CHAPTER III

METHODOLOGY

3.10. Overview

This chapter outlines the methodology of the study. The first section brings out the overview of the chapter. The second section states the problem, objectives, and hypotheses to be tested. The third section describes the research design and procedure in which population, sample, tools, validity and reliability, procedure of data collection and statistical techniques used in the data analysis.

3.20. The Problem

Evaluation of the Revised Biology Curriculum at High School Level in the Constructivist Perspective and Practice.

3.30. Objectives of the Study

1. To evaluate the revised biology curriculum at high school level in the constructivist perspective as perceived by State Resource Group (SRG) with respect to the dimensions such as

   i) Nature and principles of constructivism

   ii) Nature of strategies of classroom transaction

   iii) Role of teacher

   iv) Nature of student activities and
Methodology

v) Nature of strategies of assessment.

2. To analyse textbook of revised biology curriculum at high school level in the constructivist perspective as perceived by the SRG for the subject of biology.

3. To study the practises and problems of students at high school biology classrooms in the constructivist perspective in the dimensions such as

   i) Role of teacher
   ii) Nature of student activities
   iii) Nature of strategies of classroom transaction
   iv) Nature of group activity and
   v) Nature of strategies of assessment.

4. To compare the mean scores of practises and problems of students at high school biology classrooms in the constructivist perspective in the dimensions role of teacher, nature of student activities, nature of strategies of classroom transaction, nature of group activity, and nature of strategies of assessment in the sub groups such as

   i) Boys and girls
   ii) Rural and urban school students
   iii) High achievers and low achievers and
   iv) Aided, government and unaided school students.
5. To study the practises and problems of biology teachers at high school level in the constructivist perspective in the dimensions such as

i) Role of teacher

ii) Nature of student activities

iii) Nature of strategies of classroom transaction

iv) Nature of group activity and

v) Nature of strategies of assessment.

6. To compare the mean scores of practises and problems of biology teachers at high school level in the constructivist perspective in the dimensions role of teacher, nature of student activities, nature of strategies of classroom transaction, nature of group activity, and nature of strategies of assessment in the sub groups such as

i) Rural and urban school teachers

ii) Aided, government and unaided school teachers

iii) Qualified, academically more qualified, and professionally more qualified teachers

iv) Less experienced, experienced, and more experienced teachers and

v) Less aged, aged, and more aged teachers.
7. To study the correlation between practises of students with practises of biology teachers at high school level in the constructivist perspective in the dimensions such as

i) Role of teacher

ii) Nature of student activities

iii) Nature of strategies of classroom transaction

iv) Nature of group activity and

v) Nature of strategies of assessment.

8. To study the correlation between problems of students with problems of biology teachers at high school level in the constructivist perspective in the dimensions such as

i) Role of teacher

ii) Nature of student activities

iii) Nature of strategies of classroom transaction

iv) Nature of group activity and

v) Nature of strategies of assessment.
3.40. Hypotheses of the Study

1. There exists a significant difference in the mean scores of practises and problems of students at high school biology classrooms in the constructivist perspective in the dimensions role of teacher, nature of student activities, nature of strategies of classroom transaction, nature of group activity, and nature of strategies of assessment in the sub groups such as
   i) Boys and girls
   ii) Rural and urban school students
   iii) High achievers and low achievers and
   iv) Aided, government and unaided school students.

2. There exists a significant difference in the mean scores of practises and problems of biology teachers at high school level in the constructivist perspective in the dimensions role of teacher, nature of student activities, nature of strategies of classroom transaction, nature of group activity, and nature of strategies of assessment in the sub groups such as
   i) Rural and urban school teachers
   ii) Aided, government and unaided school teachers
   iii) Qualified, academically more qualified, and professionally more qualified teachers
   iv) Less experienced, experienced, and more experienced teachers and
v) Less aged, aged, and more aged teachers.

3. There exists a significant relationship between practises of students and practises of biology teachers at high school level in the constructivist perspective in the dimensions such as
   i) Role of teacher

   ii) Nature of student activities

   iii) Nature of strategies of classroom transaction

   iv) Nature of group activity and

   v) Nature of strategies of assessment.

4. There exists a significant relationship between problems of students with problems of biology teachers at high school level in the constructivist perspective in the dimensions such as
   i) Role of teacher

   ii) Nature of student activities

   iii) Nature of strategies of classroom transaction

   iv) Nature of group activity and

   v) Nature of strategies of assessment.
3.50. Research Design and Procedure

The investigator selected normative survey as the method of study. The population, sampling procedure, sample, tools, validity and reliability of the tools, collection of data and statistical techniques used for the study are given in the following pages.

3.5.1. Population of the Study

Population of the study includes all schools, all teachers teaching biology at VIII\textsuperscript{th}, IX\textsuperscript{th} and X\textsuperscript{th} standards at high school level and all students studying in standard VIII, IX, and X of Thrissur Revenue District. The distribution of population of the study is given in the Table 3.1.

Table 3.1

Distribution of the Population of the Study

<table>
<thead>
<tr>
<th>Category</th>
<th>Government Schools</th>
<th>Aided Schools</th>
<th>Unaided Schools</th>
<th>Government School Teachers</th>
<th>Aided School Teachers</th>
<th>Unaided School Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>80</td>
<td>150</td>
<td>31</td>
<td>141</td>
<td>297</td>
<td>38</td>
</tr>
<tr>
<td>Total</td>
<td>261</td>
<td></td>
<td></td>
<td>476</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.5.2. Sampling Procedure

The sample consisted of 16 members of State Resource Group (SRG) for the subject biology at high school level of Kerala State, 120 high school teachers teaching biology at VIIIth, IXth and Xth standard from different schools of Thrissur Revenue District and 960 IXth standard students from different schools of Thrissur Revenue District. Due representation was given to each strata of teachers and students such as Government, Aided, Unaided, Male, Female, Rural and Urban using proportionate stratified random sampling technique. The Thrissur Revenue District consists of 80 Government high schools, 150 Aided high schools and 31 Unaided high schools. Therefore the same proportion was included in the sample by having the ratio of schools as 8:15:3. The Thrissur Revenue District consists of three educational districts, viz., Chavakkad, Irinjalakkuda, and Thrissur. So the sample consisted of schools from Chavakkad, Irinjalakkuda, and Thrissur, taking into consideration the proportion of types of schools in each educational district. In order to ensure adequate sample size in all sub samples the investigator collected data from 11 Government high schools, 15 Aided high schools, and 9 Unaided schools; i.e., a total of 35 schools. The schools were selected randomly by taking every n\textsuperscript{th} number of listed schools from the office of the Deputy Director of Education (DDE), Thrissur Revenue District. The sampling distribution of teachers and students are given in the Figures 3.1, 3.2, 3.3, 3.4, 3.5, 3.6 and Table 3.2.
3.5.2.1. **Sample selected for the Study**

Teachers Selected Based on Type of School

Figure 3.1. Teachers Selected for the Study Based on Type of School

Teachers Selected Based on Age

Figure 3.2. Teachers Selected for the Study Based on Age
Methodology

Teachers Selected Based on Teaching Experience

Figure 3.3. Teachers Selected for the Study Based on Teaching Experience

Teachers Selected Based on Qualification

Figure 3.4. Teachers Selected for the Study Based on Qualification
Teachers Selected Based on Locale

![Diagram showing the distribution of teachers based on locale with N = 120.](image)

Figure 3.5. Teachers Selected for the Study Based on Locale

Students Selected Based on Type of School

![Diagram showing the distribution of students based on type of school with N = 960.](image)

Figure 3.6. Students Selected for the Study Based on Type of School

- Rural school Teachers: 83 (69%)
- Urban school Teachers: 37 (31%)
- Government school students: 320 (34%)
- Aided school students: 320 (33%)
- Un-aided school students: 320 (33%)

N = 120

N = 960
Table 3.2

Students Selected for the Study Based on Gender, Locale, and Achievement

<table>
<thead>
<tr>
<th>Gender</th>
<th>Locale</th>
<th>Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td></td>
<td></td>
<td>960</td>
</tr>
<tr>
<td></td>
<td></td>
<td>960</td>
</tr>
</tbody>
</table>

3.5.3. Tools Used for the Study

This section deals with the development of tools of research employed in the study. For the present study the investigator developed and used five tools as

1. A Philosophical, Psychological, and Sociological Preference Analysis Scale (PPSPAS) to collect data from SRG members

2. A Score card namely Evaluation Scale for Constructivist Biology Textbook (ESCBT) to analyse the biology textbooks at high school level

3. A Questionnaire to collect data from high school teachers about the Practises and Problems of Teachers (QPPT) in the constructivist biology classrooms

4. A Questionnaire to collect data from high school students about the Practises and Problems of Students (QPPS) in the constructivist biology classrooms and

91
5. **Interview Guides** to collect data from selected biology teachers and students at high school level.

Each tool is detailed below with sample items.

### 3.5.3.1. Philosophical, Psychological and Sociological Preference Analysis Scale for Constructivist Biology Curriculum (PPSPAS)

The investigator developed the Philosophical, Psychological and Sociological Preference Analysis Scale (PPSPAS) following the style adapted by Wiles and Bondi (1993) considering the constructivist principles suggested by Jha (2009), Herr (2008), Agrawal (2007), Llewellyn (2002), Windschitl (2002), Enger and Yager (2001) and Martin (2000). The five major dimensions of curriculum considered for developing the scale were: 1) Nature and principles of constructivist curriculum, 2) Strategies of constructivist curriculum transaction, 3) Role of teacher in the constructivist curriculum, 4) Nature of student activities in the constructivist curriculum, and 5) Strategies of assessment in the constructivist curriculum. A sample item from Part 3 of the scale is given below.

4. The curriculum enables the teachers to execute their roles as guide, director, midwife, facilitator, scaffold, etc.,

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

The respondent was asked to put a ✓ mark according to the constructivist preferences reflected in the high school biology curriculum. The PPSPAS is given as Appendix A on page 244.
The following Table 3.3 shows the dimensions and distribution of items in the Philosophical, Psychological, and Sociological Preference Analysis Scale for constructivist biology curriculum (PPSPAS).

Table 3.3

Distribution of Items in the Philosophical, Psychological, and Sociological Preference Analysis Scale for Constructivist Biology Curriculum (PPSPAS)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Dimensions of Constructivist Biology Curriculum</th>
<th>No. of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nature and Principles of Constructivist Curriculum</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>Strategies of Constructivist Curriculum Transaction</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Role of Teacher in the Constructivist Curriculum</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>Nature of Student Activities</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>Strategies of Assessment in the Constructivist Curriculum</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>41</strong></td>
</tr>
</tbody>
</table>

The SRG members were requested to respond to the 41 items according to the strength of reflection of constructivist preferences in the high school biology curriculum. Scoring of items was on a scale of 1 through 5. The score 1 indicates strong disagreement and the score 5 indicates strong agreement.
3.5.3.2. Evaluation Scale for Constructivist Biology Textbook (ESCBT)

The investigator developed the ESCBT based on Vogel’s Spot Check Evaluation Scale for High School Science Textbooks (cited in Thurber & Collette, 1964), Sund and Trowbridge’s Science Textbook Comparing Scale (cited in Carin & Sund, 1970), Textbook Evaluation Checklist given by De Roche (cited in Rasheed, 2000) and Constructivist Science Textbook Review Form developed by Martin (2000). Vogel (1951) developed the Spot Check Evaluation Scale for High School Science Textbooks considering ten major domains of science textbooks. Each domain of textbook was reflected by five statements each having a score of two and a total score of 100. The investigator adapted the scale and expanded the ten areas focusing on the constructivist principles as suggested by Sund and Trowbridge (1967) and Martin (2000). A sample item from section II (organisation) is given below.

<table>
<thead>
<tr>
<th>6. Activities given are relevant and problem based in nature</th>
<th>Excellent</th>
<th>Good Average</th>
<th>Above Average</th>
<th>Average</th>
<th>Below Average</th>
<th>Inferior</th>
<th>Poor</th>
</tr>
</thead>
</table>

The respondent was asked to put a ✓ mark according to constructivist preferences. The ESCBT is given as Appendix B on page 252.

The following Table 3.4 shows the domains and number of items in the ESCBT.
Table 3.4

The Domains and Number of Items in the Evaluation Scale for Constructivist Biology Textbook (ESCBT)

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Domains of Constructivist Biology Textbook</th>
<th>No. of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Authenticity</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Organisation</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Content</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>Presentation</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Accuracy</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>Readability</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>Adaptability</td>
<td>10</td>
</tr>
<tr>
<td>8</td>
<td>Utilisation of Teaching Aids</td>
<td>10</td>
</tr>
<tr>
<td>9</td>
<td>Illustrations</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>Appearance</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>
Thus a total of 100 items were included in the scale incorporating constructivist principles and ideals. The items were scored as 7 for Excellent, 6 for Good, 5 for Above Average, 4 for Average, 3 for Below Average, 2 for Inferior, and 1 for Poor.

3.5.3.3. Questionnaire on Practises and Problems of Teachers in the Constructivist Biology Classrooms (QPPT)

The investigator developed the questionnaire considering the factors involved in curriculum as envisaged by Dillon (2009) and Mc Cormick and James (1983). The three factors suggested by Dillon (2009) are - - 1) Nature of curriculum, 2) Elements of curriculum and 3) Practice of curriculum. Mc Cormick and James (1983) has considered the five relevant factors of curriculum as: 1) School environment, 2) School climate, 3) Pupil, 4) School and 5) community. The investigator analysed these factors taking into consideration the theoretical underpinnings of constructivist curriculum as suggested by Jha (2009), Herr (2008), Agrawal (2007), Llewellyn (2002), Windschitl (2002), Enger and Yager (2001) and Martin (2000) to prepare the questionnaire for analysing the practises and problems of teachers in the constructivist biology classrooms. The questionnaire on practises and problems of teachers in the constructivist biology classrooms consists of 20 dimensions. The choices included under each dimension are given in Table 3.5.
### Table 3.5

The Dimensions and Choices in the Questionnaire on Practises and Problems of Teachers (QPPT) in the Constructivist Biology Classrooms

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Dimensions of Constructivist Practises and Problems of Teachers</th>
<th>No. of Choices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Use of Textbook in the Classroom</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Use of Notebook in the Classroom</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Process of Seminar in the Classroom</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>Process of Project in the Classroom</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>Devices used for Teaching</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>Products Evolved During learning</td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td>Structure of Group in the Classroom</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>Process of Learning in the Group</td>
<td>11</td>
</tr>
<tr>
<td>9</td>
<td>Role of Teacher During learning</td>
<td>8</td>
</tr>
<tr>
<td>10</td>
<td>Management of Time During the Process of Teaching</td>
<td>6</td>
</tr>
<tr>
<td>11</td>
<td>Process of Peer-assessment</td>
<td>7</td>
</tr>
<tr>
<td>12</td>
<td>Process of Self-assessment</td>
<td>7</td>
</tr>
<tr>
<td>13</td>
<td>Process of Group-assessment</td>
<td>7</td>
</tr>
<tr>
<td>14</td>
<td>Factors Contributing to Effective Learning</td>
<td>8</td>
</tr>
<tr>
<td>15</td>
<td>Process of Questioning</td>
<td>7</td>
</tr>
<tr>
<td>16</td>
<td>Process of Experimentation</td>
<td>10</td>
</tr>
<tr>
<td>17</td>
<td>Condition of New Approach in the Classroom</td>
<td>8</td>
</tr>
<tr>
<td>18</td>
<td>Teacher Behaviour</td>
<td>8</td>
</tr>
<tr>
<td>19</td>
<td>Manipulation of Errors</td>
<td>6</td>
</tr>
<tr>
<td>20</td>
<td>Strategies Adopted for Allotment of CE Grade</td>
<td>8</td>
</tr>
</tbody>
</table>

**Total** 155
A sample item is given below.

### 6. Products evolved during learning

<table>
<thead>
<tr>
<th>Item</th>
<th></th>
<th>Item</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Brochure</td>
<td></td>
<td>8. Question box</td>
<td></td>
</tr>
<tr>
<td>4. collage</td>
<td></td>
<td>10. Magazines, publications</td>
<td></td>
</tr>
<tr>
<td>5. Concept cartoons</td>
<td></td>
<td>11. Concept maps</td>
<td></td>
</tr>
<tr>
<td>6. Poem</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Other Remarks**

The QPPT is given as Appendix C on page 267.

The choices of each dimension were provided with small rectangles □ to indicate the condition of occurrences by tick ✓ or X mark according to the practises of constructivist ideals in the classrooms. A space was also provided to write responses other than the options given to each dimension. The responses were scored as ‘1’ for presence of practice of constructivist perspectives and ‘0’ for its absence. The responses written in the large space provided were used for qualitative analysis.
3.5.3.4. Questionnaire on Practises and Problems of Students (QPPS) in the Constructivist Biology Classrooms

The investigator developed an identical questionnaire as in the case of questionnaire on Practises and Problems of teachers (QPPT). However, eight additional probing items (20+8) were included in the QPPS as students can give relevant information when compared to teachers keeping the dimensions grouped for the study. A sample item is given below.

9. Products evolved during learning

<table>
<thead>
<tr>
<th>1. Poster</th>
<th>2. Notice</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Concept cartoons</td>
<td>6. Poem</td>
</tr>
<tr>
<td>7. Stories</td>
<td>8. Magazines</td>
</tr>
</tbody>
</table>

Other Remarks

The QPPS is given as Appendix D on page 279.

The dimensions and choices of QPPS are given in the Table 3.6.
### Table 3.6
Dimensions and Choices in the Questionnaire on Practises and Problems of High School Students (QPPS) in the Constructivist Biology Classrooms

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Practises and Problems of High School Students in the Constructivist Biology Classrooms</th>
<th>No. of Choices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Process of Induction of Learning Process</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Use of Notebook During the Process of Learning</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Process of Writing During Learning</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>Process of Seminar in the Classroom</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Process of Projects in the Classroom</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Devices Used by the Teacher for Teaching</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>Devices Used for Data Collection During Learning</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>Facilities and Materials Used During Learning</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>Products Evolved During Learning</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>Process of Learning in the Group</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>Process of Grouping</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>Materials Used for Group Discussion</td>
<td>5</td>
</tr>
<tr>
<td>13</td>
<td>Structure of Group in the Classroom</td>
<td>7</td>
</tr>
<tr>
<td>14</td>
<td>Role of Teacher in the Classroom</td>
<td>7</td>
</tr>
<tr>
<td>15</td>
<td>Conduct of Experiments for Learning</td>
<td>10</td>
</tr>
<tr>
<td>16</td>
<td>Process of Experimentation During Learning</td>
<td>6</td>
</tr>
<tr>
<td>17</td>
<td>Process of Peer-assessment</td>
<td>7</td>
</tr>
<tr>
<td>18</td>
<td>Process of Self-assessment</td>
<td>7</td>
</tr>
<tr>
<td>19</td>
<td>Process of Group-assessment</td>
<td>7</td>
</tr>
<tr>
<td>20</td>
<td>Teacher Behaviour</td>
<td>7</td>
</tr>
<tr>
<td>21</td>
<td>Manipulation of Errors</td>
<td>6</td>
</tr>
<tr>
<td>22</td>
<td>Use of Concepts and Hypotheses</td>
<td>5</td>
</tr>
<tr>
<td>23</td>
<td>Learning Process in the Classroom</td>
<td>6</td>
</tr>
<tr>
<td>24</td>
<td>Directions of Teacher During Learning</td>
<td>5</td>
</tr>
<tr>
<td>25</td>
<td>Process of Questioning</td>
<td>8</td>
</tr>
<tr>
<td>26</td>
<td>Factors Contributing to Effective Learning</td>
<td>6</td>
</tr>
<tr>
<td>27</td>
<td>Management of Time During Teaching</td>
<td>4</td>
</tr>
<tr>
<td>28</td>
<td>Strategies Adopted for Allotment of CE Grade</td>
<td>7</td>
</tr>
</tbody>
</table>

**Total** 185
Methodology

The choices under each dimension were provided with small rectangles □ to indicate the condition of occurrences by ✓ or X mark according to the practice of constructivist ideals in the classrooms. A space was also provided to all items to write responses other than the options given to each domain. The responses were scored as ‘1’ for presence of practices of constructivist perspectives and ‘0’ for its absence. The responses written in the large space provided were used for qualitative analysis.

3.5.3.5. Interview Guides for Teachers and Students

Interview guides were prepared to collect qualitative information from selected teachers and students. As the guides keep the same dimensions grouped for the study the investigator used them to supplement the quantitative data and for triangulation.

Sample item from Interview Guide I (for teachers) is given below.

Do you feel that you keep justice in allotting CE grades to students? What are the criteria that you have adopted for this?

Sample item from Interview Guide II (for students) is given below.

Do you feel that your teacher keeps justice in allotting CE grades? How do you feel about the criteria that s/he adopted for this?

The Interview Guides are given as Appendix E (for teachers) and F (for students) on pages 294 and 295 respectively.
3.5.4. Validity and Reliability of Tools

3.5.4.1. Validity of the Tools

The tools address the different dimensions of constructivist paradigm and process of curriculum transaction. This allows the researcher to ensure content validity, that every items/choices corresponds to a desired measurement and that everything that should be measured is actually measured (Best & Kahn, 1992) or the content is judged to be representative of the appropriate universe or domain of content (McMillan & Schumacker, 1989). The procedure adapted to ensure the content validity of the tools was: (1) The investigator analysed the conceptual underpinnings of constructivism based on relevant authentic sources, (2) The items and choices were prepared based on the conceptual framework and objectives of the study, (3) The tools were subjected to review of a panel of experts which consisted of one faculty from university department, and two faculties from District Institute of Education and Training (DIET) for expert validation, (4) The recommendations of the panel were considered for final drafting of items in connection with adequacy of domains, items, and choices included in the tool, and (5) The tool was administered to one SRG, two teachers, and a sample of 45 students of IX\textsuperscript{th} standard. By analysing the responses and feedbacks of respondents the tools were finalized. The appearance of items were so worded and structured by the investigator to ensure the face validity of the tools. As the tools measure independent conceptual dimensions of constructivist practises and problems no external criterion against which the test items correlated could be available (Ferguson, 1971). So no statistical procedures were used for establishing criterion validity, construct validity and concurrent validity.
3.5.4.2. Reliability of the Tools

The items of the tools address related, independent dimensions of the constructivist curriculum and process, the investigator adopted item-interrelationship method for establishing internal consistency of the tools. The Cronbach’s Alpha is a much general form used for items that are not scored right or wrong. It is the most appropriate type of reliability for survey research and other questionnaires in which there is a range of possible answers for each item (McMillan & Schumacker, 1989). It is based on homogeneity, or amount of correlation among the item responses within one test. It involves calculating the correlations between the scores of items and scores of the whole test. It describes estimates of reliability based on the average correlation among items within a test (Nunnally & Bernstein, 2010). The Cronbach’s Alpha reliability coefficients are given in the Tables 3.7, and 3.8.
Table 3.7

**a) Cronbach’s Alpha Reliability Coefficients for the Items of Practises of Teachers in the Constructivist Biology Classrooms (Tool-QPPT)**

<table>
<thead>
<tr>
<th>Role of teacher</th>
<th>Nature of Student Activities</th>
<th>Strategies of Classroom Transaction</th>
<th>Nature of Group Activity</th>
<th>Strategies of Assessment</th>
<th>Practises of Students in (Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role of teacher</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nature of Student Activities</td>
<td>.693</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategies of Classroom Transaction</td>
<td>.774</td>
<td>.595</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nature of Group Activity</td>
<td>.716</td>
<td>.579</td>
<td>.728</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Strategies of Assessment</td>
<td>.586</td>
<td>.574</td>
<td>.621</td>
<td>.579</td>
<td>1.000</td>
</tr>
<tr>
<td>Practises of Students in (Total)</td>
<td>.852</td>
<td>.779</td>
<td>.851</td>
<td>.825</td>
<td>.876</td>
</tr>
</tbody>
</table>

Table 3.7

**b) Cronbach’s Alpha Reliability Coefficients of the Items of Problems of Teachers in the Constructivist Biology Classrooms (Tool-QPPT)**

<table>
<thead>
<tr>
<th>Role of teacher</th>
<th>Nature of Student Activities</th>
<th>Strategies of Classroom Transaction</th>
<th>Nature of Group Activity</th>
<th>Strategies of Assessment</th>
<th>Practises of Students in (Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role of teacher</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nature of Student Activities</td>
<td>.583</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategies of Classroom Transaction</td>
<td>.653</td>
<td>.545</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nature of Group Activity</td>
<td>.730</td>
<td>.557</td>
<td>.725</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Strategies of Assessment</td>
<td>.471</td>
<td>.232</td>
<td>.378</td>
<td>.489</td>
<td>1.000</td>
</tr>
<tr>
<td>Practises of Students in (Total)</td>
<td>.857</td>
<td>.666</td>
<td>.881</td>
<td>.920</td>
<td>.587</td>
</tr>
</tbody>
</table>
Table 3.8

a) Cronbach’s Alpha Reliability Coefficients for the Items of Practises of Students in the Constructivist Biology Classrooms (Tool-QPPS)

<table>
<thead>
<tr>
<th>Role of teacher</th>
<th>Nature of Student Activities</th>
<th>Strategies of Classroom Transaction</th>
<th>Nature of Group Activity</th>
<th>Strategies of Assessment</th>
<th>Practises of Students in (Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role of teacher</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nature of Student Activities</td>
<td>.694</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategies of Classroom Transaction</td>
<td>.734</td>
<td>.798</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nature of Group Activity</td>
<td>.497</td>
<td>.659</td>
<td>.598</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Strategies of Assessment</td>
<td>.462</td>
<td>.481</td>
<td>.504</td>
<td>.383</td>
<td>1.000</td>
</tr>
<tr>
<td>Practises of Students in (Total)</td>
<td>.840</td>
<td>.925</td>
<td>.931</td>
<td>.734</td>
<td>.587</td>
</tr>
</tbody>
</table>

Table 3.8

b) Cronbach’s Alpha Reliability Coefficients of the Items of Problems of Students in the Constructivist Biology Classrooms (Tool-QPPS)

<table>
<thead>
<tr>
<th>Role of teacher</th>
<th>Nature of Student Activities</th>
<th>Strategies of Classroom Transaction</th>
<th>Nature of Group Activity</th>
<th>Strategies of Assessment</th>
<th>Practises of Students in (Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role of teacher</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nature of Student Activities</td>
<td>.085</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategies of Classroom Transaction</td>
<td>.489</td>
<td>.139</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nature of Group Activity</td>
<td>.325</td>
<td>.024</td>
<td>.528</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Strategies of Assessment</td>
<td>.379</td>
<td>.003</td>
<td>.314</td>
<td>.202</td>
<td>1.000</td>
</tr>
<tr>
<td>Practises of Students in (Total)</td>
<td>.663</td>
<td>.232</td>
<td>.894</td>
<td>.779</td>
<td>.394</td>
</tr>
</tbody>
</table>
The results show that the reliability coefficients are very high at a .01 level of significance. This indicates satisfactory reliability of the tools and consistency in measuring what they intend to measure over time. But some of the items in the dimensions of problems of students and problems of teachers show no significant correlation. Even though the investigator included these items in the final tool as these items represent independent dimensions of constructivist paradigm.

3.5.5. Collection of Data

The investigator collected the list and address of each SRG member from Core SRG members and directions were made clear to respond to each item. The tools were administered directly by the investigator and collected data from 16 SRG members of Kerala State for the subject of biology at high school level [using Philosophical, Psychological, and Sociological Preference Analysis Scale for Constructivist Biology Curriculum (PPSPAS), and Evaluation Scale for Constructivist Biology Textbook (ESCBT)].

The investigator directly collected data from 120 biology teachers in the three educational Districts keeping the ratio of teachers as in each educational Districts of Thrissur Revenue District using the Questionnaire on Practises and Problems of Teachers in the Constructivist Biology Classrooms (QPPT). Interview Guides on Practises and Problems of Teachers in the Constructivist Biology Classrooms were also used to collect
additional information from 34 selected biology teachers and used for qualitative analysis and triangulation.

The investigator collected the data directly from 960 students from Thrissur Revenue District using the Questionnaire on Practises and Problems of Students in the Constructivist Biology Classrooms (QPPS). The data so collected were scored and tabulated for analysis. The midterm achievement scores was used for locating high achieving and low achieving students. Interview Guides on Practises and Problems of Students in the Constructivist Biology Classrooms were also used to collect additional information from 78 students and used for qualitative analysis and triangulation.

3.5.6. Statistical Treatment of Data

The tabulated data were subjected to objective-wise analysis using Statistical Package for Social Sciences (SPSS). The statistical techniques used were Percentage Analysis, Tests of Normality and Homoscedasticity, t-test, One-way ANOVA, Correlation (Pearson Product Moment) and Univariate Analysis of Variance.
CHAPTER IV

ANALYSIS OF DATA