et al., (2006)**, conducted a laboratory study where rowers received tactile instructions when to move the legs and the back while exercising with a rowing machine. The findings of their study indicated that tactile instructions can help athletes maintain a high performance level. Several studies suggest that tactile instructions can support the learner in acquiring motor skills.

Bloomfield and Badler (2008) reported that tactile stimuli at the arm help novices learn karate arm movements in a virtual reality setup. **Nakamura, et al., (2005)** applied tactile stimuli at the wrist to instruct dance beginners when to perform a movement. In general, the participants were able to increase the number

of correct movements and to perform these movements faster compared to dancing without tactile cues. Tactile stimuli were also shown to be effective for learning to play musical instruments. For example, **Holland, et al., (2010)** used tactile stimuli at the wrists and ankles for teaching drum patterns. **Huang, et al., (2010)** used tactile stimuli at the fingers for teaching piano melodies.

Besides instructing when and how to perform a movement, a tactile stimulus can also act as feedback when the movement is wrong. In general, feedback does not instruct the learner how to perform a movement but it can implicitly indicate the direction to move in order to correct the error. For example, **Lieberman, et al., (2007)**, asked participants to mimic an arm movement that was shown on a computer display.

A motion capture system tracked and analyzed the performed movements. Real-time tactile feedback at the arm represented the deviations from the target movements. This feedback resembled a force-field around the correct movement path and indicated the intended movement direction. According to the findings of their laboratory study, **Lieberman, et al., (2007)** reported that the addition of tactile feedback to motor training could improve performance and could support learning.

The findings of several studies indicate that artificial tactile stimuli could be beneficial for learning motor skills, such as dancing (**Nakamura, et al., 2005**), rowing (**Van, et al., 2006**), and karate moves (**Bloomfield and Badler, 2008**). There is also evidence that tactile stimuli can facilitate the learning of musical instruments (**Holland, et al., 2010 and Huang, et al., 2010**). Even so, the work (**Nakamura, et**

al., 2005, Van, et al., 2006 and Bloomfield and Badler, 2008) did not consider realistic training scenarios but focused on laboratory settings, nor did it focus on sports training (Holland, et al., 2010 and Huang, et al., 2010). To better understand the potential and pitfalls of using tactile stimuli for teaching sport skills, it is important to consider a broad range of physical activities, user groups, learning conditions, and real-world scenarios.

1.5. SOCCER REFEREE'S VIBRATOR EQUIPMENTS

In association football, the referee is the person responsible for enforcing the Laws of the Game during the course of a match. Referee is the final decision-making authority on all facts connected with play, and is the only official on the pitch with the authority to start and stop play and impose disciplinary action against players during a match. At most levels of play the referee is assisted by two assistant referees (formerly known as linesmen), who are empowered to advise the referee in certain situations such as the ball leaving play or infringements of the Laws of the game occurring out of the view of the referee. ([https://en.wikipedia.org/wiki/Referee_\(association_football\)](https://en.wikipedia.org/wiki/Referee_(association_football))). Soccer referee's equipments are whistle, timepiece, yellow, red card, notebook, Assistant referee's flag, Pressure gauge, Electronic boards, vanishing spray and Transmitter. Among these instruments as far as our study is concerned transmitter is taken into account. The transmitter is a common equipment for referees in top-flight leagues and international competitions. It is a radio-like device used by the officials to communicate with each other during a game. The transmitter is typically made of a body, which is worn at the waist, and a mouthpiece and earphone (<http://www.football-bible.com/soccer-info/soccer-referee-equipment.html>). The assistant referee's carried an electronic flag that was

connected with the vibrator which was fixed in referee's arm. When the assistant referee switched on the button, referee would feel vibration on his arm and assistant referee communicated with referees in the line for the foul, offside or any other incident (<http://www.goalnepal.com/news.php?id=13876>).

Harold (2005) in his invention relates to a system of devices that can be integrated into elements that are designed to assist the referee in football, such as the referee's whistle, the linesmen's flags, the playing area and the ball. The inventive system can also be used for American football and for any other ball sports. The invention makes use of a series of sensor elements, LEDs (light-emitting diodes) or indicator bulbs, vibration indicators, a control console, a laser light and radiofrequency signal transmitter/receiver mechanisms together with the respective microchips thereof, all of which are known in electronics. The aforementioned elements are adapted and used as auxiliary refereeing supports in the standard elements, i.e. the whistle, flags and rectangular playing area, and, in this way, can be used to provide instant correct solutions to playing situations that could give rise to dubious decisions and subsequent disputes.

1.6. SIGN LANGUAGE

Sign language refers to the indigenous language used by the deaf group in a country. Every country has a sign language of its own, which has developed spontaneously within the deaf group of that country. In an effort to improve deaf people's living conditions, the removal of communication barriers is of paramount importance. A deaf person must have the right to use sign language as his natural language in any social situation. The status of sign language must be raised to that of

a scheduled language in India. This is the primary need of the deaf community in India today (**Indian Sign Language Dictionary**).

Signs can be decomposed into a set of minimal, meaningless units, including the features of hand configuration, movement and place of articulation. Hand configuration (more commonly ‘handshape’) describes the extension or flexion of one or more fingers and the orientation of the hand relative to the body and can be described in terms of a hierarchy of complexity, where the ‘simplest’ hand shapes involve the fewest number of features (selection of fingers, contact between fingers, etc.). Although sign languages are often described as ‘manual’ languages, multiple channels are used. The hands are the major articulators and their configuration, movement, and arrangement in space provide most lexical and grammatical information. However, other articulators are also involved. Mouth actions include mouthing, which provide lexical information derived from spoken language forms, while mouth gestures are also used for adverbials and echo phonology (**Woll, 2001**).

In most sporting events there are always players and referee(s) who use whistle, buzzers, and bells to conduct the events or games. In deaf sporting events whistle, buzzers or bells cannot be meaningful, making it necessary for visual communication and/or alternatives to be used. For example to signal the start of a race a light might be used or a hand signal while coloured flags might signal a foul or illegal play. The signals for “ball” and “strike” were the invention of William Hoy, who played basketball for 17 years, (**Deaf Sports**). In Games and Sports, umpires express their decision through various standard recognizable signs to carry-out the game smoothly as per laid down rules for the respective games. Different

games and events require different signs and signals for official purposes and informal practices. Coaches are known to use various signs and signals directly or discretely which are usually kept secret and practiced only among the team members. Coaches design new signs and signals to help their team surprise their opponents and win matches, Hence it has to be recognized that signs usually play a major role in coaching. In events involving players with hearing disability the role of a coach in evolving efficient sign/signals to appraise the team workout strategies, motivating players is important and necessary.

When players with hearing and speech disabilities are involved the importance of sign language, visual and contact signaling (vibrator) become very relevant and important. This is because common audible clues (signaling) like whistling are ineffective in players with such disability. This research work focuses on effective sign and signaling for players with hearing and speech disability. Among the various aids developed to help players with hearing disability the efficacy of the vibrator especially in games like football and handball is quite noticeable.

1.7. TRAINING AND HANDBALL SKILLS

The handball is a complete collective sporting modality, characterized by a great amount and variety in its movements, ball manipulations and interaction with other athletes. Elite male handball players, who play indoors on a small court, may be more homogeneous as a whole compared to other “big playing field” sports. Among them, the morphological, physiological, technical tactical, psychic and environmental variables are highlighted.

The evaluation of the performance implicates the recognition and denomination of the individual level of the components of the sporting performance or of a conditioning situation. It is essential that all the variables related to the athletes' performance be evaluated. Athletes in all sports use psychological preparation as a tool to enhance their performance. Psychological preparation has many different forms and is directly related to personal preference (**Shahbazia, et al., 2011**).

Junior category and psychomotor development of physical availability is medium to be built technical training through a large number of repetitions of specific skills and game skills requiring high-level sensory system. Better results can be obtained only by the players with a perfect individual technique to cope with the increasingly complex situations encountered in the game and as required by the game, often under conditions of adversity, to limit or running out of time (**Ion, et al., 2014**).

In high-skilled athletes, variability increased again (a functional variability that provides flexibility to the system allowing it to cope with perturbations). Several studies have highlighted that movement variability differs depending on the skill level of the athletes and changes during the movement. To score goals in team handball, throwing players must maximize their ball release speed and their throwing accuracy; however, the ball release speed is the main performance factor determining the throwing movement (**Van den Tillaar & Ettema, 2006; Wagner and Muller, 2008**).

In sport and games, particularly ball games, game situations continually change during the event, as well as during a particular movement. Skilled athletes are able to adapt to these changing game situations leading to differences in movement variability. Team-handball throw, (Schorer, Baker, Fath, & Jaitner, 2007) movement variability was consistent with a U-shaped curve depending on the skill level of the athlete. Schorer, et al., (2007) and Wilson, et al., (2008) found a high variability in low-skilled athletes and a decrease in variability of skilled athletes resulting in a more consistent and regulated performance.

1.8. HIGHLIGHTS OF DEAF AND DUMB PEOPLE

Recent education census report says, “Among the 9 percent of handicapped people in India, 80 to 90 percent people are studious to promote themselves in education and social environment. There is a massive enrolment of handicapped students every year and the strength is steadily increasing. For example, among 69 government colleges in Tamil Nadu, around 900 to 950 handicapped students have enrolled and 150 to 175 handicapped faculty members working for the benefit of their fraternity.

Curriculum for deaf and dumb and with other difficulties is entirely different. Because students with difficulties can speak and hear which cover 80 percent of teaching and learning process. But for deaf and dumb, sign language and inter-personal methods such as touch and display can alone be used. Higher education is a concept which shapes the overall personality of a student through extra-curricular activities. Among the extra-curricular activities there are many varieties of events to channelize their positive energy and get shaped as a social well-being. The possible college level extra-curricular activities are,

- a) Sports and games (Track events and Individual events)
- b) National Cadet Corps
- c) National Service Scheme
- d) Rotaract Club
- e) Red Ribbon Club
- f) Green Club for Environment cleanliness
- g) Youth Red Cross.

Not long ago individuals having some physical or mental defects were looked down as useless persons for the society. The term 'Handicapped' or 'Disabled' were leveled against their identity. They were not whole heartedly accepted by others in the society. With the passage of time the outlook began to change.

"Deaf and Dumb" is the term commonly used to describe persons who through being deaf are unable to hear the spoken words of others, and who, consequently, remain dumb. Being deaf is the cause, dumb the consequence. Thus the term "deaf and dumb" is a misnomer, for the deficiency is single, not two-fold, although in the result it affects the two organs of hearing and speech. Among various special populations deaf & dumb is a very common type of disability seen in our society not in a very negligible quantity. It is needed to take special care and attention of this population from their childhood to give them ample opportunity to be self sufficient in future. That is why various schools have been established for the special populations in our country starting from late seventies up to date. It is needed not only to give them education but also to build a healthy body and mind for them

having the prime necessity of physical education as well to make them conscious about their physique, health and fitness (**Ghosh, 2014**).

Social reformers and educationists are striving hard to integrate the physically challenged person with the main stream. It is our social responsibility to see it that physically challenged people leads a self reliant independent and emotionally stable life. Educationists and school administrators are now working together to fulfill that aim. Advancement in scientific knowledge is helping them in many ways in their effort. It is not easy to integrate these people with the society. Due to physical disability, they face many challenges to perform any task as par with the normal people (**Ghosh, 2014**).

Youth is an integral part of democratic society and future asset of mankind. It is universally recognized that Sport is an effective way for channelizing the energies of Youth for productive and meaningful purpose. Fitness has proved as a powerful but highly undervalued and under exploited tool for promoting solidarity and in contributing to an atmosphere of tolerance and understanding to the special population as an undefined part of the society.

After having gone through the various studies, investigator planned to study the effectiveness of Deaf and Dumb students' participation in the college sports activities. The work carried out on hearing impaired players of handball team with and without sign / vibrator shows and proves effectiveness of this type of signaling among such players.

The researcher is working in the physical education department of Presidency College in Chennai which has two departments exclusively for the

hearing impaired students. The interest and enthusiasm shown by these students towards sports made the researcher select this area/topic of research, which should benefit this section of students and coaching abilities as a whole. This is the reason for selecting the topic and carrying out research in the area of sports.

1.9. OBJECTIVES OF THE STUDY

The following are the specific objectives of this study.

1. To find out the effect of specified training with vibrator aid on selected psychomotor variables and skills in handball among deaf and dumb college students.
2. To find out the effect of specified training with combination of vibrator aid & sign language instruction on selected psychomotor variables and skills in handball among deaf and dumb college students.

1.10. STATEMENT OF THE PROBLEM

The present study was to find out the effect of specified training with sign language and vibrator aid on selected psychomotor variables and skills in handball among deaf and dumb college students.

1.11. HYPOTHESES

It was hypothesized that

1. There would be a significant improvement on selected psycho motor and skill related variables in handball due to the influence of specified training with vibrator aid instruction.

2. There would be a significant improvement on selected psycho motor and skill related variables in handball due to the influence of specified training with combination of vibrator aid & sign language instruction.
3. There would be a significant improvement difference between specified training with vibrator aid and combination of vibrator aid & sign language instruction on selected criterion variables among deaf and dumb students.

1.12. SIGNIFICANCE OF THE STUDY

The results of the study may be useful to the following ways.

1. This work explored the use of real-time vibrator and combination of vibrator aid & sign language instructions for teaching sport skills in a realistic scenario.
2. This study will provide guideline for deaf and dumb college men students to improve their psychomotor and handball skills.
3. It would further add to the quantum of knowledge in the area of sign language and vibrator training.
4. The result can be used by the physical education teachers for further development in playing abilities of their trainees.
5. The study may help other physical educators to conduct further research in this area.

1.13. DELIMITATIONS

1. To achieve the purpose of the study, forty five deaf and dumb men students were selected randomly from the Presidency College, Chennai. The subjects' age ranged between 18 and 25 years and their hearing impaired level is 90%.

2. Selected subjects were divided into three equal groups namely experimental group I (VTG=15) vibrator aid training group, Group II (VSTG=15) combination of vibrator aid & sign language training group and Group III served as control group (CG = 15).
3. The following dependent variables were selected for this study: Psychomotor variables namely reaction time and movement time, Skills namely nine meter front throw, dominant hand speed pass, over head pass, accuracy throw, jump and throw and dribbling.
4. The duration of the training period was restricted to twelve weeks and the number of sessions per week was confined to five.
5. The level of significance was fixed at 0.05 level, which was considered to be appropriate.
6. The data were collected prior to and also immediately after the training period.

1.14. LIMITATIONS

1. Subjects' previous training was not considered.
2. Subjects included in the study could not be controlled with regard to their life style, diet and habits which might have influenced their performance.
3. Subject's body type and the socio-economic status of subjects were not taken into consideration.

1.15. MEANING AND DEFINITION OF THE OPERATIONAL TERMS

1.15.1. Deaf and Dumb

Deaf person - a person with a severe auditory impairment, dummy, silent person - a person who does not talk.

1.15.2. Sign Language

Sign language refers to the indigenous language used by the deaf group in a country.

1.15.3. Vibrator Aid

Vibrator aid is an instrument that produce the vibrotactile (pulsation and touch) sensation generally means the stimulation of skin surface at certain frequency using vibrating contactors.

1.15.4. Handball

Handball is a team sport in which two teams of seven players each (nine outfield players including a goalkeeper) pass a ball using their hands with the aim of throwing it into the goal of the other team. A standard match consists of two periods of 30 minutes, and the team that scores more goals wins.

1.15.5. Specified Training

The term specified training”” means “specific to one’s sport or activity,” which means the individual should be engaged in perfect practice to improve their skills. Sport specific training is simply fitness and performance training, designed specifically for sports performance enhancement. Training programs for sports performance enhancement could include areas such as strength, speed, power, endurance, flexibility, mobility, agility, techniques and strategies.

In the current study, specified training exercises are handball related drills, stretching, cone drills, jogging, rotation exercises, sprints, single jump, burpee, sit-ups, biceps and triceps curl.

1.15.6. Specified Training with Vibrator Aid

In the current study, during the supervised sessions the specified training with vibrator aid group was given the specified training exercises. At the same time, the medium of instruction was given by using vibrator aid only. During the unsupervised sessions, the specified training could have been included with jogging, stretching and rotation exercises.

1.15.7. Specified Training with Combination of Vibrator aid & Sign Language

In the current study, during the supervised sessions the specified training with vibrator aid and followed by sign language group was given specified training exercises. At the same time the medium of instruction was given by using vibrator aid followed by sign language. In addition to the specified training, jogging, stretching and rotation exercises were also executed to the combination of Vibrator aid & Sign Language group.

1.15.8. Reaction Time

Reaction time is the interval time between the presentation of a stimulus and the initiation of the muscular response to that stimulus.

1.15.9. Movement time

The time elapsed between the beginning and the end of a movement.

1.15.10. Passing and Throwing

This is one of the basic, technical elements. A pass must be accurate, fast and tactically useful. A position of hands while catching a ball, decision to whom a pass should be directed depends on the player's position in a particular situation. A pass should be directed to that player whose position may menace the opponent.

1.15.11. Accuracy Throw

Accuracy throw is an act of throwing a handball with the combination of both confidence and precision.

1.15.12. Jump shot

This shot is mainly used by the offence players to attack a tactile group. The performance of this shot is preceded by a cross-legged jump or a jump towards the goal. Correct performance of the shot and particularly the position of the trunk and proper co-ordination of arms and legs make the one the strongest.

1.15.14. Dribbling

A dribble is the act of running with the ball at feet while maintaining possession. It is often used to take the ball around an opposition player.

CHAPTER II

REVIEW OF RELATED LITERATURE

INTRODUCTION

The related literature reviewed for better understanding of the problem investigated and to interpret the results are presented in this chapter. The reviews are classified under the following headings:

1. Studies related to specified training on handball skills and performance
2. Studies related to deaf and dumb
3. Studies related to vibrator aid and sign language training
4. Summary of the literature.

2.1. STUDIES RELATED TO SPECIFIED TRAINING ON HANDBALL SKILLS AND PERFORMANCE

Eliasz (2015) studied the relationships between throwing velocity and motor ability parameters of the high-performance handball players. Statistically significant differences were found between maximal ball velocity during throws with a cross-over step, and ball velocities during other analyzed throws. The highest ball velocity was achieved during the throw with a cross-over step performed by play-makers. Among the motor ability factors, total muscle strength of the body (ISI), strength of trunk flexors (abdominal muscles) and maximal arm (shoulder joint) angular velocity (MSD) have a decisive effect on the ball velocity in analyzed throwing techniques. The maximal arm speed is the most important factor determining ball velocity during-technically the simplest - throw on the spot. Muscle strength has greater influence on ball velocity during - technically more complicated - throw with an upward jump.

Ion, et al., (2014) examined the learning to play handball technique is to find and assimilate technical processes driving expression of the players optimal opportunities and increase their effectiveness as structured driving current game. This research was conducted at the level of junior handball teams during a competitive year in which research subjects were in training a large percentage of technical exercises, assessed by control samples prepared by federation of specialized or domain experts. To assess the level of technical training and progress have passed control samples at the beginning and end of the research.

Loffing and Hagemann (2014) conducted two experiments to examine experienced and novice team-handball goalkeepers' ability to predict the type of throw in handball penalties and to identify the observers' reliance on local versus globally distributed spatial cues. In Experiment 1, following a 2 (Skill) 5 (Temporal Occlusion Condition) factorial design participants were provided with videos of team-handball penalties where the amount of viewing time was varied. In Experiment 2, another sample of experienced and novice goalkeepers watched videos of spatially manipulated penalties where specific parts of the thrower's body or the ball were either removed or presented in isolation (2 [Skill] 9 [Display Condition] factorial design). In Experiment 1, experienced goalkeepers outperformed novices and both groups similarly improved their performances with later occlusion conditions. In Experiment 2, experienced goalkeepers were again superior to novices, and local cues (e.g., ball and hand) were sufficient for better than chance predictions in both groups.

Moreover, experienced in contrast to novice goalkeepers (i) suffered from the removal of and (ii) benefited from the addition of distal (i.e., throwing arm

and ball) as well as proximal (i.e., upper body) kinematic features. This research is in line with previous findings on perceptual-cognitive expertise in sports and suggests that experienced team-handball goalkeepers rely on multiple, globally distributed cues when making anticipatory judgments.

Wei and Ji (2014) randomly selected a 60 elderly with mild cognitive impairment (MCI) and they were divided into training group (n = 30) and control group (n = 30). The mini-mental state examination (MMSE) score and abilities of daily living scale (ADL) score before, after 3-month, and after 6-month handball training period was measured. The results showed that MMSE score was increased and ADL score was decreased in training group after 3-month and 6-month intervention ($P < 0.05$), while there were no significant changes in MMSE or ADL in control group. These preliminary results indicated that handball training can improve cognitive ability in MCI.

Singh and Ram (2013) correlated anthropometric dimensions and physical fitness components with playing ability and also to develop the regression equation for the prediction of handball players playing ability. The research was conducted on Inter-University level 200 male handball players of age range 18-25 years. Twenty seven anthropometric measurements and six physical fitness components as independent variables and cumulative score of two skill tests as dependent variable were evaluated of each subject. SPSS (11.5) computer software was used to analyze the data. The study revealed that the body weight and linear measurements, i.e., standing height, sitting height, total arm length, upper arm length, leg length, thigh length, lower leg length, hand length and hand breadth; body diameter measurements, i.e., elbow and shoulder diameters; body girth

measurements, i.e., shoulder, chest and abdomen girths; skin-fold measurements, i.e., biceps, triceps and sub-scapular skin-folds; body composition variables i.e., lean body mass and fat weight and physical fitness components i.e., speed, agility, arm and leg strength have significant correlations with playing ability of handball players. The multiple correlations of highly correlated nine independent variables taken together with playing ability has been found highly significant and hence the developed equation can be used in the prediction of playing ability.

Cetin and Ozdol (2012) determined the effects of 12-week strength training on the jumping throw performance in young handball players. 18 handball players (age: 13.66 ± 0.5 year; height: 160.0 ± 6.25 cm; weight: 49.0 ± 8.97 kg) participated to the study. The Training Group Program: A 12 week strength training and handball technical training program were supervised 3 times a week and each session was 60 min. Control Group Program: A 12 week handball technical training program were supervised 3 times a week and each session was 60 min. Push up, vertical jump (VJ), performances and some kinematic parameters (velocity (VCG) and height (hCG) of center of gravity) were evaluated before and after training program.

For kinematics parameters, performances were recorded with a camera (50Hz) and evaluated with Video point 2.0. program. There were significant differences between before and after training program in push up and the height of center of gravity parameters ($p < 0.05$). But there is no significant differences found that vertical jump (VJ) and velocity of center of gravity (VCG) ($p > 0.05$).

Graib, et al., (2012) identified the impact of anxiety and tension on the level of performance of basketball aiming skills for deaf players in Jordan, because its appropriateness for this study the researcher used the descriptive approach, a deliberately sample composed of 10 practitioners of the game of basketball players from the Prince Ali Deaf Club (Zarka) was chosen, a number of conclusions have been reached some of them was the high performance skills of aiming caused a low level of concern among members of the sample.

The relationship between the two variables were statistically significant but was in reverse, the researchers recommended a growing interest in developing performance skills in basketball and aiming skill in basketball and carrying out more experimental and competitive games for the purpose of eliminating the barrier of fear and tension, and granting the deaf players high confidence in his performance.

Wagner, et al., (2012) determined differences in performance and movement variability for several throwing techniques in different phases of the throwing movement, and of different skill levels. Twenty-four team-handball players of different skill levels ($n = 8$) performed 30 throws using various throwing techniques. Upper body kinematics was measured via an 8 camera Vision motion capture system and movement variability was calculated. Results indicated an increase in movement variability in the distal joint movements during the acceleration phase.

In addition, there was a decrease in movement variability in highly skilled and skilled players in the standing throw with run-up, which indicated an increase in the ball release speed, which was highest when using this throwing

technique. The researchers asserted that team-handball players had the ability to compensate an increase in movement variability in the acceleration phase to throw accurately, and skilled players were able to control the movement, although movement variability decreased in the standing throw with run-up.

Debanne and Laffaye (2011) conducted a study to predict the throwing velocity of the ball in Handball with anthropometric variables and isotonic tests. The aims of this study were; to (1) investigate the influence of general anthropometric variables, Handball specific anthropometric variables, and upper-limb power and strength on ball-throwing velocity in a standing position and (2) predict this velocity using multiple regression methods. Forty- two skilled male Handball players (age 21.0 ± 3.0 years; height = 1.81 ± 0.07 m; body mass = $78.3+11.3$ kg) participated in the study. Researchers measured general anthropometric variables (height, body mass, lean mass, body mass index) and Handball specific anthropometric parameters (hand size, arm span). Upper-limb dynamic strength was assessed using a medicine ball (2 kg) throwing test, and power using a one repetition maximum bench press test. All the variables studied were correlated with ball velocity. Medicine ball throwing performance was the best predictor ($r = 0.80$).

General anthropometric variables were better predictors ($r = 0.55-0.70$) than Handball specific anthropometric variables ($r = 0.35-0.51$). The best multiple regression model accounted for 74% of the total variance and included body mass, medicine ball throwing performance, and power output in the 20kg bench press. The equation formulated could help trainers, athletes, and professionals detect future talent and test athletes' current fitness.

Shahbazia, et al., (2011) investigated physical and mental fitness of Iranian men's handball national players. Samples of the research were 15 of Iranian men's handball national players. Selected physical fitness tests (such as: sit and reach, VO₂max, power, strength, speed, reaction time, agility) and OMSAT3 questionnaire used for measure physical and mental fitness respectively. The results of Pearson correlation showed that there was no significant relation between the factors of physical fitness and mental preparation in athletes ($p>0.05$).

Physical fitness scores were lower than optimal level whereas they had a very good mental preparation. Although the research subjects had low physical fitness, they achieved considerable results in Asian games. Therefore, it seems that high psychological preparedness in athletes may be effective in earning such a great position (silver medal).

Buchheit, et al., (2010) compared the effects of speed/agility (S/A) training with sprint interval training (SIT) on acceleration and repeated sprint ability (RSA) in well-trained male handball players. In addition to their normal training program, players performed either S/A ($n = 7$) or SIT ($n = 7$) training for 4 wk. Speed/agility sessions consisted of 3 to 4 series of 4 to 6 exercises (e.g., agility drills, standing start and very short sprints, all of <5 s duration); each repetition and series was interspersed with 30 s and 3 min of passive recovery, respectively.

Sprint interval training consisted of 3 to 5 repetitions of 30-s all-out shuttle sprints over 40 m, interspersed with 2 min of passive recovery. Pre- and posttests included a countermovement jump (CMJ), 10-m sprint (10m), RSA test and a graded intermittent aerobic test (30-15 Intermittent Fitness Test, V(IFT)). In

well-trained handball players, 4 wk of SIT is likely to have a moderate impact on intermittent endurance capacity only, whereas S/A training is likely to improve acceleration and repeated sprint performance.

Chelley, Hermassi and Shephard (2010) investigated relationships between peak power (PP) as measured by upper limb (PPUL) and lower limb (PPLL) force-velocity tests, maximal upper limb force assessed by 1 repetition maximum bench press (1RMBP), and pullover (1RMPO) exercises, estimates of local muscle volume and 3-step running handball throwing velocity (T3-Steps). Fourteen male handball players volunteered for the investigation (age: 19.6 ± 0.6 years; body mass: 86.7 ± 12.9 kg; and height 1.87 ± 0.07 m).

Lower and upper limb force-velocity tests were performed on appropriately modified forms of a Monark cycle ergometer, with measurement of PPUL and PPLL, and the corresponding respective maximal forces (F0UL and F0LL) and velocities (V0UL and V0LL). T3-Steps were assessed using a radar Stalker ATS system. Muscle volumes of the upper and lower limbs were estimated with a standard anthropometric kit. T3-Steps was closely related to absolute PPUL and to F0UL ($r=0.69$, $p<0.01$ for both relationships). T3-Steps was also moderately related to 1RMBP and 1RMPO ($r=0.56$, $p<0.05$; $r=0.55$, $p<0.05$ respectively), and to PPLL and F0LL ($r=0.56$, $p<0.05$; $r=0.62$, $p<0.05$, respectively). When PPLL was expressed per unit of limb muscle volume, the relationship with T3-Steps disappeared. This suggests the importance of muscle volume to performance in throwing events.

Force-velocity data may prove useful in regulating conditioning and rehabilitation programs for handball players. Our results also highlight the contribution of both the lower and the upper limbs to handball throwing velocity, suggesting the need for coaches to include upper and lower limb strength and power programs when improving the throwing velocity of handball players.

Garcia, et al., (2010) analyzed the differences in general and specific throwing capacity of handball players as a function of the age category. Differences between throwing velocity to goal without and with opposition have also been addressed. Ninety four handball senior and U-18 players were assessed in four different situations of throwing: 1) heavy medicine ball throw, 2) light medicine ball throw, 3) throwing velocity without opposition and 4) throwing velocity with opposition. Senior players were found to perform far better than the U-18 players in all four throwing situations ($p < 0.001$; $t_1 = 6.958$; $t_2 = 8.244$; $t_3 = 8.059$; $t_4 = 5.399$; $df = 92$).

Throwing velocity was higher without than with opposition for both groups; the throwing velocity of the senior group was 7.79% lower ($p < 0.01$; $t = 8.317$; $df = 47$) when there was opposition, whereas U-18 players' velocity lowered by 6.03% ($p < 0.01$; $t = 4.469$; $df = 45$). The results suggest that age can be a determining factor in handball players' throwing capacity, both general and specific. Likewise, the presence and interference of a goalkeeper appears to affect throwing velocity in a negative way, especially in senior players.

Rivilla-García (2010) analyzed the differences in distance throwing with heavy and light medicine ball and throwing velocity between handball players

of different competitive and professional level. Likewise, the relationship between the three throwing test of progressive specificity was analyzed: throwing with heavy medicinal ball (TH), throwing with light medicinal ball (TL) and throwing velocity (TV). For this purpose, sixty-five professional (P), semi- professional (S) and non-professional (N) players were evaluated.

In the three throwing test, the results revealed that the values were significantly better as the competitive and professional level increased (TH: $F_{2, 63} = 34.399$; TL: $F_{2, 63} = 53.75$; TV: $F_{2, 63} = 70.364$). Thus, in all throwing situations, the professional group showed higher values ($p < 0.001$) than the semi-professional and non-professional groups. In all groups, significant and positive correlation between the three throwing tests were observed ($p < 0.01$).

The correlation value between TH-TV (P: $r = 0.469$; S: $r = 0.619$; N: $r = 0.687$) was lower than the correlation value between TL-TV (P: $r = 0.652$; S: $r = 0.818$; N: $r = 0.891$). Therefore, handball players' throwing ability is a decisive factor in competitive and professional level. Moreover, the results suggest that the TL is a better predictor of throwing velocity than the TH, more so in non-professional players.

Rivilla–Garcia, et al., (2010) analyzed the differences in throwing capacity among the playing positions in elite and amateur male team handball players ($n = 48$) in four throwing tests: throwing with a heavy (THMB) and light medicine ball (TLMB), throwing velocity without (TV) and with opposition (TVO). The backs achieved the highest scores while goalkeepers had the lowest scores in the most specific tests, TLMB ($F_{4, 43} = 2.886$; $p < 0.05$), TV ($F_{4, 43} = 4.857$; $p < 0.05$) and

TVO ($F_{4, 43}=12.828$; $p<0.01$). The analysis of differences revealed that TV was higher than TVO ($p<0.01$) in all cases. The results suggest that the playing position is determinant in specific throws. Furthermore the influence of opposition is significant in throwing velocity, decreasing it in all positions.

Vuleta, et al., (2010) defined reliability and factorial validity of four field specific handball tests used for the assessment of explosive (throwing) power of elite handball players. The subjects were 18 top level Croatian national handball players. The participants were tested during the middle of the competitive season. Three throws were measured for each test (R4M, R6M, R9MRS and R9MJS). The reliability was assessed through the AVR, ICC and Cronbach's α coefficients, and the validity through the correlations obtained by the principal components factor analysis. The R6M, R9MRS and R9MJS tests had high reliability coefficients ($\alpha = 0.93, 0.93$ and 0.91).

The principal components analysis extracted one statistically significant component. The R4M test had the lowest correlation with the component ($r = 0.52$), and the other three tests had correlation coefficients between 0.88 and 0.93. The results of the study proved that the most reliable and appropriate tests to assess the explosive (throwing) power of handball players are the R6M and R6MRS tests.

Wagner, et al., (2010) studied that the jump throw is the most applied throwing technique in team- handball ; however, a comprehensive analysis of 3D-kinematics of the team-handball jump throw is lacking. Therefore, the purpose of our study was: 1) to measure differences in ball release speed in team-handball jump throw and anthropometric parameters between groups of different levels of

performance and (2) to analyze upper body 3D- kinematics (flexion/extension and rotation) to determine significant differences between these groups.

Three-dimensional kinematic data was analyzed via the Vicon MX 13 motion capturing system (Vicon Peak, Oxford, UK) from 26 male team- handball players of different performance levels (mean age: 21.2 ± 5.0 years). The participants were instructed to throw the ball (IHF Size 3) onto a target at 8 m distance, and to hit the center of a square of 1×1 m at about eye level (1.75 m), with maximum ball release speed. Significant differences between elite vs. low level players were found in the ball release speed ($p < 0.001$), body height ($p < 0.05$), body weight ($p < 0.05$), maximal trunk internal rotation ($p < 0.05$), trunk flexion ($p < 0.01$) and forearm pronation ($p < 0.05$) as well as trunk flexion ($p < 0.05$) and shoulder internal rotation ($p < 0.001$) angular velocity at ball release.

Results of the study suggest that team-handball players who were taller and of greater body weight have the ability to achieve a higher ball release speed in the jump throw, and that an increase in trunk flexion and rotation angular velocity improve the performance in team-handball jump throw that should result in an increase of ball release speed.

Buchheit, et al., (2009) compared the effect of high-intensity interval training (HIT) versus specific game-based handball training (HBT) on handball performance parameters. Thirty-two highly-trained adolescents (15.5 ± 0.9 y) were assigned to either HIT ($n=17$) or HBT ($n=15$) groups, that performed either HIT or HBT twice per week for 10 weeks. The HIT consisted of 12-24 x 15 s runs at 95% of the speed reached at the end of the 30-15 Intermittent Fitness Test (V(IFT))

interspersed with 15 s passive recovery, while the HBT consisted of small-sided handball games performed over a similar time period.

Before and after training, performance was assessed with a counter movement jump (CMJ), 10 m sprint time (10 m), best (RSAbest) and mean (RSAMEAN) times on a repeated sprint ability (RSA) test, the V(IFT) and the intermittent endurance index (iEI). After training, RSAbest (-3.5±2.7%), RSAMEAN (-3.9±2.2%) and V(IFT) (+6.3±5.2%) were improved ($P < 0.05$), but there was no difference between groups. In conclusion, both HIT and HBT were found to be effective training modes for adolescent handball players. However, HBT should be considered as the preferred training method due to its higher game-based specificity.

Buchheit, et al., (2009) determined whether a 4-a-side handball (HB) game is an appropriate aerobic stimulus to reach and potentially enhance maximal oxygen uptake ($\dot{V}O_{2max}$), and whether heart rate (HR) is a valid index of $\dot{V}O_2$ during a handball game. Nine skilled players (21.0 ± 2.9 yr) underwent a graded maximal aerobic test (GT) where $\dot{V}O_{2max}$ and HR – $\dot{V}O_2$ relationship were determined. $\dot{V}O_2$, HR and blood lactate ([La]_b) were recorded during a 2×225 s (interspersed with 30 s rest) 4-a-side handball game and were compared to those measured during an 480-s running intermittent exercise (IE). Mean $\dot{V}O_2$ tended to be higher in handball compared to IE (93.9 ± 8.5 vs. $87.6 \pm 7.4\%$ $\dot{V}O_{2max}$, $p = 0.06$), whereas HR was similar (92.3 ± 4.9 vs. $93.9 \pm 3.9\%$ of the peak of HR, $p = 0.10$). [La]_b was lower for handball than for IE (8.9 ± 3.5 vs. 11.6 ± 2.1 mmol l⁻¹, $p = 0.04$).

Time spent over 90% of $\dot{V}O_2\text{max}$ was higher for handball than for IE (336.1 ± 139.6 s vs. 216.1 ± 124.7 s; $p = 0.03$). The HR – $\dot{V}O_2$ relationship during GT was high ($r^2 = 0.96$, $p < 0.001$) but estimated $\dot{V}O_2$ from HR was lower to that measured ($p = 0.03$) in handball, whereas there was no difference in IE. 4-a-side handball game can be used as a specific alternative to IE for enhancing aerobic fitness in handball players. Nevertheless, the accuracy of HR measures for estimating $\dot{V}O_2$ during handball is poor.

Singh, et al., (2009) prepare the ‘norms profile’ of specific skills of handball players with a view to compare and evaluate further planning of handball game as it’s not being practiced in our country at present. So, an objective was set by the researchers to prepare the norms for each important specific skill of handball game at school, university and senior level of performance. Total of five hundred eighty six (N=586) players of handball were examined during School National championship (N=200), All India Inter University championship (N=195) and Senior National championship (N=191).

The tests of specific skills of Handball, standardized by Singh (2007) were used to record the specific skills of handball players. The percentile values were distributed through SPSS. These prepared norms are presented in tabular form. The research evaluation highlights that there is an increase of specific skills with participation level of handball players. Speaking specifically, the different levels’ include the level of school to university and then from university to senior level. The implicational interpretation will result in the form of an increased competitive ability of the players.

Ziva and Lidora (2009) studied physical characteristics, physiological attributes, throwing velocity, accuracy and on court performances of male Handball players. For this purpose amateur player, experienced players, professional and national team players were selected. Five main findings emerged from our review: (1) Elite players are heavier and have higher fat-free mass than amateur players. (2) The maximal oxygen uptake of male players was between 50 and 60 ml kg⁻¹ min⁻¹. (3) Throwing velocity was higher by as much as 9% in elite male players compared with amateur male players. (4) Heart rates can rise above 160 beats min⁻¹ in male players during a game. (5) On- court distance covered in a game averaged approximately 4 km and ranged between 2 and 5 km, depending on playing position.

The methodological concerns based on the reviewed studies are: (a) a lack of on-court physiological data; (b) a lack of experimental/manipulative studies; (c) limited data on throwing accuracy; and (d) a lack of longitudinal studies. The practical implications include: (a) strength and power exercises should be emphasized in conditioning programmes, as they are associated with both sprint performance and throwing velocity; (b) speed and agility drills should also be implemented in conditioning programmes; and (c) specificity of training based upon the position of the player is of great importance when planning strength and conditioning programmes.

Marques, et al., (2007) examined the relationship between ball throwing velocity during a 3-step running throw and dynamic strength, power, and bar velocity during a concentric-only bench-press exercise in team-handball players. Fourteen elite senior male team-handball players volunteered to participate. Each volunteer had power and bar velocity measured during a concentric-only bench-

press test with 26, 36, and 46 kg, as well as having 1- repetition-maximum (1-RMBP) strength determined. Ball-throwing velocity was evaluated with a standard 3-step running throw using a radar gun.

Ball-throwing velocity was related to the absolute load lifted during the 1-RMBP ($r = .637$, $P = .014$), peak power using 36 kg ($r = .586$, $P = .028$) and 46 kg ($r = .582$, $P = .029$), and peak bar velocity using 26 kg ($r = .563$, $P = .036$) and 36 kg ($r = .625$, $P = .017$). Conclusions: The results indicate that throwing velocity of elite team-handball players is related to maximal dynamic strength, peak power, and peak bar velocity. Thus, a training regimen designed to improve ball-throwing velocity in elite male team-handball players should include exercises that are aimed at increasing both strength and power in the upper body.

Nikolaos, et al., (2007), compared a 6-month specific handball training program and a typical physical education program on various strength and jumping skills. The participants (M age = 13.7 years, SD = 1.5) were divided into the Handball Group ($n = 51$) and the Physical Education Group ($n = 70$). The Handball Group performed 3 sessions/week (60 min) including ball-handling drills, horizontal and vertical jump-shots, fast-break, and several defensive skills. The Physical Education Group performed the program provided by the Ministry of Education including track and field and other team-sport drills.

Analyses of covariance showed that the handball group displayed greater improvement in explosive strength of upper limbs, jumping performance, maximum isometric force of right grip, and 10 m running velocity. These findings showed that handball training can significantly improve preadolescent performance of upper and

lower limbs. The inclusion of specific handball drills into the physical education program is recommended.

Rogulj, et al., (2007) found the influence of some motor abilities on Ball Speed during Shot in Handball. The influence of basic motor abilities on the speed of ball during the jump shot and the floor shot in Handball has been analyzed with the sample consisting of 42 students of the first year of the Faculty of kinesiology in Split. The predatory system consisted of 8 variables intended to estimate speed, agility, movement frequencies, stamina & explosive and repetitive strength whereas the ball movement speed as a criterion variable was measured by radar pistol.

The result of the regression analysis indicates that the ball movement speed was determined in a great deal by motor ability efficacy. Individually, the ball movement speed during the jump shot and the floor shot is determined, at the level of statistical importance, only by explosive strength in the form of throw. It was acceptable because this very ability from the aspects of kinesiology and anatomy requires, to the maximum extent, the kinetic efficacy of the ball throw in Handball.

Schorer, et al., (2007) examined the movement patterns of 5 left-handed handball players (ranging from beginner to national level) who threw a handball to different sections of a goal as if a goalkeeper were present. The authors used time-continuous, 3-dimensional kinematic data to assess intraindividual movement patterns and considered subjects' intraindividual differences relative to different targets. Cluster analysis yielded the highest assignment rates for level of expertise; a mean of 92% of trials was correctly assessed.

The authors observed an interaction with expertise for the intraindividual movement patterns. Variability in the novice throwers was increased, whereas (a) advanced throwers experienced a period of stability, and (b) the expert thrower's variability was increased. The results indicate that random variability characterizes novice motor performance, whereas active functional variability may exemplify expert motor performance.

Tillaar and Ettema (2007) investigated the contribution of upper extremity, trunk, and lower extremity movements in over arm throwing in team handball. In total, 11 joint movements during the throw were analyzed. The analysis consists of maximal angles, angles at ball release, and maximal angular velocities of the joint movements and their timing during the throw. Only the elbow angle (extension movement range) and the level of internal rotation velocity of the shoulder at ball release showed a significant relationship with the throwing performance. Also, a significant correlation was found for the timing of the maximal pelvis angle with ball velocity, indicating that better throwers started to rotate their pelvis forward earlier during the throw. No other significant correlations were found, indicating that the role of the trunk and lower limb are of minor importance for team handball players.

Visnapuu, et al., (2007) reported that in handball and basketball the longer the finger length the better the accuracy of the shot or throw. All shots and throws are finished with the wrist and fingers. It can be proposed that athletes with longer fingers and greater hand surface parameters also probably have greater grip strength. The aim of this study was to investigate the influence of general body and hand-specific anthropometric dimensions on handgrip strength in boys participating

in handball and basketball training. In total, 193 boys aged 10-17 years participated in this study. They were divided into 6 groups: 10-, 11-, 12-, 13-, 14-15-, and 16-17-year-olds. The body height and body mass were measured and body mass index was calculated as general anthropometric parameters. The outlines of the hands of the boys were drawn on paper with a thin marker. Three groups of hand anthropometric parameters were measured: 5 finger spans, 5 finger lengths, and 5 perimeters of the hand. Handgrip strength was measured on the dominant hand with a Lafayette dynamometer.

As a rule, general anthropometric parameters determined the maximal handgrip strength more accurately than did specific hand anthropometric parameters. From the specific hand anthropometric parameters, finger lengths and perimeters of the hand significantly correlated with the maximal handgrip strength. In summary, fingers are the smallest, lightest parts of the motor apparatus, and, therefore, they represent the parts most easily deflected by force from the ball, but at the same time, finger control was especially important for the accuracy of different shots, both in handball and basketball. Thus, it was especially necessary to measure finger length and perimeters of the hand for practical reasons.

Marques and Gonzalez (2006) investigated the changes in physical parameters produced during an in-season resistance training (RT) and detraining (DT, or RT cessation) in 16 high level team handball players (THPs). Apart from normal practice sessions, THPs underwent 12 weeks of RT. Subjects performed 3 sets of 3-6 reps with a load of 70-85% concentric 1 repetition maximum bench press (1RMBP), 3 sets of 3-6 reps with a load of 70-95% of 4 repetition maximum parallel squats (4RMPS), plus vertical jumps and sprints. The 1RMBP, 4RMPS, speed over

30 m (S30), jump (countermovement jump height [CMJ]; CMJ with additional weights [20kg and 40kg], and ball throw velocity (BTv) were tested before the experimental period (T1), after 6 weeks (T2), and after the 12-week experimental period (T3). Immediately after these 12 weeks, THPs started a 7-week DT period, maintained normal practices.

The CMJ and the BTv were the only parameters evaluated during DT. The most important gains ($p < 0.001$) in S30 were obtained between T1-T2 and T1-T3. The BTv improved significantly ($p < 0.001$) only between T1-T2 and T1-T3. The most relevant increases ($p < 0.001$) in jumping performance took place between T1-T2 and T1-T3. The 1RMBP showed significant increases ($p < 0.001$) only between T1-T2 and T1-T3. The 4RMPS increased significantly between all testing trials. After the DT, THPs showed no significant losses in CMJ performance. However, they declined significantly in BTv ($p = 0.023$). The results suggest that elite THPs can optimize important physical parameters over 12 weeks in-season and that 7 weeks of DT, although insufficient to produce significant decreases in CMJ, are sufficient to induce significant decreases in BTv. It is concluded that after RT cessation THPs reduced BTv performance.

Souza, et al., (2006) analyzed the changes in metabolic and motor performance variables in handball players during a training program following a model proposed by Verkhoshanski and adapted by Oliveira. Eleven handball players, from 20 to 32 years old, body weight 89.5 ± 10.4 kg (70.2 and 105.1 kg), height of 184.4 ± 6.7 cm (171.8 and 198 cm) participated in this study. All participants were members of “UniFil/Londrina” Handball Team of Londrina, Paraná. The subjects were tested and retested after developing a 16-week training program, prior to the

start of the National League Championship. Data were analyzed using t-test for repeated measures ($p < 0.05$).

The results showed very important adaptations with an increase in velocity strength (7.8%, $p < 0.05$), explosive strength (8.1%, $p < 0.05$) and agility (6.4%, $p < 0.05$). Moreover, the training program allowed for some metabolic adaptations, such as anaerobic power (30.5 and 37.5%, $p < 0.05$), and the total time the players could stand at the Yo-yo test, respectively. Aerobic power, measured by $\dot{V}O_{2\max}$, also increased (8.1%, $p < 0.05$). The results suggest that the program proposed was able to create positive motor capacities responses that were observed in the lasting training posterior effect.

Gorostiaga, et al., (2005) compared physical characteristics (body height, body mass [BM], body fat [BF], and free fatty mass [FFM]), one repetition maximum bench-press (1RM (BP)), jumping explosive strength (VJ), handball throwing velocity, power-load relationship of the leg and arm extensor muscles, 5- and 15-m sprint running time, and running endurance in two handball male teams: elite team, one of the world's leading teams (EM, $n = 15$) and amateur team, playing in the Spanish National Second Division (AM, $n = 15$). EM had similar values in body height, BF, VJ, 5- and 15-m sprint running time and running endurance than AM.

However, the EM group gave higher values in BM (95.2 ± 13 kg vs. 82.4 ± 10 kg, $p < 0.05$), FFM (81.7 ± 9 kg vs. 72.4 ± 7 kg, $p < 0.05$), 1RM (BP) (107 ± 12 kg vs. 83 ± 10 kg, $p < 0.001$), muscle power during bench-press (18 - 21 %, $p < 0.05$) and half squat (13 - 17 %), and throwing velocities at standing (23.8 ± 1.9 m .

s (-1) vs. 21.8 ± 1.6 m . s (-1), $p < 0.05$) and 3-step running (25.3 ± 2.2 m . s (-1) vs. 22.9 ± 1.4 m . s (-1), $p < 0.05$) actions than the AM group. Significant correlations ($r = 0.67 - 0.71$, $p < 0.05 - 0.01$) were observed in EM and AM between individual values of velocity at 30 % of 1RM (BP) and individual values of ball velocity during a standing throw. Significant correlations were observed in EM, but not in AM, between the individual values of velocity during 3-step running throw and the individual values of velocity at 30 % of 1RM (BP) ($r = 0.72$, $p < 0.05$), as well as the individual values of power at 100% of body mass during half-squat actions ($r = 0.62$, $p < 0.05$).

The present results suggest that more muscular and powerful players are at an advantage in handball. The differences observed in free fatty mass could partly explain the differences observed between groups in absolute maximal strength and muscle power. In EM, higher efficiency in handball throwing velocity may be associated with both upper and lower extremity power output capabilities, whereas in AM this relationship may be different. Endurance capacity does not seem to represent a limitation for elite performance in handball.

Pori, Bon and Sibila (2005) studied the jump shot is one of the most important elements of specific handball motor behaviour. The researchers wanted to assess it with the method of expert modelling. The sample of subjects consisted of ten male elite handball players, members of the national Slovenian teams that play in the first national handball division (average height - 191.1 ± 4.48 cm; average body mass - 90.0 ± 4.40 kg, average age - 23.4 ± 4.2 years; average training experience in senior teams - 5.3 ± 2.1 years).

The investigators analysed six backcourt players, two wing players and two pivots. Each of the subjects executed, after a 20-minute warm-up, three jump shots. Data processing was performed by APAS (Ariel Dynamics, California, USA). Expert modelling was performed with the SPEX expert system. The researchers formed a success tree containing 17 variables, representing all five phases of the jump shot. In order to assess the validity of this kinematic model, three independent referees also assessed the quality of the jump shot. The ranks obtained from their marks were then compared with the ranks obtained with the SPEX expert model.

On the basis of the obtained results the researchers then constructed an expert mark for each analysed player. The level of concordance of the referees was high ($W = 0.875$), the coefficient of correlation between the actual ranks and the referee ranks was statistically significant (0.912). The final finding was that a kinematic model of the jump shot constructed in this way can also be a good criterion for assessing the quality of the basic technique of the jump shot for seniors.

Rogulj, et al., (2005) identified the differences in motor and psychological variables according to playing positions from a sample of 53 elite female junior and senior national Handball players, Motor status included 8 variables for assessment of explosive strength of landing and throwing, agility, speed strength, movement frequency, and flexibility. Psychological status was analyzed through 4 dimensions according to Eysenck: extroversion, psychotic behaviour, neurotic behaviour, and lie.

The anthropologic features analyzed showed statistically significant differences. Considering motor abilities, differences were recorded in the variables

for assessment of speed strength, agility and leg movement frequency, where wings predominated, whereas goalkeepers showed predominance in flexibility. In psychological status, differences were present in the variable for assessment of extroversion which was most pronounced in wings, whereas psychotic behaviour was more expressed in those at pivot position.

The differences were primarily consequential to the selection of players of a specific anthropologic profile for particular playing positions. The hypothesis of the impact of kinesiological specificities of a particular playing position on the formation of the players' anthropologic profile should be scientifically tested. Study results might find application in training and contest practice, especially in forming anthropologic models for particular positions during the process of player selection.

Skoufas, et al., (2002) studied the throwing velocity is an important task that affects substantially the performance of a handball player. Several training methods have been suggested in order to improve this ability. The purpose of this study was to investigate the effect of training with light balls to the throwing velocity of male novice athletes and the effect of a following detraining. The subjects performed 20 weeks of handball training and were divided in two groups: one was using normal handball balls for training and the other 20% lighter ones. The first ten weeks were used for handball players to be familiar with throwing technique.

The evaluation tests performed before, in the middle and the end of the specific training period and then after 4 weeks of detraining. The estimation of the throwing velocity was taken out of the mean velocity of 7 shots against a fixed

target, placed 6 meters away from the subjects. A radar gun was used for measuring the ball release velocity. The results showed that training with lighter balls could improve the performance of throwing more than using normal balls. Additionally, the benefit of training was maintained 4 weeks after detraining only for the group that used the lighter ball for training.

These findings are in agreement with previous studies that involve similar movements of other sports and suggest that the decreased resistance during training that involves ballistic movements can be advantageous for the player's performance, and therefore, trainers are encouraged to apply this method of training as a tool for improving the efficiency of shooting of novice handball players.

2.2. STUDIES RELATED TO DEAF AND DUMB

Ghosh (2014) compared the selected physical fitness components between the Deaf & Dumb and Normal school boys of west Bengal. For the purpose of the study forty two (N=42)) subjects were randomly chosen of which twenty two were deaf and dumb boys (n=22) and twenty were normal school boys (n=20). The age of the children ranged from 12 to 20 years. They were selected from three separate districts of West Bengal Kolkata, Burdwan and Hooghly. The five different physical fitness components i.e. Speed, Agility, Muscular endurance, Flexibility and Explosive leg strength were considered as variables for the present study. The data were collected by using standard tools and techniques. Mean, standard deviation (SD) and independent t-test were the statistics used in this study for data interpretation. Level of significant difference between two groups was set at $p < 0.05$.

For statistical calculations Excel Spread Sheet of windows version 7 was used. Result of present study revealed that in Speed, Agility and Muscular

Endurance no significant difference existed between the Normal and Deaf & Dumb Boys. But in Flexibility & Explosive leg strength significant difference existed between the Normal and Deaf & Dumb Boys. It can be concluded from the results of the study that in flexibility the normal boys were better than the deaf and dumb boys but the Explosive leg strength of the Deaf & Dumb Boys were better than the normal boys.

Khidr (2010) designed to know the effect of using a computer as a new way to learn some judo skills to the players with hearing difficulty who suffer from loneliness. This research had been applied on young students, aged 13-15 years from the deaf and dumb school in Zagzig city. The Researcher adapted the experimental method for two groups which had been divided into a study group and a control group using previously and later measurements for both groups. The researcher used Bortious intelligent measure that has a scale to estimate loneliness. The educational computer program was found to have a positive effect on learning judo skills to the players with hearing difficulty who suffer from loneliness.

Singleton and Morgan (2005) had stated that bilingual deaf education is all about providing a child with the acquisition of both languages so that he was able to successfully negotiate his way in both worlds (i.e., hearing and deaf). A child with bilingual skills should possess linguistic and cognitive competence as well as a clear understanding of his identity so that he can choose to participate in either linguistic and cultural group, depending on the situation. In addition, it was important to remember that deaf educational placement is not about tracking a deaf child into either world, but rather, allowing access to both.

Ibrahim (2004) studied the motives associated with football practice with deaf and dumb Egyptian Union registered disabled sports, aimed at designing a scale to measure motivation of deaf and dumb to exercise football and identify the motivations of deaf to exercise football, and ranking the motivation of deaf and dumb to practice football, and the study also aimed to identify differences in motivations between deaf footballers, the researcher used descriptive approach for the study sample of (48) deaf player, and in the light of the particular sample study the motivations for practicing football for the deaf was the rewards the physical fitness and health, the challenge of disability, social relations and fame.

Abdullah and Yakoot Zidane (2000) conducted a study aimed to put a proposal training program for developing capacity linked to mobility performance skill for some volleyball skills of deaf and dumb, and it also aimed to know the impact of special mobility abilities on the level of skills for some volleyball skills related to sending from top and passing by hands from top and defensive of sending and passing by hands from down “crushing blows’ for deaf and dumb, the researcher used several researcher methods in this study, experimental and scanning approach, experimental design approach and semi experimental approach, the study sample consisted of (30) deaf student, the results helped in achieving the expected objectives of the study with the superiority of experimental group to control group .

Ali, Radwan and Zakaria Mohammed (2000) conducted a study to note the impact of a proposal program on some variables of cognitive dynamic sense, functional varieties and physical variables of the deaf and dumb, the researchers use experimental approach to a sample of (18) students, divided into two groups experimental (9) and control (9), the main results was that the proposed

program had led to improved capacity of cognitive dynamic sense under study and physical and functional variables.

According to **Zozo and Hassan (1999)** the effectiveness of using preliminary games to learn basic skills proposal to teach basic skills and improving some mobility capabilities in handball for deaf and dumb. The researcher used experimental approach on a sample of 60 pupils from the sixth and seventh graders from hearing-impaired, they were divided into two groups, experimental (30) students and controller (30) students, the most important results were that the preliminary games led to learn games and improve the basic skills of handball in the deaf and dumb and improving the motor capacity associated with these skills.

Almuhandis (1990) conducted a study to see the impact of kinetic education program proposed on kinetic consent and some components of the motor performances to the pupils with impaired hearing (9-12) years, the researcher used the experimental approach on a sample of (55) pupils of hearing-impaired aged (9 – 12) divided into two experimental number (28) and control (27) and the most significant results of the program had a positive impact on components of motor performance and on the degree of motor satisfaction.

2.3. STUDIES RELATED TO VIBRATOR AID AND SIGN LANGUAGE TRAINING

Spelmezan, et al., (2012) demonstrated the potential for teaching sport skills with realtime tactile instructions. Ten amateurs learned a riding technique with a wearable system that automatically provided tactile instructions during descents. These instructions were in sync with the movements of the snowboard and signaled how to move the body. Author found that tactile instructions could help

snowboarders to improve their skills. This report gave insights into the snowboarders' opinion and gave recommendations for teaching sport skills with tactile instructions. The findings helped identify the conditions under which tactile instructions can support athletes in sports training.

Warnock, McGee-Lennon and Brewster (2012) carried out an empirical user study with aged participants which evaluated the performance, disruptiveness and subjective workload of visual, audio, tactile and olfactory notifications and then compared the results with earlier findings in younger participants. It was found that disruption and subjective workload were not affected by modality, although some modalities were more effective at delivering information accurately. It was concluded that although further studies need to be carried out in a real-world settings, the findings support the argument for multiple modalities in assisted living technology.

Auvray, et al., (2011) conducted a study to investigate the extent to which tactile information that was unavailable for full conscious report can be accessed using partial-report procedures. In Experiment 1, participants reported the total number of tactile stimuli (up to six) presented simultaneously to their fingertips (numerosity judgment task). In another condition, after being presented with the tactile display, they had to detect whether or not the position indicated by a (visual or tactile) probe had previously contained a tactile stimulus (partial-report task). Participants correctly reported up to three stimuli in the numerosity judgment task, but their performance was far better in the partial-report task: Up to six stimuli were perceived at the shortest target-probe intervals.

A similar pattern of results was observed when the participants performed a concurrent articulatory suppression task (Exp. 2). The results of a final experiment revealed that performance in the partial-report task was overall better for stimuli presented on the fingertips than for stimuli presented across the rest of the body surface. These results demonstrated that tactile information that was unavailable for report in a numerosity task can nevertheless sometimes still be accessed when a partial-report procedure was used instead.

Alathari (2009) conducted a study on the impact of instructional method of sign language and lip reading in teaching some basic skills in volleyball game for the deaf and mute, and aimed to identify the impact of the practical approach of the method of sign language and lip reading to learn some basic skills in volleyball game for deaf and mute, it also aimed to identify the best method in teaching some basic skills in volleyball game for the deaf and mute. The sample of the study consisted of 20 players of Hope Institute for deaf in Baghdad Governorate, experimental approach has been used in this study, and the results showed that both methods of sign language and lip reading had a positive impact on learning and mastery of skills. The results showed that sign language was more effective than lip-reading in learning the skills of throwing the ball from the bottom ,and throwing it front bottom to front and didn't show any difference in the skill of throwing form the top between lip reading and sign language.

Eccarius and Brentari (2007) analyzed the phonological and prosodic properties of two-handed classifiers in three sign languages—American Sign Language, Hong Kong Sign Language, and Swiss German Sign Language. Their analysis was two-fold—first they examined the restrictions the forms placed on

handshape choice, and then they looked at their prosodic and morpho-syntactic structures by examining the interaction between the temporal relations of the two hands and other prosodic cues, such as eye blinks.

From the point of view of well-formedness at the word level, their work showed that: (i) in the majority of cases, two-handed classifiers obeyed the Dominance Condition of Battison (1978) while all other forms limited their complexity in a similar way at the featural level; (ii) different classified types exhibited systematic behavior with regard to their internal handshape complexity, in particular with regard to a difference between whole entity and handling classifiers, and (iii) in the majority of cases, two-handed classifiers have the same timing properties as prosodic words.

With regard to larger prosodic units, they have found evidence of the prosodic–syntactic interface at work in classifier constructions in a number of systematic ways involving national phrases. Two-handed classifiers can be divided into four major groups with regard to their prosodic structure, one of which was found only in Hong Kong Sign Language, while the other three exhibited a general pattern that applied to all three of the sign languages in their study. The findings revealed that the phonological structures and principles that hold true in non-classifier forms were also obeyed by classifiers to a large extent.

Gallace, et al., (2007) studied only under conditions of unimodal stimulus presentation. It was therefore unclear whether the same limitations on correctly reporting the number of unimodal visual or tactile stimuli presented in a display might be expected under conditions in which participants had to count

stimuli presented simultaneously in two or more different sensory modalities. In Experiment 1, they investigated numerosity judgments using both unimodal and bimodal displays consisting of one to six vibrotactile stimuli (presented over the body surface) and one to six visual stimuli (seen on the body via mirror reflection). Participants had to count the number of stimuli regardless of their modality of presentation.

Bimodal numerosity judgments were significantly less accurate than predicted on the basis of an independent modality-specific resources account, thus showing that numerosity judgments might rely on a unitary amodal system instead. The results of a second experiment demonstrated that divided attention costs could not account for the poor performance in the bimodal conditions of Experiment 1. they discussed these results in relation to current theories of cross-modal integration and to the cognitive resources and/or common higher order spatial representations possibly accessed by both visual and tactile stimuli.

Morgan and Woll (2007) gave a brief overview of the description of the constructions in sign language known as classifiers. Authors focused on the need to carryout theoretically driven linguistic analyses of their use in order to understand the structure and function of these pervasive devices within the grammars of different sign languages. Research on classifiers at the level of phonology, morphology, syntax, semantics and discourse structure as well as in different populations of signers (native, non-native, child and atypical signers) will assist us in the understanding of these complex structures within the context of current research on sign language linguistics.

Tait, Nikolopoulos and Lutman (2007) assessed the effect of age at implantation on the development of vocal and auditory preverbal skills in implanted children. The study assessed 99 children, 33 in each of three groups (those implanted between 1 and 2 years; 2 and 3 years; and 3 and 4 years). Preverbal skills were measured in three areas: turn taking, autonomy and auditory awareness of spoken language, using the Tait video analysis method.

The youngest implanted group made an exceptional progress outperforming in all measures than the other two groups ($p < 0.01$), 6 and 12 months post-implantation, whereas there was no such difference before implantation. In the youngest group, there was also significantly greater use of an auditory/oral style of communication: 85% of the group by 12 months post-implantation compared with 30% and 18% of the two older groups. Vocal and auditory preverbal skills developed much more rapidly in children implanted between 1 and 2 years in comparison with older implanted children and reached a significantly higher level by 6 and 12 months post-implantation.

In addition, younger implanted children were significantly more likely by 12 months post-implantation to adopt an auditory/oral mode of communication. These findings favoured cochlear implantation as early as between 1 and 2 years, provided that correct diagnosis and adequate hearing-aid trial had been achieved.

Gallace, et al., (2006) made a research work to support the claim that two different and dissociable processes were involved in making numerosity judgments regarding visual stimuli: substituting (fast and nearly errorless) for up to 4 stimuli, and counting (slow and error-prone) when more than 4 stimuli were

presented. The researchers studied tactile numerosity judgments for combinations of 1-7 vibrotactile stimuli presented simultaneously over the body surface. In experiment 1, the stimuli were presented once, while in experiment 2 conditions of single presentation and repeated presentation of the stimulus were compared.

Neither experiment provided any evidence for a discontinuity in the slope of either the RT or error data suggesting that subitisation does not occur for tactile stimuli. By systematically varying the intensity of the vibrotactile stimuli in experiment 3, the researchers demonstrated that the participants were not simply using the 'global intensity' of the whole tactile display to make their tactile numerosity judgments, instead of using information concerning the number of factors activated. The results of the three experiments reported here were discussed in relation to current theories of counting and subitising, and potential implications for the design of tactile user interfaces were highlighted.

Summers, et al., (2005) compared two experiments on the discrimination of time-varying tactile stimuli, with stimulus delivery to the distal pad of the right index finger and to the right wrist (palmar surface). Subjects were required to perceive differences in short sequences of computer-generated stimulus elements (experiment 1) or differences in short tactile stimuli derived from a speech signal (experiment 2). The pulse-train stimuli were distinguished by differences in frequency (i.e., pulse repetition rate) and amplitude, and by the presence/absence of gaps (approximately 100-ms duration). Stimulation levels were 10 dB higher at the wrist than at the fingertip, to compensate for the lower vibration sensitivity at the wrist.

Results indicate similar gap detection at wrist and fingertip and similar perception of frequency differences. However, perception of amplitude differences was found to be better at the wrist than at the fingertip. Maximum information transfer rates for the stimuli in experiment 1 were estimated at 7 bits s⁻¹ at the wrist and 5 bits s⁻¹ at the fingertip.

Finney and Dobkins (2001) measured contrast sensitivity in deaf and hearing subjects to moving stimuli over a range of speeds (0.125–64°/s). It was hypothesized that if ASL use drives differences between hearing and deaf subjects, such differences may occur over a restricted range of speeds most commonly found in ASL. In addition, the researchers tested a third group, hearing native signers who learned ASL early from their deaf parents, to further assess whether potential differences between groups results from ASL use.

These experiments reveal no overall differences in contrast sensitivity, nor differences in visual field asymmetries, across subject groups at any speed tested. Thus, differences previously observed between deaf and hearing subjects for discriminating the direction of moving stimuli did not generalize to contrast sensitivity for moving stimuli, a result that has implications for the neural level at which plastic changes occurred in the visual system of deaf subjects.

Summers, et al., (1997) carried out experiments to investigate the information transfer available via a single vibrator on the fingertip. In a first experiment, for stimuli with durations 80 to 320 ms, discrimination of a one-octave step change in frequency at the halfway point was investigated. Results were similar for three stimulus types--sinewave, monophasic pulse and tetraphasic pulse--

suggesting temporal cues were more important than spectral cues in this task. In a second experiment, subjects were required to perceive changes in a sequence of stimulus elements.

A presentation rate of 6.25 elements s⁻¹ was found to give better results than a rate of 12.5 elements s⁻¹. In the former case, the potential information transfer per element was estimated to be approximately 1.0 bits, corresponding to an information transfer rate of around 6 bits s⁻¹. Implications for the design of a tactile aid to lip reading were discussed.

Phillips, et al., (1994) conducted a study of clinical experience and research findings gathered from using vibrotactile aids over 7 years. This interest grew from a research project to evaluate four wrist-worn vibrotactile aids for the rehabilitation of the profoundly deaf. To facilitate this, a training programme was developed to help patients get the most from the aid. Having found that the RNID/Summit Tam vibrotactile aid was the most appropriate, this has been fitted to over 50 patients. The results of the comparative trial, an evaluation of our methods and a discussion of our clinical experience using vibrotactile aids with profoundly deafened patients are presented.

Summers, et al., (1994) established the best strategy for transmitting speech-derived information via a single tactile channel, measurements were made on the perception of frequency- and/or amplitude-modulated pulse-train stimuli, with a comparison of the electrotactile and vibrotactile modalities. In one experiment, vibrotactile perception of 2-oct step changes in stimulus frequency was found to be significantly better than electrotactile on a time-scale appropriate for the

transmission of speech features (e.g., with practiced subjects, information transfer of 69% with 200-ms vibrotactile stimuli, 32% with 200-ms electrotactile stimuli). Perception of step changes in stimulus amplitude was similar in the two modalities when changes in amplitude were tailored to match the different dynamic ranges available.

In a second experiment, vibrotactile-perception of voice fundamental frequency with various codings was investigated. Both experiments showed information transfer for vibrotactile stimuli to be greater when frequency and amplitude modulation were used together rather than with one or the other in isolation (sentence-stress identification scores: 66% for FM stimuli, 69% for AM stimuli, 80% for FM/AM stimuli). It could be concluded that frequency- and amplitude-modulated vibratory stimulation was a good choice in a practical device for the profoundly hearing impaired.

Galvin, et al., (1993) conducted a study to maximize the benefits available through a tactile device, it must be accompanied by an effective and adaptive training program. There are a number of factors to be considered in the design of such a training program, including the type of tasks and response formats to include, the amount of training, subject motivation and device use, the characteristics of the potential user population, the specific device to be used and the type of information it provided, and the evaluation procedures to be followed.

The type and saliency of the information provided by a particular tactile device were highlighted as the most important yet neglected consideration in designing a training program. The training program used with the University of

Melbourne's multiple-channel electrotactile device was presented to show how these important factors might be addressed, to indicate the flexibility required in a training program, and to provide a general framework on which researchers may base the development of programs for other tactile devices.

Morley and Rowe (1990), in their study the effect of changes in amplitude on the perceived pitch of cutaneous vibratory stimuli was studied in psychophysical experiments designed to test whether the coding of information about the frequency of the vibration might be based on the ratio of recruitment of the PC (Pacini corpuscle-associated) and RA (rapidly adapting) classes of tactile sensory fibres. The study was based on the previous data which showed that at certain vibration frequencies (e.g. 150 Hz) the ratio of recruitment of the PC and RA classes should vary as a function of vibration amplitude.

Sinusoidal vibration at either 30 Hz or 150 Hz, and at an amplitude 10 dB above subjective detection thresholds was delivered in a 1 s train to the distal phalangeal pad of the index finger in eight human subjects. This standard vibration was followed after 0.5 s by a 1 s comparison train of vibration which (unknown to the subject) was at the same frequency as the standard but at a range of amplitudes from 2 to 50 dB above the detection threshold. A two-alternative forced-choice procedure was used in which the subject had to indicate whether the comparison stimulus was higher or lower in pitch (frequency) than the standard.

Marked differences were seen from subject to subject in the effect of amplitude on perceived pitch at both 30 Hz and 150 Hz. At 150 Hz, five out of the eight subjects reported an increase in pitch as the amplitude of the comparison

vibration increased, one experienced no change, and only two experienced the fall in perceived pitch that was predicted if the proposed ratio code contributed to vibrotactile pitch judgements. At 30 Hz similar intersubject variability was seen in the pitch-amplitude functions. The results did not support the hypothesis that a ratio code contributes to vibrotactile pitch perception. This study concluded that temporal patterning of impulse activity remains the major candidate code for pitch perception, at least over a substantial part of the vibrotactile frequency bandwidth.

Weisenberger (1989) evaluated the Siemens Hearing Instruments Minifonator, a single-channel, wrist-worn vibrotactile aid in a laboratory setting with hearing-impaired adults. Eight subjects, with hearing loss greater than 70 dB in the better ear, were administered a test battery including sound-field detection, speech awareness threshold, environmental sound identification, syllable rhythm and stress categorization, and sentence identification subtests.

Performance on each subtest was compared for hearing-aided and tactile-aided conditions. Mean performance levels for the two conditions were comparable for all but one subtest. However, closer inspection revealed that the data for the hearing-aided condition were bimodal: some subjects proved to be good hearing aid users and other performed at chance levels with their hearing aids.

Performance in the tactile-aided conditions did not show such variability and mean levels fell between the hearing-aided levels for "good" and "poor" hearing aid users. The effects of training with the device were assessed for two normal-hearing subjects, who were trained in 1-hour daily sessions over a several week

period on the environmental sounds and syllable rhythm and stress subtests. Results indicated substantial improvements in performance over the course of training.

Weisenberger and Russell (1989) compared two commercially available single-channel vibrotactile aids, designed to transmit information about acoustic stimuli to persons who cannot perceive such stimuli through conventional amplification, in a number of tasks with the same subjects. Both devices employed a vibratory transducer worn on the wrist. One device represented characteristics of the envelope of the waveform by using it to modulate the amplitude of a 250-Hz carrier vibration (an amplitude-modulated, or AM, signal). The other device presented and amplitude-modulated a broad-band signal whose spectral characteristics preserved information about the signal. Subjects performed several tasks.

On some tasks (sound detection, environmental sound identification, syllable rhythm and stress categorization) information about the envelope of the stimulus was expected to be sufficient for good performance. On others (speech sound recognition) additional information about the spectral fine structure of the signal spectrum was anticipated to be required for good performance. Results indicated that the subjects performed comparably with both devices on all tasks, suggesting that they did not make use of the spectral information available in the more complex signal.

2.4. SUMMARY OF THE LITERATURE

The reviews are presented under the three sections namely studies related to specified training on handball skills and performance (n=34), studies related to deaf and dumb (n=10), and studies related to vibrator aid and sign language training (n=18). All the research studies that are presented in this section

prove that specified training with vibrator aid instruction, specified training with combination of vibrator aid and sign language methods contribute significantly for better improvement in psychomotor and Handball skill performance. From the previous presentation of studies (**Abdullah, 2000**), (**Ali, et al., 2000**), (**Button, et al., 2003**), (**Chelley, et al., 2010**), (**Eliasz, 2015**), (**Ellis and Stewart, 1997**), (**Etnyre, 1998**), (**Gallace, et al., 2015**), (**Gorostiaga, et al., 2005**), (**Graib, et al., 2012**), (**Ibrahim, 2004**), (**Ion, et al., 2014**), (**Khidr, 2010**), (**Morley and Rowe, 1990**), (**Muller and Loosch, 1999**), (**Singh, et al., 2009**), (**Summers, et al., 2005**), (**Vulet, et al., 2006**), (**Wagner, et al., 2010**), (**Weisenberger and Russel, 1989**), (**Woll, 2001**) and (**Zozo and Hassan, 1999**), were carried out in the area of sports for disabled, including deaf and hearing difficulties. Hence, in the present investigation, the researcher aimed to notice the importance of sporting activities to contribute to solving the problems of people with special needs and adapting to society.

CHAPTER III

METHODOLOGY

Research methodology involves a systematic procedure by which the researcher starts from the initial identification of the problem to its final conclusion. The role of methodology is to carry out the research work in a scientific and valid manner. The purpose of the study was to find out the effect of specified training with sign language and vibrator aid on selected psychomotor variables and skills in handball among deaf and dumb college students. In this chapter, selection of subjects, selection of variables, experimental design, selection of tests, pilot study, reliability of data, instruments reliability, orientation to the subjects, training programme, test administration collection of data and statistical technique adapted to analyse the data are presented.

3.1. SELECTION OF SUBJECTS

The purpose of the study was to investigate the effect of specified training using sign language and vibrator aid on selected psychomotor variables namely, reaction time and movement time and skills in handball namely, 9 meter front throw, dominant hand speed pass, overhead pass, accuracy throw, jump and throw, and dribbling among deaf and dumb college students.

For the present study, forty five deaf and dumb men students were selected randomly from Presidency College, Chennai. The age of the subjects ranged between 18 and 25 years and their hearing impaired level is 90%. Selected subjects divided into three equal groups namely Group I (VTG) vibrator aid training group (n=15), Group II (VSTG) combination of vibrator aid & sign language training group and Group III (CG) served as control group (n=15).

All subjects were informed about the nature of the study and their consent was obtained to co-operate till the end of the experiment. For the pilot study and final study experimental groups (namely VTG and SVTG) were trained-up for 12 weeks using selected vibrator training and combined (sign and vibrating) training were given independently. The subjects were free to withdraw their consent, in case they felt any discomfort during the period of their participation but there were no dropouts. A qualified physician examined the subjects medically and declared them fit for the study.

3.2. SELECTION OF VARIABLES

3.2.1. Dependent Variables

Technique is the basis of any team sport. The technique is a skill which is necessary to play a game. The technique is conditioned by motor abilities of players and the frequency of exercise repetitions. The exercise repetitions provide fast and spontaneously in performing the activities. If the players have good technique, they will pay more attention to team work and properly perform tactical tasks during the game. A player is considered to be capable of playing handball if he can run fast and on purpose, change his direction of movement, catch and pass a ball in any direction regardless of the speed, shoot from any situation, free himself from an opponent, move on the court with a ball and co-operate with other players (Czerwinski and Taborsky, 1997).

Considering the activities which are performed on the court, handball technique consists of many. They are catching the ball, passing, shooting, dribbling, feinting, offensive and defensive movements, and goalkeeper's technique. This is one of the basic technical elements. A pass must be accurate, fast and tactically

useful. It should be accurate so that a player has no problem when catching the ball. Position of hands while catching a ball, decision to whom a pass should depend on the player's position in a particular situation. A pass should be directed to the player, whose position may menace the opponent. Both right and left hand catching and passing must be practiced (**Czerwinski and Taborsky, 1997**).

Shots are one of the most important elements of handball. They are vital elements that decide the scores. While shooting, the muscles of the lower and upper limbs, pelvic region and trunk are extremely engaged. One can assume that shooting is performed similarly to passing but with a stronger action of the trunk and upper limbs. The shot power is conditioned by the distance and hand action time on a ball. The greater the distance that the hand on the ball covers in the time unit, the stronger the shot will be performed. After receiving the ball and before dribbling, a player holds the ball with both hands. The ball is being dribbled sideways at hip level. Bouncing on the ground is performed by the combined action of the elbow and wrist joints. The angle of the bounced ball depends on the speed that the player is moving with. The faster the run, the more the angle becomes obtuse (**Czerwinski and Taborsky, 1997**).

Measuring throwing accuracy indicated that the percentage of missed throws did not differ between skill levels and throwing techniques. Low-skilled, as well as skilled and high-skilled level players, were able to strike the target frequently, utilizing all throwing techniques. The mean percentage of missed throws ranged from 15% to 26%. These results are in agreement with recent studies in team-handball (**Bayios & Boudolos, 1998; van den Tillaar & Ettema, 2003b; Wagner et al., 2010a**) that found no speed-accuracy trade-off in team-handball

throwing. Both high-skilled and low-skilled players were able to throw accurately, but with different ball release speed that increased with skill level. In the context of this study, it must be mentioned that testing conducted during this study did not reflect numerous situations that are invoked on players during actual team handball competition. To score a goal in competition, team-handball players throw the ball at the side or above the defensive block player to an area of the goal where the goalkeeper is not able to defend the goal area. These playing situations are quite different from the ones that were conducted in this study, where a performer was asked to throw at a target as required by the testing protocol. It is possible that throwing accuracy that is similar between the different skill levels and throwing techniques during testing may be quite different in team-handball competition. This is a limitation of our study that is similar to recent studies reported on team-handball throwing (**Van den Tillaar & Ettema, 2003a, 2003b, 2006; Wagner et al., 2010**). However, author wish to convey that ball release speed in the testing situation is similar to ball release speed in competition. The absence of the speed-accuracy trade-off in the present study that is typical for team-handball throws necessitated another interpretation of movement variability as in goal-orientated throwing tasks like basketball (**Button, et al., 2003**) or dart throwing (**Etnyre, 1998; Gross & Gill, 1982; Müller & Loosch, 1999**). It was not the question of how the differences in movement variability explain the differences in the throwing accuracy. It was the question of how the differences in movement variability explain the ability to throw just as accurately when the ball release speed significantly increases.

Skill-related differences were found in various sporting domains including tennis (**Goulet, Bard, & Fleury, 1989**), badminton (**Abernethy &**

Russell, 1987; Abernethy & Zawi, 2007), volleyball (**Loffing, Schorer, Hagemann, & Baker, 2012**), soccer (**Williams & Burwitz, 1993**), cricket (**Muller, Abernethy, & Farrow, 2006**) and handball (**Canal-Bruland and Williams, 2010**). In team-handball, besides predicting ball flight direction (**Schorer, Loffing, Hagemann, & Baker, 2012**) or detecting whether a shooter is about to make a shot or not (**Cañal-Bruland & Schmidt, 2009; Cañal-Bruland and Williams, 2010**), goalkeepers are also required to identify the type of throw. Based on the above facts the researcher selected the following variables as dependent variables for this study.

1. Reaction time
2. Movement time
3. 9 meters front throw
4. Dominant Hand Speed Pass
5. Overhead Pass
6. Accuracy Throw
7. Jump & Throw, and
8. Dribbling

3.2.2. Independent Variables

Top performance under situation-related conditions demands optimal relationships and development of all functional (cardio-respiratory and energy capacities), motor abilities, technical, tactical skills and knowledge of handballers in the function of their moving with and without the ball both in the actions on defence and attack (**Vulet, et al., 2006**).

Although technical skills, anthropometric characteristics and muscle strength and power are the most important factors for successful participation in elite levels of handball (HB) leagues, (**Gorostiaga, et al., 2005 and Rannou, et al., 2001**) the importance of aerobic capacity should not be underestimated.

Ion, et al., (2014) stated in his study specific driving skill training is important in handball game. Automation of techniques and the correct techniques in the training process must ensure an appropriate workload, resulted in a large number of repetitions for each subject by using the global method of learning, as well as the analytical. Throwing is one of the most important skills in team handball (**Eliasz et al., 1990; Muijen et al., 1991; Marczinka 1993**). Two basic factors are of importance with regard to the efficiency of shots: accuracy and throwing velocity. Naturally, the faster the ball is thrown at the goal, the less time defenders and goalkeeper have to save the shot.

To achieve the purpose of the present investigation, the following variables were selected as independent variables.

1. Specified training with vibrator aid
2. Specified training with combination of vibrator aid & sign language method.

3.3. EXPERIMENTAL DESIGN

The experimental design used for this study was similar to a random group design involving forty five subjects, who were divided at random into three groups of fifteen each. This study consisted of two experimental groups: Group I - vibrator training (VTG) and Group II – combination of sign language vibrator training (VSTG) and a control group (CG). All the subjects were tested prior to and

after the experimentation on selected dependent variables such as reaction time, movement time, 9 meter front throw, dominant hand speed pass, overhead pass, accuracy throw, jump and throw, and dribbling.

3.4. SELECTION OF TESTS

The following standardized tests were used to collect the relevant data on selected dependent variables and they are presented in Table I.

TABLE I
SELECTION OF TESTS AND UNITS OF MEASUREMENT

Variables	Tests	Units of Measurement
Reaction Time	Nelson Reaction Time Test	In Seconds
Movement Time	Nelson Movement Time Test	In Seconds
9 Meter Front Throw	Zinn Team Handball Skills Battery	In Points
Dominant Hand Speed Pass	Zinn Team Handball Skills Battery	In Seconds
Overhead Pass	Zinn Team Handball Skills Battery	In Points
Accuracy Throw	Bergemann Test	In Points
Jump and Throw	Bergemann Test	In Point
Dribbling	Knox Speed Dribble Test	In Seconds

3.5. PILOT STUDY

A pilot study was conducted to assess the 1 RM and initial capacity of all the subjects in order to fix the load. For this, 10 deaf and dumb college men students were selected at random and divided into two groups of five each, in which group I underwent specified training with vibrator aid, group II performed specified training with combination of vibrator aid & sign language under the supervision of the researcher. However, the individual differences were considered. While constructing

the training programmes, the basic principles of sports training namely progression, over load and specificity were followed.

3.6. RELIABILITY OF THE DATA

Three months before the commencement of the pilot study, the reliability of the data was established by using 10 subjects at random. To ensure reliability, test and re-test method was executed. In between the test and retest one-day rest was given to all the subjects. The researcher using the same equipments under identical conditions tested for all the selected variables twice on the same subjects. The intra class co-efficient of correlation was used to find out the reliability of the data and the results are given in table II.

TABLE II
INTRA CLASS CO-EFFICIENT OF CORRELATION ON SELECTED
VARIABLES

S.No.	Variables	'R' value
1	Reaction Time	0.81*
2	Movement Time	0.80*
3	9 Meter Front Throw	0.84*
4	Dominant Hand Speed Pass	0.85*
5	Overhead Pass	0.86*
6	Accuracy Throw	0.84*
7	Jump and Throw	0.83*
8	Dribbling	0.82*

*Significant at 0.01 level.

(Table value required for significance at 0.01 level of confidence is 0.77)

Since the obtained 'R' values are much higher than the required value, the data are accepted as reliable in terms of instrument, tester and the subjects.

3.7. INSTRUMENTS RELIABILITY

Instruments like measuring tape, marking tape, stopwatches, and vibrator aid available in the laboratory of Department of Physical Education, Presidency College, Chennai were all reliable and manufactured by standard companies. Instrument reliability was also established by test-retest method.

3.8. ORIENTATION TO THE SUBJECTS

The investigator explained the purpose of the training programme and also the involvement of the subjects. Before the commencement of the training programme, the vibrator aid training procedure and techniques were taught to group I (VTG) and the combination of vibrator aid and sign language training programme were taught to group II (SVTG). Three one-hour sessions were spent on alternate days (Mondays, Wednesdays and Fridays) to practice the specified training exercises. Two one-hour sessions were spent on alternate days (Tuesdays and Thursdays) to practice handball drill training. This helped them to perform the training exercises and understand the vibrator aid and sign language instructions perfectly. The sign language was taught by Mr. S. Vinoth and Mr. M. Bala, Asst. Professors, Dept. of computer Sci.,(Deaf and dumb), experts in the field of sign language. The used sign language are presented in **Appendix K**.

3.9. TRAINING PROGRAMME

The subjects underwent their respective training programme under strict supervision. The group I (VTG) underwent specified training with vibrator aid, group II (VSTG) underwent specified training with the combination of vibrator aid and sign language but group III (CG) did not participate any training programme during the training period. They treated as control group. The duration of training

period was restricted to 12 weeks and the number of sessions per week was confined to five. Prior to the training period, at the end of the fifth week the subjects' load (1 RM and 100%) was assessed. Each Individual's training load and intensity were fixed according to the training principles. Prior to every training session, subjects underwent 5-10 minutes of warm-up exercise, which included stretching, jogging, striding, parallel squats, and jump and toe touch. All the subjects involved in training programme were questioned about their stature throughout the training period. None of them reported any injuries. However, muscle soreness was reported in the early weeks, but it subsided later.

Specified training with vibrator aid group (VTG) was instructed to “start and stop” for one stimulus, “change of exercise” for two stimuli and “correction/error” for three stimuli. Based on the response of the subjects in the pilot study, the training schedules were constructed and presented in the following tables.

**TABLE III
TRAINING SCHEDULE (MONDAY)**

Specified Training Exercises on Monday	Intensity			Sets			Rest Between sets
	I Phase 1-4 weeks	II Phase 5-8 weeks	III Phase 9-12 weeks	I Phase 1-4 weeks	II Phase 5-8 weeks	III Phase 9-12 weeks	
4 Cone drill	60%	65%	70%	1	2	3	7 -9 min
Single leg jump	60%	65%	70%	1	2	3	7 -9 min
Sit-ups	60%	65%	70%	1	2	3	7 -9 min
Straddle press	60% of 1 RM	65% of 1 RM	70% of 1 RM	1	2	3	7 -9 min
	8-12 Reps	8-12 Reps	8-12 Reps				
Burpee	60%	65%	70%	1	2	3	7 -9 min
Duration of Vibration	6sec	6sec	4sec	--	--	--	--

TABLE IV
TRAINING SCHEDULE (WEDNESDAY)

Specified Training Exercises on Wednesday	Intensity			Sets			Rest Between sets
	I Phase 1-4 weeks	II Phase 5-8 weeks	III Phase 9-12 weeks	I Phase 1-4 weeks	II Phase 5-8 weeks	III Phase 9-12 weeks	
4 Cone drill	60%	65%	70%	1	2	3	7 -9 min
Sprints	60%	65%	70%	1	2	3	7 -9 min
Sit-ups	60%	65%	70%	1	2	3	7 -9 min
Biceps Curl	60% of 1 RM	65% of 1 RM	70% of 1 RM	1	2	3	7 -9 min
	8-12 Reps	8-12 Reps	8-12 Reps				
Burpee	60%	65%	70%	1	2	3	7 -9 min
Duration of Vibration	6sec	6sec	4sec	--	--	--	--

TABLE V
TRAINING SCHEDULE (FRIDAY)

Specified Training Exercises on Friday	Intensity			Sets			Rest Between sets
	I Phase 1-4 weeks	II Phase 5-8 weeks	III Phase 9-12 weeks	I Phase 1-4 weeks	II Phase 5-8 weeks	III Phase 9-12 weeks	
4 Cone drill	60%	65%	70%	1	2	3	7 -9 min
Sit-ups	60%	65%	70%	1	2	3	7 -9 min
Toe Jump	60%	65%	70%	1	2	3	7 -9 min
Triceps Curl	60% of 1 RM	65% of 1 RM	70% of 1 RM	1	2	3	7 -9 min
	8-12 Reps	8-12 Reps	8-12 Reps				
Burpee	60%	65%	70%	1	2	3	7 -9 min
Duration of Vibration	6sec	6sec	4sec	--	--	--	--

TABLE VI
TRAINING SCHEDULE
(SPECIFIED DRILLS PRACTICED DURING THE TRAINING
PROGRAMME)

Drills practiced on Tuesday & Thursday	Distance	Repetition			Sets			Rest between sets
		1-4 weeks	5-8 weeks	9-12 weeks	1-4 weeks	5-8 weeks	9-12 weeks	
Zig-zag dribbling	40 m X 20m	2	4	6	1	2	3	4 -7 min
Two men pass	40 m X 20m	2	6	8	1	2	3	4 -7 min
Three men pass	40 m X 20m	2	6	8	1	2	3	4 -7 min

3.10. TEST ADMINISTRATION

3.10.1. Ruler Drop Test

Objective

To assess the student's reaction time.

Equipment

Metre ruler.

Direction

The ruler is held by the assistant between the outstretched index finger and thumb of the subject's dominant hand, so that the top of the subject's thumb is level with the zero centimetre line on the ruler. The assistant instructs the subject to catch the ruler as soon as possible after it has been released. The assistant releases the ruler and the subject catches the ruler between the index finger and thumb as quickly as possible. The assistant is to record distance between the bottom of the

ruler and the top of the subject's thumb where the ruler has been caught. The test is repeated two more times and the average value was recorded as score. (Nelson, 1981).

Scoring

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

d = distance in metres

v = initial velocity = 0

a = acceleration due to gravity = 9.81m/s^2

t = time in seconds

As $v = 0$, then $vt = 0$ therefore the algorithm is $t = \sqrt{2d/a}$.

3.10.2. Ruler Drop Test

Objective

To assess the subject's movement time.

Equipment

Metre ruler.

Direction

The ruler is held by the assistant between the outstretched palms of the subject's right and left hand, so that the top of the subject's thumb is level with the zero centimetre line on the ruler. The assistant instructs the subject to catch the ruler as soon as possible after it has been released. The assistant releases the ruler and the subject catches the ruler between their palms as quickly as possible. The assistant is to record distance between the bottom of the ruler and the top of the subject's palm where the ruler has been caught. The test is repeated 2 more times and the average value is used in the assessment. (Nelson, 1981).

Scoring

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

d = distance in metres

v = initial velocity = 0

a = acceleration due to gravity = 9.81m/s^2

t = time in seconds

As $v = 0$, then $vt = 0$ therefore the algorithm is $t = \sqrt{2d/a}$.

3.10.3. 9 meter front throw

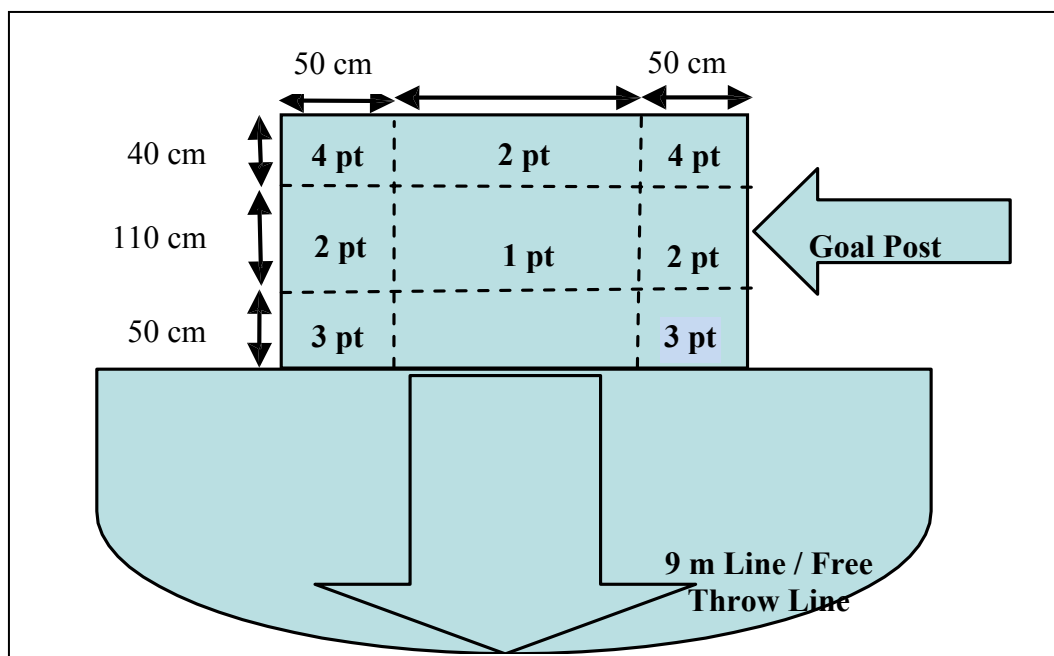
Objective

To evaluate throwing ability of the subjects.

Equipments

Handballs, rope, a measuring tape.

Markings



Direction

The subject gets 10 throws, 5 when executing a jump throw and 5 when executing a set throw. The subject can take three steps before releasing a ball but the last step must be executed outside the free throw line (9 meter line). If a ball hits the court surface before it reaches the goal, no point is scored. (Zinn, 1981).

Scoring

The score for 10 trials is the sum of points awarded on each attempt.

3.10.4. Dominant Hand Speed Pass**Objective**

To evaluate passing ability of the subjects.

Equipments

Handballs, rope, a measuring tape.

Direction

The subject stands behind the restraining line. Upon the signal 'begin', the subject uses the dominant hand to bounce a ball against the wall as rapidly as possible. He catches the return bounce and repeats until 10 bounces hit the wall. All bounces must come from behind the restraining line and the subject must catch all passes with both hands. A stop watch is started as soon as the ball first contacts the wall and is stopped when the ball hits the wall on the 10th bounce. Two trials are given. (Zinn, 1981).

Scoring

Time for the better of two timed trials is the final score. Time is recorded to the nearest 1/10th of a second.

3.10.5. Overhead Pass

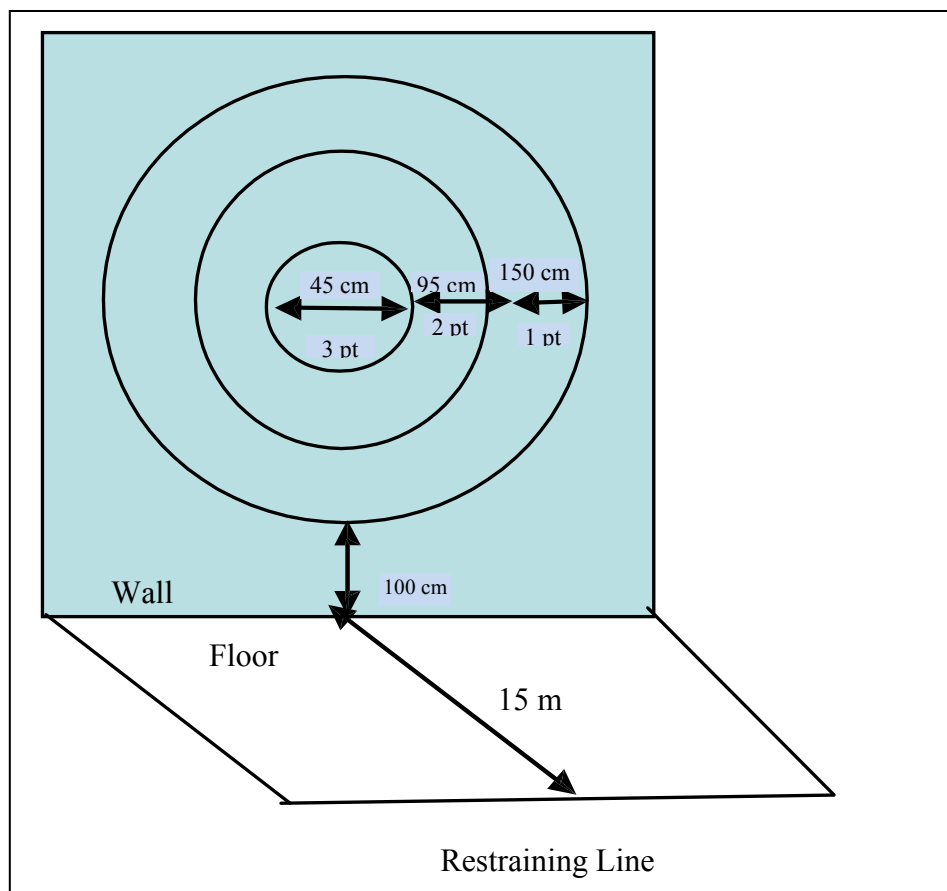
Objective

To evaluate passing ability of the subjects.

Equipments

Handballs, rope, a measuring tape.

Markings



Direction

Subjects are positioned behind the restraining line. Using a one-armed throw, they throw a ball at the target. Ten passes are made and all must be executed from behind the restraining line. Points are awarded for the passes. (Zinn, 1981).

Scoring

The score is the total for 10 throws.

3.10.6. Accuracy Throw

Objective

To assess throwing accuracy of the subjects.

Equipments

Automobile tyre, Iorn rope and handball.

Target Marking

A automobile tyre hanging vertically from the regular handball goal post.

Direction

Subjects are advised to use any one method of throw. The subjects stand behind the 7 meter throw line. When the vibrator is stimulated, they throw the handball towards the hanging automobile tyre. If the thrown ball passes through the hanging automobile tyre, 2 points are awarded to the subjects. If the ball touches the hanging automobile tyre, 1 point is awarded to the subjects. (**Bergemann, 2004**).

Scoring

The total of ten trials is the test score.

3.10.7. Jump and Throw

Objective

To assess the subject's jump and throw ability.

Equipments

Volleyball net, Automobile tyre, Iorn rope and handball.

Target Marking

Regular volleyball net is placed on the 7 meter line from the regular handball goal post with the height of 2.44 meter. An automobile tyre hanging vertically from the regular handball post, the bottom of the tyre rested on the floor.

Direction

Subjects are advised to use jump shot method of throw. The subjects stand behind the 7 meter throw line and the volleyball net. When the vibrator is stimulated, they jump and shot the handball (over the net at a height of 2.43 meters) towards the hanging automobile tyre. 10 throws are given to the subjects. Two points are awarded for hitting the tyre or passing throw the center and 1 point is awarded for passing through the goal mouth. (Bergemann, 2004).

Scoring

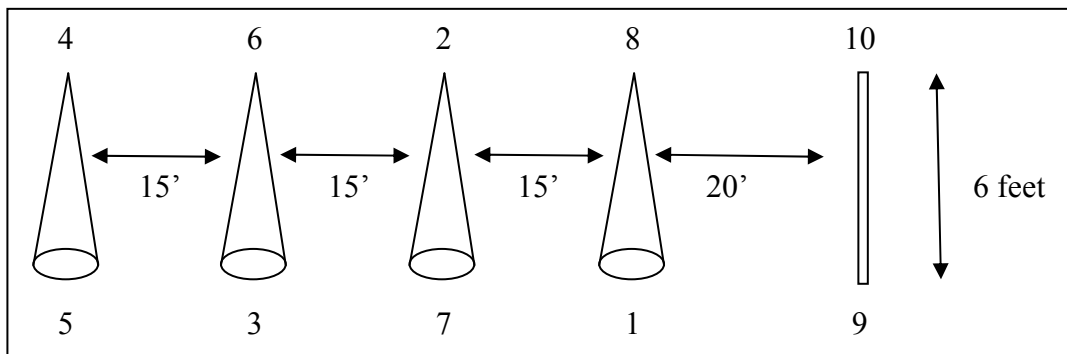
The total of ten trials is the test score.

3.10.8. Dribbling**Objective**

To assess the subject's dribbling ability.

Equipments

Cone, stop watch and handball.

Target Marking**Direction**

The subject places the ball on the starting line and then stands back of it, with hands on knees. When the vibrator is stimulated, they pick up the ball and dribble in a zig-zag manner up and down.

Scoring

Timing is taken from when the vibrator is stimulated to when the subjects returns to the starting line. The score is the time in seconds (**Knox, 1947**).

3.9. COLLECTION OF DATA

The data on selected dependent variables for pre and post tests were collected three days before and after the training programme respectively. Reaction time, movement time and dribbling were tested on the first day. On the second day, 9 meter front throw, dominant hand speed pass and overhead pass were tested, and accuracy throw and jump and throw were tested on the third day.

3.12. STATISTICAL TECHNIQUE

The data was collected from the three groups before and after the experimental period. The collected data were statistically examined for significant different by dependent 't' test. No attempt was made to equate the groups in any manner. Hence, to make adjustments for difference in the initial means and test the adjusted posttest means for significant differences, the analysis of covariance (ANCOVA) was used. Whenever the 'F' ratio was found to be significant, Scheffe's test was used as post-hoc test to determine which of the paired means differed significantly. In all cases, the criterion for statistical significance was set at 0.05 level of confidence ($P < 0.05$).

3.12.1. Assumptions for ANCOVA

A preliminary analysis was conducted to determine whether the prerequisite assumptions of one-way univariate **ANCOVA** were met before preceding the univariate analysis. Thus, the assumption of equality of variance (homogeneity), was examined and presented below.

Levene's Test of equality of error variances on selected variables were calculated and presented in table VII.

TABLE VII
LEVENE'S TEST OF EQUALITY OF ERROR VARIANCES ON SELECTED
VARIABLES OF VTG, VSTG TRAINING GROUPS AND CONTROL
GROUP

Variables	F Ratio	df1	df2
Reaction Time	2.550	2	42
Movement Time	0.827	2	42
9 Meter Front Throw	2.112	2	42
Dominant Hand Speed Pass	1.825	2	42
Overhead Pass	1.395	2	42
Accuracy Throw	1.092	2	42
Jump and Throw	0.718	2	42
Dribbling	0.511	2	42

* significant at 0.05 level

(The table value required for 0.05 level of significance with df 2, 42 is 3.22)

The results from the Levene's Test for homogeneity of variance of comparing the three groups regardless of the ability level for each of the dependent variables indicates that homogeneity of variance has been met for all the eight dependent variables. The 'F' ratio values for all dependent variables are less than the table value of 3.22 against with df 2 and 42 at 0.05 level of confidence. Hence, it is concluded that the assumption of homogeneity of variance has been met.

CHAPTER IV

RESULTS AND DISCUSSION

4.1. OVERVIEW

The analysis of the data collected is presented in this chapter. The purpose of the investigation was to find out the effect of specified training with sign language and vibrator aid on selected psycho motor variables and skills in handball among deaf and dumb college students. To achieve this purpose, 45 deaf and dumb male students those who were selected from Presidency College, Chennai, Tamil Nadu, India. The age of the subjects ranged between 18 and 25 years.

The study was formulated as a true random group design, consisting of pretest and post test. The selected subjects were divided into two experimental groups namely vibrator aid training group and combination of vibrator aid and sign language training group and control group on the basis of their level of challenge with fifteen subjects (n=15) in each. The effect of the two independent variables namely VTG and VSTG on reaction time and movement time as psycho motor variables and 9 M front throw, dominant hand speed pass, over head pass, accuracy throw, jump & throw and dribbling as skills in handball were investigated. The duration of the training period was twelve weeks and the number of sessions per week was confined to five. However, control group was not exposed to any specific training but they participated in the regular scheduled work.

All the subjects were tested on selected dependent variables prior to and after the treatment. The data pertaining to the variables in this study were examined by using dependent t-test to find out significant changes and analysis of covariance (ANCOVA) for each variable separately in order to determine the differences if any

among the adjusted post test means. Whenever 'F' ratio for the adjusted post-test was found to be significant, the Scheffe's test was used as post-hoc test to determine the three paired mean differences. The level of significance was fixed at 0.05 level of confidence in all the cases.

4.2. TEST OF SIGNIFICANCE

Clarke and Clarke (1972) said "These data must be analyzed in an appropriate manner to the research design. Such analysis can only be appropriate to the research design. Such analysis can only be accomplished through the application of pertinent statistics".

This is the vital portion of the thesis for achieving the conclusion by examining the hypothesis. The procedure of testing the hypothesis was either by accepting the hypothesis or rejecting the same in accordance with the results obtained in relation to the level of confidence.

The test was usually called the test of significance since one can test whether the difference between the three groups or within many groups the scores were significant or not. In this study, however, the obtained F value was greater than the table value, the hypothesis was accepted to the effect that there existed significant difference among the means of the groups compared and if obtained F-value was lesser than the table value, then the hypothesis was rejected to the effect that there existed no significant difference among the means of the groups under study.

4.2.1. LEVEL OF SIGNIFICANCE

The purpose of this study was to find out the effect of specified training with sign language and vibrator aid on selected psycho motor variables and skills in handball among the deaf and dumb college students. The collected data were analyzed by using the analysis of covariance (ANCOVA) to find out the significant differences if any between the groups on selected criterion variables separately. In all the cases, 0.05 level of confidence was fixed to test of significance which was considered as appropriate for this study.

4.3. COMPUTATION OF DEPENDENT 't' TEST, ANALYSIS OF COVARIANCE AND SCHEFFE'S POST HOC TEST ON REACTION TIME

The analysis of dependent 't' test on the data obtained for **reaction time** of the pre-test and post-test means of VTG, VSTG and CG were analysed and presented in Table VIII.

TABLE VIII
SUMMARY OF MEAN STANDARD DEVIATION AND DEPENDENT 't'
TEST FOR THE PRE AND POST TESTS ON REACTION TIME OF
EXPERIMENTAL AND CONTROL GROUPS

(Reaction time scores are expressed in seconds)

		VTG	VSTG	CG
Pre test	Mean	0.213	0.213	0.212
	SD	0.010	0.012	0.009
Post test	Mean	0.196	0.182	0.210
	SD	0.015	0.016	0.013
't' test		6.961*	7.368*	0.764

*Significant at .05 level. The table value required for .05 level of significance with df 14 is 1.761.

4.3.1. Results of Dependent ‘t’ Test on Reaction Time

Table VIII shows that the pre-test mean values of VTG, VSTG and CG on **reaction time** are 0.213, 0.213 and 0.212 respectively and the post-test mean values on **reaction time** are 0.196, 0.182 and 0.210 respectively. The obtained dependent t-ratio values between the pre and post test means of VTG, VSTG and CG on **reaction time** are 6.961, 7.368 and 0.764 respectively. The table value required for significant difference with df 14 at .05 level is 1.761. Since, the obtained ‘t’ ratio values of experimental groups are greater than the table value, it is understood that specified training with vibrator aid and specified training with combination of vibrator aid & sign language groups had significantly improved in the performance of **reaction time**. However, the control group had not significantly improved in the performance of **reaction time**. The obtained ‘t’ value for the control group is less than the table value as they were not subjected to any specific training.

The analysis of covariance on **reaction time** of VTG, VSTG and CG were analysed and presented in Table IX.

TABLE IX
ANALYSIS OF COVARIANCE FOR THE DATA ON REACTION TIME
AMONG EXPERIMENTAL AND CONTROL GROUPS

Adjusted Post Test Means			Sources of Variance	Sum of Squares	df	Mean Squares	F-Ratio
VTG	VSTG	CG					
0.196	0.182	0.210	Between	0.00607	2	0.00303	18.938*
			Within	0.00651	41	0.00016	

* Significant at 0.05 level of confidence.

The table value for significance at 0.05 with df 2 and 41 is 3.23.

4.3.2. Results of Analysis of Covariance on Reaction Time

Table IX shows that the adjusted post-test means of VTG, VSTG and CG on **reaction time** are 0.196, 0.182 and 0.210 respectively. The obtained F-ratio

value is 18.938, which is higher than the table value 3.23 with df 2 and 41 required for significance at .05 level. Since the value of F-ratio is higher than the table value, it indicates that there exist significant differences among the adjusted post-test means of VTG, VSTG and CG. To find out which of the paired means had a significant difference on **reaction time**, the Scheffe's post-hoc test was applied and the results are presented in Table X.

TABLE X
SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN THE ADJUSTED
POST TEST PAIRED MEANS OF REACTION TIME

VTG	VSTG	CG	Mean Difference	Confidential Interval
0.196	0.182		0.014*	0.012
0.196		0.210	0.015*	0.012
	0.182	0.210	0.028*	0.012

*Significant at .05 level.

4.3.3. Results of Scheffe's Test on Reaction Time

The table X shows that the adjusted post test mean difference on **reaction time** between VTG and VSTG, VTG and CG and between VSTG and CG are 0.014, 0.015 and 0.028 respectively which are higher than the confidence interval value of 0.002 at .05 level of confidence.

The pre and post test mean values of VTG, VSTG and CG on **reaction time** are graphically represented in figure 1.

The adjusted post test mean values of VTG, VSTG and CG on **reaction time** are graphically represented in figure 2.

FIGURE 1
PRE TEST AND POST TEST MEAN VALUES OF VTG, VSTG
AND CG ON REACTION TIME

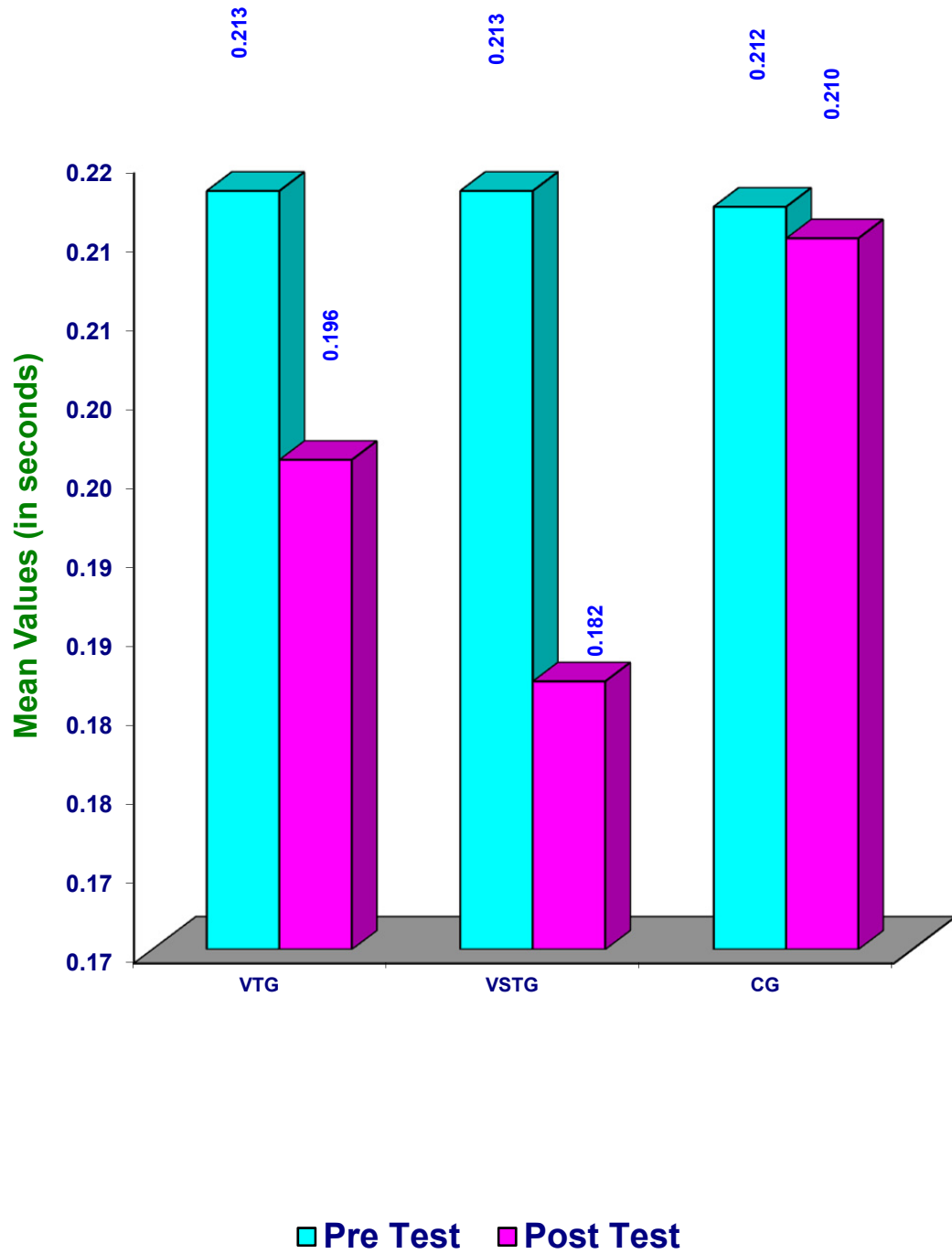
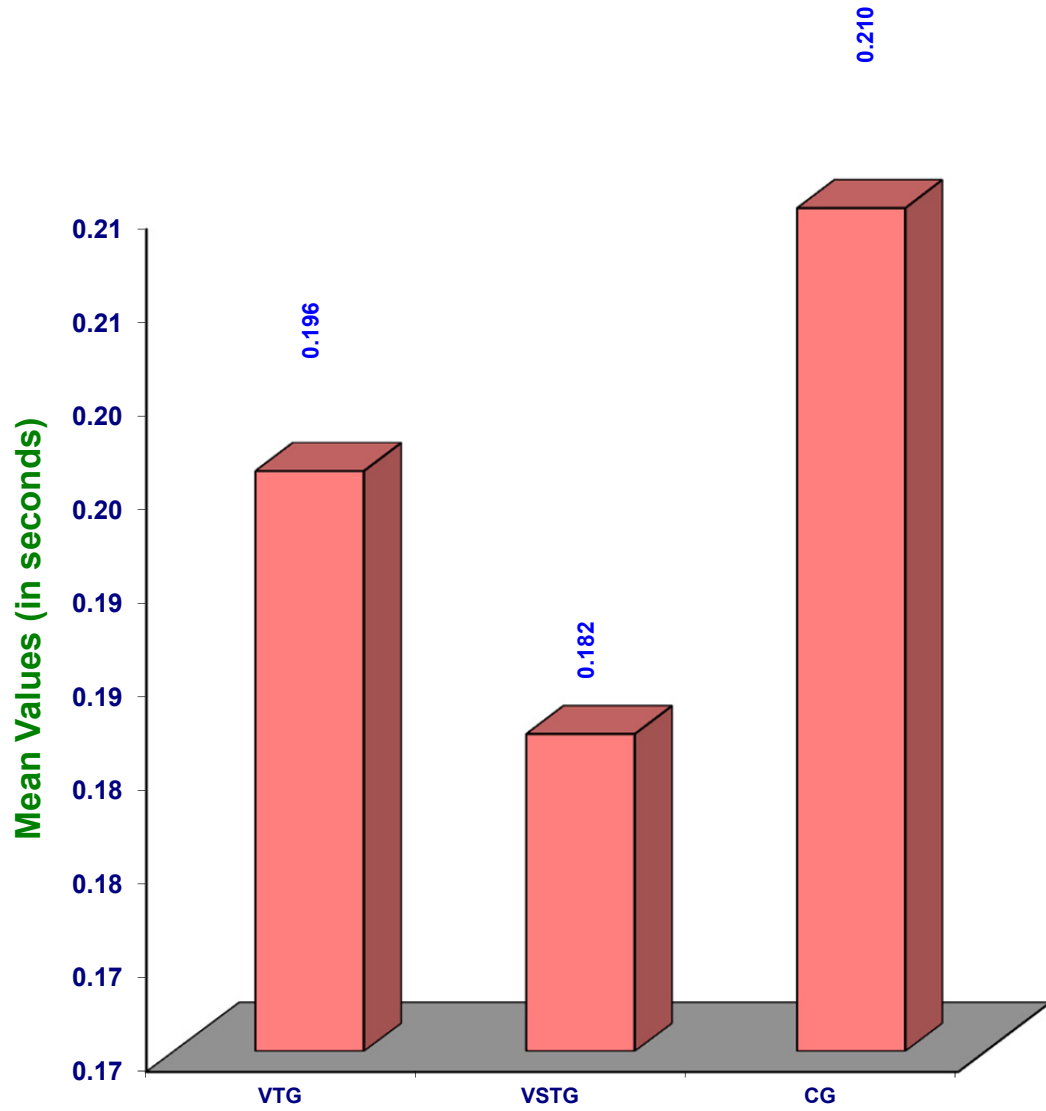


FIGURE 2
ADJUSTED POST TEST MEAN VALUES OF VTG, VSTG AND CG ON REACTION TIME



■ Adjusted Post Test Mean

4.3.4. Discussion on Findings on Reaction Time

The result of the study indicates that both the experimental groups significantly differed when compared to the control group on **reaction time**. However, it is further revealed that the experimental group namely VTG and VSTG had reduced **reaction time** better than the control group (CG) but VSTG had reduced **reaction time** better than the other two groups.

Sreejit (1988) concluded that basketball and volleyball players had a marked difference in their hand reaction times. **Sharma, Khan and Butchiramaiah (1986)** found out that the competitive volleyball players respond more quickly to the visual and auditory stimuli when compared to the recreational volleyball players. The present study also revealed that 12 weeks of specified training with vibrator aid and specified training with combination of vibrator aid and sign language reduced the reaction time. The present findings also very well sustained by the researchers **Shahbazia (2011), Reddy (1993) and Wei and Ji (2014)**.

4.4. COMPUTATION OF DEPENDENT ‘t’ TEST, ANALYSIS OF COVARIANCE AND SCHEFFE’S POST HOC TEST ON MOVEMENT TIME

The analysis of dependent ‘t’ test on the data obtained for movement time of the pre-test and post-test means of VTG, VSTG and CG were analysed and presented in Table XI.

TABLE XI
SUMMARY OF MEAN STANDARD DEVIATION AND DEPENDENT ‘t’ TEST FOR THE PRE AND POST TESTS ON MOVEMENT TIME OF EXPERIMENTAL AND CONTROL GROUPS

(Movement time scores are expressed in seconds)

		VTG	VSTG	CG
Pre test	Mean	0.285	0.290	0.286
	SD	0.008	0.007	0.009
Post test	Mean	0.271	0.262	0.281
	SD	0.010	0.009	0.009
‘t’ test		9.065*	11.045*	1.365

*Significant at .05 level. The table value required for .05 level of significance with df 14 is 1.761.

4.4.1. Results of Dependent ‘t’ Test on Movement Time

Table XI shows that the pre-test mean values of VTG, VSTG and CG on **movement time** are 0.285, 0.290 and 0.286 respectively and the post-test mean values on **movement time** are 0.271, 0.262 and 0.281 respectively. The obtained dependent t-ratio values between the pre and post test means of VTG, VSTG and CG on **movement time** are 9.065, 11.045 and 1.365 respectively. The table value required for significant difference with df 14 at .05 level is 1.761. Since, the obtained ‘t’ ratio values of experimental groups are greater than the table value, it is understood that specified training with vibrator aid and specified training with combination of vibrator aid & sign language groups had significantly improved in

the performance of **movement time**. However, the control group had not significantly improved in the performance of **movement time**. The obtained 't' value for the control group is less than the table value as they were not subjected to any specific training.

The analysis of covariance on **movement time** of VTG, VSTG and CG were analysed and presented in Table XII.

TABLE XII
ANALYSIS OF COVARIANCE FOR THE DATA ON MOVEMENT TIME
AMONG EXPERIMENTAL AND CONTROL GROUPS

Adjusted Post Test Means			Sources of Variance	Sum of Squares	df	Mean Squares	F-Ratio
VTG	VSTG	CG					
0.273	0.260	0.282	Between	0.00347	2	0.00174	29.000*
			Within	0.00242	41	0.00006	

* Significant at 0.05 level of confidence.

The table value for significance at 0.05 with df 2 and 41 is 3.23.

4.4.2. Results of Analysis of Covariance on Movement Time

Table XII shows that the adjusted post-test means of VTG, VSTG and CG on **movement time** are 0.273, 0.260 and 0.282 respectively. The obtained F-ratio value is 29.000, which is higher than the table value 3.23 with df 2 and 41 required for significance at .05 level. Since the value of F-ratio is higher than the table value, it indicates that there exist significant differences among the adjusted post-test means of VTG, VSTG and CG. To find out which of the paired means had a significant difference on **movement time**, the Scheffe's post-hoc test was applied and the results are presented in Table XIII.

TABLE XIII
SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN THE ADJUSTED
POST TEST PAIRED MEANS OF MOVEMENT TIME

VTG	VSTG	CG	Mean Difference	Confidential Interval
0.273	0.260		0.013*	0.007
0.273		0.282	0.009*	0.007
	0.260	0.282	0.022*	0.007

*Significant at .05 level.

4.4.3. Results of Scheffe's Test on Movement Time

Table XIII shows that the adjusted post test mean difference on **movement time** between VTG and VSTG, VTG and CG and between VSTG and CG are 0.013, 0.009 and 0.022 respectively which are higher than the confidence interval value of 0.007 at .05 level of confidence.

The pre and post test mean values of VTG, VSTG and CG on **movement time** are graphically represented in figure 3.

The adjusted post test mean values of VTG, VSTG and CG on **movement time** are graphically represented in figure 4.

FIGURE 3
PRE TEST AND POST TEST MEAN VALUES OF VTG, VSTG
AND CG ON MOVEMENT TIME

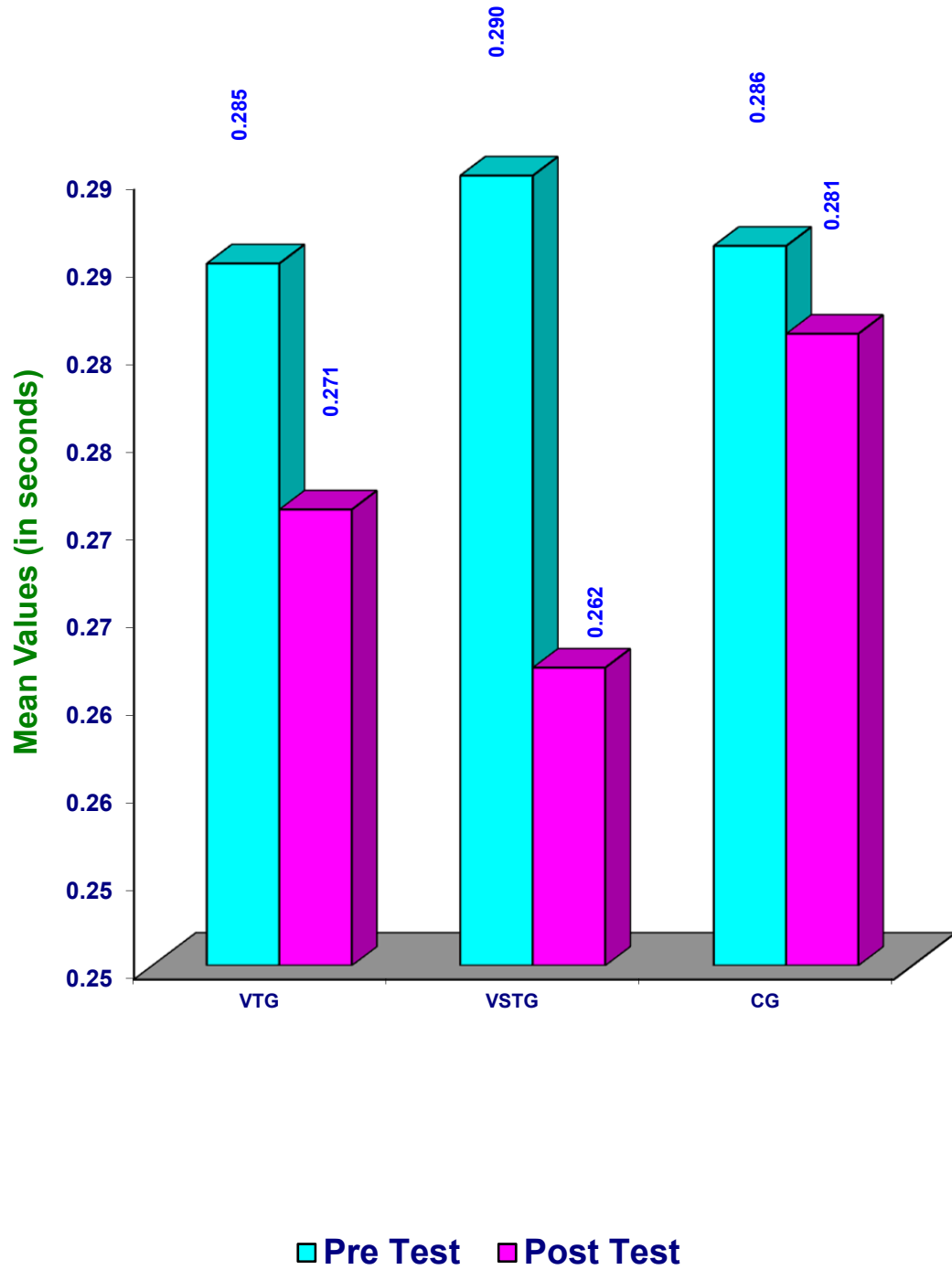
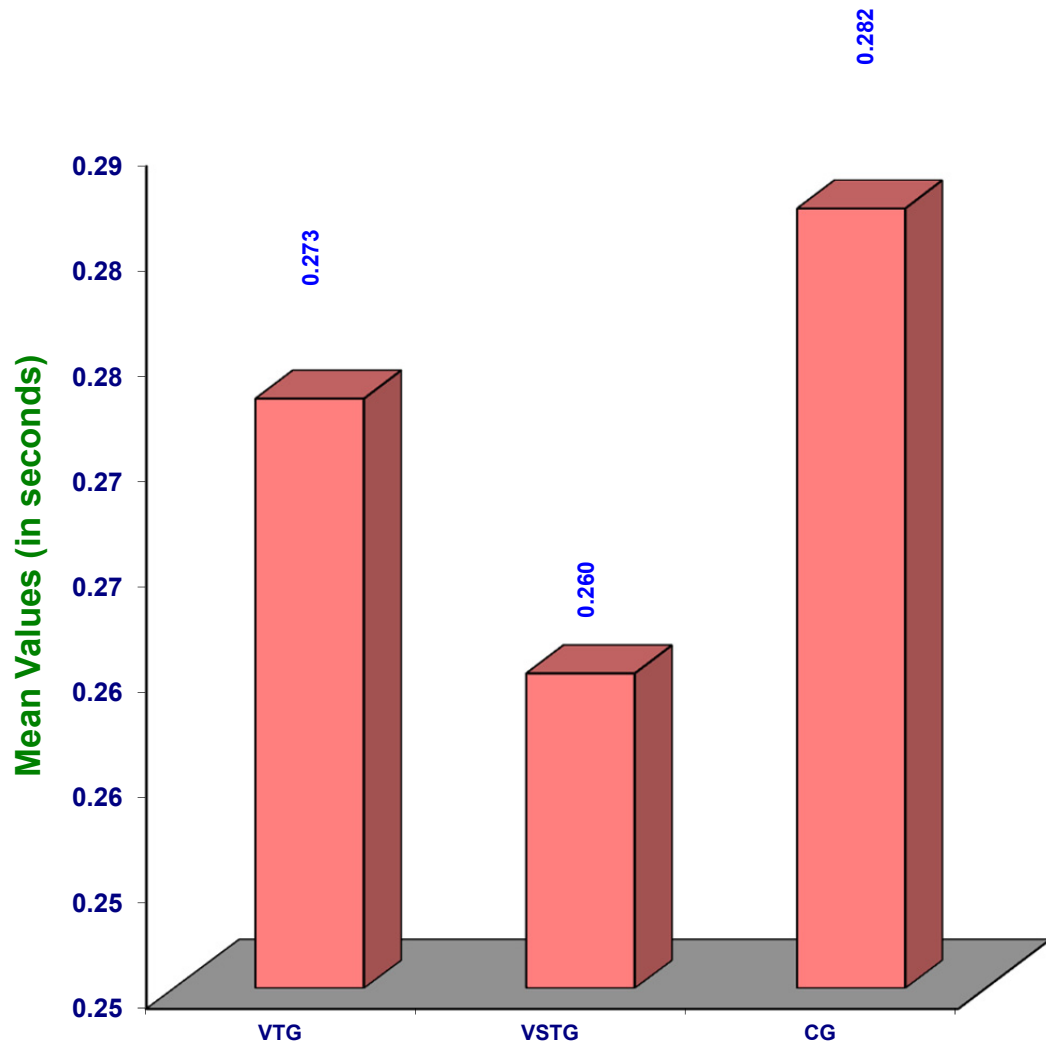


FIGURE 4
ADJUSTED POST TEST MEAN VALUES OF VTG, VSTG AND
CG ON MOVEMENT TIME



■ Adjusted Post Test Mean

4.4.4. Discussion on Findings on Movement Time

The result of the study indicates that both the experimental groups were significantly differed when compared to control group on **movement time**. However, it is further revealed that the experimental group namely VTG and VSTG had improved in the performance of **movement time** better than the control group (CG) but VSTG had improved in the performance of **movement time** better than the other two groups.

Wei and Ji (2014) concluded that due to training effect the cognitive abilities improved movement time had a close relation with the cognitive abilities. **Sharma, Khan and Butchiramaiah (1986)** also stated that national level Volleyball players are superior to the state level players in visual and auditory reaction time and concentration. The present study also revealed that 12 weeks of specified training with vibrator aid and specified training with combination of vibrator aid and sign language improved the movement time.

4.5. COMPUTATION OF DEPENDENT ‘t’ TEST, ANALYSIS OF COVARIANCE AND SCHEFFE’S POST HOC TEST ON 9M FRONT THROW

The analysis of dependent ‘t’ test on the data obtained for **9M front throw** of the pre-test and post-test means of VTG, VSTG and CG were analysed and presented in Table XIV.

TABLE XIV
SUMMARY OF MEAN STANDARD DEVIATION AND DEPENDENT ‘t’ TEST FOR THE PRE AND POST TESTS ON 9M FRONT THROW OF EXPERIMENTAL AND CONTROL GROUPS

(9M Front Throw scores are expressed in points)

		VTG	VSTG	CG
Pre test	Mean	10.867	11.267	11.400
	SD	1.642	1.486	0.737
Post test	Mean	15.000	17.200	11.933
	SD	2.236	2.484	1.033
‘t’ test		7.923*	12.191*	1.069

*Significant at .05 level. The table value required for .05 level of significance with df 14 is 1.761.

4.5.1. Results of Dependent ‘t’ Test on 9M Front Throw

Table XIV shows that the pre-test mean values of VTG, VSTG and CG on **9M front throw** are 10.867, 11.267 and 11.400 respectively and the post-test mean values on **9M front throw** are 15.000, 17.200 and 11.933 respectively. The obtained dependent t-ratio values between the pre and post test means of VTG, VSTG and CG on **9M front throw** are 7.923, 12.191 and 1.069 respectively. The table value required for significant difference with df 14 at .05 level is 1.761. Since, the obtained ‘t’ ratio values of experimental groups are greater than the table value, it is understood that specified training with vibrator aid and specified training with combination of vibrator aid & sign language groups had significantly improved in

the performance of **9M front throw**. However, the control group had not significantly improved in the performance of **9m front throw**. The obtained 't' value for the control group is less than the table value as they were not subjected to any specific training.

The analysis of covariance on **9M front throw** of VTG, VSTG and CG were analysed and presented in Table XV.

TABLE XV
ANALYSIS OF COVARIANCE FOR THE DATA ON 9M FRONT THROW
AMONG EXPERIMENTAL AND CONTROL GROUPS

Adjusted Post Test Means			Sources of Variance	Sum of Squares	df	Mean Squares	F-Ratio
VTG	VSTG	CG					
15.264	17.125	11.745	Between	222.829	2	111.414	39.171*
			Within	116.615	41	2.844	

* Significant at 0.05 level of confidence.

The table value for significance at 0.05 with df 2 and 41 is 3.23.

4.5.2. Results of Analysis of Covariance on 9M Front Throw

Table XV shows that the adjusted post-test means of VTG, VSTG and CG on **9M front throw** are 15.264, 17.125 and 11.745 respectively. The obtained F-ratio value is 39.171, which is higher than the table value 3.23 with df 2 and 41 required for significance at .05 level. Since the value of F-ratio is higher than the table value, it indicates that there exist significant differences among the adjusted post-test means of VTG, VSTG and CG. To find out which of the paired means had a significant difference on **9M front throw**, the Scheffe's post-hoc test was applied and the results are presented in Table XVI.

TABLE XVI
SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN THE ADJUSTED
POST TEST PAIRED MEANS OF 9M FRONT THROW

VTG	VSTG	CG	Mean Difference	Confidential Interval
15.264	17.125		1.861*	1.564
15.264		11.745	3.518*	1.564
	17.125	11.745	5.380*	1.564

*Significant at .05 level.

4.5.3. Results of Scheffe's Test on 9M Front Throw

Table XVI shows that the adjusted post test mean difference on **9M front throw** between VTG and VSTG, VTG and CG and between VSTG and CG are 1.861, 3.518 and 5.380 respectively which are higher than the confidence interval value of 1.564 at .05 level of confidence.

The pre and post test mean values of VTG, VSTG and CG on **9M front throw** are graphically represented in figure 5.

The adjusted post test mean values of VTG, VSTG and CG on **9M front throw** are graphically represented in figure 6.

FIGURE 5
PRE TEST AND POST TEST MEAN VALUES OF VTG, VSTG
AND CG ON 9M FRONT THROW

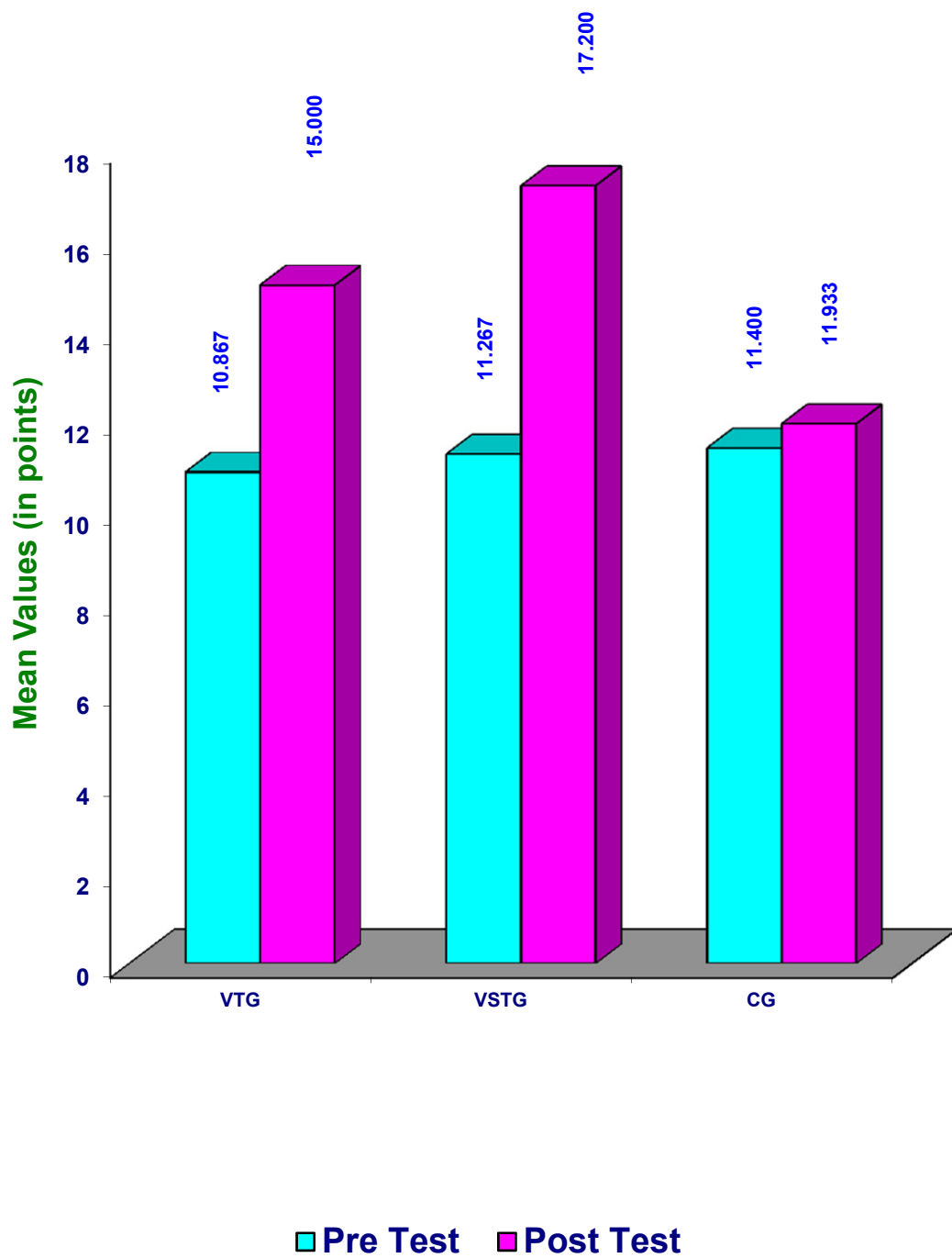
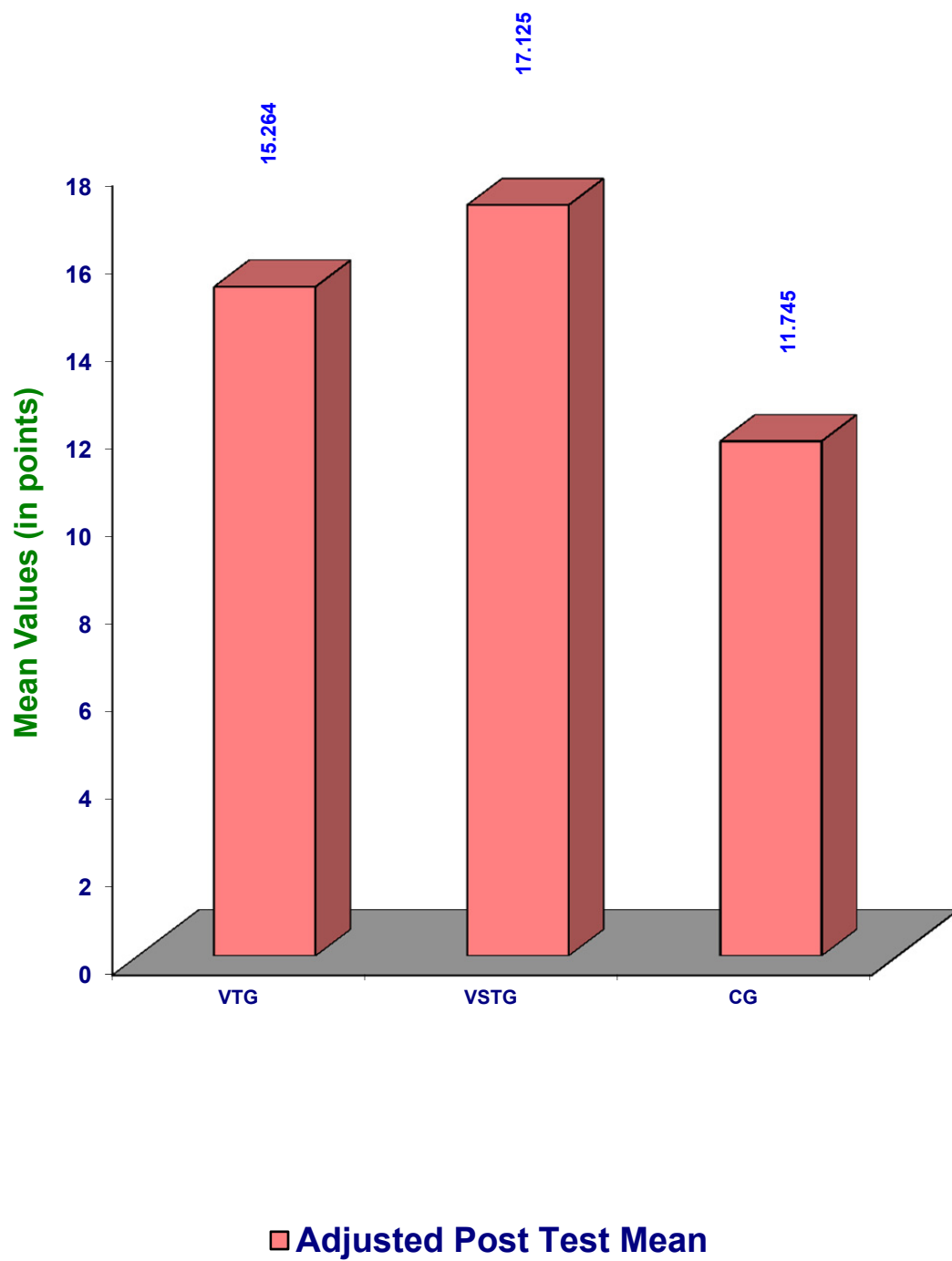


FIGURE 6
ADJUSTED POST TEST MEAN VALUES OF VTG, VSTG AND
CG ON 9M FRONT THROW



4.5.4. Discussion on Findings on 9M Front Throw

The result of the study indicates that both the experimental groups were significantly differed when compared to control group on **9M front throwing ability**. However, it is further revealed that the experimental group namely VTG and VSTG had improved the **9M front throwing ability** better than the control group (CG) but VSTG had improved the **9M front throwing ability** better than the VTG and CG.

Wagner and Muller (2008) suggested that team-handball players who were taller and of greater body weight have the ability to achieve a higher ball release speed in the jump throw and **Wagner, et al., (2012)** concluded that team-handball players had the ability to compensate an increase in movement variability in the acceleration phase to throw accurately, and skilled players were able to control the movement, although movement variability decreased in the standing throw with run-up. **Rivilla-García (2010)** suggested that handball players' throwing ability was a decisive factor in competitive and professional level. The present study also revealed that 12 weeks of specified training with vibrator aid and specified training with combination of vibrator aid and sign language improved the 9M front throwing ability. The result of the present investigation is also incorporated with the findings of **Cetin and Ozdol (2012)**, **Eliasz, (Apr, 2015)**, **Marques, et al., (2007)**, **Skoufas, et al., (2002)**, **Rogulj, et al., (2007)**, **Ziva and Lidora (2009)** and **Pori, Bon, and Sibila, (2005)**.

4.6. COMPUTATION OF DEPENDENT ‘t’ TEST, ANALYSIS OF COVARIANCE AND SCHEFFE’S POST HOC TEST ON DOMINANT HAND SPEED PASS

The analysis of dependent ‘t’ test on the data obtained for **dominant hand speed pass** of the pre-test and post-test means of VTG, VSTG and CG were analysed and presented in Table XVII.

TABLE XVII
SUMMARY OF MEAN STANDARD DEVIATION AND DEPENDENT ‘t’ TEST FOR THE PRE AND POST TESTS ON DOMINANT HAND SPEED PASS OF EXPERIMENTAL AND CONTROL GROUPS

(Dominant hand speed pass scores are expressed in seconds)

		VTG	VSTG	CG
Pre test	Mean	46.733	46.400	45.933
	SD	1.668	2.261	2.314
Post test	Mean	44.667	42.467	45.067
	SD	2.193	2.031	2.404
‘t’ test		11.973*	21.438*	1.179

*Significant at .05 level. The table value required for .05 level of significance with df 14 is 1.761.

4.6.1. Results of Dependent ‘t’ Test on Dominant Hand Speed Pass

Table XVII shows that the pre-test mean values of VTG, VSTG and CG on **dominant hand speed pass** are 46.733, 46.400 and 45.933 respectively and the post-test mean values on **dominant hand speed pass** are 44.667, 42.467 and 45.067 respectively. The obtained dependent t-ratio values between the pre and post test means of VTG, VSTG and CG on **dominant hand speed pass** are 11.973, 21.438 and 1.179 respectively. The table value required for significant difference with df 14 at .05 level is 1.761. Since, the obtained ‘t’ ratio values of experimental groups are greater than the table value, it is understood that specified training with vibrator aid and specified training with combination of vibrator aid & sign language groups had

significantly improved in the performance of **dominant hand speed pass**. However, the control group had not significantly improved in the performance of **dominant hand speed pass**. The obtained 't' value for the control group is less than the table value as they were not subjected to any specific training.

The analysis of covariance on **dominant hand speed pass** of VTG, VSTG and CG were analysed and presented in Table XVIII.

TABLE XVIII
ANALYSIS OF COVARIANCE FOR THE DATA ON DOMINANT HAND SPEED PASS AMONG EXPERIMENTAL AND CONTROL GROUPS

Adjusted Post Test Means			Sources of Variance	Sum of Squares	df	Mean Squares	F-Ratio
VTG	VSTG	CG					
44.318	42.426	45.456	Between	69.912	2	34.956	29.574*
			Within	48.461	41	1.182	

* Significant at 0.05 level of confidence.

The table value for significance at 0.05 with df 2 and 41 is 3.23.

4.6.2. Results of Analysis of Covariance on Dominant Hand Speed Pass

Table XVIII shows that the adjusted post-test means of VTG, VSTG and CG on **dominant hand speed pass** are 44.318, 42.426 and 45.456 respectively. The obtained F-ratio value is 29.574, which is higher than the table value 3.23 with df 2 and 41 required for significance at .05 level. Since the value of F-ratio is higher than the table value, it indicates that there exist significant differences among the adjusted post-test means of VTG, VSTG and CG. To find out which of the paired means had a significant difference on **dominant hand speed pass**, the Scheffe's post-hoc test was applied and the results are presented in Table XIX.

TABLE XIX
SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN THE ADJUSTED
POST TEST PAIRED MEANS OF DOMINANT HAND SPEED PASS

VTG	VSTG	CG	Mean Difference	Confidential Interval
44.318	42.426		1.893*	1.008
44.318		45.456	1.137*	1.008
	42.426	45.456	3.030*	1.008

*Significant at .05 level.

4.6.3. Results of Scheffe's Test on Dominant Hand Pass

The table XIX shows that the adjusted post test mean difference on **dominant hand speed pass** between VTG and VSTG, VTG and CG and between VSTG and CG are 1.893, 1.137 and 3.030 respectively which are higher than the confidence interval value of 1.008 at .05 level of confidence.

The pre and post test mean values of VTG, VSTG and CG on **dominant hand speed pass** are graphically represented in figure 7.

The adjusted post test mean values of VTG, VSTG and CG on **dominant hand speed pass** are graphically represented in figure 8.

FIGURE 7
PRE TEST AND POST TEST MEAN VALUES OF VTG, VSTG
AND CG ON DOMINANT HAND SPEED PASS

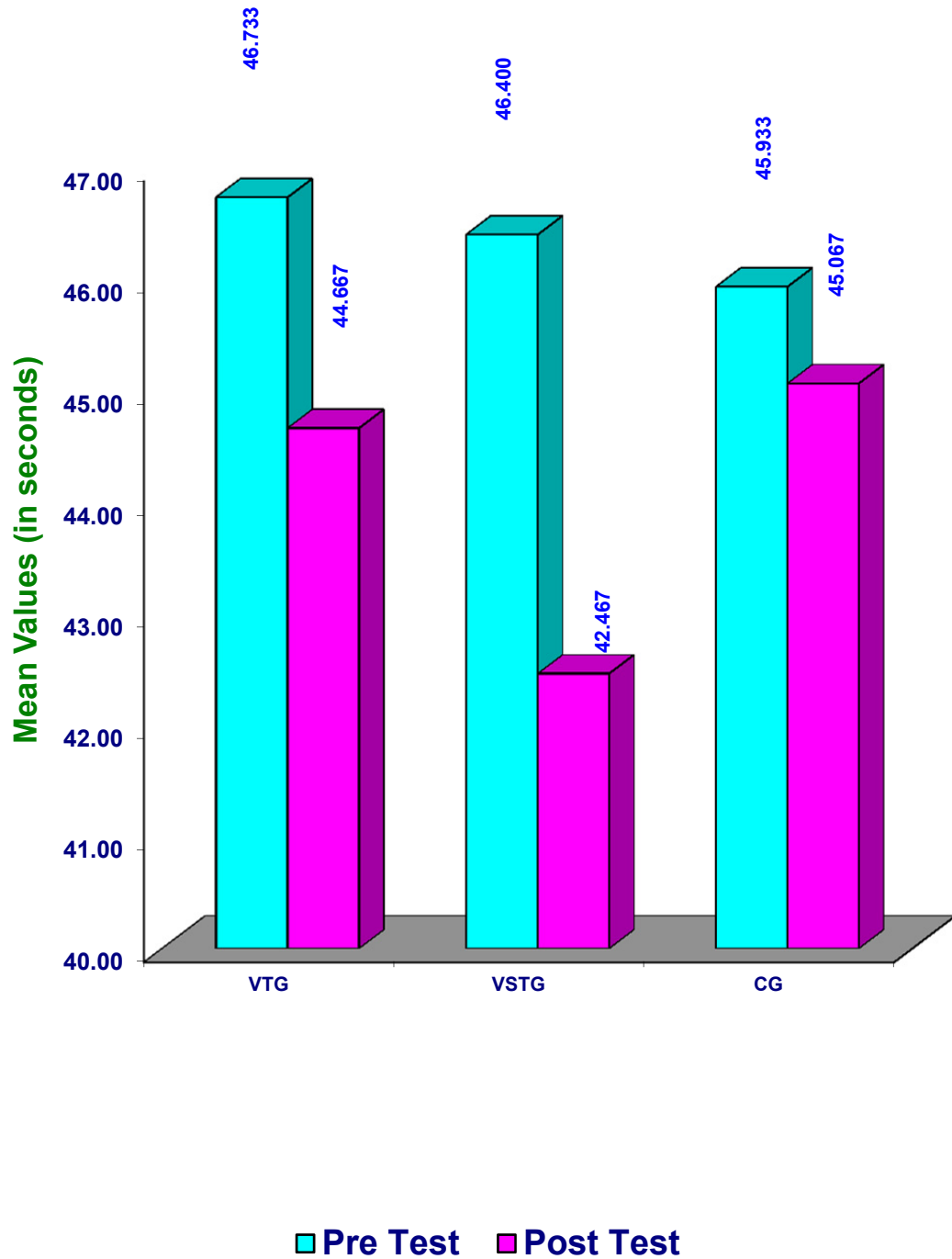
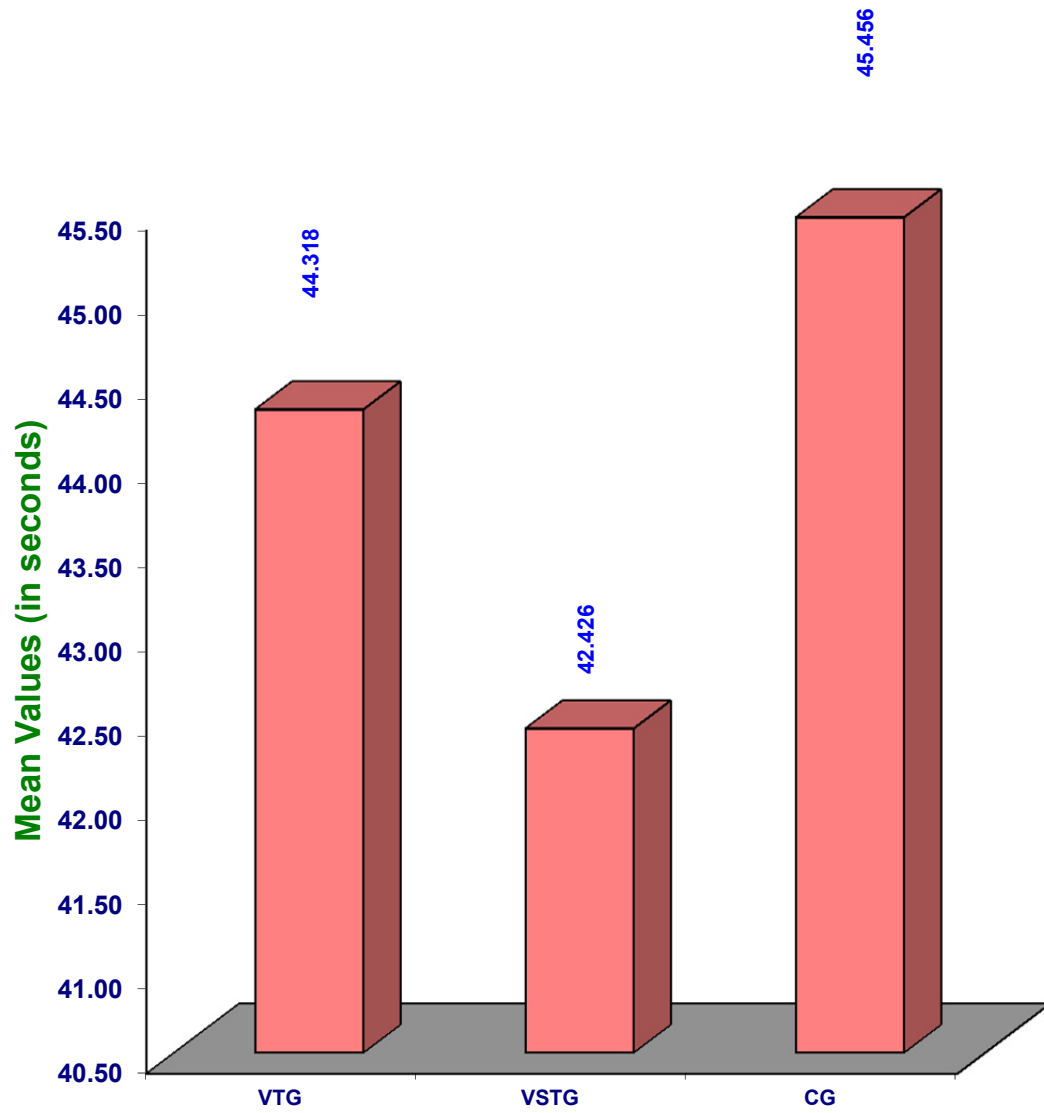


FIGURE 8
ADJUSTED POST TEST MEAN VALUES OF VTG, VSTG AND
CG ON DOMINANT HAND SPEED PASS



■ Adjusted Post Test Mean

4.6.4. Discussion on Findings on Dominant Hand Speed Pass

The result of the study indicates that both the experimental groups significantly differed when compared to the control group on **dominant hand speed pass**. However, it is further revealed that the experimental group namely VTG and VSTG had improved in the performance of **dominant hand speed pass** better than the control group (CG) but VSTG had improved in the performance of **dominant hand speed pass** better than the other two groups.

The present study also revealed that 12 weeks of specified training with vibrator aid and specified training with combination of vibrator aid and sign language improved dominant hand speed pass.

4.7. COMPUTATION OF DEPENDENT ‘t’ TEST, ANALYSIS OF COVARIANCE AND SCHEFFE’S POST HOC TEST ON OVERHEAD PASS

The analysis of dependent ‘t’ test on the data obtained for **overhead pass** of the pre-test and post-test means of VTG, VSTG and CG were analysed and presented in Table XX.

TABLE XX
SUMMARY OF MEAN STANDARD DEVIATION AND DEPENDENT ‘t’ TEST FOR THE PRE AND POST TESTS ON OVERHEAD PASS OF EXPERIMENTAL AND CONTROL GROUPS

(Overhead pass scores are expressed in points)

		VTG	VSTG	CG
Pre test	Mean	6.400	7.000	6.667
	SD	1.056	1.558	1.291
Post test	Mean	8.200	10.133	7.133
	SD	1.146	1.187	1.685
‘t’ test		7.585*	11.225*	0.201

*Significant at .05 level. The table value required for .05 level of significance with df 14 is 1.761.

4.7.1. Results of Dependent ‘t’ Test on Overhead Pass

Table XX shows that the pre-test mean values of VTG, VSTG and CG on **overhead pass** are 6.400, 7.000 and 6.667 respectively and the post-test mean values on **overhead pass** are 8.200, 10.133 and 7.133 respectively. The obtained dependent t-ratio values between the pre and post test means of VTG, VSTG and CG on **overhead pass** are 7.585, 11.225 and 0.201 respectively. The table value required for significant difference with df 14 at .05 level is 1.761. Since, the obtained ‘t’ ratio values of experimental groups are greater than the table value, it is understood that specified training with vibrator aid and specified training with combination of vibrator aid & sign language groups had significantly improved in

the performance of **overhead pass**. However, the control group had not significantly improved in the performance of **overhead pass**. The obtained 't' value for the control group is less than the table value as they were not subjected to any specific training.

The analysis of covariance on **overhead pass** of VTG, VSTG and CG were analysed and presented in Table XXI.

TABLE XXI
ANALYSIS OF COVARIANCE FOR THE DATA ON OVERHEAD PASS
AMONG EXPERIMENTAL AND CONTROL GROUPS

Adjusted Post Test Means			Sources of Variance	Sum of Squares	df	Mean Squares	F-Ratio
VTG	VSTG	CG					
8.344	9.978	7.144	Between	59.827	2	29.914	20.574*
			Within	59.633	41	1.454	

* Significant at 0.05 level of confidence.

The table value for significance at 0.05 with df 2 and 41 is 3.23.

4.7.2. Results of Analysis of Covariance on Overhead Pass

Table XXI shows that the adjusted post-test means of VTG, VSTG and CG on **overhead pass** are 8.344, 9.978 and 7.144 respectively. The obtained F-ratio value is 20.574, which is higher than the table value 3.23 with df 2 and 41 required for significance at .05 level. Since the value of F-ratio is higher than the table value, it indicates that there exist significant differences among the adjusted post-test means of VTG, VSTG and CG. To find out which of the paired means had a significant difference on **overhead pass**, the Scheffe's post-hoc test was applied and the results are presented in Table XXII.

TABLE XXII
SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN THE ADJUSTED
POST TEST PAIRED MEANS OF OVERHEAD PASS

VTG	VSTG	CG	Mean Difference	Confidential Interval
8.344	9.978		1.633*	1.118
8.344		7.144	1.200*	1.118
	9.978	7.144	2.833*	1.118

*Significant at .05 level.

4.7.3. Results of Scheffe's Test on Overhead Pass

The table XXII shows that the adjusted post test mean difference on **overhead pass** between VTG and VSTG, VTG and CG and between VSTG and CG are 1.633, 1.200 and 2.833 respectively which are higher than the confidence interval value of 1.118 at .05 level of confidence.

The pre and post test mean values of VTG, VSTG and CG on **overhead pass** are graphically represented in figure 9.

The adjusted post test mean values of VTG, VSTG and CG on **overhead pass** are graphically represented in figure 10.

FIGURE 9
PRE TEST AND POST TEST MEAN VALUES OF VTG, VSTG
AND CG ON OVERHEAD PASS

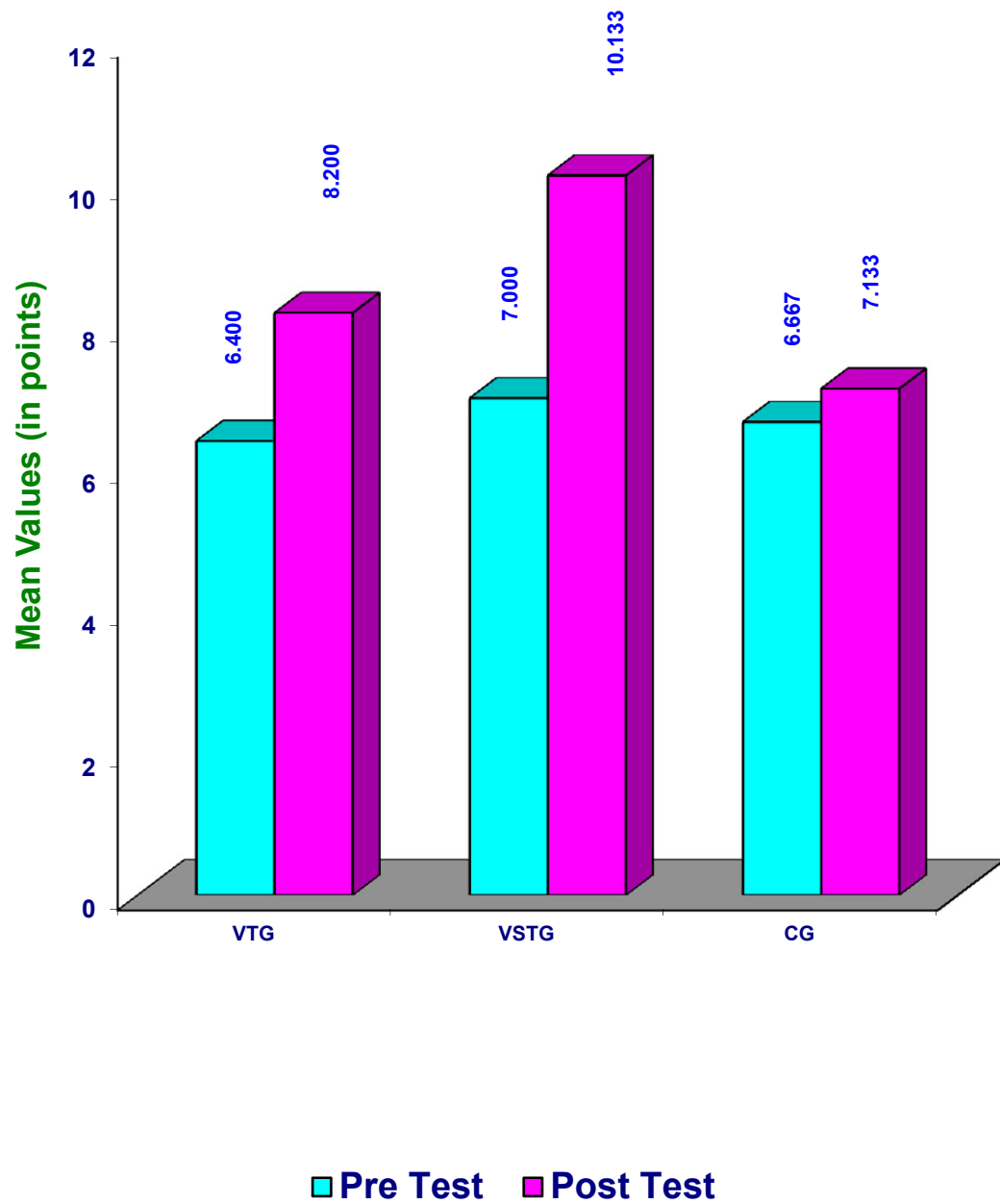
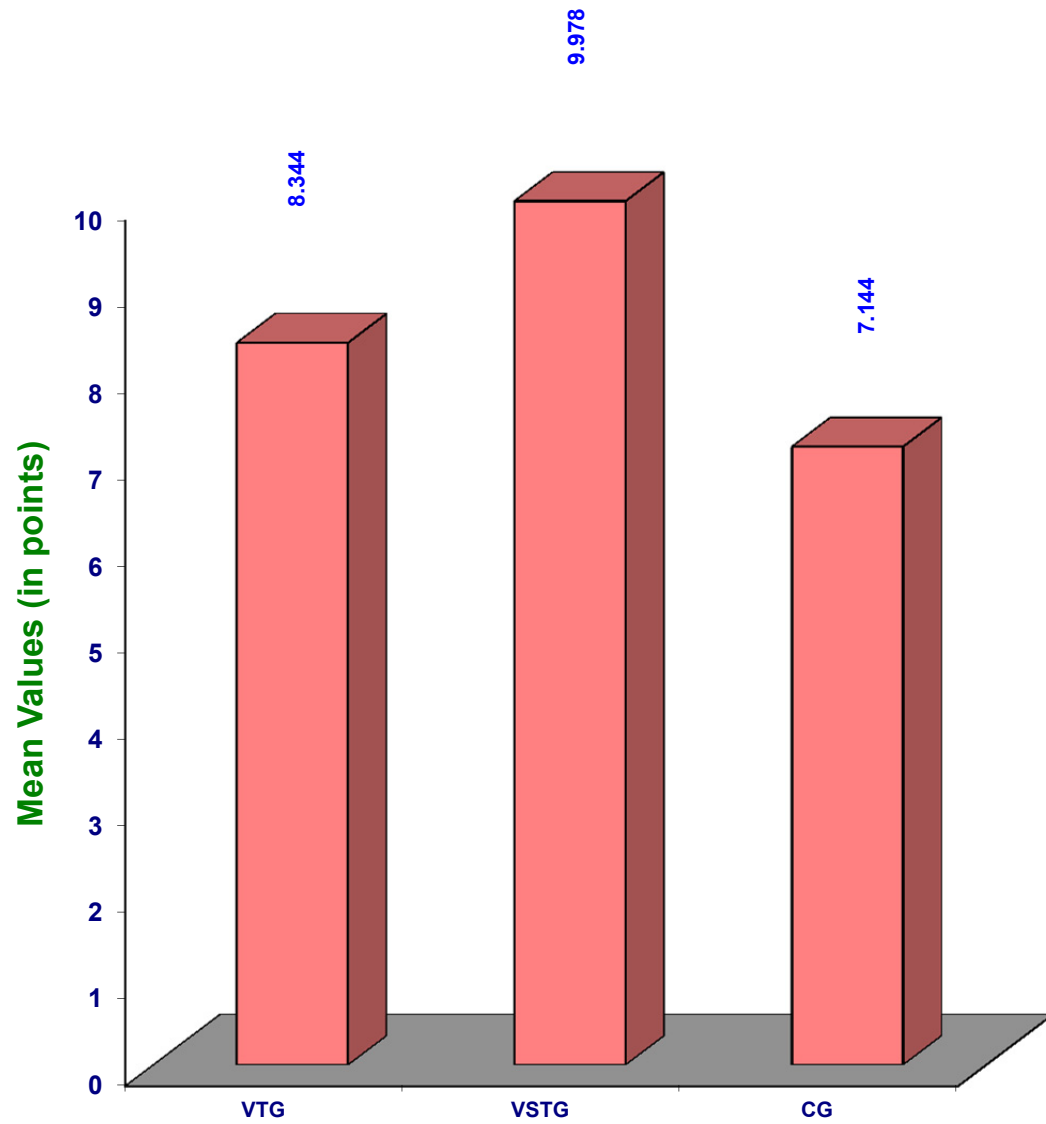


FIGURE 10
ADJUSTED POST TEST MEAN VALUES OF VTG, VSTG AND
CG ON OVERHEAD PASS



■ Adjusted Post Test Mean

4.7.4. Discussion on Findings on Overhead Pass

The result of the study indicates that both the experimental groups were significantly differed when compared to the control group on **overhead passing ability**. However, it is further revealed that the experimental group namely VTG and VSTG had improved in the performance of **overhead passing ability** better than the control group (CG) and sign and vibrator training group (SVTG) had improved in the performance of **overhead passing ability** better than the other two groups.

Reddy (1993) in his study concluded that the accuracy improved due to regular involvement in physical activity and on the whole results showed that the students improved significantly in coordinative abilities after their active involvement in physical activity which comprised of gymnastics, athletics and yoga. The present study also revealed that 12 weeks of specified training with vibrator aid and specified training with combination of vibrator aid and sign language improved the overhead passing ability of the deaf and dumb students.

4.8. COMPUTATION OF DEPENDENT ‘t’ TEST, ANALYSIS OF COVARIANCE AND SCHEFFE’S POST HOC TEST ON ACCURACY THROW

The analysis of dependent ‘t’ test on the data obtained for **accuracy throw** of the pre-test and post-test means of VTG, VSTG and CG were analysed and presented in Table XXIII.

TABLE XXIII
SUMMARY OF MEAN STANDARD DEVIATION AND DEPENDENT ‘t’ TEST FOR THE PRE AND POST TESTS ON ACCURACY THROW OF EXPERIMENTAL AND CONTROL GROUPS

(Accuracy throw scores are expressed in points)

		VTG	VSTG	CG
Pre test	Mean	4.733	4.867	4.667
	SD	0.594	0.743	0.724
Post test	Mean	5.600	6.533	4.867
	SD	0.632	0.743	1.125
‘t’ test		8.641*	12.574*	1.497

*Significant at .05 level. The table value required for .05 level of significance with df 14 is 1.761.

4.8.1. Results of Dependent ‘t’ Test on Accuracy throw

Table XXIII shows that the pre-test mean values of VTG, VSTG and CG on **accuracy throw** are 4.733, 4.867 and 4.667 respectively and the post-test mean values on **accuracy throw** are 5.600, 6.533 and 4.867 respectively. The obtained dependent t-ratio values between the pre and post test means of VTG, VSTG and CG on **accuracy throw** are 8.641, 12.574 and 1.497 respectively. The table value required for significant difference with df 14 at .05 level is 1.761. Since, the obtained ‘t’ ratio values of experimental groups are greater than the table value, it is understood that specified training with vibrator aid and specified training with combination of vibrator aid & sign language groups had significantly improved in

the performance of **accuracy throw**. However, the control group had not significantly improved in the performance of **accuracy throw**. The obtained 't' value for the control group is less than the table value as they were not subjected to any specific training.

The analysis of covariance on **accuracy throw** of VTG, VSTG and CG were analysed and presented in Table XXIV.

TABLE XXIV
ANALYSIS OF COVARIANCE FOR THE DATA ON ACCURACY THROW
AMONG EXPERIMENTAL AND CONTROL GROUPS

Adjusted Post Test Means			Sources of Variance	Sum of Squares	df	Mean Squares	F-Ratio
VTG	VSTG	CG					
5.618	6.446	4.937	Between	16.867	2	8.434	18.618*
			Within	18.585	41	0.453	

* Significant at 0.05 level of confidence.

The table value for significance at 0.05 with df 2 and 41 is 3.23.

4.8.2. Results of Analysis of Covariance on Accuracy throw

Table XXIV shows that the adjusted post-test means of VTG, VSTG and CG on **accuracy throw** are 5.618, 6.446 and 4.937 respectively. The obtained F-ratio value is 18.618, which is higher than the table value 3.23 with df 2 and 41 required for significance at .05 level. Since the value of F-ratio is higher than the table value, it indicates that there exist significant differences among the adjusted post-test means of VTG, VSTG and CG. To find out which of the paired means had a significant difference on **accuracy throw**, the Scheffe's post-hoc test was applied and the results are presented in Table XXV.

TABLE XXV
SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN THE ADJUSTED
POST TEST PAIRED MEANS OF ACCURACY THROW

VTG	VSTG	CG	Mean Difference	Confidential Interval
5.618	6.446		0.828*	0.624
5.618		4.937	0.681*	0.624
	6.446	4.937	1.509*	0.624

*Significant at .05 level.

4.8.3. Results of Scheffe's Test on Accuracy Throw

The table XXV shows that the adjusted post test mean difference on **accuracy throw** between VTG and VSTG, VTG and CG and between VSTG and CG are 0.828, 0.681 and 1.509 respectively which are higher than the confidence interval value of 0.624 at .05 level of confidence.

The pre and post test mean values of VTG, VSTG and CG on **accuracy throw** are graphically represented in figure 11.

The adjusted post test mean values of VTG, VSTG and CG on **accuracy throw** are graphically represented in figure 12.

FIGURE 11
PRE TEST AND POST TEST MEAN VALUES OF VTG, VSTG
AND CG ON ACCURACY THROW

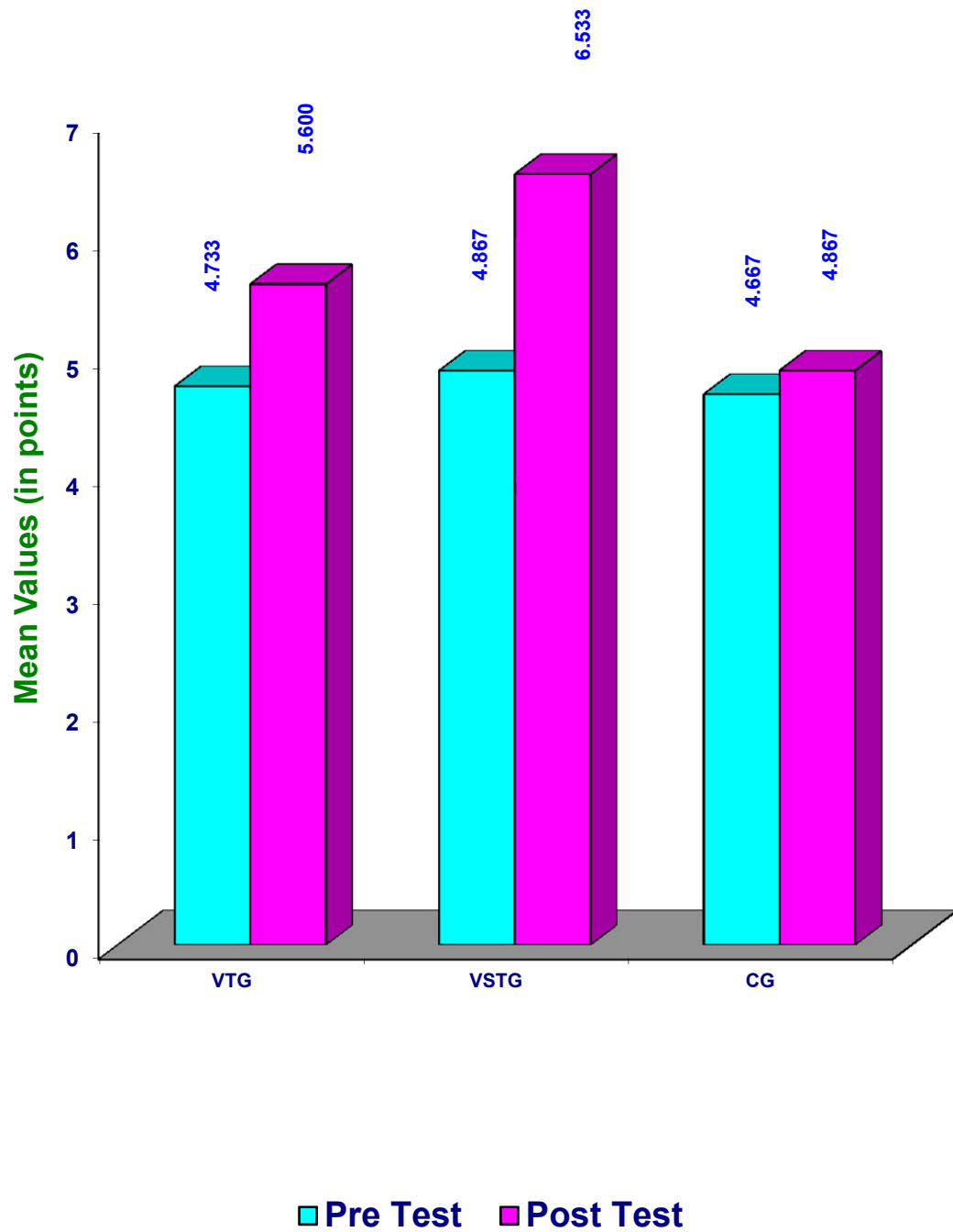
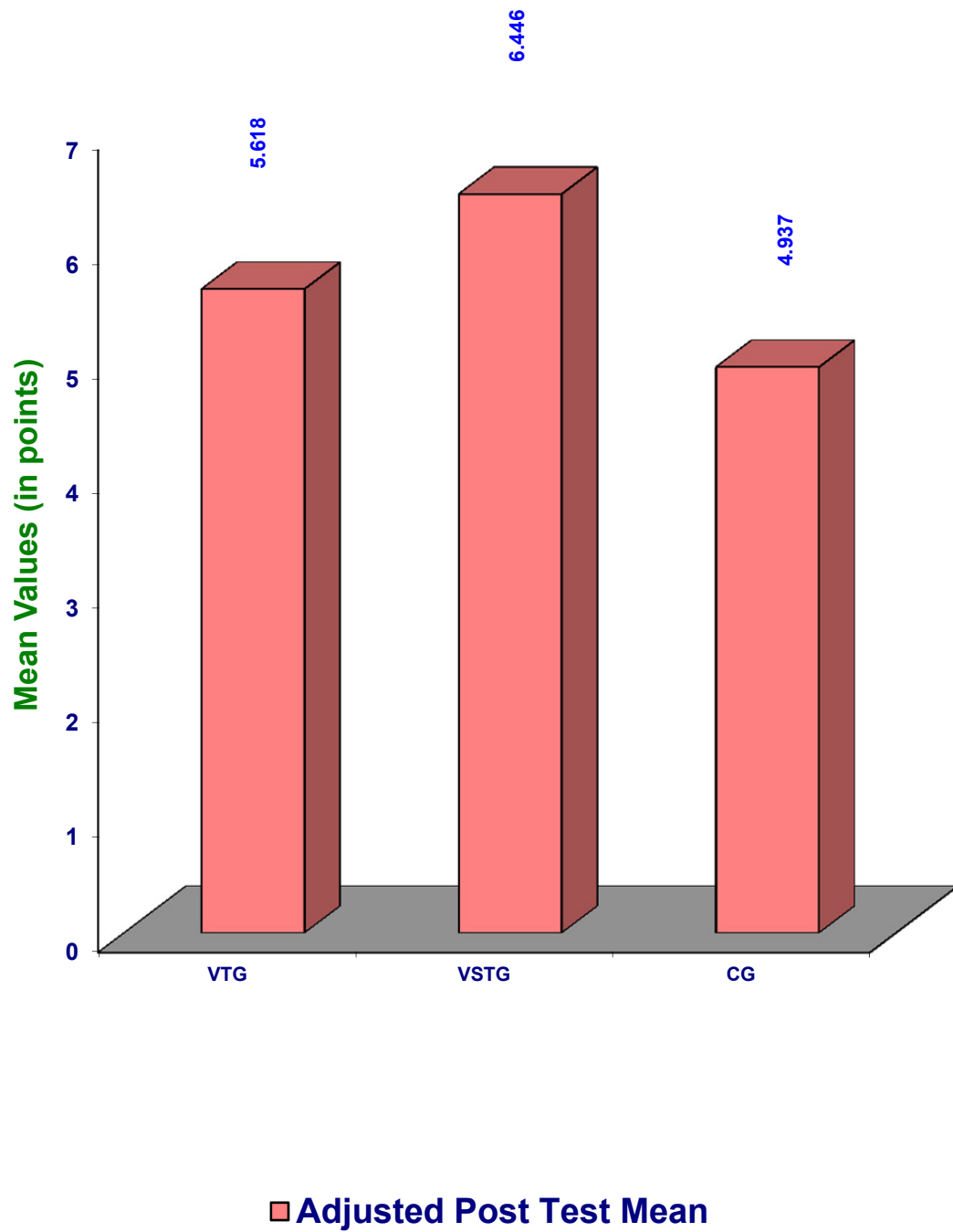


FIGURE 12
ADJUSTED POST TEST MEAN VALUES OF VTG, VSTG AND
CG ON ACCURACY THROW



4.8.4. Discussion on Findings on Accuracy Throw

The result of the study indicates that both the experimental groups were significantly differed when compared to the control group on **accuracy throw**. However, it is further revealed that the experimental group namely VTG and VSTG had improved in the performance of **accuracy throw** better than the control group (CG) but VSTG had improved in the performance of **accuracy throw** better than the other two groups.

Ziva and Lidora (2009) concluded that throwing velocity is higher by as much as 9% in elite male players compared with amateur male players and suggested that strength and power exercises should be emphasized in conditioning programmes, as they are associated with both sprint performance and throwing velocity. **Rogulj, et al., (2007)** found that the ball movement speed during the jump shot and the floor shot was determined, at the level of statistical importance, only by explosive strength in the form of throw. It is acceptable because this very ability from the aspects of kinesiology and anatomy requires, to the maximum extent, the kinetic efficacy of the ball throw in Handball. **Visnapuu, et al., (2007)** stated that finger control is especially important for the accuracy of different shots, both in handball and basketball. The present investigation also exposed that specified training with vibrator aid and specified training with combination of vibrator aid and sign language improved the accuracy throw. The findings of the present study also supported with the findings of **Reddy (1993) and Marques and Gonzalez (2006)**.

4.9. COMPUTATION OF DEPENDENT ‘t’ TEST, ANALYSIS OF COVARIANCE AND SCHEFFE’S POST HOC TEST ON JUMP AND THROW

The analysis of dependent ‘t’ test on the data obtained for **jump and throw** of the pre-test and post-test means of VTG, VSTG and CG were analysed and presented in Table XXVI.

TABLE XXVI
SUMMARY OF MEAN STANDARD DEVIATION AND DEPENDENT ‘t’ TEST FOR THE PRE POST AND ADJUSTED POST TESTS ON JUMP AND THROW OF EXPERIMENTAL AND CONTROL GROUPS

(Jump and throw scores are expressed in points)

		VTG	VSTG	CG
Pre test	Mean	3.667	3.533	3.600
	SD	0.900	0.516	1.056
Post test	Mean	4.800	5.733	3.733
	SD	1.265	0.961	0.961
‘t’ test		7.221*	9.646*	0.423

*Significant at .05 level. The table value required for .05 level of significance with df 14 is 1.761.

4.9.1. Results of Dependent ‘t’ Test on Jump and Throw

Table XXVI shows that the pre-test mean values of VTG, VSTG and CG on **jump and throw** are 3.667, 3.533 and 3.600 respectively and the post-test mean values on **jump and throw** are 4.800, 5.733 and 3.733 respectively. The obtained dependent t-ratio values between the pre and post test means of VTG, VSTG and CG on **jump and throw** are 7.221, 9.646 and 0.423 respectively. The table value required for significant difference with df 14 at .05 level is 1.761. Since, the obtained ‘t’ ratio values of experimental groups are greater than the table value, it is understood that specified training with vibrator aid and specified training with combination of vibrator aid & sign language groups had significantly improved in

the performance of **jump and throw**. However, the control group had not significantly improved in the performance of **jump and throw**. The obtained 't' value for the control group is less than the table value as they were not subjected to any specific training.

The analysis of covariance on **jump and throw** of VTG, VSTG and CG were analysed and presented in Table XXVII.

TABLE XXVII
ANALYSIS OF COVARIANCE FOR THE DATA ON JUMP AND THROW
AMONG EXPERIMENTAL AND CONTROL GROUPS

Adjusted Post Test Means			Sources of Variance	Sum of Squares	df	Mean Squares	F-Ratio
VTG	VSTG	CG					
4.747	5.787	3.733	Between	31.588	2	15.794	22.595*
			Within	28.640	41	0.699	

* Significant at 0.05 level of confidence.

The table value for significance at 0.05 with df 2 and 41 is 3.23.

4.9.2. Results of Analysis of Covariance on Jump and Throw

Table XXVII shows that the adjusted post-test means of VTG, VSTG and CG on **jump and throw** are 4.747, 5.787 and 3.733 respectively. The obtained F-ratio value is 22.595, which is higher than the table value 3.23 with df 2 and 41 required for significance at .05 level. Since the value of F-ratio is higher than the table value, it indicates that there exist significant differences among the adjusted post-test means of VTG, VSTG and CG. To find out which of the paired means had a significant difference on **jump and throw**, the Scheffe's post-hoc test was applied and the results are presented in Table XXVIII.

TABLE XXVIII
SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN THE ADJUSTED
POST TEST PAIRED MEANS OF JUMP AND THROW

VTG	VSTG	CG	Mean Difference	Confidential Interval
4.747	5.787		1.040*	0.775
4.747		3.733	1.013*	0.775
	5.787	3.733	2.053*	0.775

*Significant at .05 level.

4.9.3. Results of Scheffe's Test on Jump and Throw

The table XXVIII shows that the adjusted post test mean difference on **jump and throw** between VTG and VSTG, VTG and CG and between VSTG and CG are 1.040, 1.013 and 2.053 respectively which are higher than the confidence interval value of 0.775 at .05 level of confidence.

The pre and post test mean values of VTG, VSTG and CG on **jump and throw** are graphically represented in figure 13.

The adjusted post test mean values of VTG, VSTG and CG on **jump and throw** are graphically represented in figure 14.

FIGURE 13
PRE TEST AND POST TEST MEAN VALUES OF VTG, VSTG
AND CG ON JUMP AND THROW

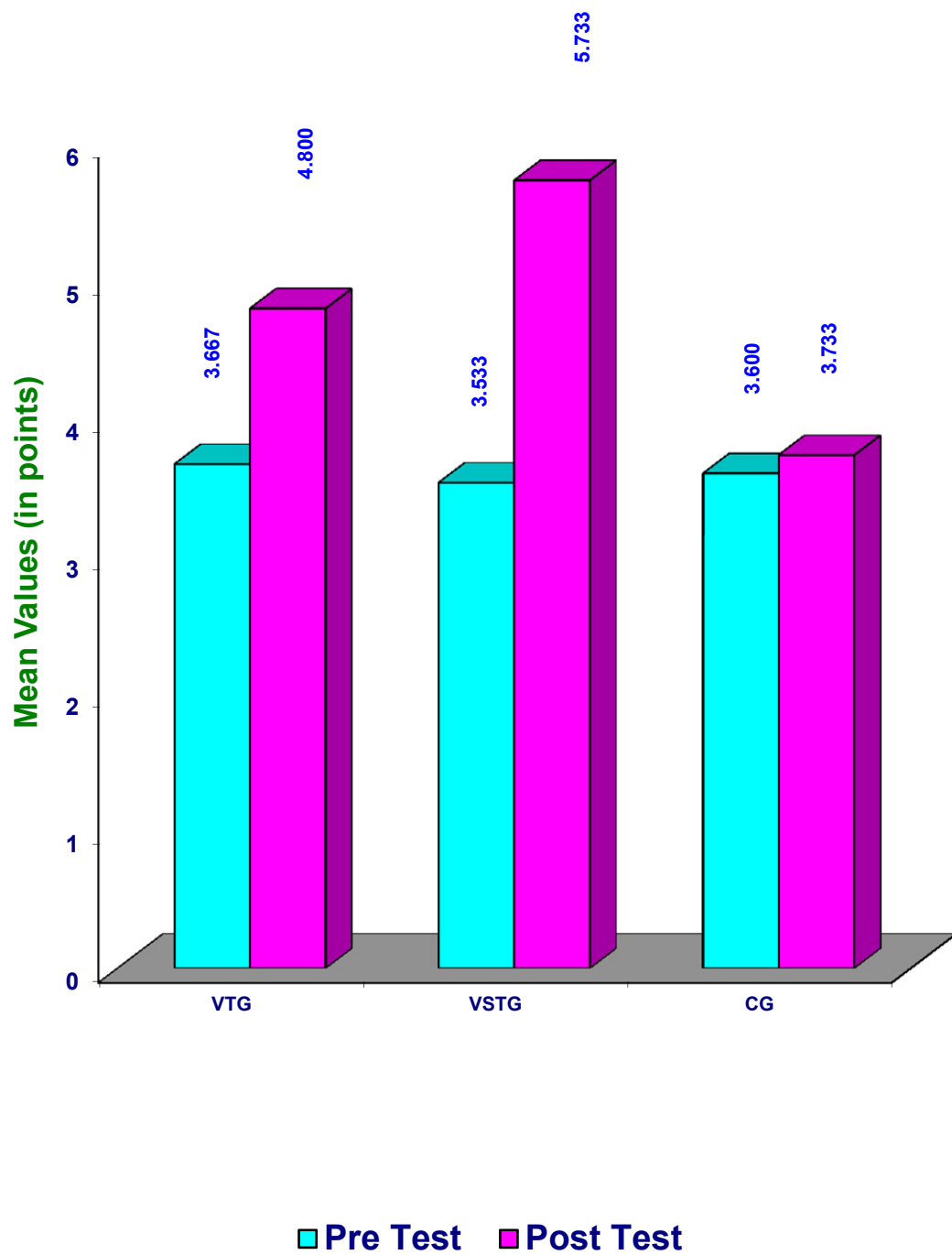
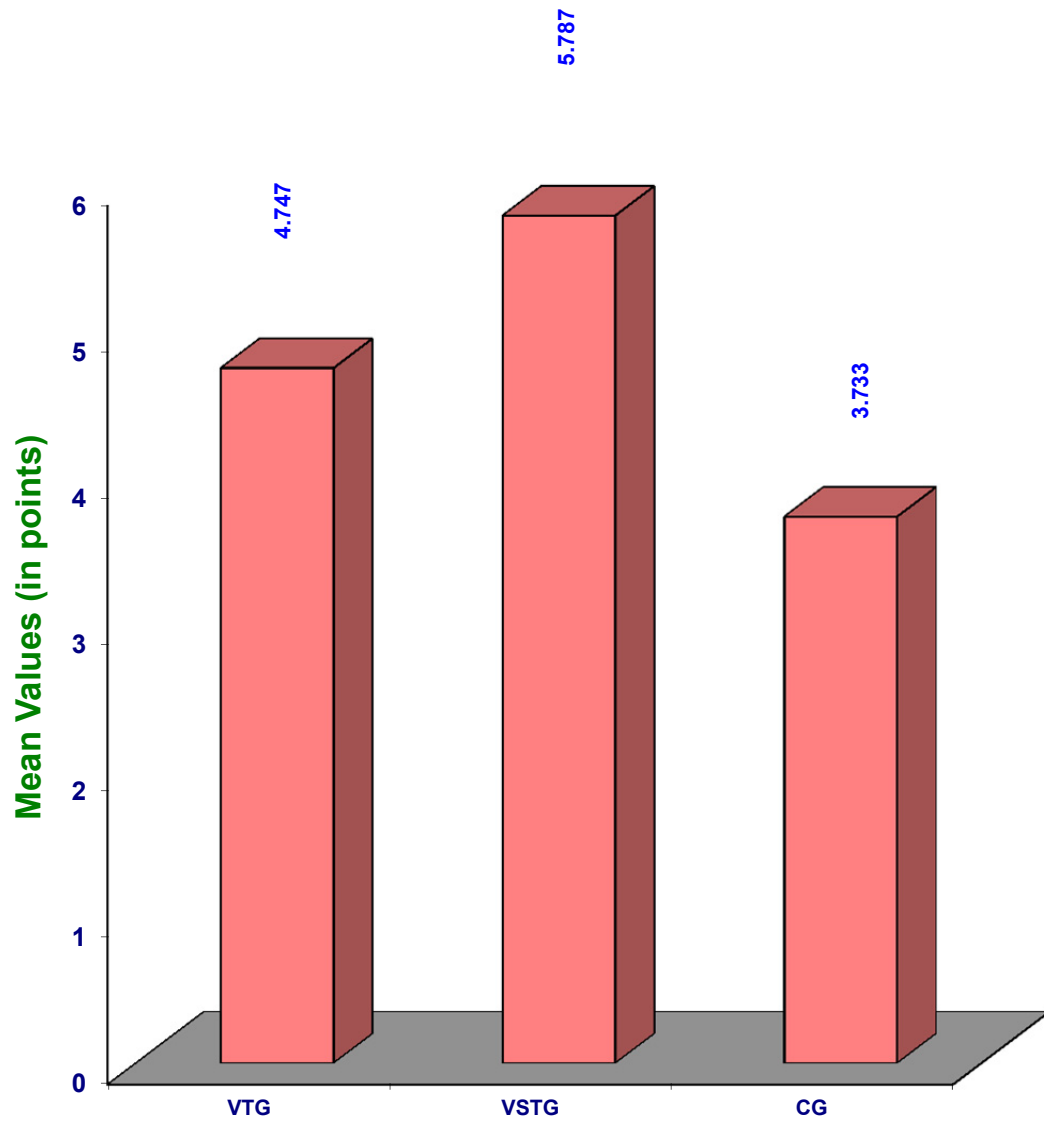


FIGURE 14
ADJUSTED POST TEST MEAN VALUES OF VTG, VSTG AND
CG ON JUMP AND THROW



■ Adjusted Post Test Mean

4.9.4. Discussion on Findings on Jump and Throw

The result of the study indicates that both the experimental groups significantly differed when compared to the control group on **jump and throw**. However, it is further revealed that the experimental group namely VTG and VSTG had improved in the performance of **jump and throw** better than the control group (CG) but VSTG had improved in the performance of **jump and throw** better than the other two groups.

Cetin and Ozdol (2012) concluded that there were significant differences between before and after training program in push up and the height of center of gravity parameters and but there is no significant differences found that vertical jump (VJ) and velocity of center of gravity (VCG). **Wagner and Muller (2008)** suggest that team-handball players who were taller and of greater body weight have the ability to achieve a higher ball release speed in the jump throw. The present study also concealed that the 12 weeks of specified training with vibrator aid and specified training with combination of vibrator aid and sign language improved the jump and throw. The result of the present investigation is also incorporated with the findings of **Rogulj, et al., (2007)** **Ziva and Lidora (2009)** and **Pori, Bon, and Sibila (2005)**.

4.10. COMPUTATION OF DEPENDENT ‘t’ TEST, ANALYSIS OF COVARIANCE AND SCHEFFE’S POST HOC TEST ON DRIBBLING

The analysis of dependent ‘t’ test on the data obtained for **dribbling** of the pre-test and post-test means of VTG, VSTG and CG were analysed and presented in Table XXIX.

TABLE XXIX
SUMMARY OF MEAN STANDARD DEVIATION AND DEPENDENT ‘t’ TEST FOR THE PRE AND POST TESTS ON DRIBBLING OF EXPERIMENTAL AND CONTROL GROUPS

(Dribbling scores are expressed in seconds)

		VTG	VSTG	CG
Pre test	Mean	39.333	38.933	38.400
	SD	2.610	2.219	2.414
Post test	Mean	36.267	33.733	37.333
	SD	2.890	2.017	3.331
‘t’ test		7.668*	12.373*	0.948

*Significant at .05 level. The table value required for .05 level of significance with df 14 is 1.761.

4.10.1. Results of Dependent ‘t’ Test on Dribbling

Table XXIX shows that the pre-test mean values of VTG, VSTG and CG on **dribbling** are 39.333, 38.933 and 38.400 respectively and the post-test mean values on **dribbling** are 36.267, 33.733 and 37.333 respectively. The obtained dependent t-ratio values between the pre and post test means of VTG, VSTG and CG on **dribbling** are 7.668, 12.373 and 0.948 respectively. The table value required for significant difference with df 14 at .05 level is 1.761. Since, the obtained ‘t’ ratio values of experimental groups are greater than the table value, it is understood that specified training with vibrator aid and specified training with combination of vibrator aid & sign language groups had significantly improved in the performance

of **dribbling**. However, the control group had not significantly improved in the performance of **dribbling**. The obtained 't' value for the control group is less than the table value as they were not subjected to any specific training.

The analysis of covariance on **dribbling** of VTG, VSTG and CG were analysed and presented in Table XXX.

TABLE XXX
ANALYSIS OF COVARIANCE FOR THE DATA ON DRIBBLING AMONG
EXPERIMENTAL AND CONTROL GROUPS

Adjusted Post Test Means			Sources of Variance	Sum of Squares	df	Mean Squares	F-Ratio
VTG	VSTG	CG					
35.894	33.696	37.744	Between	122.287	2	61.143	16.078*
			Within	155.931	41	3.803	

* Significant at 0.05 level of confidence.

The table value for significance at 0.05 with df 2 and 41 is 3.23.

4.10.2. Results of Analysis of Covariance on Dribbling

Table XXX shows that the adjusted post-test means of VTG, VSTG and CG on **dribbling** are 35.894, 33.696 and 37.744 respectively. The obtained F-ratio value is 16.078, which is higher than the table value 3.23 with df 2 and 41 required for significance at .05 level. Since the value of F-ratio is higher than the table value, it indicates that there exist significant differences among the adjusted post-test means of VTG, VSTG and CG. To find out which of the paired means had a significant difference on **dribbling**, the Scheffe's post-hoc test was applied and the results are presented in Table XXXI.

TABLE XXXI
SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN THE ADJUSTED
POST TEST PAIRED MEANS OF DRIBBLING

VTG	VSTG	CG	Mean Difference	Confidential Interval
35.894	33.696		2.198*	1.809
35.894		37.744	1.850*	1.809
	33.696	37.744	4.048*	1.809

*Significant at .05 level.

4.10.3. Results of Scheffe's Test on Dribbling

The table XXXI shows that the adjusted post test mean difference on **dribbling** between VTG and VSTG, VTG and CG and between VSTG and CG are 2.198, 1.850 and 4.048 respectively which are higher than the confidence interval value of 1.809 at .05 level of confidence.

The pre and post test mean values of VTG, VSTG and CG on **dribbling** are graphically represented in figure 15.

The adjusted post test mean values of VTG, VSTG and CG on **dribbling** are graphically represented in figure 16.

FIGURE 15
PRE TEST AND POST TEST MEAN VALUES OF VTG, VSTG
AND CG ON DRIBBLING

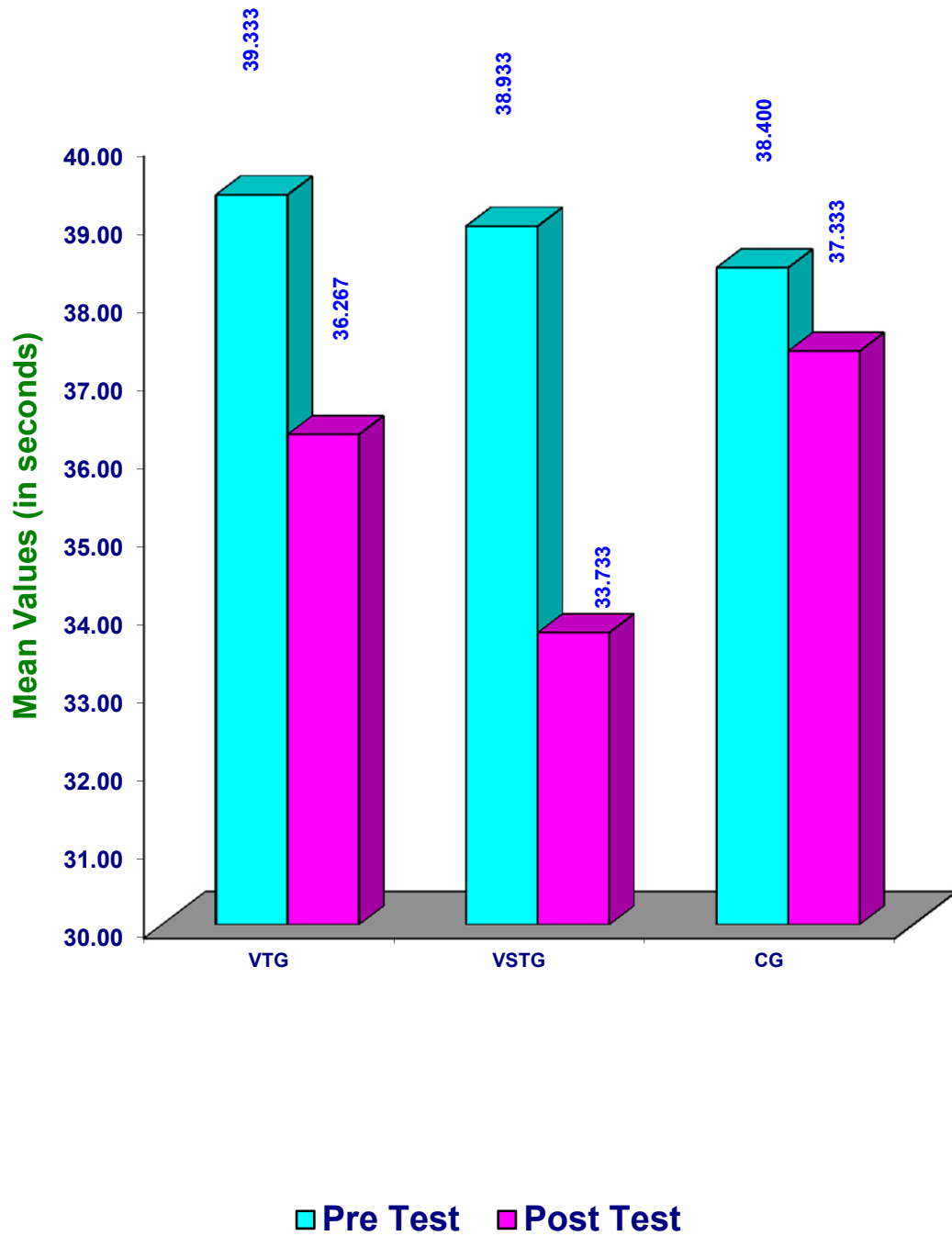
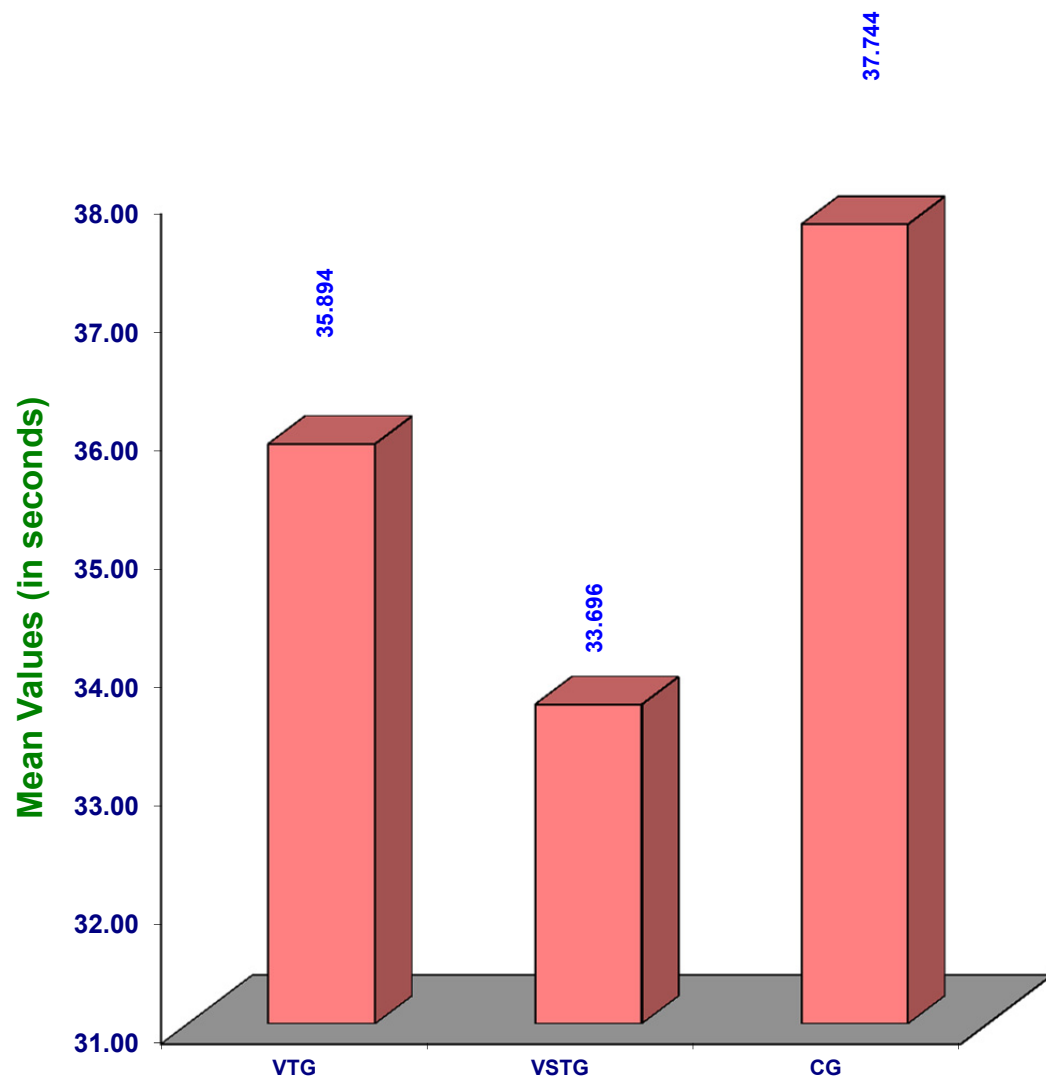


FIGURE 16
ADJUSTED POST TEST MEAN VALUES OF VTG, VSTG AND
CG ON DRIBBLING



■ Adjusted Post Test Mean

4.10.4. Discussion on Findings on Dribbling

The result of the study indicates that both the experimental groups significantly differed when compared to the control group on **dribbling**. However, it is further revealed that the experimental group namely VTG and VSTG had improved in the performance of **dribbling** better than the control group (CG) but VSTG had improved in the performance of **dribbling** better than the other two groups.

Zozo and Hassan (1999), in their study concluded that the preliminary games led to learn games and improve the basic skills of handball in the deaf and dumb and improving the motor capacity associated with these skills.

Alathari (2009), also concluded that sign language was more effective than lip-reading in learning the skills of throwing the ball from the bottom ,and throwing it front bottom to front, and didn't show any difference in the skill of throwing form the top between lip reading and sign language.

Mihaila Ion, (2014), examined the learning to play handball technique is to find and assimilate technical processes driving expression of the players optimal opportunities and increase their effectiveness as structured driving current game. This research was conducted at the level of junior handball teams during a competitive year in which research subjects were in training a large percentage of technical exercises, assessed by control samples prepared by federation of specialized or domain experts. To assess the level of technical training and progress have passed control samples at the beginning and end of the research. The present investigation also revealed that the 12 weeks of specified training with vibrator aid

and specified training with combination of vibrator aid and sign language improved the dribbling.

4.11. SUMMARY OF FINDINGS

The results of the study indicate that significant difference exists among the pre, post and adjusted post test means of experimental and control groups on selected dependent variables among deaf-and-dumb subjects.

Successful performance in handball is determined by the specific technical-tactical skills (or knowledge of the elements) and by the quality level of basic physical condition or fitness. Successful performance of handball technical-tactical elements depend primarily on the level of the coordination-related abilities and on the strength/power fitness. Previous Croatian studies on situation-related motor abilities (**Vuleta, Simenc, & Ticic, 1990**), make it possible to presume that there are five latent situation-related motor dimensions accuracy, ball handling, motion speed without the ball, motion speed with the ball and ball throwing power. **Abdullah and Yakoot Zidane (2001)**, recommend that special training programme improved the Volleyball skill among the deaf-and-dumb students. **Zozo and Hassan (1999)**, stated that preliminary games led to learn games and improve the basic skills of handball among the deaf-and-dumb students and improving the motor capacity associated with these skills.

Previous research conducted by **Spelmezan,, et al., (2012)**, focused on designing tactile stimuli that could intuitively represent body movements. Accuracy of throwing at the goal is an ability to realize cumulative attacking engagement of the whole team in score-open situations which is the last controlled action on the attack. For acquiring motor skills, such as in sports training, it is important that the

learner frequently receives instructions on how to perform the skill and feedback on the performance. Coaches typically give instructions and feedback before and after a trial, and concurrently during the execution of the movements. Yet in many sports the coach cannot correct the learner during an exercise. A good case in point is snowboarding. Snowboarders receive instructions before descending the slope and delayed feedback after the ride. During the ride, they are spatially separated from their coach. They have to rely on their own perception of what is right or wrong (Van, et al., 2006). Vulet, et al., (2006), stated that teaching and training programmes should simultaneously develop all motor abilities and continuously apply operators (training contents) in which aiming and hitting of targets of various sizes and forms is performed both from standing positions and while moving. Present research also reported that deaf-and-dumb subjects were able to recognize and to identify vibration-aid and sign language instructions during the training period. In the present investigation the result showed that, the use of a vibrator aid instruction based specified training and combination of vibrator-aid and sign language instruction based specified training improve dribbling, accuracy throw, jump and throw performance in handball.

Galvin, et al., (1993), studied the training program used with the University of Melbourne's multiple-channel electrotactile device is presented to show how these important factors may be addressed, to indicate the flexibility required in a training program and to provide a general framework on which researchers may base the development of programs for other tactile devices. Spelmezan, (2012), identified the conditions under which tactile instructions can support athletes in sports training. Alathari and Manatee (2009), study showed that

sign language was more effective than lip-reading in learning the skills of throwing the ball from the bottom and throwing it front bottom to front among deaf and mute. **Gallace, et al., (2007)**, concluded that in relation to current theories of cross-modal integration and to the cognitive resources and/or common higher order spatial representations possibly accessed by both visual and tactile stimuli. The present study also used the tactile instructions and sign language method during the specified training sessions. In the analysis of the data indicating that specific training with vibrator aid and specific training with combination of vibrator aid & sign language method improves the psycho-motor variables and skills in handball among deaf and dumb college students.

4.12. DISCUSSION ON HYPOTHESES

1. It was mentioned in the first hypothesis that there would be a significant improvement on selected psycho motor and skill related variables in handball due to the influence of specified training with vibrator aid instruction. The result of the present study showed that significant improvement on selected criterion variables such as reaction time, movement time, 9 meter front throw, dominant hand speed pass, overhead pass, accuracy throw, jump and throw, and dribbling among deaf and dumb college students. Hence, the first hypothesis was accepted at 0.05 level of confidence.
2. It was mentioned in the second hypothesis that there would be a significant improvement on selected psycho motor and skill related variables in handball due to the influence of specified training with combination of vibrator aid & sign language instruction. The analysis of the data revealed that due to the influence of specified training with vibrator aid and sign language significantly

improved on selected criterion variables among deaf and dumb college students. Hence, the second hypothesis was also accepted at 0.05 level of confidence.

3. In the third hypothesis, it was mentioned that there would be a significant improvement difference between specified training with vibrator aid and specified training with combination of vibrator aid and sign language instruction on selected criterion variables among deaf and dumb students. The result of the present investigation also showed that the deaf and dumb college students who underwent specified training with combination of vibrator aid and sign language instruction improved significantly on selected criterion variables than that of who underwent specified training with vibrator aid instruction. Hence, the third hypothesis was accepted at 0.05 level of confidence.

CHAPTER V

SUMMARY CONCLUSIONS AND RECOMMENDATIONS

5.1. SUMMARY

The purpose of the study was to investigate the effect of specified training with sign language and vibrator aid on selected psychomotor variables namely, reaction time and movement time and skills in handball namely 9 meter front throw, dominant hand speed pass, overhead pass, accuracy throw, jump and throw and dribbling among deaf and dumb college students.

For the present study, forty five deaf and dumb men students were selected randomly from Presidency College, Chennai. The age of the subjects ranged between 18 and 25 years and their hearing impairment level is 90%. Selected subjects were divided into three equal groups namely experimental group I (VTG) underwent specified training with vibrator aid (n=15), Group II (SVTG) underwent specified training with combination of vibrator aid & sign language and Group III (CG) served as control group (n=15). The selected criterion variables psychomotor and handball skills were assessed prior to and immediately after the 12 weeks of training period by using the standardized tests. The experimental design used in this study was pre and post test random group design involving 45 subjects. The collected data were analyzed by using Analysis of Covariance (ANCOVA). Whenever the 'F' ratio was found to be significant, Scheffe's test was used as post-hoc test to determine which of the paired means differed significantly. In all cases the criterion for statistical significance was set at 0.05 level of confidence (P<0.05).

5.2. CONCLUSIONS

The current study focuses on specified training with vibrator aid and sign language on selected psychomotor variables and skills in handball among deaf-and-dumb college students. The researchers investigated only male handball players, and training was designed only for them.

1. Twelve weeks of specified training with vibrator aid and combination of vibrator aid & sign language instruction based training reduced the reaction and movement time.
2. The present research concluded that specified training with vibrator aid and combination of vibrator aid & sign language improved the passing and throwing skills in handball.
3. Our findings indicate that specified training with vibration aid and combination of vibration aid & sign language could support deaf-and-dumb students in improving dribbling and accuracy performance.
4. At the same time enhancing the performance of all the dependent variables, specified training with combination of vibrator aid & sign language was better than the specified training with vibrator aid.
5. Based on the findings, the researcher concluded that specified training with vibration aid and specified training with combination of vibration aid & sign language are practical approaches for learners in enhancing handball skills if these instructions are adapted to meet up the learners' needs during training.

5.3. RECOMMENDATIONS TO THE SOCIETY

1. Since the specified training with combination of vibration aid & sign language is identified as the decisive training, it is recommended to the coaches and physical education teachers to include them in their regular schedule of coaching and training programme.
2. It is proposed vibration aid and sign language instructions will be gradually introduced during the training sessions and correct the errors committed by the players to enhance the performance of the players.
3. Intend to conduct a long-term study where vibration aid and sign language instructions are gradually introduced during training.

5.4. RECOMMENDATIONS TO THE RESEARCHERS

The results of the study brought out the following recommendations for further studies in this area.

1. Substantiate the findings in other training settings and for other physical activities/sports and games.
2. The intensity of the training and number of training sessions can be fixed according to the age and gender level of the subjects.
3. The present study thus needs to be strengthened or supported by more relevant research studies.

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APPENDIX A
RAW SCORES OF VTG, VSTG AND CG ON REACTION TIME

S.No.	VTG		VSTG		CG	
	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
1	0.20	0.17	0.21	0.20	0.22	0.23
2	0.20	0.18	0.21	0.20	0.21	0.20
3	0.21	0.19	0.20	0.19	0.22	0.21
4	0.23	0.21	0.21	0.17	0.21	0.21
5	0.21	0.19	0.21	0.19	0.23	0.23
6	0.22	0.20	0.19	0.16	0.20	0.19
7	0.21	0.20	0.19	0.17	0.21	0.22
8	0.21	0.19	0.22	0.17	0.21	0.20
9	0.21	0.19	0.21	0.18	0.20	0.21
10	0.21	0.20	0.23	0.16	0.21	0.22
11	0.22	0.21	0.22	0.16	0.20	0.19
12	0.21	0.20	0.22	0.20	0.21	0.22
13	0.20	0.18	0.22	0.20	0.22	0.21
14	0.23	0.20	0.23	0.19	0.22	0.20
15	0.23	0.23	0.22	0.19	0.21	0.21

APPENDIX B
RAW SCORES OF VTG, VSTG AND CG ON MOVEMENT TIME

S.No.	VTG		VSTG		CG	
	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
1	0.29	0.28	0.29	0.26	0.29	0.29
2	0.29	0.28	0.28	0.26	0.29	0.28
3	0.28	0.27	0.29	0.25	0.29	0.28
4	0.29	0.28	0.29	0.26	0.28	0.27
5	0.27	0.26	0.28	0.25	0.30	0.29
6	0.29	0.26	0.29	0.26	0.28	0.28
7	0.29	0.28	0.29	0.27	0.29	0.30
8	0.28	0.27	0.30	0.27	0.29	0.27
9	0.29	0.28	0.29	0.27	0.29	0.29
10	0.29	0.27	0.29	0.25	0.27	0.27
11	0.29	0.28	0.30	0.26	0.28	0.27
12	0.29	0.28	0.29	0.27	0.27	0.28
13	0.27	0.26	0.30	0.26	0.30	0.29
14	0.29	0.27	0.29	0.28	0.28	0.28
15	0.27	0.25	0.28	0.26	0.29	0.28

APPENDIX C
RAW SCORES OF VTG, VSTG AND CG ON 9 M FRONT THROW

S.No.	VTG		VSTG		CG	
	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
1	9	14	12	20	11	12
2	11	14	12	18	10	11
3	8	12	11	18	10	11
4	14	16	13	20	11	12
5	10	13	11	18	11	12
6	11	15	14	20	12	13
7	12	14	11	18	12	13
8	11	16	12	18	12	9
9	11	13	12	19	11	12
10	9	17	11	14	12	13
11	9	13	10	13	12	13
12	12	21	11	14	12	12
13	11	17	12	19	12	12
14	12	15	9	15	12	12
15	13	15	8	14	11	12

APPENDIX D
RAW SCORES OF VTG, VSTG AND CG ON DOMINANT HAND
SPEED PASS

S.No.	VTG		VSTG		CG	
	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
1	43	40	48	44	44	43
2	49	48	46	42	49	48
3	46	45	48	44	48	47
4	48	46	44	41	49	47
5	48	47	46	41	44	41
6	47	45	40	37	48	47
7	47	45	46	43	46	48
8	46	43	48	44	44	45
9	46	43	46	43	47	45
10	44	41	45	41	47	43
11	47	45	48	44	43	42
12	47	45	48	43	49	48
13	48	46	49	45	43	42
14	46	44	46	41	44	45
15	49	47	48	44	44	45

APPENDIX E
RAW SCORES OF VTG, VSTG AND CG ON OVERHEAD PASS

S.No.	VTG		VSTG		CG	
	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
1	6	8	5	8	8	9
2	6	9	5	9	6	7
3	6	8	6	9	6	7
4	6	7	9	11	7	9
5	6	8	10	12	5	6
6	5	7	9	11	8	9
7	7	8	7	10	8	9
8	6	8	7	12	8	9
9	5	7	9	10	5	8
10	6	8	6	10	5	7
11	6	7	7	11	5	7
12	7	8	7	10	8	4
13	8	9	6	9	8	6
14	9	10	6	11	7	5
15	7	11	6	9	6	5

APPENDIX F
RAW SCORES OF VTG, VSTG AND CG ON ACCURACY THROW

S.No.	VTG		VSTG		CG	
	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
1	5	6	5	7	5	6
2	4	5	5	7	5	4
3	5	6	4	5	5	4
4	6	7	4	6	5	6
5	5	6	4	6	5	4
6	5	6	5	7	4	5
7	5	5	4	6	5	6
8	4	5	5	6	4	5
9	5	6	5	6	5	4
10	4	5	6	7	4	3
11	5	6	5	7	6	7
12	4	5	5	7	5	6
13	5	5	6	8	5	4
14	4	5	6	7	4	5
15	5	6	4	6	3	4

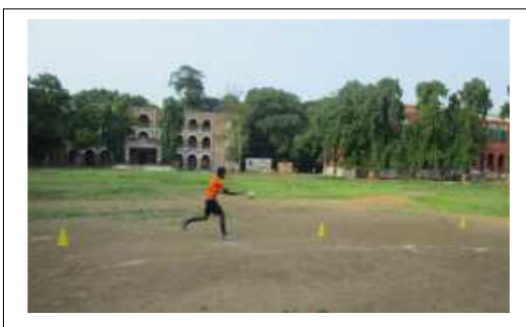
APPENDIX G
RAW SCORES OF VTG, VSTG AND CG ON JUMP AND THROW

S.No.	VTG		VSTG		CG	
	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
1	4	5	3	4	3	4
2	3	4	3	5	4	3
3	4	5	4	5	3	4
4	3	4	3	5	1	2
5	3	4	3	6	3	2
6	3	4	4	7	4	5
7	3	4	4	6	4	4
8	3	4	3	6	4	3
9	4	5	3	6	3	3
10	3	4	4	6	5	4
11	4	5	4	8	5	4
12	4	5	4	6	5	5
13	5	5	4	5	3	4
14	6	9	3	6	4	5
15	3	5	4	5	3	4

APPENDIX H
RAW SCORES OF VTG, VSTG AND CG ON DRIBBLING

S.No.	VTG		VSTG		CG	
	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
1	40	36	36	31	38	34
2	36	38	37	34	39	37
3	40	38	39	36	38	36
4	36	33	38	34	36	35
5	42	38	38	34	39	38
6	34	29	40	32	41	40
7	38	34	39	36	45	44
8	38	36	39	34	39	38
9	40	35	42	36	38	36
10	40	37	39	33	35	36
11	38	34	40	32	36	35
12	42	40	43	36	39	45
13	42	39	42	36	36	35
14	41	38	36	32	39	34
15	43	39	36	30	38	37

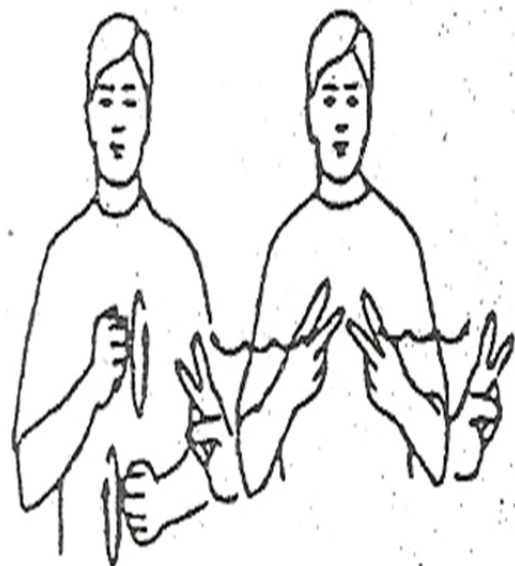
APPENDIX I
PILOT STUDY RELATED PHOTOS



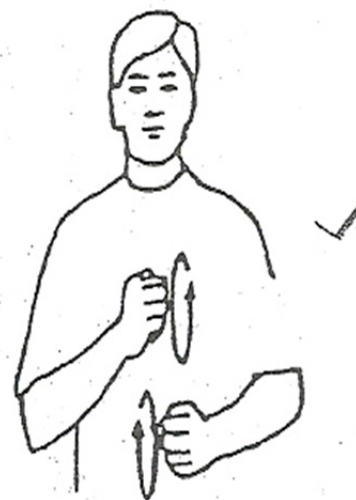
APPENDIX J
TRAINING PERIOD RELATED PHOTOS



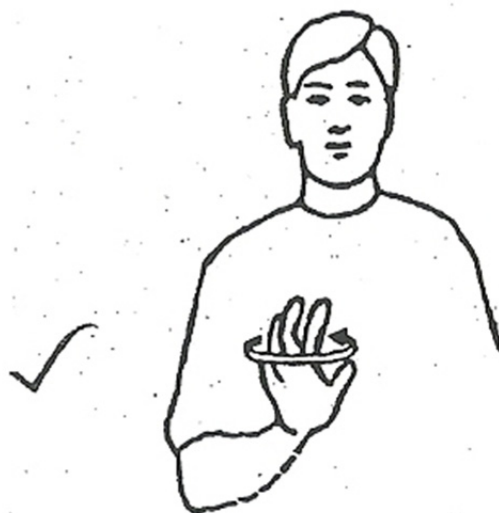
APPENDIX K
TRAINING RELATED SIGN LANGUAGE PHOTOS



GAMES



SPORTS



BALL

APPENDIX K (Contd...)



PLAY SIGN - 1



PLAY SIGN - 2

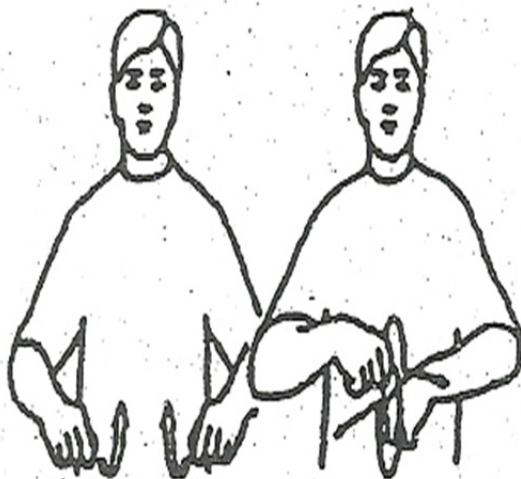


DO



FOLLOW

APPENDIX K (Contd...)



SHOE



SOCKS

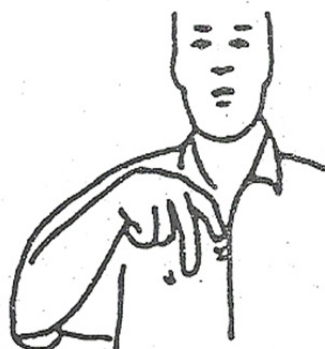


TODAY



TOMORROW

APPENDIX K (Contd...)

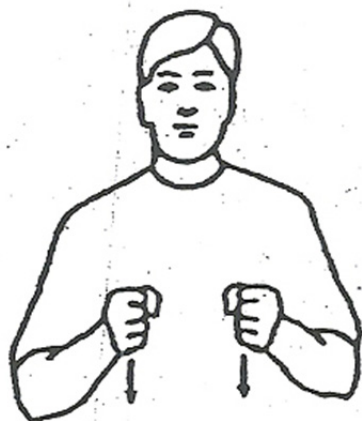


107A 1/2

WALK



RUN



SIT



STAND

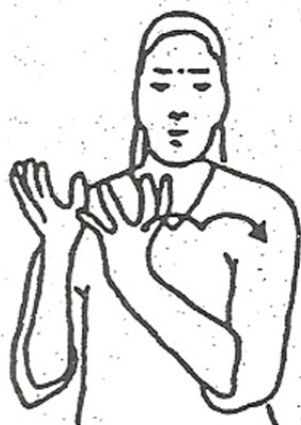
APPENDIX K (Contd...)



JUMP



CATCH



CARRY



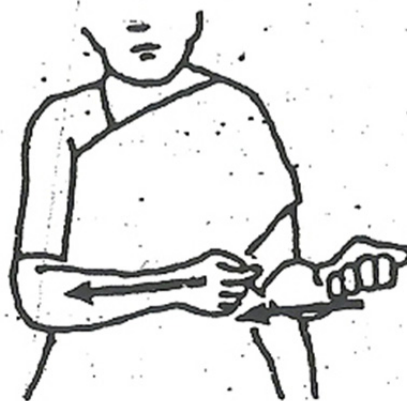
PUSH

PUSH

APPENDIX K(Contd...)



TRAVEL



PULL



MEET



CHASE

APPENDIX K (Contd...)



EVENING SIGN 1



EVENING SIGN 2



DOUBT



THINK