Chapter IV

Design of the Study
CHAPTER- IV
DESIGN OF THE STUDY

4.1. Introduction
The design of the study provides an understanding of how the research was conducted and organized in order to obtain information that could be helpful for developing the different research components. It refers to the plan which is structured and implemented to test the formulated hypotheses and answer the research questions through adopting a suitable methodology. The way in which research is conducted may be conceived of in terms of the research strategy employed and so the research instruments utilized in the pursuit of a goal, the research objectives, the quest for the solution of a problem and the research question. The aim of the study is to enhance the reading performance of students at risk of dyslexia in English through multisensory strategic orientation supplemented with technology. The researcher found mixed methods of research design as a suitable methodology to investigate the present study. The mixed methodology is a combination of quantitative and qualitative research approach. This chapter provides an outline of the process of mixed methodology adopted for the conduct of research and data collection process. The rationale of this chapter is to:

- spell out the objectives to be achieved.
- formulate the hypotheses and describe the rationale of the hypotheses.
- explain the research design of the study.
- describe the sample selection.
- explain the process of data collection.

4.2 Objectives of the Study
The aim of the present study is to improve at risk of dyslexic students’ reading performance in English through multisensory strategic orientation supplemented with technology. In order to achieve the aim, the following objectives are set to be accomplished:
➢ To identify the students at risk of dyslexia studying in the Government Tamil Medium Schools of Puducherry region at the primary level.
➢ To standardize “At Risk of Dyslexia Screening Tool (ARDST)” to identify at risk of dyslexic students.
➢ To diagnose the reading difficulties in English of students at risk of dyslexia.
➢ To develop a multisensory strategic orientation supplemented with technology for teaching reading skills to the students at risk of dyslexia based on the diagnosis.
➢ To find out the effectiveness of multisensory strategic orientation supplemented with technology for enhancing the reading performance in English of students at risk of dyslexia.
➢ To study the effectiveness of multisensory strategic orientation supplemented with technology on enhancing the reading performance in English of students at risk of dyslexia with reference to components of reading.
➢ To determine whether gender of the students at risk of dyslexia affect the reading performance in English.
➢ To analyse the effectiveness of multisensory strategic orientation supplemented with technology for enhancing the reading performance in English of students who are mildly and severely at risk of dyslexia.
➢ To evolve the pedagogical implications based on findings of the study for developing the reading skills of students at risk of dyslexia.
➢ To formulate recommendations from the study for future policy making and planning for developing the reading skills of students at risk of dyslexia at the primary level.

4.3. Research Questions

A research question is a question that is worth asking for a qualitative analysis. A good research question requires more than looking something up. The following research questions are formulated by the investigator to get a comprehensive understanding of the concepts of the present study which are to be answered through qualitative analysis by adopting case analysis and interview technique:
1) Does the multisensory strategic orientation supplemented with technology enhance the reading performance in English of students at risk of dyslexia?

2) Does the multisensory strategic orientation supplemented with technology enhance the reading performance in English of students at risk of dyslexia with reference to the components of reading: alphabet knowledge, phonological awareness, word recognition and oral reading fluency?

3) How far the multisensory strategic orientation supplemented with technology help to enhance the reading performance in English of students who are mildly at risk of dyslexia and severely at risk of dyslexia?

4) Does the multisensory strategic orientation supplemented with technology help to reduce the oral reading errors of students at risk of dyslexia?

4.4 Rationale for the Hypotheses

The hypotheses of the present study were framed to achieve the objectives of the study and formulated in light of the empirical evidences of the previous research findings and theories. Creswell (2009) emphasized the significance of establishing homogeneity between the control group and experimental group for the pre-test post-test control design. A hypothesis was framed in order to verify that the control group and experimental group were equal in terms of their pre-test scores. A hypothesis was formulated to check whether the tradition method of teaching helped to enhance the reading performance of students at risk of dyslexia. A hypothesis was developed to verify whether the multisensory strategic orientation supplemented with technology improved the reading performance of students at risk of dyslexia. There were abundant of empirical research studies confirmed the effectiveness of differentiated reading interventions in developing reading skills of students with dyslexia and at risk dyslexics (Joshi, Dahlgren, & Boulware-Gooden, 2002; Khan Zeenat & Dandegoankar, 2014; Torgesen, 2002; Wilson & O’Connor, 1995; Bailet et al., 2009; Ryder, Tunmer & Greaney, 2008). But most of the empirical studies were conducted in western countries and the studies reported that differentiated reading intervention improved the reading skills of dyslexics. The aim of the investigator of the present study was to verify whether the multisensory strategic orientation supplemented with technology assist to improve the reading performance in English of bilingual students at risk of dyslexia who had less exposure to English language. Research studies recorded the effectiveness
of reading interventions over traditional method of teaching reading skills to struggling readers such as dyslexics and at risk dyslexics (Torgesen, Wagner, Rashotte, Herron, & Lindamood, 2010; Hatcher et al., 2006; Giess, 2005; Sadasivan, 2009; De Graaff, Bosman, Hasselman, & Verhoeven, 2009; Oakland, Black, Stanford, Nussbaum, & Balise, 1998). Therefore a hypothesis was formulated to verify how far the multisensory strategic orientation was effective in enhancing the reading performance in English of bilingual students at risk of dyslexia than the traditional way of teaching to these students. Singleton (2009), Duff (2008) and Krishnan (2012) confirmed the efficacy of the differentiated reading intervention in improving the reading skills of students with dyslexia through comparing the immediate post test scores and delayed post test scores. In line with these research studies, the current study also verifies its effectiveness of the multisensory strategic orientation through testing the delayed post test scores of both groups.

Research studies also focused on exploring the gender differences on reading abilities of students with dyslexia (Rutter et al, 2004; Miles, Haslum & Wheeler 1998; Knopik, Alarcón, & DeFries, 1998; Eno & Woehlke, 1980) because more number of boys were identified as dyslexics than girls (Snowling, 2012; Wheldall & Limbrick, 2010; Limbrick, Wheldall & Madelaine, 2008). Indeed it is important to explore whether traditional method of teaching and multisensory strategic orientation make any differences in the reading performance of students at risk of dyslexia with reference to their gender. In line with these research studies, the present study also verifies the role of gender in reading development of students at risk of dyslexia. The efficacy of the multisensory strategic orientation in developing the reading performance of students at risk of dyslexia shall be verified through calculating gain score and effect size.

4.5 Hypotheses of the Study

A hypothesis is a prediction the researcher makes about the expected relationships among variables (Creswell, 2007). For the accomplishment of the objectives, the hypotheses of the present study were formulated based on the previous research findings and review of similar studies in the field of inquiry, and to achieve the targets of the present work:
1. Students of Experimental group and Control group do not differ significantly in their reading performance in English in the pre-test.

2. Students of Control group do not differ significantly in their reading performance in English between the pre-test and the post-test.

3. Students of Experimental group do not differ significantly in their reading performance in English between the pre-test and the post-test.

4. Students of Experimental group and control group do not differ significantly in their reading performance in English in the post-test.

5. Students of Control group do not differ significantly in their reading performance in English among the pre-test, post-test and delayed post-test.

6. Students of Experimental group do not differ significantly in their reading performance in English among the pre-test, post-test and delayed post-test.

7. Students of Experimental group and control group do not differ significantly in their reading performance in English in the delayed post-test.

8. Students of Control group do not differ significantly in their reading performance in English in the post-test with reference to gender.

9. Students of Experimental group do not differ significantly in their reading performance in English in the post-test with reference to gender.

10. Students of Control group do not differ significantly in their reading performance in English in the pre-test and the post-test with reference to components of reading:
    i) Alphabet knowledge
    ii) Phonological awareness
    iii) Word Recognition
    iv) Oral Reading Fluency

11. Students of Experimental group do not differ significantly in their reading performance in English in the pre-test and the post-test with reference to with reference to components of reading:
    i) Alphabet knowledge
    ii) Phonological awareness
12. Students of Experimental group and control group do not differ significantly in their reading performance in English in the post-test with reference to components of reading:
   i) Alphabet knowledge
   ii) Phonological awareness
   iii) Word Recognition
   iv) Oral Reading Fluency

13. Students of Experimental group and control group do not differ significantly in their interest towards reading scores in the post-test.

14. There is no significant relationship between the interest towards reading and the post-test scores in the reading performance in English of the control group.

15. There is no significant relationship between the interest towards reading and the post-test scores in the reading performance in English of the experimental group.

16. The gain score of the experimental group reading performance in English is higher than that of the control group on reading performance in English.

17. The reading performance in English of students at risk of dyslexia in the experimental group is greater than that of the control group in the post-test.

4.6. Research Design of the Study

The research design is the conceptual structure of the research procedure. It provides planning on selection of subjects, data gathering devices and data analysis techniques in relation to objectives of research. Burns and Grove (2010) defined a research design as “a blueprint for conducting a study with maximum control over factors that may interfere with the validity of the findings”. The research design of the study was schematically represented in the figure 5.1.
Figure 4.F.1: Research Design of the Study

- Mixed Methods Research
  - Sequential Explanatory Method
  - Quantitative Research
  - Qualitative Research
  - Pre-test and Post-test Control Design
- Variables
  - Multisensory Strategic Orientation (IDV)
  - Reading Performance in English (DV)
  - Interest towards Reading (IV)
- Tools
  - 1. ARDST
  - 2. Experts Rating Scale
  - 3. Diagnostic test
  - 4. Reading Performance test
  - 5. Reading Interest Scale
  - 6. Rubrics
- Sample
  - Students at risk of Dyslexia
    - EG = 16
    - CG = 16
- Analysis
  - Descriptive Analysis
  - Inferential Analysis

Note: ARDST – At Risk of Dyslexia Screening Tool, IDV – Independent Variable; DV – Dependent Variable; IV – Intervening Variable; EG – Experimental Group; CG – Control Group
The figure 4.F.1 shows the outline of the research design adopted by the researcher. The study focuses on developing the reading performance in English of students at risk of dyslexia through multisensory strategic orientation supplemented with technology. The researcher employed an experimental method, a quantitative research approach to test the efficacy of the multisensory strategic orientation supplemented with technology to improve the reading performance of at risk dyslexics. The experimental method is an appropriate method for determining the causal effect of an isolated, single independent variable on dependent variables and it also allows for precise control of variables. It helps to test hypotheses of causal relationship between variables. In addition the researcher adopted a qualitative research approach, case analysis method to get in depth understanding of how far the multisensory strategic orientation enhanced the reading performance in English of students who were mildly and severely at risk of dyslexia. Therefore, the researcher found that Sequential Explanatory Design, a mixed method research was appropriate to conduct the present study.

Figure 4.F.2: Sequential Explanatory Design

Source: Adapted from Creswell et al. (2003).

As it is seen from the figure 4.F.2, the researcher made use of both quantitative approach and qualitative approach. In the first phase of the study, the researcher conducted experimental study and collected quantitative data. In the second phase of the study, the researcher conducted case analyses and collected qualitative data through using observation technique. Inferences were drawn through mixing the quantitative analysis and qualitative analysis for the educational implications of the study.
4.6.1. **Rationale for adopting Mixed Methods**

Mixed methods research is a methodology for conducting research that involves collecting, analyzing, and integrating quantitative and qualitative research (and data) in a single study. The purpose of this form of research is that both qualitative and quantitative researches, in combination, provide a better understanding of a research problem or issue than either research approach alone (Creswell & Plano Clark, 2011). Mixed methods provide the strengths of both quantitative and qualitative research, overcoming the limitations and prejudices of a single approach, and assists in acquiring a comprehensive understanding of the problem being studied. Denscombe (2008) suggests that mixed method research increases the accuracy of the data by using the principles of triangulation. Triangulation is a technique that facilitates validation of data through cross verification from two or more sources. In particular, it refers to the application and combination of several research methods in the study of the same phenomenon. One research method can be used to compare or verify the findings of a different method. On this rationale, the researcher adopted mixed methods of research to investigate the research problem of the study through combining the strategies of inquiry both the qualitative and quantitative research methods. The significance of adopting a research method was to match the research design with the research questions and to the purpose statement of the research problem. The present study used a Sequential Explanatory Design, incorporating both qualitative and quantitative data collected to gain a more complete picture of what is being researched. Another justification for adopting the mixed methods research is that it is effective in identification and intervention studies in relation to researches on Special Educational Needs (Collins, Onwuegbuzie, & Sutton, 2006). There are many studies which highlight and support mixed methods for educational intervention studies on children with SEN. On this rationale, the researcher of the present study found that mixed methods research was an appropriate design to study the research problem.

For the present study, the researcher realized that single methodology of research was inadequate to get in depth understanding of the research problem of the study. The sample size in the experimental design was small and lacks normal distribution because the students belong to the category of special needs children. The effectiveness of the multisensory strategic orientation supplemented with technology
was verified through quantitative analysis. In order to confirm the impact of the multisensory strategic orientation on developing reading performance in English of students at risk of dyslexia, the study needs in depth qualitative analysis, case analysis of students who are mildly and severely at risk of dyslexia. Therefore, the research problem selected for the study needs both quantitative analysis and qualitative analysis to get a complete understanding of the research problem.

4.7. Operational Definition of the Key Terms

The operational definition describes how the variables have been operated in the present study in a measurable term by the investigator. The operational definition of the key terms is as follows:

At Risk of Dyslexia

In the present study, the term at risk of dyslexia refers to the students who are inconsistent and have deficits in alphabet knowledge, reading, phonological awareness and writing.

Reading Performance

For the present study reading performance refers to the scores gained by the students in reading performance test which consists of alphabet knowledge test, phonological awareness test, word recognition test and oral reading fluency test.

Multisensory Strategic Orientation

In the present study, the term multisensory strategic orientation is referred as a tool to develop the reading performance in English of students at risk of dyslexia by providing training through multisensory techniques and reading strategies supplemented with technology in the four components of reading such as alphabet knowledge, phonological awareness, word recognition and oral reading fluency for the duration of thirty hours for the enhancement of reading performance.

Enhancing

The term enhancing means intensifying or improving something already existing. In the present study, it refers to an improvement in the reading performance in English in the components of reading namely alphabet knowledge, phonological awareness, word recognition and oral reading fluency.
Technology

Technology used in teaching learning process aims at improving performance by creating and managing various technological processes and resources. Technology in the present study refers to the use of audios, videos, and animated videos.

4.8. Variables of the Study

Variables are the attributes involved in solving the research problem and in turn lead to fulfil the research gap. The attributes should influence each other. The present study is an attempt to investigate the efficacy of multisensory strategic orientation supplemented with technology for developing the reading performance of students at risk of dyslexia. The variables involved are:

**Independent variable:** Multisensory strategic orientation supplemented with technology functions as an independent variable in the present investigation.

**Dependent variable:** Reading performance in English of the Students at risk of dyslexia is the attribute acting as a dependent variable.

Controlling the Intervening variables

In a classroom situation intervening variables are motivation and interest. The researcher motivated the students to make them be ready for learning. Interest is one of the predominant factors that affect the reading performance of students with dyslexia and at risk dyslexia. Numerous studies have confirmed the impact of interest towards reading on reading performance of students with dyslexia (Taylor, Frye & Maruyama, 1990; Guthrie & Wigfield, 2000; Stanovich, 1986; Anderson, Fielding & Wilson, 1988; Stansberry, 2009; Grabe, 2003). In the present study interest towards reading is an intervening variable.

4.9 Sample for the Study

The sample for the present study consisted of students who are at risk of dyslexia studying in standard III in a government school located at Bahour commune in Puducherry region. The rationale for selecting this particular government school was that large numbers of students with specific learning disabilities were identified by the Directorate of School Education, Puducherry through Sarva Shiksha Abiyan (SSA) programme. Moreover, the school provided an inclusive education for the students with
disabilities. On this rationale the researcher has chosen this particular government school located in rural area for the conduct of the present study.

4.9.1 Steps involved in the Sample Selection Process

There were no special schools for the students with dyslexia and at risk of dyslexia in Puducherry region, one of the union territories in India. At first in the year 2010, the Directorate of School Education, Puducherry has taken initiative steps to identify the students who have specific learning disabilities under SSA programme in collaboration with National Institute of Empowering Persons with Multiple Disabilities (NIEPMD) and Jawaharlal Nehru Institute of Post Graduate Medical and Educational Research (JIPMER). SSA programme initially identified five hundred and fifty seven students with specific learning disabilities studying in twenty nine schools. The researcher approached the Directorate of School Education, Puducherry to collect the list of schools in which the students were identified as having specific learning disabilities. From the list of schools, the researcher selected a government school located in a rural area at Bahour commune in Puducherry region where more numbers of students were identified as having specific learning disabilities. In that way, the sample site for conducting the research was identified.

From the review of related studies in India, the researcher found that there was a lack of standardized tools to identify the students with dyslexia and at risk dyslexics studying in bilingual government schools. Lack of standardized tools to identify the bilingual dyslexics and at risk dyslexics was one of the impediments in conducting research in India in the field of dyslexia (Ramaa, 2000; Saravanabhavan & Saravanabhavan, 2010). The researcher realized that there was a need to develop a screening tool to identify students at risk of dyslexia. The development and validation of At Risk of Dyslexia Screening Tool was described in the previous chapter (see chapter 3). The students for the study were selected through administering “At Risk of Dyslexia Screening Tool” by the teacher. The students exhibited the symptoms of at risk of dyslexia and inconsistencies in their reading performance were selected as sample for the present study.
4.9.2. Identification of Students “At Risk of Dyslexia”

The students who exhibited inconsistent reading performance in the diagnostic tests were selected as sample for the study. The scores secured by the students in the diagnostic tests were given in the table 4.T.1.

<table>
<thead>
<tr>
<th>Students Name Referred by Teacher</th>
<th>Diagnostic Test 1 (Scores)</th>
<th>Diagnostic Test 2 (Scores)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alphabet Knowledge</td>
<td>Phonological Awareness</td>
</tr>
<tr>
<td>Sudharsan</td>
<td>21</td>
<td>8</td>
</tr>
<tr>
<td>Tamilvanan</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>Komathi</td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td>Gautham</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>Subha</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Ragul</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Chitra</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>Vinotha</td>
<td>18</td>
<td>7</td>
</tr>
<tr>
<td>Angalan</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>Sasidharan</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>Prakash</td>
<td>22</td>
<td>8</td>
</tr>
<tr>
<td>Swetha</td>
<td>24</td>
<td>10</td>
</tr>
<tr>
<td>Velvizhi</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>Amarnath</td>
<td>19</td>
<td>11</td>
</tr>
<tr>
<td>Praveen</td>
<td>21</td>
<td>8</td>
</tr>
<tr>
<td>Tamilarasi</td>
<td>17</td>
<td>7</td>
</tr>
<tr>
<td>Bhavatharani</td>
<td>26</td>
<td>9</td>
</tr>
<tr>
<td>Ragunathan</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Ravi Kumar</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>Perumal</td>
<td>22</td>
<td>7</td>
</tr>
<tr>
<td>Subash</td>
<td>19</td>
<td>9</td>
</tr>
<tr>
<td>Sentamizhi</td>
<td>23</td>
<td>11</td>
</tr>
<tr>
<td>Nisanthi</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>Udaikumar</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Vignesh</td>
<td>26</td>
<td>11</td>
</tr>
<tr>
<td>Punitha</td>
<td>24</td>
<td>7</td>
</tr>
<tr>
<td>Priyadharshini</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>Gobi</td>
<td>21</td>
<td>10</td>
</tr>
<tr>
<td>Anbumathi</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>Anand</td>
<td>27</td>
<td>12</td>
</tr>
<tr>
<td>Ramya</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>Prithivi</td>
<td>22</td>
<td>9</td>
</tr>
</tbody>
</table>
Research Ethical Clearance for the Study

Prior permission was obtained by the researcher from the concerned authorities stating that the collected data were used for research purpose alone. As per the research ethical guidelines, the students in the control group were also exposed to the multisensory strategic orientation supplemented with technology for developing their reading performance after completion of experimentation. The identity of the students was not revealed in the present study. Fictitious names were assigned to students to follow the guidelines of ethical issues in social science research.

The researcher obtained permission from the concerned government authorities and stakeholders to visit the schools, collect data and conduct experiment with students at risk of dyslexia. The following were the authorities:

- The Chief Educational Officer of the Directorate of School Education, Puducherry, to access the schools under SSA for the study.
- Permission was obtained from the principal of the school to collect quantitative and qualitative data for the research.

4.10 Quantitative Research Method: Design of the Experimental Method

The first phase of the study, a quasi experimental design with Pre-test Post-test control group design was adopted to verify the efficacy of multisensory strategic orientation supplemented with technology to develop the reading performance of students at risk of dyslexia. The rationale of this design was to gather empirical data in order to estimate the effectiveness of the multisensory strategic orientation and allow outcomes of the control and intervention group to be compared. From the review of related studies the researcher found that many researchers adopted the pre-test post-test control group design to study the effectiveness of remedial reading interventions to dyslexics (Torgesen, et al., 2010; Nisha & Kumar, 2013; Hatcher et al., 2006; Khan Zeenat & Dandegoankar, 2014; Joshi, et al., 2002; De Graaff, et al, 2009; Oakland, et al., 1998; Giess, 2005; Wilson & O’Connor, 1995). National Reading Panel (2000) conducted meta-analysis of the empirical studies carried out in the field of dyslexia and emphasised the use of pre-test post-test control group design.
Researchers namely Slavin, Lake, Chambers, Cheung and Davis (2009), Scammacca, Vaughn, Roberts, Wanzek and Torgesen (2007), and Slavin, Cheung, Groff and Lake (2008) suggested from their meta analysis of the research studies conducted in the thrust area of dyslexia that the pre-test post-control group design was a suitable experimental design to find out the effectiveness of a particular reading intervention. The objective of the present study was to ascertain the efficacy of multisensory strategic orientation to improve the reading performance of students at risk of dyslexia. In line with other empirical studies, the researcher adopted the pre-test post-test control group design for the conduct of the experimental study.

4.10.1. Participants of the Experimental Design

The total sample size for the experimental research study comprised of thirty two students who are at risk of dyslexia. In which the experimental group comprised of sixteen students (N= 16: Boys = 9 & Girls = 7) and the control group consists of sixteen (N= 16: Boys = 9 & Girls = 7) students at risk of dyslexia. The researcher adopted stratified random sampling technique for the selection of participants for the experimental research study. A pre-test was administered individually to each students selected for the experimental study in a classroom by the researcher. Based on the students’ pre-test scores and academic performance in the term exams, the students were divided into two groups, the control group and experimental group through adopting a stratified random sampling technique. It was verified that the students in the control group and experimental group did not differ significantly in terms of the pre-test mean scores on reading performance in English.

4.10.2 Experimentation

The researcher has obtained permission from the Directorate of School Education, Puducherry to conduct an experimental study in the government school located in a rural area at Bahour Commune. The permission letter was handed over to the headmistress of the school and the same has been obtained from her. Before starting the reading intervention to students at risk of dyslexia in the control group and the experimental group, all students were administered a pre-test on reading performance in English by the researcher. Then the students were divided into two groups based on their pre-test scores on reading performance in English. The treatment was focused on
Many research studies emphasised that the students with dyslexia and at risk dyslexics need to be provided reading intervention to minimize their reading errors in a systematic (Phillips et al., 2008; Torgesen et al., 2001; Torgesen, 2005; Scammacca et al., 2007; Roberts, Torgesen, Boardman & Scammacca, 2008), structured (Oakland, et al., 1998; Traub & Bloom 2000), explicit (Joshi, et al., 2002; Vellutino, et al., 2004; McIntyre & Picketing, 1995; Torgesen, Wagner, & Rashotte, 1997; Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2002; Griffin, Burns, & Snow, 1998; Torgesen, et al., 2001) and intensive manner (National Reading Panel, 2000). Therefore the researcher of the present study provided an intensive instruction to the students at risk of dyslexia. The insights gained from the review of research studies, the researcher found that interventions in reading skills for the students with dyslexia and at risk dyslexics were ranging from 15 minutes to 90 minutes (Duff et al, 2008; Rasinski, Homan & Biggs, 2009) and from 16 sessions to 88 sessions of five to twenty weeks duration (Johnston & Watson, 2005; Hatcher, 2006; Watts & Gardner, 2013). The National Reading Panel (2000) stated that twenty hours of intensive training in reading skills for dyslexics would enhance the reading performance of students with dyslexia. In a study by Hatcher et al (2006) provided remedial reading instructions to struggling readers for twenty minutes for the duration of twenty weeks and at the end of the intervention the students significantly gained improvement in the reading skills. Many research studies have examined the efficacy of short and intensive remedial reading interventions for struggling readers for enhancing their reading skills. A research study by Duff et al.
(2008) found that students in the treatment group had improved scores on reading tests after receiving thirty minutes reading instruction per day for the period of nine weeks. In line with these empirical studies, the researcher provided intensive training in the four components of reading to the students in the experimental group and the control group for the duration of thirty hours, six weeks of training. The sample lesson plan was given in the appendix (No.VI) how the multisensory strategic orientation was provided to the students. After six weeks of intensive instruction, the students in both the groups were administered immediate post test. Reading interest of the students was also observed by the researcher and data was collected from the students through administering reading interest scale after the experimentation. Later, a delayed post test was also administered to both the groups after a period of one week gap. The duration and time schedule for all the activities of the experimentation was provided in the tabulated column as follows:

**Table 4.T.2: Duration and Time Schedule of the Experimentation**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Components of Reading</th>
<th>Multisensory Strategic Orientation in the Components of Reading and Schedule</th>
<th>Duration</th>
</tr>
</thead>
</table>
| 1     | Alphabet Knowledge    | i) Teaching of two alphabets per day (A to Z) - (Name, sound and shape of the alphabet) – 13 days  
       |                       | ii) Teaching of Similar looking alphabets - 5 days  
       |                       | iii) Teaching of Alphabet songs – 3 days  
       |                       | iv) Training in Rapid Naming of Alphabets- 3 days  
       |                       | v) Teaching A to Z alphabets – Names, shapes and sounds- 6 days | Twenty minutes per day |
| 2     | Phonological Awareness| i) Phonological awareness tasks (Sentence awareness, Rhyming awareness and phonemic awareness ) - 26 days  
       |                       | Revision of Phonological Awareness tasks - 4 days | Fifteen minutes per day |
| 3     | Word Recognition      | High Frequency Words - Four words per day – 25 days  
       |                       | Revision of high frequency words - 5 days | Ten minutes per day |
| 4     | Oral Reading Fluency  | Text Reading Practice – 30 days | Fifteen minutes per day |
The students at risk of dyslexia in both the groups were provided intensive instruction, thirty hours of training in all the above mentioned components of reading for improving their reading performance in English. Finally, after the completion of experimentation the students in the control groups were also exposed to the treatment, multisensory strategic orientation supplemented with technology.

**Description of the Reading Performance Test**

The reading performance test was developed by the investigator based on the experimentation and reviews done in the second chapter. The assessment tool covers the components of reading taken by the investigator. The tool has been divided mainly into four parts which measures alphabet knowledge, phonological awareness, word recognition and oral reading fluency. The tool was constructed based on Grade Level Assessment Tool and Annual survey for Educational Research (ASER) tool to measure reading performance of students at the primary level. For each correct answer one mark was allotted and for wrong answer zero mark was allotted. The tool was given to the experts in the field of English language teaching for obtaining their opinion. Based on their opinion modifications such as rewording, rephrasing, addition or deletions were done.

**4.10.3 Controlling the Threats of Internal and External Validity**

The important step in the experimental design process is to check the threats that affect the validity of the constructed design for the present study. The need for identifying the threats is necessary to minimise the threats that affect the validity of the research design, so that the data obtained by the researcher will be relevant and perfect. According to Creswell (2009), and Campbell and Stanley (1963), the threats that affects the validity of an experimental design are classified into two categories such as threats to internal validity and threats to external validity.

**Procedures Adopted to Control the Threads to Internal Validity**

Threats to internal validity refer to experimental procedures, treatments, or experiences of the participants in an experiment that threaten the researcher’s ability to draw conclusions about cause and effect (Creswell, 2009). The procedures adopted by
the researcher to minimize the threats to internal validity of the experimental design were described as follows:

**History**

The Factors that influences simultaneously the outcome of the study during the experimentation are the history threats for the experimental design. The history threats were controlled by not giving additional exposure to content selected for the study. The content was selected from different grade level rather than the prescribed textbook. The time factor is one of the major historical threats which were controlled during the experiment naturally because it was conducted for shorter period of time rather than longer duration.

**Maturation**

Maturation refers to changes occur within the sample during the passage of time. These changes threaten the internal validity because they may produce effects that could affect the experimental treatment. In the present experimental study, both the experimental and control groups were selected from the same grade level. If any maturational changes occurred in one sample or the group, the same may occurred among the others too. In this way the maturational threat was controlled by the researcher.

**Testing**

Taking a test once may affect the subjects’ performance when the test is taken again, regardless of any treatment. This is called the testing effect. In the present study, the samples are students at risk of dyslexia belong to the category of special needs children. Therefore the repetition of test would not be a threat to internal validity of the experimentation.

**Instrumentation**

The instrumentation threat to internal validity is a result of a change in the instruments used during the study. In the present study same testing instrument was used and the test was administered by the researcher throughout the experiment. In this way the instrumentation threat to the internal validity was controlled.
Statistical Regression

The term statistical regression refers to subjects who score extremely high or extremely low on a pre-test to score closer to the mean on a post-test. There were no highest scores secured by the samples in the present study.

Selection

Selection is a threat when there are important differences between the experimental and control groups even before the experiment begins. There was no selection bias in the present study because the samples were pretested before the treatment. The samples were divided in two groups based on the scores of the pre-test. The research ascertained which group will receive the treatment by tossing the coin. In this way randomisation was ascertained to control selection bias.

Mortality

Experimental mortality or attrition threat occurs when there is a drop out during the experiment due to any reason, such as, illness, lack of interest, parents intervention, lack of time, etc. They should not be involved for the remaining experimentation. The break that the sample gets during the experimentation will affect the overall result of the both the experiment as well as control group. Therefore the researcher ensured that all the samples must be present throughout the experiment and the same has been ensured from their parents by getting the consent of their child’s participation in the experiment. In this way the researcher controlled the mortality threats in the present experiment.

Experimenter effect

Experimenter effect refers to unintentional effects that the researcher has on the study. This threat was controlled through providing reading instruction to both the groups by the researcher. In this way the experimenter effect was controlled in the present study.

Diffusion

Diffusion occurs when participants in one group exchanges information about the treatment to students in the control group. In the present study the students in both the groups were selected in the same school environment, and taught in the closed and
controlled classroom setting. In this way the diffusion of the participant was controlled but after the class hours it was difficult to control it. Since the students were from the same school and the chances of meeting together was more but the exchange of information would not create any impact because they are at the small age group. Henceforth the researcher partially controlled the diffusion threat.

**Selection-Maturation Interaction**

Subject-related variables and time-related variables may interact. Suppose that subjects in two comparison groups differ with respect to the independent variable and a subject-related variable such as age. Inclusion of different maturation rates in the experimental group causes threats to internal validity. The researcher controlled the selection of different maturation students in the treatment group by assigning the students on both the groups, based on the screening procedure and randomisation. Moreover, the students selected for the study were at same age level studying in standard III.

**Subject Effect**

There are attitudes developed during the study affect the performance of the dependent variable is called subject effect which in turn cause threat to internal validity. The subjects may respond differently just because they are being studied which is referred as Hawthorne effect. In order to eliminate this threat, the students in the control group were also provided instruction in a same environmental setting through conventional method of teaching by the researcher.

**Procedures Adopted to Control the Threads to External Validity**

Threats to external validity refer to characteristics of the sample, setting, or timing that threaten the researcher’s ability to generalize the conclusions to a population. The controlling measures adopted by the researcher in the experimental design to minimize the treats to external validity are explained as follows:

**Multiple-treatment interference**

When the same students receive two or more treatments, there may be a carryover effect between treatments such the results cannot be generalized to single
treatments. It is also referred as catalyst effect. In the present study only one treatment was provided to each group throughout the study. Hence this threat was eliminated.

**Setting-Treatment Interaction**

Artificially, there are some threats that affect the interaction between the setting and treatment which makes the researcher find difficult in generalising the findings. The present study was conducted in a government school and the findings obtained in this setting may differ when the experiment was conducted in private school. The students at risk of dyslexia may be given early childhood intervention on reading as a special coaching in private schools. The research controlled these threats in the present study by designing the strategic orientation based on the needs of the struggling readers. Similarly, it was suggested by the researcher to adopt the strategic orientations as per the needs of the sample on any setting in turn the generalised findings will be valid.

**Reactive or interaction effect of testing**

A pre-test might increase or decrease a subject's sensitivity or responsiveness to the experimental variable. Since the students selected for the study are special needs children, the sensitivity of the pre-test may not affect the external validity. Pre-test was conducted just to measure the difference between the entre level behaviour and exit level behaviour. Immediate post-test and delayed post-test were conducted to ascertain the effectiveness of multisensory strategic orientation in enhancing reading performance of students at risk of dyslexia.

**4.11 Qualitative Research Method**

The next phase of the sequential explanatory mixed methods design is the implementation of qualitative research method. According to Creswell (1998), a qualitative research is “an inquiry process of understanding” where the researcher develops a “complex, holistic picture, analyzes words, reports detailed views of informants, and conducts the study in a natural setting”. To get an in depth understanding of the research problem in the present study, the research adopted a case analysis method, with an aim of examining the efficacy of multisensory strategic orientation supplemented with technology for improving the reading performance in
English of students at risk of dyslexia. Case analysis is considered as a comprehensive research strategy or methodology (Yin 2003; Denzin & Lincoln, 2011) through which the researcher explores one or more cases over time through detailed, in-depth data collection involving numerous sources of information such as tests and observations. In the first phase of the research, quantitative data was collected to ascertain the effectiveness of multisensory strategic orientation in developing reading performance of students at risk of dyslexia. The qualitative approach, case analysis of the students participated in the experimentation further helps to confirm the efficacy of multisensory strategic orientation in enhancing the reading performance of students at risk of dyslexia.

4.11.1. Procedures Adopted for Collecting Qualitative Data for Case Analysis

In the second phase of the present study involved case analysis of two students, participated in the experimental group who were provided multisensory strategic orientation supplemented with technology. For conducting case analysis, two students were selected, a student who was mildly at risk of dyslexia and another student who was severely at risk of dyslexia identified through At Risk of Dyslexia Screening tool and their reading performance in the pre-test. A non probability sampling technique, a purposive sampling technique was adopted for the selection of sample for conducting case analysis.

The researcher obtained permission from the headmistress of the school to collect qualitative data from the students for case analysis. After obtaining permission from the concern authority, the data was collected from the selected two students and English language teachers. The researcher used observation technique to gather qualitative data for the case analysis. The demographic details of the students were collected from their class teacher. Triangulation method was utilised to check the credibility of the data. The researcher observed the reading performance of the two students during different phases of the experimentation.

The researcher developed rubrics for assessing the reading performance in English of students at risk of dyslexia. The rubrics assessment tool helped the researcher to assess the reading performance in English of students at risk of dyslexia.
in the four major components of reading such as alphabet knowledge, phonological awareness, word recognition and oral reading fluency. These four components of reading are assessed based on the 4 point scale assessment. The points are categorized as 10 for Not Developed, 20 for Emerging, 30 for Nearing Proficient and 40 for Proficient. The collected qualitative data was analysed in the next chapter to confirm the findings of quantitative research method, experimental design adopted to study the research problem of the present study.

4.12 Conclusion

The methodology adopted in the present study was mixed methods research, a sequential explanatory design. This chapter described the rationale for adopting mixed methods research and the procedures of data collection for the quantitative and qualitative methods. In this chapter, the researcher also explained the controlling measures adopted by the experimenter to minimize the threats to the experimental design such as threats to internal and external validity. Therefore modus operandi followed for this study was elaborated in the present chapter. The collected data were analysed in the next chapter.