CHAPTER V

SUMMARY AND CONCLUSION

5.0 Introduction

The present study is entitled “Effect of Tech aided Grade 2 Braille Tutoring System for Students with Visual Impairment”. Braille is a code and this is a system of reading and writing a unique language used by persons with visual impairment. Braille enables persons with visual impairment to read through touch. This study is related to development of Tech Aided Grade 2 braille tutoring system. English braille is known as Grade 2 Braille. There are three levels in English Braille. Grade 1 Braille is the exact transcription of printed English. Grade 2 Braille has contractions which mean English words are abbreviated. Grade 3 is of personal short hands which is not standardized as Grade 1 and Grade 2 Braille. This Grade 2 Braille is Contracted Braille system of “short cuts” where one letter might represent an entire word. There are letter combinations, or contractions, that represent whole words without spelling out each letter in the word. Contracted Braille takes up less space and improves an individual’s speed in both reading and writing**.** Contractions are simply shorthand for words and part-words. Braille uses contractions to facilitate the speed of reading by touch that is strongly correlated to the number of characters in a text and also to reduce the bulk of embossed transcriptions. Braille symbols for contractions can use either one cell or several consecutive cells. Grade2 Braille actually save the most effort in reading Braille and in storing embossed Braille. Grade2 Braille are generally much easier to learn for both children and adults.

5.1 Rationale

Among the many learning challenges faced by students with visual impairments, the development of literacy is particularly problematic. The braille code is one means of developing literacy for blind individuals in which each letter and number of the English alphabet is represented by a unique tactile symbol. Each symbol is composed of the presence or absence of a raised dot in up to six locations in a cell comprised of two columns and three rows. Each dot is approximately 1 mm in diameter, and there is approximately 1.5 mm between the midpoints of each dot

location within a standard cell. Each word of the English language can be transcribed into braille with a point-to-point correspondence between the text letter and the braille symbol. Recent research suggests the literacy rates for visually impaired students have decreased considerably in recent years, while the visually impaired population has grown (Braille Institute, 2010). Estimates by the National Braille Press suggest that only 12% of legally blind individuals can read braille, which is a substantial decline from the 50% of reported braille readers in the 1960s (Brittain, 2007).

Along with the decline in literacy rates, classroom-based braille instruction has decreased over the past several decades. In 1968, 40% of students with visual impairment enrolled in elementary and secondary education were reported to be reading braille, but in more recent years these estimated levels dropped to between 9% and 22% (Braille Institute, 2010; Department of Field Services of the American Printing House for the Blind, 2009; National Federation of the Blind, 2009). Some have suggested that individuals with visual impairment may be less reliant on braille due to the increased availability of large-print books and advances in technology that make auditory media more available and accessible (Johnson, 1996). Although technology may replace the need for braille literacy under some circumstances, the complete omission of braille literacy may limit individuals' opportunities for independence throughout life (e.g., braille is often available in public places such as elevators and ATMs, and much of the current technology is not transportable). Ryles (1996) reported that adults who were congenitally legally blind and were taught braille as their first means of literacy had higher employment rates, higher educational levels, and better financial stability, on average, than adults with similar disabilities but who were first taught as large-print readers.

In addition to technological advances, several sources have suggested that declining braille instruction is attributable, in part, to a deficit in qualified braille instructors (Bell, 2010; Johnson, 1996; Mason, Davidson, &McNerney, 2000; National Federation of the Blind, 2009; Ponchillia& Durant, 1995), the use of general education teachers with no braille training as braille instructors (Johnson, 1996), a lack of training programs, and different standards of qualification in those programs that do exist (Amato, 2009). Standards for training instructors of the visually impaired differ considerably among states. There is a general consensus that an instructor needs to be

able to read braille, both for rapid prompting and correcting during instruction and to create instructional material (Bell, 2010; Pierce, 2006).

The traditional approach to teaching braille is to teach tracking and pre-literacy (or pre-braille) skills, then move to the alphabet, alphabet words, short-form words, contractions, and then final-letter contractions. This method is very time consuming before the student can successfully read grade-level materials. This method goes against the adaptability needed for a diverse population of readers presented in a multi-case study of reading (Vaughn, 2019 In a traditional school setting it can take years to advance their reading ability to a rate competitive with their sighted peers. Braille readers lack the incidental learning as print readers receive daily through environmental print. Teachers of the blind must orchestrate opportunities for the braille reader to experience these learning moments throughout the curriculum. Many of the current programs for teaching young braille readers isolate them into a separate curriculum where they are not experiencing the same learning environment as their sighted peers. These programs not only isolate the student from their sighted peers, they are often not motivating and contain unauthentic learning activities for the student. Gambrell and Marinak (2009) recognized all highly effective reading programs had certain characteristics that distinguished the program as highly effective and motivating was one of those characteristics. The teacher of the blind must create meaningful, authentic activities across the curriculum motivating the student to interact with the curriculum while learning braille. Relevance provides the motivation to want to learn to readeven when students have previously been unsuccessful. (Wormsley, 2011)

The Individuals with Disabilities Education Act (USA) amendments of 2004 rec-ognized the importance of assistive technology devices for students with disabilities.Individual Education Plan teams must appropriately consider the complete range of devices and services available to students with visual impairment because the devices may affect the development of students' self-confidence and self-esteem. Also, students trained in the skills neces-sary to cope with their disability-specific needs by using assistive technology devices are increasingly capable of participating fully with their nondisabled peers in general education settings (Educating blind and visually impaired students, 2000).

Though it is known that teachers are trained to teach pupils in schools and conduct lessons every day, teaching pupils with visual impairment constitutes a challenge for teachers (Simalalo, 2006). Pupils with visual impairment require alternative forms of teaching and learning methods. This includes the use of Braille to read and write and other assistive devices that increase accessibility to education. One of the most important skills when learning Braille is that it is such a unique skill to have. However in today's context pupils with visual impairment are deprived of Braille reading skills. The World Blind Union strongly recommends that all blind and severely partially-sighted children be given the opportunity to learn and become proficient in Braille reading and writing skills and they receive instruction from those who are thoroughly trained and qualified to teach Braille. Braille can be written using individual letters of the alphabet, and this is known as Grade 1 or uncontracted Braille. It can also be written using contractions or Grade2 Braille. It is quick, simple and can be faster to read than grade 1 Braille. Unlike the eyes, the fingers cannot be taught to take in a whole line at a glance. The information is put into smaller packages. If the child can run her fingers over the letter c and read the word "can,"or the letter l and read the word "like,"she can, in a sense, absorb information at a tactile glance. Reading a whole-word contraction is quicker than having to read "c-a-n"or "l-i-k-e. Grade2 Braille save time and space because Braille is big and takes up more space than standard print. Grade2 Braille also make reading and writing Braille much faster. Most braille, like books, signs in public places, menus, and most other braille materials, are done in Grade2. Heather Field (2012) recommended teaching contracted Braille from the start. The amount a child can read is limited to the number of actual dots he/she can get under the fingertips at a given time.

Considering the present context, a survey of literature related to technology aided Grade2 Braille was explored in Indian context. But studies on technology based braille tutoring system were hardly found . Hence an attempt was made to develop technology based Grade2 Braille Tutoring System which intended to provide three modes viz., Learning Mode, Practice Mode and Evaluation Mode. The newly developed tech aided system is for independent use for visually impaired persons ,student teachers and special teachers and anyone interested to learn Braille.

5.2 Objectives of the Study

The objectives of the study were to:

1. Develop Tech Aided Grade2 Braille Tutoring System to enhance Braille literacy of students with visual impairment.
2. Study the effect of Tech Aided Grade2 Braille Tutoring System by introducing it to the students with visual impairment.
3. Compare the test mean scores of Grade2 Braille obtained by the students with visual impairment before ,during and after introduction of Tech Aided Grade2 Braille Tutoring System.
4. Compare the Progress Monitoring scores of Grade2 Braille obtained during the course of intervention.
5. Rate the effectiveness of the Tech Aided Grade2 Braille Tutoring System by introducing it to the special education student teachers and special teachers.
6. Study the influence of Gender on learning of Grade2 Braille with Tech Aided Tutoring System.
7. Study the influence of Grade on learning of Grade2 Braille with Tech Aided Tutoring System.
8. Study the influence of Locality on learning of Grade2 Braille with Tech Aided Tutoring System

5.3 Method

The method of this study has two stages

Stage I: Develop Tech Aided Grade2 Braille

Stage II: Study the effectiveness of Tech Aided Grade2 Braille by introducing it to the students with visual impairment

Content Preparation for Development of TAG2B

Alphabet stands for English alphabet. They are 26 in numbers. Contraction is the shortest way of writing the Braille that helps the Braille user to read and write faster. They are called as Grade 2 Braille. In the present study they were categorized into 11 modules. such as ‘Alphabet word signs, Strong word, Lower word, Dot 5 with initial letter, Dot 4-5with initial letter, Dot 4-5-6 with initial letter, Final letter, Short

form words, Indicators, Punctuation and Grouping punctuation'. Totally, they are 170 contracted English words in Braille besides 26 alphabets, Indicators (25) and Punctuation (25). The 'QWERTY' key of existing computer key board has been converted to Braille keys by downloading Duxbury software. Duxbury Keys for Level 1: Alphabet and Level II: Grade2 Braille was formulated and framed into Eleven modules and converted into Digital content for development of Tech Aided Graded 2 Braille Tutoring system.

5.4. Stage I: Develop Tech Aided Grade2 Braille

Based on the requirement of 'TAG2B', various diagrams like end product of tool, object oriented diagram, static and behaviour diagrams of UML were created. Attributes, methods and their relationships were identified. Based on this, the development team developed the software. Hence the output for the former phase is the input of the later phase. There are three builds in developing TAG2B. Design of developing alphabet of Braille comes in build 1. Design of developing first 5 Grade2 Braille were done in build 2. Last 6 Grade2 Braille were done in build 3.The entire 'TAG2B' modules was divided into smaller units. Each unit was developed in separate build-ups. Once the smaller unit of the software was developed, it was necessary to verify the software whether it works perfectly or not and hence verification and validation was done. Then the software was released to the end user to check if the acknowledgement was positive or negative. Based on the acknowledgement the 'TAG2B' software was modified. Document was done converting entire 'TAG2B'software into words and Braille configurations. It was a user manual to guide the user how to operate the 'TAG2B' software. It describes the step by step working process of the software. This helps for the layman to understand the 'TAG2B' tool and to use it indicating the time consumed for entire desired work.

5.5 Stage II: Study the effectiveness of Tech Aided Grade2 Braille

To study the effectiveness of Tech Aided Grade2 Braille, samples from students with visual impairment population have been selected.

a. Site Selected

The study was conducted in Inclusive Schools in Coimbatore district of Tamil Nadu. The students with visual impairment from Grade VIII to XII were selected.

b. Selection of the Sample

The sample comprised of 42 students with visual impairment (boys-22; girls-20) from Grade VIII to XII studying in 26 Higher Secondary Schools in Coimbatore District of Tamil Nadu .In the selection of the sample, Inclusion and Exclusion criteria were kept in mind.

Inclusion criteria

a. Inclusion includes students with visual impairment
b. visual acuity not exceeding 6/60
c. students with visual impairment studying in urban schools as specified in District Educational Office
d. Students with visual impairment studying in Inclusive schools from Grade IX to XII.

Exclusion criteria

a. students with visual impairment with associated disability,
b. students studying in Private schools,
c. visual acuity exceeding 6/60
d. Students whose parents were not willing to permit their ward to participate in the study

c. Design of the Study

Stratified random sampling technique was adopted to select the sample. The design adopted in the study is Quasi Experimental Design. It is a Single Group Design. Pre observations/ test and Post observations/ test were made besides Treatment. The layout of the design is O1× O2. Here O1 is Pre observation, O2 is Post observation and × is Treatment in this experimental study.

d. Tool

i. Personal Data Bank

To collect general information regarding Gender, Grade and type of the School, Personal data bank was developed.

ii. Tool to assess the level of acquisition of Braille Alphabet

The tool was used to measure the acquisition of Braille skills. This involved 26 items in Manual Braille related to Braille alphabet. Knowing the Braille Alphabet is a pre-requisite to move on to Grade2 Braille and hence a test was administered and 1 score was given for each correct response. The test items was in tactile braille format. This test was administered as pretest.

Scoring: For each correct response, one score and Zero score for incorrect response

iii. Assessment of Performance of Grade2 Braille

The test was aimed to measure the performance of students with visual impairment on Grade2 Braille. Two hundred and twenty Grade2 Braille were included from the new edition of the Braille Primer (1955) and checklist of Literacy Braille skills(revised 2016) which offers a complete course in Grade2 standard English Braille. Here in this study'TAG2B' were used.

Scoring: For each correct response one score and zero score for incorrect response.

iv. Measuring Internal Consistency of Tool

A rating scale related to measure the internal consistency of Tech Aided Grade2 Braille Tutoring System was developed. It was in the form of 4 point rating scale viz Strongly Agree, Agree, Disagree and Strongly Disagree. The reliability of the items of the module were analyzed and was found to be 0.88. Hence no changes with regard to the items of the test were made in the main study.

v. Intervention Strategies

After conduct of pretest using the tactile Braille format developed, training regarding the Braille Alphabet and Grade2 Braille contractions were given in sessions. A demonstration was given on Tech Aided Grade2 Braille Tutoring System which has

voice over with minimal Computer key usage. Then the students with visual impairment were given intervention & training on the application of Tech Aided Tutoring System with the help of three applications viz.. Learning Mode, Practice Mode and Evaluation Mode. The students with visual impairment were taught and familiarized with Grade1 & Grade2 Braille. The Computer Program was set up as an individualized Unit for each student participant. The Braille Alphabet were introduced one by one in a sequence with the possibility of listening to the instructions for typing the letter cell corresponding to the required Alphabet followed by the Grade2 Braille. The Braille cell will be automatically displayed on the screen. This option is available in all the three modes Learning Mode, Practice Mode and Evaluation Mode. The students were exposed to this phase for a duration of two months to get a better practice regarding Grade2 Braille. Finally, the students with visual impairment were evaluated to know the performance level of students regarding Alphabet and Grade2 Braille. The Computer Program was set up as an individualized unit for each student participant. In this phase the computer was programmed to display the word Grade2 Braille and the student types the dots required. Once the dots are typed the student with visual impairment can learn, Practise and self-evaluate their performance.

Statistical analysis were used to Analyse the Software Component, to know the impact of 'Tech Aided Grade2 Braille Tutoring system' and for Comparison of acquisition of Grade2 Braille among students with visual impairment and the influence of Gender, Grade and Locality on learning Grade2 Braille .

5.6 Findings

The major findings of the study are

5.6.1 Result1: Impact of the Tech Aided Grade2 Braille Tutoring System

1. About 16% of the respondents agreed that students with visual impairment use Mechanical Braille for learning, and students use 'Alphabet word signs ,Group signs, dot 5 and dot4-5 plus initial letters' to read and write as against 84% of them reported that students with visual impairment never use mechanical brailler to read and write before introduction of 'Tech Aided Braille Tutoring System'.

2. Around 80% of the respondents reported that 'Tech Aided Grade2 Braille Tutoring System 'was helpful to learn 'Alphabet word signs, Group signs, Short forms, Word meaning, Spelling in Standing Alone contractions' since the audio format synchronize with the video format
3. Approximately 73% of the respondents reported that 'Tech Aided Grade2 Braille Tutoring System' was self-instructional, helpful to learn and practice Grade2 Braille individually, and was self-evaluative saving time .
4. About 74% of the respondents agreed that 'Tech Aided Grade2 Braille Tutoring System' involves minimum keys and hence it is easy to use the system for learning and practice Braille at any time.
5. Almost 80% of the respondents reported that 'Tech Aided Grade2 Braille Tutoring System' is effective for online teaching and peer tutoring in addition using this system reduces the task of special teachers.
6. About 18% of the respondents reported that 'Tech Aided Grade2 Braille Tutoring System' requires basic computer knowledge, limits the tactual mode of learning and has less of interaction with peer group and special teachers as the challenges of the tutor system.

5.6.2 Result2: Effect of Tech Aided Grade2 Braille among Students with Visual Impairment

1. When analyzed the performance score in **'Alphabet word sign'**, the students secured highest score in posttest than pretest revealing a significant impact of 'TAG2B' (Mean:Pre-1.50;Post-17.71) in learning Alphabet word sign.
2. The performance score for **'Strong Word'** revealed that the students secured highest score in posttest than pretest revealing a significant impact on the effective intervention with the usage of 'TAG2B' (Mean:Pre-0.93;Post-13.48)
3. Pertaining to the scores for **'Lower sign'**, the posttest score (Post mean 7.40) was higher than pretest (Mean-0.29) indicating the effect of TAG2B on learning contractions
4. As regards to the score in '**Dot-5 with Initial Letter'**, the posttest score was higher than pretest and thus impacting the effect of 'TAG2B' (Mean:Pre-0.86;Post-16.07) on learning ' Dot-5 with Initial Letter'

5. Regarding the performance of score for '**Dot4-5 with Initial Letter'**, the students secured highest score in posttest than pretest indicating a significant impact on the effective intervention with the usage of 'TAG2B' (Mean:Pre-0.19;Post-3.45)
6. Analysing the performance score for'**Dot4-5-6with Initial Letter'**, the posttest score was higher than pretest score impacting 'TAG2B' on learning braille contractions (Mean:Pre-0.21;Post-3.64).
7. Analyzing the performance score for **Final Letter** revealed that the students secured highest score in posttest than pretest revealing a significant impact of TAG2B (Mean:Pre-0.00;Post-8.98)
8. When compared the performance of posttest and pretest score in **Short Forms**, the students secured highest score in posttest than pretest indicating a significant impact of 'TAG2B' (Mean:Pre-2.64;Post-57.98)

5.6.3 Result3: Progress Monitoring score before, during and after introduction of Tech Aided Grade2 Braille Tutoring System

1. In Progress Monitoring (PM)1 to 4 tests ,the score was steadily increasing as: PM1 (M=6.74) ;PM2 (M= 10.45); PM3 (M=13.33) & PM4 (M=15.38) .
2. As regards to the analysis for' **Strong Word Signs'** there was an improvement from pretest (M=0.93) to posttest (M=13.48). The results presented that there was a gradual and graded improvement on learning Strong Word Sign [PM1 (M=5.38), PM2 (M=7.71), PM3 (M=10.07) & PM4 (M=11.98)].
3. The analysis for '**Lower Signs'** revealed that there was graded improvement from pretest (M=0) to posttest (M=8.98) .The results indicated that there was a gradual and graded improvement in learning 'Lower Signs contraction' with the newly developed' TAG2B tutoring system' PM1 (M=2.50), PM2 (M=3.90), PM3 (M=5.60) & PM4 (M=7.24)] .
4. As regards to the analysis for **'Dot-5 with Initial Letter'** there was an improvement from pretest to posttest. (Pre mean (M=0),Post mean M=8.98) .The findings revealed that there was a graded improvement in learning Dot-5 with Initial Letter with the newly developed 'TAG2B tutoring system' [PM1 (M=2.50), PM2 (M=3.90), PM3 (M=5.60) & PM4 (M=7.24)] .

5. The analysis for '**Dot 4-5 with Initial Letters'** revealed that there was improvement from pretest (M=0.00)to posttest (M=8.98). The findings revealed that there was a graded improvement in learning Dot 4-5 with Initial Letters with the newly developed 'TAG2B tutoring system' [PM1 (M=2.50), PM2 (M=3.90), PM3 (M=5.60) & PM4 (M=7.24)].
6. The ANOVA for **'Dot 4-5-6 with Initial Letters'** presented that there was gradual improvement from pretest (M=0.00) to posttest (M=8.98). The results showed that there was a graded improvement in learning Dot 4-5-6 with Initial Letters with the newly developed 'TAG2B tutoring system' [PM1 (M=2.50), PM2 (M=3.90), PM3 (M=5.60) & PM4 (M=7.24)].
7. As regards to the analysis for '**Final Letter Contractions'** it was found that there was gradual improvement from pretest (M=0) and posttest (8.98). The findings reported that there was a graded improvement in learning Final Letter Contractions with the newly developed TAG2B tutoring system [PM1 (M=2.50), PM2 (M=3.90), PM3 (M=5.60) & PM4 (M=7.24)].
8. The ANOVA analysis for '**Short Forms'** predicted that there was an improvement from pretest (M=2.64) to posttest (M=57.98). The PM summarizes that there was a graded improvement in learning 'short forms 'with the newly developed 'TAG2B tutoring system' [PM1 (M=16.83), PM2 (M=27.71), PM3 (M=39.33) & PM4 (M=48.02)] .

5.6.4 Result4: Analysis of Covariance of Gender, Grade and Locality

1. The 'ANCOVA' result stated that there is no significant difference between Boys and Girls in performing in 'Alphabet Word Sign, Strong Word Signs, Lower Signs, Dot5 Initial Letter, Dot 4-5 Initial Letter, Dot 4-5-6 with Initial Letter, Final Letter Contractions and Short Forms'. Hence '**Gender'** seems to be independent of its own.
2. The study revealed that there was no significant difference among VIII to XII students in performing in 'Alphabet Word Sign, Strong Word Signs, Lower Signs, Dot 5with Initial Letter, Dot 4-5 with Initial Letter, Dot 4-5-6 with Initial Letter, Final Letter Contractions and Short Forms'. Hence '**Grade'** seems to be independent of its own.

3. The study indicated that there was no significant difference between locality in performing in 'Alphabet Word Sign, Strong Word Signs, Lower Signs, Dot5with Initial Letter, Dot 4-5 with Initial Letter, Dot 4-5-6with Initial Letter, Final Letter Contractions and Short Forms'. Hence '**Locality'** seems to be independent of its own.
4. The adjusted F value for interaction among Gender, Grade and locality is not significant and determines that there was no significant influence of resultant of interaction among '**Gender, Grade and locality'** when Pre score was taken as covariate. It may therefore be concluded that 'Alphabet Word Sign , Strong Word Signs, Lower Signs, Dot5with Initial Letter, Dot 4-5 with Initial Letter, Dot 4-5-6with Initial Letter, Final Letter Contractions and Short Forms' was found to be independent of its own.

5.7 Discussion

Louis Braille developed a six-dot braille code in the early 1800s, thus creating an effective way for persons who are visually impaired to communicate through reading and writing (Holbrook, 2011). Poor knowledge of braille contractions may hinder reading and writing fluency, which is imperative for success in school. Research has shown that students are at risk of advancing in school with poor, fragmented braille skills if they have not had high-quality instruction during their elementary school years, which may hinder their progress in all other school subjects (Koenig & Holbrook, 2000).

During the past 50 years, teachers have used contracted braille as the preferred method of teaching reading to children and adults. Contracted braille, previously referred to as grade 2 braille, involves the use of the traditional alphabet, along with 189 different characters and contractions that represent a group of letters or whole words (Ashcroft, Henderson, Sanford, & Koenig, 1991). Over 450 rules govern the use of these contractions (Miller & Rash, 2001). Learning contracted braille is often complicated for young or beginning readers. "The cognitive demands of young blind children are greater than those required of their sighted peers if all of the contractions are presented during the first year of school" (Mangold, 2000) . Beginning readers are also distinctly challenged because so much of their time and attention is spent decoding

braille contractions that their comprehension of text is affected (Knowlton & Wetzel, 1996).

Students with visual impairments require braille instruction from teachers of students with visual impairments, who are responsible for teaching direct braille literacy skills to students from kindergarten through at least the third grade (Koenig & Holbrook, 2000). Reading contracted braille involves more intellectual exertion than does reading uncontracted (previously referred to as grade 1) braille and therefore leaves fewer cognitive resources available for interpreting text(Troughton, 1992). Learning contracted braille also appears to be particularly challenging for persons with cognitive impairments. In a national survey of 1,663 teachers, the majority of the sample (54.1%) attributed the recent decline in braille literacy to the in-crease in the number of students with multiple disabilities (Wittenstein & Pardee, 1996). "For students whose IQ is below 85, braille is an extremely inefficient medium of communication" Nolan and Kederis. Students with cognitive impairments, learning contracted braille may be simply feasible contractions, such as sh, th, and ch, that represent a blended sound that is distinctive from the two letters that constitute it may actually be an advantage to braille readers (Arter, 1998). In the study, neither the advantage of fewer symbols nor the use of special symbols for blends were strong enough to influence general word-recognition skills. The complexity of rules for recognizing words is also a factor in word recognition.

The current study evaluated the efficacy of the 'TAG2B'tutoring system at learning, practice and evaluative modes at two levels namely Alphabet and Grade2 Braille. This study extended previous research in a number of important ways. First, the current software was written as a stand-alone program that could be downloaded on any personal computing device and used to learn basic Grade 1 & 2 braille. Second, the current software targeted many additional relations beyond those of previous research. (Scheithauer & Tiger, 2012) .Both researches targeted 26 print-to-braille relations (letters); the current program targeted a total of 246 relations including Grade and Grade2 Braille. The outcomes pertaining to the learning and practice of contracted braille were similar to those of (Scheithauer & Tiger, 2012; Scheithauer et al., 2013) in that all participants met mastery criterion given exposure to computerized instruction, but it is worth noting that mastery criterion was met more rapidly in the current study

than in both prior reports through progress monitoring test. The purpose of the 'TAG2B' tutoring system was to provide practice to students with visual impairment when they are not able to get the guidance from the itinerant special teacher.TAG2B' tutoring system has been tested for error free and bug free feature.TAG2B' software did work well for all the three modes viz. Learning, Practising and Evaluation.

5.8 Suggestions

1. The present study is Tech aided for teaching-learning of Grade2 to students with visual impairment. Further study may be pursued as synthesized voice input and output with refreshable display.
2. A research study on how assistive products improve an individual's functioning and promote independency and their wellbeing may be pursued.
3. Further research may be conducted on the impact of Assistive technology to respond to the challenges arise from accident.
4. For educational purposes, studies on various approaches in assistive technology such as sensor based, image processing based and application based may be conducted.

5.9 Educational Implications

5.9.1 Theoretical Implications

In the present research, the anticipated outcome that students with visual impairment to perform the Grade2 Braille has happened. The procedure of using the Tech aided Grade2 Braille might be used as a set of guidelines for application by teachers and students with visual impairment. The guidelines can be in the form of Print and Braille. The training institutes may incorporate a component of Assistive technology for the students with visual impairment in the curriculum. The study outcome might help the Special Teachers and Teacher educators to get reoriented to enrich their knowledge in the latest development in the field.

5.9.2 Practical Implications

This study proved that students with visual impairment can learn Grade2 Braille at school level independently. Another practical implication is that this system is designed to use it in inclusive school. Inclusive classroom teacher can use the system to demonstrate Grade2 Braille to other students in the classroom. This can change the attitude of the inclusive classroom teachers and peers towards students with visual impairment and they consider this system as an effective learning system for all.

5.9.3 Implication to Textbook Writers

Application of technology to the education particularly to learn Grade2 Braille is a recent phenomenon in Special Education in Indian context. Books by Indian authors in Special Education are being slowly emerged. The development of this system and its efficacy in performing learn Grade2 Braille by persons with visual impairment evidenced in the study has implication to book writers. The writers can incorporate this indigenous development in their writings.

5.9.4 Implication for Product Development

The user and the special teachers in the study expressed the usability and the advantage of this system. The prototype developed in the research has scope for product development and the developers can get detailed guidance from the research team on how to design user friendly device for wider usage.

5.10 Recommendations

1. This study proved that Assistive technology can be a level player and a great equalizer for students with visual impairment. Hence students with visual impairment need to acquire a plethora of technology skills that will provide alternatives for collecting and communicating information. The study recommends that the teacher training curriculum for students with visual impairment may be designed with the instruction in the application of Assistive technology, information on its availability and maintenance.
2. Many research studies indicate that Assistive technology is boon to persons with disabilities giving promising means to accommodate barriers to independence. But it is adverse that such devices are underutilized by persons

with disabilities and the main reason is lack of knowledge and skill among educational personnel. Hence this study recommends the educators and related stakeholders to be well oriented on the benefit of assistive technology and encourage students with disabilities to use the same which would be an equalizer in mainstream education.

3. The Government of India may give financial assistance to improve any prototype developed and make it available as a product for the purpose of educating students with different categories of disability on par with their non-disabled counterparts. The cost of the devices is also a barrier and the government may address the issue of cost and availability.

5.11 Conclusion

Reading is an essential aspect in the context of learning and education in general. Braille remains the main medium of reading and writing among persons with visual impairment. Early introduction Braille contractions can allow beginning readers to take larger chunks of text at a time and help them to process information faster. This study stands as evidence that students who are introduced to more contractions perform better on reading and writing. There is so much technology around in today's society to learn Braille. Technological advancements continue to provide new opportunities to access Braille. This study results demonstrate that technology can be incorporated into Braille instruction and gives important motivational and learning advantages.