CHAPTER V
SUMMARY AND CONCLUSION

5.0 Introduction

The eye is truly a magnificent organ and our primary link to the outside world. The present study entitled "Developing Spatial Ability among Visually Impaired Students" is related to the enhancement of spatial abilities in visually impaired children. Spatial ability is a collection of cognitive skills which are responsible for the performance of the individual in different walks of life. The Spatial Abilities of Visually Impaired was compared with that of Blind-folded Sighted Students. Spatial Ability in this study is related to Distance Estimation, Mental Rotation, Delineation, Assembling, and Rotational Displacement. This chapter presents the major findings emerged out of the study, and concluding remarks based on the findings of the study. It also points out of the Recommendations and Suggestions for Further Research followed with Conclusion.

5.1 Major Findings

The major findings emerged out of this study are :

1. The overall results revealed that Intervention helped acquiring Spatial Ability Skill among Visually Impaired Students.
2. In all the Spatial Ability Skill, Blind-folded Sighted secured higher score in the pretest but the Visually Impaired Students outperformed them in the posttest.
3. The Visually Impaired Students secured higher score in Basic Concept test, Distance Estimation, Mental Rotation and Delineation Skill in the posttest but their score was lesser in the pretest.
4. Pertaining to the level of gain the students achieved, the Visually Impaired students secured more gain in the posttest.
5. As regards to Time Taken for Assembly Test and the test for Rotational Displacement, the Blind-folded Sighted students have taken less time in pretest but in the posttest, the Visually Impaired Students performed with

lesser time than the Blind-folded Sighted students. However in the Assembly of Triangle, both Visually Impaired and Blind-folded Sighted students have taken the same amount of time.

6. Considering the influence of Gender on Spatial Ability, the study revealed that Gender did not influence. However Grade did influence, the Higher Grade Students secured higher score than the Lower Grade students.
7. The ANCOVA test revealed that Gender and Type of students (Visually Impaired and Blind-folded Sighted) did not have interaction but Grade and Type of Students have interaction.
8. Braille Reading Skill did not influence on Distance Estimation, Mental Rotation and Delineation Skill.

5.2 Discussion

The major goal of the study was to analyze whether Spatial Ability will be acquired by the visually impaired persons if training is given. The study is in line with the study conducted by Uttal DH et al (2012) who concluded that we can indeed improve spatial skills, and that such training can transfer to new tasks. Moreover, not only can the right sort of training improve spatial skill in general, and across age and gender, but the effect of training appears to be stable and long-lasting.

The next objective was to compare the spatial skill ability among visually impaired students vs blind-folded sighted students. A number of studies have been conducted having visually impaired and blind-folded sighted students as participants. The present study revealed that the blind-folded sighted students secured higher score than visually impaired students before training. But after systematic training, the present study has demonstrated that visually impaired students acquired spatial skills and outperformed blind-folded sighted students. This finding in incongruence with the findings of Albert Postma et al (2005) stating that visually impaired persons have shown considerable improvement in visual and haptic experiences. But this study is in contrast with the study by Fisher (1964) that blind participants performed poorer than the blind-folded sighted participants in auditory and tactile localization. But the present study involved training to visually impaired students in spatial skills.

R.W. Van Boven e tal (2000) stated that Braille Readers have superior spatial acuity but this finding in not incongruence with the present study which showed that Braille Reading did not influence spatial ability.

Regarding Gender difference in spatial ability, mixed findings are noted. Tim Koscik (2008) reported that Men consistently outperform women on spatial tasks, including mental rotation, which is the ability to identify how a 3-D object would appear if rotated in space. A new study shows a connection between this sex-linked ability and the structure of the parietal lobe, the brain region that controls this type of skill. Moshe Hoffman and his team (2011) suggested that that conventional thinking that male outperform female in spatial ability might be wrong. He and his team have published a paper on the *Proceedings of the National Academy of Sciences* that suggests that spatial ability comes more as a result of the environment in which a person is raised, rather than from gender. But the present study supports Moshe Hoffman that Gender did not influence Spatial ability.

5.3 Recommendation

1. Spatial skill predicts achievement in learning particularly science and technology. But they get little attention in schools. Hence it may be recommended that curriculum should give specific suggestions for fostering spatial skills among school children.
2. The development of "number sense" and spatial thinking are closely tied, and early spatial intelligence predicts a child's performance in mathematics. A growing body of research suggests that children hone spatial skills through certain kinds of play. The educational personnel may pay attention to incorporate activities that develop spatial skill in the play.
3. The students with visual impairment in Indian context today mainly learn core curriculum at schools. They are deprived of expanded curriculum which has an impact on their lives. The present study revealed that visually impaired students can acquire skills if they are trained systematically. Hence the study suggests that visually impaired students need to not only learn the areas of the core curriculum, but they must learn important life skills in order to be successful in life. Embedding spatial skills within the curriculum will help

students in Braille Reading and Orientation & Mobility and ultimately help them to be independent.

4. The training institutes may incorporate a component in to the curriculum so that the teacher trainees may understand the significance of spatial skills and in turn they impart the knowledge to the students.
5. It is recommended that parents can attach importance to spatial ability and they may be oriented by the school personnel to embed spatial skill development activities in play at home environment.

5.4 Suggestion for Further Research

The present study suggests researchers to investigate on

- Spatial visualization and gender differences
- Development of spatial ability test in Indian Context
- Drawing ability and spatial ability among hearing impaired students
- Influence of spatial ability on computer performance task of visually impaired adults
- Development of spatial thinking in school children
- Teachers' ways of developing spatial activities.

5.5 Educational Implications

The findings of the present study have implication for Teachers, Teacher Educators, and Text Book Writers.

Teachers

Children with disability in the class room has a problem that many teachers face today. Spatial ability is also important for success in many fields of study. Visual spatial skills are of great importance for success in solving many tasks in everyday life. Visually impaired children can be encouraged from an early age to adopt appropriate strategies that will improve the quality of their spatial representation. The study will help the teachers to adopt the strategies developed.

Teacher Educators

The strategies adopted and the data analyzed may be helpful to the teacher educators to follow and introduce a component in the curriculum.

Textbook Writer

Book by the Indian authors in the filed of Special Education are recently being emerged. The spatial ability programme evidenced in the study have implication for the writers. The book writers incorporate the activities fostering spatial ability and the evaluation procedure in their book writings.

5.6 Conclusion

Loss of vision is believed to have a great impact on the acquisition of spatial knowledge. Moreover, blindness has a negative impact on the development of blind people's spatial skills. It is often assumed that the spatial senses (vision, hearing and the tactual senses) operate as distinct and independent modalities and, moreover, that vision is crucial to the development of spatial abilities. The aims of the present study were to examine the performance of individuals with visual impairments on spatial tasks. This study stands evidence that participants with visual impairments are competent to perform spatial task if systematic training is provided at the early age.