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CHAPTER - III

METHODOLOGY
AND DESIGN OF THE STUDY

Introduction

The status of the teacher reflects the socio-cultural ethos of a society. It is said that, no people can rise above the level of its teachers, while speaking of teachers it include heads of educational institutions, whole-time teachers in institutions of formal education, instructors of non-formal and adult education centers, teachers engaged in instruction through various techniques of distance learning and also voluntary and part-time workers who may be engaged for playing a specific role for a specific period of time. The academic attainment of the students mainly depends upon the teachers, the infrastructure and physical facilities of the school. The principals/headmasters also play important role in building up the institution. Certain variables like personality, attitude, adjustment, interest are also main contributors for the estimation of students' academic achievement. Hence, the present study attempts to investigate the impact of students' personality and attitude towards science with the teacher effectiveness on the academic achievement of the students.
The investigator in this chapter going to present the methodology adopted and design of the study. Following aspects are duly considered;

i) Statement of the problem.

ii) Variables involved in the study

iii) Rationale for the Study – Empirical Evidences for the selected variables.

iv) Delimitation of the Study.

v) Definition of Technical Terms.

vi) Research hypothesis.

vii) Method of Research

viii) Tools used for the collection of the data.

ix) Sample and Sampling Procedure

x) Data Collection Procedure.

xi) Statistical Techniques Used for the analysis of the data.

3.1) Statement of the problem

The study was undertaken with a view to investigate “INTERACTIVE EFFECT OF TEACHER EFFECTIVENESS, SECONDARY SCHOOL STUDENTS PERSONALITY AND ATTITUDE TOWARDS SCIENCE ON THEIR ACADEMIC ACHIEVEMENT.”
3.2) Variables involved in the study

i) Independent variables (Predictors)

The independent variables considered in the present study were;

i) Students' Personality (Introversion, Extroversion, Neuroticism)

ii) Students' Attitude towards Science (desirable and undesirable attitude)

iii) Teachers' Teaching Effectiveness (Effective and Ineffective teaching)

ii) Dependent Variable (Criterion)

Academic-achievement of Students in Science

3.3) Rationale for the Study – Empirical Evidences for the selected variables.

i) Student's Personality

Student's personality factor is the independent variable in the present study. The personality factors considered are introversion, extraversion and neuroticism.

Cattel (1956) defines personality as “that which predicts what a person will do when placed in a given situation”.

Quraishi (1972) noted that teachers' verbal behaviour in the classroom was related to the personality and attitude of the students.

Gupta (1977) found that the personality of the students like, adjustment, home environment, health, social, emotional, attitude factors are the determinants for the academic achievements. Goel (1978) found that, the
extravert students had larger transaction response and always creating disturbances in the classroom than the introvert students.

Kumar (1979) observed that, the personality factors of students like, introversion and extraversion and neuroticism affected the academic achievement of the students at the secondary level. Mallik (1984) showed that, personality factors like, intelligence, emotional stability, introversion and extroversion contributes much for the academic attainment and growth of the pupils at the secondary level, especially for learning of science and mathematics.

Gupta (1989) studied causes of failure of the students in science and mathematics. The variables considered were intelligence and personality factor like, introversion and extroversion and attitude of the students. The results indicated that, large number of failure was mainly due to low attitude and high extroversion of the students. Intelligence was also found very less amongst most of the students.

Students Attitude towards Science

The term 'Attitude' is defined by Freeman (1965) as "a dispositional readiness to respond to certain situations, persons, objectives or ideas in a consistent manner, which has been learnt and has become one's typical mode of response". It is a tendency to react in a certain way towards a designated class of stimuli. These are the ways in which an individual thinks, feels and acts. Attitude always arouses one's feelings
and emotions. Attitude ranges from Positive extreme to Negative extreme. Attitudes vary in the amount of positiveness or negativeness.

In the present study, the attitude of the students towards science teaching is conceived. It is a comparatively stable, emotional and learned pattern of behaviour, which predisposes the individual to act in some consistent way towards his or her learning. It may range between favourable attitudes to unfavourable attitude. A favourable attitude makes the work not only easier but also more satisfying and professional rewarding. An unfavourable attitude makes the teaching task harder, more tedious and unpleasant.

Mann (1980) studied that the personality factors like, attitude and adjustment largely contributed towards the academic attainment of the students especially in the subjects like, Science and Mathematics.

Kumar, Yogesh. (1989). A comparative study of adjustment, attitude, interest and level of aspiration of the tribal and non-tribal students of the secondary level. The study yielded the results like; attitude and adjustment are the main predictors of the academic achievement.

Gupta (1989) studied causes of failure of the students in science and mathematics. The variables considered were intelligence and personality factor like, introversion and extroversion and attitude of the students. The results indicated that, large number of failure was mainly due to low attitude and high extroversion of the students. Intelligence was also found very less amongst most of the students.
Rajan (1990) studied the causes of low achievement in Science and Mathematics of the students at the secondary level. The study included the personality variables like intelligence, introversion and extraversion, attitude and SES of the students. It was found that, the personality factors like introversion and extraversion were equally responsible for low achievement like intelligence.

**Teachers Effectiveness**

Kulandaivel and Rao (1968) revealed that a teacher as viewed by the students was one who teaches well, inspires good qualities re-teaches a lesson when not understood, treats the students alike, reprimands student for their follies and tries to reform students problematic type. Debnath (1971) identified knowledge of the subject matter, sincerity in teaching, mastery of the method of teaching academic qualifications, mode of exposition, sympathetic attitude, discipline, student’s participation, proper use of instructional aids and the art of questioning as correlates of teaching efficiency. Chhaya (1974) found that effective teachers had significantly better personality adjustment and more favourable attitude towards teaching than ineffective teachers. Kamala Arora (1976) found that effective teaches were satisfied with their job, had favourable attitude towards teaching profession, friendly relations, democratic attitude, modern teaching techniques than ineffective teachers.
Maheshwari (1976) found that effective teachers used the categories of “accepts feeling, praise, uses student ideals, questions, student response and initiation” whereas ineffective teachers employed “lecture, direction and authority” categories in the classroom behaviour.

Grewal (1976) found that the main predictors of teacher effectiveness were home, health, social, emotional and total adjustment, dominance, verbal and non-verbal intelligence.

Gupta (1976) noted that ‘high’ effective teachers were more intelligent emotionally stable assertive, conscientious, adventurous, tender-minded, less suspicious, high self-control, less tense and frustrated.

Sharma (1979) suggested that thirty practical lessons, evaluation lessons, craft work, five assignments, participation in sports and NSS programme, hostel administration, community service are essential for development of teacher competencies.

Chandra and Singh (1980) studied the emotive aspects of work and found the values of social service, intellectual challenge and independence appealed to effective teachers, but for ineffective teachers was economic return.

Mutha (1980) found that personality variables – ascendance-submission, anxiety, marital adjustment, extraversion, neuroticism, job satisfaction, teaching aptitude, real self-discrepancy, religious, social, theoretical, aesthetic, economic, political values and intelligence significantly predicted the teacher’s effectiveness.
Interactive effects of teacher effectiveness and pupil personality on pupil achievement

Studies of Eysenck (1957 and 1960), Furneaus (1956), Savage (1962), Eysenck and Cookson (1969), Mohan (1973), Entwistle (1970), child (1964) and others revealed that low neurotics and low extraverts (introverts) achieve more than high extraverts and high neurotic students.

Based on the above evidence the investigator expects that students with low extraversion and low neuroticism will achieve higher than the high neurotic and high extravert students.

Interactive Effects of Teacher Behaviour and Pupil Personality on Pupil Achievement

From the seventies there has been a lot of interest generated in the Aptitude X Treatment Interaction effects (ATI effects). That is to say, investigators are interested in determining what kind of teacher style suits what kind of pupil. The aim of such studies is to find out a match between student aptitude and teacher style of teaching. Student aptitudes may be personality, Socio-Economic Status (SES), age and sex (Crombach and Snow, 1977, p. 321). In this investigation also, besides determining the relationships between teacher behaviour and pupil achievement on the one hand and pupil personality and pupils' achievement on the other, an attempt has been made to study ATI effects. Student aptitudes considered are extraversion and neuroticism.
and treatment variable is teacher behaviour in terms of indirect and direct influence.

**Dowaliby and Schumer (1970)** studied teacher centred versus the student centered mode of college classroom instruction as related to manifest anxiety. The aim of the study was to know the possibility of an ATI effect between two modes of classroom instruction and student anxiety. The student aptitude was manifest anxiety and the treatment variable was in terms of teacher centered and student centered mode of classroom teaching. The results revealed disordinal interaction while the teacher centered mode optimized learning for high anxious students, the student centered approach resulted in superior performance for low anxious students.

**Katharki and Deshpande (1984)** studied interactive effects of teacher behaviour and pupils' neuroticism on pupil achievement. The student aptitude was neuroticism and the treatment variable was teacher behaviour in terms of direct and indirect influence. The results revealed that low neurotics under indirect teacher influence achieved higher than under direct teacher influence.

### 3.4) Delimitation of the Study

The aim of the investigation was to study the impact of teacher's effectiveness and students' personality and attitude towards science on academic achievement.
The study was thus confined to recognized Government, Private-aided and private un-aided secondary schools located in Belgaum Division (Un-divided Dharwad, Karwar, Bijapur and Belgaum Districts). Students studying IX standards during the academic year 2003-2004 and teachers teaching science subjects were only involved in the study.

While measuring academic achievement the study was confined only to the performance of the students in science subjects. Particularly, focus on the selected topics in the Chemistry.

3.5) Definitions of the Technical Terms

Few terms appear frequently in the report of investigation and they have been used with specific meaning. These are as follows:

i) Students personality

The studies of Child (1964), Eysenck (1968) Eysenck and Cookson (1969) and Entwistle (1971) revealed that, the personality factors of students like, extroversion and introversion, neuroticism play important role in the classroom as well as the academic attainment of the students. Some time these factors also affect the other type of development of the students as well as the effective teaching by the teachers.

Kurt Singer (1978) studied the importance of students personality can be seen particularly in his /her relationship with teachers and in the climate of feeling which he / she is able to produce. He further states
that, every learning process is accompanied by personnel feelings and is affected by the social relationship within the learning group and if the individuals' feelings and needs which run parallel into the intellectual learning process are ignored. The whole learning process suffers. This implies that, the effective teaching of a teacher depends upon the personality factors of the students.

Carl Jung (1964) proposed two types of personality dimensions depending upon the inward or outward flow of libido and he named them 'introversion and extroversion' Eysenck (1982) later expanded these concepts and used them in his own tests. 'Extraversion' is the tendency of an individual orienting towards the external word, during rather than thinking and approaching life as oriented by and related to the object rather than himself (Singh and Singh, 1979). 'Introversion is the tendency of an individual tending to retreat from the external world and engage in mediation absorbing in his own thoughts and generally approaching life from the standpoint of his own subjective values (Singh and Singh 1979). In the present study students' personality will be conceived from 'extroversion' and 'introversion' point of view.

'Extraversion' refers to an outgoing candid and accommodating nature that adapts easily to a given situation quickly from attachment and setting aside any possible misgivings, will often venture forth with careless confidence into an unknown situation. 'Introversion', in contrast, signifies a hesitant, reflective, retiring nature that keeps itself
to itself, shrinks from objectives, is always slightly on the defensive and prefers to hide behind mistrustful scrutiny.

**Teachers' Teaching Effectiveness**

Borich and Fenton (1977) have identified three forms of teacher competencies: knowledge, performance, and consequence. 'Knowledge' competencies specify cognitive understanding the teacher is expected to demonstrate. 'Performance' competencies refer to the ongoing teaching behaviours as measured in terms of its effectiveness in the classroom. 'Consequence' competencies refer to the pupil outcomes provided by the teacher's proper use of an array of knowledge and performance competencies.

Gage (1962) describes teachers' effectiveness in terms of teacher effects on the realization of some value, where value takes the form of some educational objectives defined in terms of pupil behaviour, ability or characteristics.

Flanders and Siman (1969) points out that, teachers' effectiveness is concerned with relationship between the characteristics of teachers' teaching act and their effects on the educational outcome of classroom teaching. In the present study, teachers teaching effectiveness is used to refer to the results a teacher gets or to the amount of progress the pupils make toward some specified goal, i.e., achievement in mathematics. It implies that teaching effectiveness can be defined, and can only be assessed, in terms of behaviours of pupils, not behaviours of teachers.
**Academic Achievement**

Achievement refers to the scholastic or academic achievement of the student at the end of an educational programme. A good number of variables such as personality characteristics of the learners, the SES, the organizational climate of the school, curriculum planning, etc., influence achievement in different degrees. These variables are generally referred to as correlates of achievement.

The factors, which influence on academic achievement of students, are many. Students' IQ, health, peer group, past experience, attitude towards the school subjects and teachers, the emotional care, parents' love and affection, family environment, SES, etc., are some of the factors which affect the academic achievement of students. In the present study, teacher's personality, teachers' attitude towards teaching profession and teachers' teaching effectiveness are the factors which are conceived to influence on academic achievement.

The academic achievement of students in mathematics which is considered as dependent variable in the present study is the performance of the IX Standard students in the mathematics subject at the end of the academic year 2001-2002.

3.6) **Research hypothesis**

Keeping in view the above variables and the objectives of the study, the investigator formulated following research hypothesis.
i) Effects of students' introversion and low neuroticism, extroversion and high neuroticism personality types differ significantly in terms of their influence on academic achievement in science.

ii) Effects of teachers' effective and ineffective teacher-teaching of science differs significantly in terms of the students' achievement in science.

iii) Effects of students' favourable and unfavourable attitudes towards science differs significantly in terms of their achievement in science.

iv) Interactive effects of students' personality types and students' attitude towards science differ significantly in terms of their achievement in science.

v) Interactive effects of student personality types and teachers teaching effectiveness types differ significantly in terms of their influence on academic achievement in science.

vi) Interactive effects of students' attitude towards science and teacher teaching effectiveness differ significantly in terms of their influence on academic achievement in science.

vii) Interactive effects of students' personality types and students' attitude towards science and teachers' teaching effectiveness differ significantly in terms of their influence on academic achievement in science.

**Sex of the Teachers**

i) Effects of male teachers' teaching effectiveness on students' introversion, extraversion and neuroticism differ significantly in terms of their influence on academic achievement in science.
ii) Effects of male teachers' teaching effectiveness on students’ attitude towards science as favourable and unfavourable differ significantly in terms of their influence on academic achievement of students in science.

iii) Effects of male teachers teaching effectiveness and ineffectiveness differ significantly in terms of their influence on the academic achievement of students in science.

iv) Interactive effects of male teachers' teaching effectiveness types and students' attitude towards science differ significantly in terms of their influence on the academic achievement in science.

v) Interactive effects of students' personality types and male teachers teaching effectiveness differ significantly in terms of students' academic achievement in science.

vi) Interactive effects of male teachers' teaching effectiveness on students' attitude towards science differ significantly in terms of their influence on academic achievement of students in science.

vii) Interaction effects of students personality types X students’ attitude towards teaching of science X male teachers teaching effectiveness differ significantly in terms of their influence on academic achievement in science.

**Female Teachers**

i) Effects of female teachers’ teaching effectiveness on students' introversion, extraversion and neuroticism differ significantly in terms of their influence on academic achievement in science.
ii) Effects of female teachers' teaching effectiveness on students' attitude towards science as favourable and unfavourable differ significantly in terms of their influence on academic achievement of students in science.

iii) Effects of female teachers teaching effectiveness and ineffectiveness differ significantly in terms of their influence on the academic achievement of students in science.

iv) Interactive effect of male teachers' teaching effectiveness types and students' attitude towards science differ significantly in terms of their influence on academic achievement in science.

v) Interactive effects of students' personality types and male teachers teaching effectiveness differ significantly in terms of students' academic achievement in science.

vi) Interactive effect of male teachers' teaching effectiveness on students' attitude towards science teaching differ significantly in terms of their influence on the achievement of students' in science.

vii) Interaction effects of students personality types $X$ students' attitude towards teaching of science $X$ female teachers teaching effectiveness differ significantly in terms of their influence on academic achievement in science.

**Teacher with Minimum Qualifications**

i) Effects of minimum qualification of teachers towards teaching science and students personality types differs significantly in terms of their influence on academic achievement in science.
ii) Effects of minimum qualifications of teachers' teaching for students with favourable and unfavourable attitude towards science differ significantly in terms of their influence on academic achievement in science.

iii) Effects of minimum qualification of teachers' teaching effectiveness and ineffectiveness differ significantly in terms of their influence on academic achievement of students in Science.

iv) The interactive effects of minimum qualification teachers' teaching effectiveness and students attitude towards science and students personality types differs significantly in terms of their influence on academic achievement in science.

v) Interactive effects of minimum qualification teachers teaching effectiveness and students personality types differ significantly in terms of their influence on academic achievement in science.

vi) Interactive effects of minimum qualification teachers' teaching effectiveness and for the students' attitude towards science differ significantly in terms of their influence on academic achievement in science.

vii) Interactive affects minimum qualifications teachers teaching effectiveness $\times$ students' attitude towards science $\times$ students' personality types differ significantly in terms of their influence on academic achievement in science.

**Teachers with Higher Qualifications**

i) Effects of higher qualifications of teachers towards teaching effectiveness and students personality types differs
significantly in terms of their influence on academic achievement in science.

ii) Effects of higher qualifications of teachers' teaching for the students with favourable and unfavourable attitude towards science differ significantly in terms of their influence on academic achievement in science.

iii) Effects of higher qualifications of teachers' teaching effectiveness and ineffectiveness differ significantly in terms of their influence on academic achievement of students in Science.

iv) The interactive effects of higher qualifications teachers' teaching effectiveness and students attitude towards science and students personality types differ significantly in terms of their influence on academic achievement in science.

v) Interactive effects of higher qualifications teachers teaching effectiveness and students personality types differ significantly in terms of their influence on academic achievement in science.

vi) Interactive effects of higher qualifications teachers' teaching effectiveness and for the students' attitude towards science differ significantly in terms of their influence on academic achievement in science.

vii) Interactive effects higher qualifications teachers teaching effectiveness $\times$ students' attitude towards science $\times$ students' personality types differ significantly in terms of their influence on academic achievement in science.
Teachers with Higher Teaching Experience

i) Effects of higher teaching experience of teachers teaching effectiveness, students personality types differ significantly in terms of their influence on academic achievement in science.

ii) Effects of higher teaching experience of teachers’ teaching for the students with favourable and unfavourable attitude towards science differ significantly in terms of their influence on academic achievement in science.

iii) Effects of higher teaching experience of teachers’ teaching effectiveness and ineffectiveness differ significantly in terms of their influence on academic achievement of students in Science.

iv) The interactive effects of higher teaching experience teachers’ teaching effectiveness and students attitude towards science and students personality types differs significantly in terms of their influence on academic achievement in science.

v) Interactive effects of higher teaching experience teachers teaching effectiveness and students’ personality types differ significantly in terms of their influence on academic achievement in science.

vi) Interactive effects of higher teaching experience teachers’ teaching effectiveness and for the students’ attitude towards science differ significantly in terms of their influence on academic achievement in science.

vii) Interactive effects of higher teaching experience of teachers teaching effectiveness X students’ attitude towards science
X students' personality types differ significantly in terms of their influence on academic achievement in science.

**Teachers with Lower Teaching Experience**

i) Effects of lower teaching experience of teachers teaching effectiveness and students personality types differ significantly in terms of their influence on academic achievement in science.

ii) Effects of lower teaching experience of teachers' teaching for the students with favourable and unfavourable attitude towards science differ significantly in terms of their influence on academic achievement in science.

iii) Effects of lower teaching experience of teachers' teaching effectiveness and ineffectiveness differ significantly in terms of their influence on academic achievement of students in Science.

iv) The interactive effects of lower teaching experience teachers' teaching effectiveness and students attitude towards science and students personality types differ significantly in terms of their influence on academic achievement in science.

v) Interactive effects of lower teaching experience teachers teaching effectiveness and students' personality types differ significantly in terms of their influence on academic achievement in science.

vi) Interactive effects of lower teaching experience teachers' teaching effectiveness and for the students' attitude towards science differ significantly in terms of their influence on academic achievement in science.
vii) Interactive effects of lower teaching experience teachers teaching effectiveness X students’ attitude towards science X students’ personality types differ significantly in terms of their influence on academic achievement in science.

3.7) Method of Research

Ex Post Facto research design was used for the present study (Kerlinger, 1964, p. 374). Ex Post Facto research is a systematic empirical inquiry in which the investigator does not have direct control of independent variable because their manifestations have already occurred because they are inherently not to manipulate. Inferences about relation among variables are made, without direct intervention from concomitant variation of independent and dependent variables.

3.8) Tools used for the Study

The review of related literature revealed that, the present study requires students’ personality inventory (Introversion, Extroversion and Neuroticism). Students Attitude towards Science scale, Teacher effectiveness tool and a criterion test that is Achievement Test in Science. Hence, the investigator contacted experts and professors of Psychology and Education and explored for the appropriate tool. He finally, decided to use following tools for the study.

i) Junior Personality Inventory (JPI) Kanada version.

ii) Achievement Test in Science.

iii) Student Rating of Teaching Effectiveness Scale (SROTES).
iv) High School Students’ Attitude towards Science Scale.

3.8.1) Junior Personality Inventory (J.P.I)

The devices used for measuring the personality variables like extroversion and neuroticism range all the way from objective techniques like test of reminiscence, figural after effects, auto kinetic movements, classical conditioning and subjective devices like the rating seals, questionnaires and inventories.

Many attempts have been made to construct and standardize personality inventories during the early 1950s. The most popular amongst the latter was the Mudsly Personality Inventory (M.P.I.) constructed and standardized by Eysenck (1956).

Attempts though few, have been made to measure extraversion and neuroticism in children. Furneaus and Gibson (1961) published for the first time the Junior Maudsley Personality Inventory (J.M.P.I). After that an illustrated version of the same was developed by Gibson (1965) since easily understood by very young children. Eysenck S.B.G. (1965) too constructed a scale for children aged between 12 to 15 years, similar to that of Eysenck Personality Inventory (E.P.I.). This was popularly known as Junior Personality Inventory (J.P.I.). The J.P.I. consists of 64 items. Twenty four items each are for extraversion and neuroticism and 12 items form the lie scale. The age group on which it was standardised ranged from 7+ to 16 years.
Attempts were made in India to measure extraversion and neuroticism of individuals. Gita Das (1961) and Jalota (1964) adapted the Eysenck Personality Inventory (EPI) to measure extraversion and neuroticism of adults. Mohan (1968) adapted the Junior Eysenck Personality Inventory (JEPI) to measure extraversion and neuroticism of school-going children and translated it into Hindi.

The Hindi version of JPI contains 68 dichotomously represented items (yes or No) with 34 items for each of the two personality dimensions. Each set of 34 items actually made up of 17 parallel items which facilitate the calculation of personality and at the same time acts as a check on the tendency of faking and lying [Appendix-A].

The above Hindi version of JPI was originally standardized on a group of 400 children from Delhi and Punjab ranging in age between 11+ to 15+ years. Later on, further data was accumulated from a sample of 800 subjects from another Hindi speaking area, namely, Uttar Pradesh by Mohan and Purang (1969).

The mean scores on neuroticism and extraversion range from 13.66 to 14.80 and 14.01 to 14.98 respectively. The split-half reliabilities for neuroticism and extraversion range from 0.81 to 0.85 and 0.59 to 0.77 respectively. The item analysis too revealed that all the 68 items of both personality dimensions were retainable. The standard error of standard deviation and fiduciary limits were calculated to be 5.32 to 5.97.
and 3.91 to 4.49 for neuroticism and extraversion respectively, which speaks of the trustworthiness of the tool.

The Hindi version of JPI adapted and standardized by Mohan (1968) was felt to be appropriate as it was standardized on an Indian sample. The investigator planned to use this tool by translating the items into Kannada (Kannada being the medium of instruction in Karnataka State in which the study was to be conducted) and modifying some of the items to suit the subjects under study.

The investigator translated all the 68 items with the guidance of his guide and prepared the Kannada version of JPI [Appendix-B].

**Sample of the translated items**

i. Do your like plenty of excitement going around you? Yes/No

ii. Do you like mixing with other children? Yes/No

**Procedure of Item Analysis**

The Kannada version of JPI was administered to 300 school going pupils of Dharwad city age ranging between 11+ to 15+ (VII to IX Std.).

The investigator used Eble’s (1962) method of item analysis which is as follows:

i. Arrange the answer scripts in the descending order of scores.
ii. Take upper 27% and lower 27% of scores from the total sample.

iii. Add the counts from the upper and lower groups to the keyed correct responses divide this sum by the maximum possible sum that is, the sum of the number of papers in upper and lower groups and express the quotient as a percentage that is, multiply decimal fraction by 100 which will yield item difficulty or Facility Index.

\[
F = \frac{R_H + R_L}{2n} \times 100
\]

Where
- \( n \) = number of pupils in upper group or lower group.
- \( R_H \) = number of correct responses in upper group.
- \( R_L \) = number of correct responses in lower group

**Discrimination Index (D)**

The discrimination index of an item can be obtained by the formula –

\[
D = \frac{R_U - R_L}{n}
\]

Where
- \( R_U \) = Right answers in the upper 27% cases.
- \( R_L \) = Right answer in the lower 27% cases.
- \( n \) = Number of pupils in lower or upper group.

The item evaluation on the basis of discrimination index suggested by Ebel (1962) are reported in the below chart.
Summary of item evaluation procedure

<table>
<thead>
<tr>
<th>SI. No.</th>
<th>Discrimination Index</th>
<th>Item evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.4 and above</td>
<td>Very good item, accept it.</td>
</tr>
<tr>
<td>2</td>
<td>0.3 to 0.39</td>
<td>Reasonably good but possibly can be subjected to improvement on modification.</td>
</tr>
<tr>
<td>3</td>
<td>0.2 to 0.29</td>
<td>Marginal items need improvement.</td>
</tr>
<tr>
<td>4</td>
<td>Below 0.19</td>
<td>Poor items Reject.</td>
</tr>
</tbody>
</table>

The items having Facility Value (F) of 65 and above are to be rejected even though they may be having Discrimination Index of more than 0.3.

Validation of JPI

The mean scores for neuroticism and extraversion were found to be 13.5 and 14.45 respectively. The median scores for neuroticism and extraversion were found to be 13.4 and 15.01 respectively and the standard deviations were 6.7 and 5.7 respectively. The coefficient of correlation between extraversion and neuroticism was found to be -0.06 which proves the independence of the two personality dimensions.

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Event</th>
<th>Extraversion</th>
<th>Neuroticism</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mean</td>
<td>14.45</td>
<td>13.5</td>
</tr>
<tr>
<td>2</td>
<td>Median</td>
<td>15.01</td>
<td>13.4</td>
</tr>
<tr>
<td>3</td>
<td>S.D</td>
<td>5.7</td>
<td>6.7</td>
</tr>
<tr>
<td>4</td>
<td>Correlation Coefficient</td>
<td>-0.06</td>
<td></td>
</tr>
</tbody>
</table>

The above chart is similar to the findings of Eysenck (1965) and Mohan (1968).
Reliability of the JPI

The reliability of the above test was calculated by using split half method.

The test consists of 68 dichotomous items out of which 34 items are for extraversion and 34 items are for neuroticism. Among these 34 items, there are 17 pairs of parallel items for two dimensions. The scores for each parallel item were identified and tabled forming extroversion A and B groups. Similarly for Neuroticism also, A and B groups were obtained.

Then the split-half correlation or coefficient of internal consistency was calculated. It was found to be 0.75 and 0.78 for extraversion and neuroticism respectively (N=100).

Reliability of the test

The coefficient of reliability of the test was calculated by the method of Rational Equivalence. This method stressed the inter-correlation of the items in the test and the correlation of the items with the test as a whole. This is also known as stability coefficient. In this method KR 21 formula is used to calculate reliability and is given below.

\[
KR_{21} = \frac{K}{K-1} \left( \frac{(k-m)}{1 - \frac{m}{k}} \right)
\]

Where,

- \( K \) = Number of items in the tests
- \( P \) = Proportion of the group answering the test item correctly
- \( Q \) = Proportion of the group answering the test item wrong.
- \( \sigma \) = standard deviation of the test items
- \( m \) = Mean of the test scores.
The reliability of each sub test was calculated and is reported in the below chart.

**Reliability of sub tests established by the rational equivalence method.**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of the sub test</th>
<th>Reliability coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Following directions</td>
<td>0.681</td>
</tr>
<tr>
<td>2</td>
<td>Classification test</td>
<td>0.693</td>
</tr>
<tr>
<td>3</td>
<td>Analogies test</td>
<td>0.710</td>
</tr>
<tr>
<td>4</td>
<td>Arithmetic ability</td>
<td>0.760</td>
</tr>
<tr>
<td>5</td>
<td>Vocabulary test</td>
<td>0.698</td>
</tr>
<tr>
<td>6</td>
<td>Number series test</td>
<td>0.765</td>
</tr>
<tr>
<td>7</td>
<td>Best answer test</td>
<td>0.788</td>
</tr>
<tr>
<td>8</td>
<td>Non-verbal test</td>
<td>0.813</td>
</tr>
</tbody>
</table>

The reliability coefficients of the eight sub tests obtained are not very high. 'Rational equivalence' method under-estimates some what the reliability-coefficient by other method under-estimates some what the reliability-coefficient by other method (Garrett and Woodworth 1961, p. 342). The KR-21 formula provides a minimum estimate of reliability. So it may be confidently asserted that the test is at least as reliable as it has been found to be.

In the below chart, the means, medians, SDs and coefficients of correlation regarding reliability and validity of JPI obtained by the investigator and those obtained by Mohan (1968) are reported.

**Comparison of result of JPI by Investigator and that of Mohan (1968)**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Investigators Findings</th>
<th>Mohan's Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14.45</td>
<td>13.5</td>
</tr>
<tr>
<td>2</td>
<td>15.01</td>
<td>13.4</td>
</tr>
<tr>
<td>3</td>
<td>5.7</td>
<td>6.7</td>
</tr>
<tr>
<td>4</td>
<td>-0.06</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.75</td>
<td>0.78</td>
</tr>
<tr>
<td>6</td>
<td>+0.58</td>
<td></td>
</tr>
</tbody>
</table>
It can be seen that the above results bear a remarkable similarity and reveal that the adapted Kannada version of JEPI is reliable and valid. Hence, it was retained for the final data collection.

**Validity of the test**

**Validity of the JPI**

The validity of JPI was established by considering extreme groups. Extreme groups were obtained by locating 30 students who had scored high on both Extraversion and Neuroticism and 30 students who had scored the lowest on both Extraversion and Neuroticism, the parents of the students were requested to respond to JEPI keeping their children in mind. The coefficient of correlation between the students’ scores and their parents’ ratings was found to be +0.58 which is significant. This shows that the test has acceptable validity.

**Cross validation**

Since the sample chosen for the standardisation was considered to be small (300 pupils) for a group test of intelligence, the investigator administered the test another representative sample of the population and attempted to cross validate the original findings.

For this purpose, the investigator selected about 107 students of 11+ to 14+ ages and administered the test. The answer sheets were then subjected to detailed item analysis. The item analysis showed that all the 80 items could be retained (vide Appendix D).
Concurrent Validity

The test scores were correlated with that of final examination scores of the pupils. For this purpose, out of 300 pupils 100 pupils were chosen randomly. The test scores of these pupils were correlated with the annual examination scores (percentage). The correlation coefficient was found to be 0.56 which is reasonably high. Hence, it can be concluded that the test is valid. So the test constructed was felt to be acceptable, and was used as a tool of the study.

3.8.2) Achievement Test in Science

One of thee main objectives of the present study were to know the achievement of the pupils with different personalities when taught two different types of teacher effectiveness types. This can only be done with the help of an achievement test, so the investigator planned to construct and standardize an achievement test in Science.

Construction of Achievement Test in Science

The sample selected for the study was the IX standard students. The investigator being a Teacher Educator specializing in the teaching of sciences and having a Graduate degree in Science decided to choose a unit Chemistry from the IX standard science-I Test book.

Unit and sub units

The unit chosen was "Oxygen and Sulphur which is the Chapter in Chemistry for IX standard."
The unit consists of the following sub-topics:

i. Elements of VIA group and comparison of properties.

ii. Occurrence and extraction

iii. Allotropies: different allotropic forms of sulphur and oxygen.

iv. Similarities and dis-similarities in properties of sulphur and oxygen.

v. Laboratory preparation: study of properties, uses of sulphur-dioxide, Hydrogen sulphide, Sulphuric acid.

vi. Manufacture of sulphuric acid, sulphur and oxygen.

vii. Preparation, properties and uses of important compounds of sulphur and oxygen.

**Previous knowledge**

The students of IX standard would have studies the following concepts in their previous classes:

i) Atomic structure, atomic theory and electric configuration of elements.

ii) Periodic classification of elements, study of different groups, periods and properties of each sub-group.

iii) Theory of valence and chemical bonding.

iv) Oxidation and reduction with examples.

v) Study of Group V elements like Nitrogen and Phosphorous and their allotropies; preparation, properties, uses, compounds etc.
**Defining Educational Objectives**

An important step in the construction of an achievement test is to make a survey of the aims and objectives of instruction of the particular subject chosen. To be valid, this can only be done by examining the curricular programme prescribed by the Department of Public Instruction and the text-book prescribed.

A test, constructed must match the teaching objectives, of the course it is designated for. Various educationists have attempted to provide classification systems and lists of common classroom objectives of science teaching and testing. But the investigator for the present study has restricted him to three important categories of objectives in the cognitive domain. [Bloom 1959, p. 281]. They are: Knowledge, Application and Skill.

The specifications of each of the objectives are reported in below chart.

**Specifications of each of the objective**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Objectives</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Knowledge</td>
<td>The pupil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. recalls the some facts about oxygen and sulphur</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. recognizes the oxygen and sulphur as elements one is gas and another is non-metal.</td>
</tr>
</tbody>
</table>
3. discriminates as oxygen gas and sulphur non-metal.
4. detects the existence of oxygen in the air.
5. rectifies the doubts about the existence of oxygen.
6. sees the relationship between oxygen and other gases.
7. cites examples and illustrations about oxygen and sulphur.
8. finds similarities between oxygen and other gases, sulphur and other non-metals.
9. classifies the gases and non-metals.
10. selects appropriate apparatus, tools etc. for the preparation oxygen and sulphur gases.

2. Applications The pupil -
1. analyses the oxygen from its compounds.
2. verifies hypotheses about existence of oxygen and sulphur in the form of compounds.
3. interprets and infers about the property of both oxygen and sulphur.
4. gives the reasons for existence of oxygen and sulphur and their compounds.
5. finds cause and effect relationships
6. establish relationships between oxygen and sulphur.
7. suggests appropriate procedures for preparation and studying properties of oxygen and sulphur compounds.
8. selects with purpose the appropriate compounds.
9. solves numerical problems relating to oxygen and sulphur.
10. detects errors in writing chemicals equation
11. uses properly tool at appropriate time for preparing the gases of oxygen and sulphur.
12. advice other students to follow correct procedure.
13. uses in daily in life the oxygen and sulphur compounds properly.
14. knows importance of chemicals of oxygen and sulphur and advice to use proper apparatus.

3. **Skill The pupil-**

1. summarises observations during the preparation of oxygen and sulphur gases.
2. draws diagrams, charts, graphs, figures relating to the preparation of oxygen and sulphur compounds.
3. balances the chemical equation with speed and accurately involved in the oxygen and sulphur.
4. write the correct chemical formula, chemical reaction of oxygen and sulphur compounds.
5. arrange the apparatus (identifies the correct apparatus and chemical) for conducting experiments on oxygen and sulphur.
6. performs experiments technically and collects the gas or products etc.
7. test the properties of gases, or compounds or products of oxygen and sulphur.
8. manipulates, records, calculates, using correct formula, interprets.

**Preparation of Blue Print**

The investigator consulted his guide and other expert science teachers for the weightages of marks to be given to each objective. After due consultation, the weightage for knowledge objective arrived at was 50% for skill and application 25% each. The details are reported in chart.

In the below chart the Blue-print of the tryout form of the test is given.

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Objective</th>
<th>Weightage(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Knowledge</td>
<td>50%</td>
</tr>
<tr>
<td>2</td>
<td>Application</td>
<td>25%</td>
</tr>
<tr>
<td>3</td>
<td>Skill</td>
<td>25%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Knowledge</th>
<th>Skill</th>
<th>Application</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form of items</td>
<td>O</td>
<td>SA</td>
<td>LA</td>
<td>O</td>
</tr>
<tr>
<td>1.1</td>
<td>30(30)</td>
<td>6(6)</td>
<td>--</td>
<td>10(10)</td>
</tr>
<tr>
<td>1.2</td>
<td>30(30)</td>
<td>6(6)</td>
<td>--</td>
<td>10(10)</td>
</tr>
<tr>
<td>Sub Total</td>
<td>60(60)</td>
<td>12(12)</td>
<td>--</td>
<td>20(20)</td>
</tr>
</tbody>
</table>

Note: Figure within brackets indicate the number of questions and figures outside the brackets indicate marks.

Oxygen sub unit

Sulphur sub unit

**Types of items**
The investigator planned to include the following type of items:

i) multiple choice items,

ii) matching,
iii) right or wrong
iv) balancing and chemical equation,
v) writing the chemical formula, given names of the chemicals,
vi) Writing the names of the chemicals when the formulas are given.
vii) Given the description of the chemical-reaction the student is required to translate the same into chemical equation,
viii) Short answer type,
ix) Choosing the correct answer and
x) Choosing the appropriate and among given set of apparatus..

Parallel form tests

The investigators were interested in determining the gain in achievement scores of student which is also the criterion score. For this purpose pre and post tests were to be administered and they had to be equivalent. So the investigator planned to construct each item in parallel form and prepare two sets of achievement tests.
The number of the items in each sub-test is given in below chart.

Description of the total number of items chosen and marks allotted to each item in the achievement test.

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Sub-test</th>
<th>Total item</th>
<th>Marks allotted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Multiple choice</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>2</td>
<td>Match the following</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Right or wrong</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Balancing the chemical equation</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Writing chemical formula</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Writing names of the chemicals</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Writing chemical reaction</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>Short answer type</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>9</td>
<td>Choosing correct answer</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>Choosing correct apparatus</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>120</td>
<td>120</td>
</tr>
</tbody>
</table>
The investigator planned to construct 120 items in each test with a score of one for each item.

**Writing of Test Items**

The investigator keeping in view the objectives, the specifications of the objectives and plan of constructing different types of items, stared writing down the items in parallel form. The two identical forms (parallel forms) of the test so constructed, consisting of 120 items each were prepared and they were given to experts and other experienced science teachers for their comments and suggestions. Based on the comments and suggestions, suitable modifications were done.

**Sample of Items**

The constructed parallel form of the achievement test was in Kannada language since the medium of instruction in the schools under study was Kannada (Regional language). So the investigator has furnished herewith, a sample of items of the achievement test.

**Sample of Items (Achievement test)**

Multiple choice items:

1. Electro positivity of an element means....
   a) gaining of protons, b) losing of protons, c) gaining of electrons and d) losing of electrons.

   a) i) Electro positivity of an element means....
      a) gaining of protons, b) losing of protons, c) gaining of electrons and d) losing of electrons.
Electro negativity of an element means...

a) gaining of electrons,  b) gaining of protons,
c) loosing of electrons and (d) loosing of protons.

**Type B Questions**

i) Match the following :

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Ozone</td>
<td>Sulphur dioxide</td>
</tr>
<tr>
<td>2</td>
<td>Sulphuric acid</td>
<td>$11_2S_2O_8$</td>
</tr>
<tr>
<td>3</td>
<td>Sulphuric acid</td>
<td>Deep blue colour gas</td>
</tr>
<tr>
<td>4</td>
<td>SO$_2$</td>
<td>No reaction with platinum and gold</td>
</tr>
</tbody>
</table>

ii. The molecular weight of Sulphur means........

a) total number of protons in the molecule of sulphur
b) total number of protons and electrons in the molecule
c) total number of protons and neutrons in the molecule
d) total number of atoms present in the molecule.

**Parallel form**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
i) The molecular weight of Oxygen means......
   a) total number of protons and neutrons in the molecule
   b) total number of protons present in the molecule.
   c) total number of protons and electrons present in the molecule
   d) total number of atoms present in the molecule.

ii) You are given chemical reaction equations. Balance the chemical equations.
   1) \( \text{H}_2\text{S} + \text{O}_2 \rightarrow \text{H}_2\text{O} + \text{S} \)
   2) \( \text{NaOH} + \text{SO}_2 \rightarrow \text{Na SO}_4 + \text{H}_2\text{O} \)

iii. Short answer type
   1) Write two chemical properties of Ozone
   2) Write two important general characteristics of VIA group elements.

iv. Identify the apparatus required to prepare Sulphur dioxide in the laboratory from the list given below:

   1) Pipette    2) Buret
   3) Gas Jar    4) Spirit lamp
   5) Round bottom flask    6) Delivery tube
   7) Tripod stand    8) Water bath
   9) Retort    10) Sulphuric acid bottle
   11) Thistle funnel    12) Stand

**Tryout**

Tryout is a vital stage in the construction of a good test. Only careful analysis can show that a test is soundly constructed. The following four principles should govern the tryout:

i) every reasonable precaution should be taken to ensure normal conditions for the test.
ii) the time allowance for the test should be generous.

iii) the scoring procedure adapted should be fairly simple, and

iv) before the actual scoring begins, answer keys and scoring keys should be prepared.

**Sample for tryout**

Tryout of a test means, trying it out under test conditions on a representative cross-section of the pupils for whom the test is intended. In order that the data collected in tryout should be helpful in determining the quality and nature of the test items with respect to the population on which norms have to be established later on, the sample used for tryout should obviously reflect the population.

Out of 21 high schools of Dharwad four schools were selected randomly. Two IX standard classes of the four selected schools were chosen. In table 3.18 details of the sample are reported.

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of the school</th>
<th>Class chosen</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>K.E. Board’s School</td>
<td>IX C &amp; IX D</td>
<td>126</td>
</tr>
<tr>
<td>2</td>
<td>University Public School</td>
<td>IX A &amp; IX B</td>
<td>60</td>
</tr>
<tr>
<td>3</td>
<td>K.N.K. Girls’ School</td>
<td>IX A &amp; IX B</td>
<td>120</td>
</tr>
<tr>
<td>4</td>
<td>Basel Mission Girls’ High School</td>
<td>IX C &amp; IX D</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>400</td>
</tr>
</tbody>
</table>

The total sample consists of 400 IX standard pupils (180 girls and 200 boys). The investigator being the Teacher-Educators teaching physical science the B.Ed. trainees, took the help of B.Ed. trainees to teach the Unit for the chosen sample in different schools. The investigator along with B.Ed. trainees took two weeks to complete the
Unit. The first set of the achievement test was administered to the pupils and clear instructions were given to them. The students took about 90 minutes to complete the test and the answer sheets were collected and scored.

After a gap of a day the second set of the test (parallel form) was administered to the same set of students and the answer sheets were scored.

**Item analysis**

The duly scored answer sheets were arranged in the descending order of the scores.

The answer sheets of 27% of the students scoring highest and the answer sheets of 27% of students scoring lowest were selected for items analysis. They formed the upper and the lower group respectively.

The summary of the items retained and rejected after the item analysis is reported in the below chart.

### Results of the item analysis

**First Test and Second Test**

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Sub Tests</th>
<th>Total No. of items</th>
<th>No. of items Retained I</th>
<th>II</th>
<th>No. of items Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Multiple choice</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>Match the following</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Right or wrong</td>
<td>0</td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>Balancing chemical equation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Writing chemical formula</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
From the results of the item analysis it was clear that 76 items of the First test and 84 items of the Second test could be retained and some of the sub test items would be rejected. But as the investigator wanted to prepare two sets of test in parallel form which meant that, in both forms, equal number of items testing particular specification was to be retained, making the total items equal in both the forms. Hence, the consulted his guide and expert science teachers and with their help modified some border line test items, so that the total number of items would be the same in the two forms.

**Details of the Final form of achievement Tests**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Sub Test</th>
<th>No. of items</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Multiple Choice Type-A</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>Match the following Type-B</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Balancing the chemical equation</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Short answer type</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>Writing names of chemical formula</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Writing the names of the chemical formula</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>with given names.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Identifying the chemical apparatus</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>70</td>
<td>80</td>
</tr>
</tbody>
</table>
The final form of the test consists of 72 items distributed in 7 sub-tests as reported in table 3.22. The scoring key was also prepared.

1. Multiple choice -- One mark for each correct answer

   Total of 50

2. Matching -- One mark for each correct answer Total of 5.

3. Balancing chemical equation -- One mark for each correct balancing the equation. Total of 4.

4. Short answer type -- Two mark for each two correct answer

   If one correct answer is given one mark would be awarded. Total of 8.

5. Writing the name of the chemicals when formula were given. -- One mark for each correct answer Total of 4

6. Writing the formula when names of the chemicals were given -- One mark for each correct answer. Total of 3.

7. Identifying the correct apparatus.-- If all the required apparatus is identified. Total of 4 marks.

   If identified partly only, then Part by part marks would be awarded.

The test items were arranged in the test booklet under two sections: Section A consisting multiple choice items and Section-B consisting of rest of the sub-test item.
**Validation Procedure**

The scores of the sample of 400 students were tabulated in a frequency distribution table. The maximum score was found to be 72/80 and the minimum 20/80. The mean, median, standard deviation and quartile deviation were calculated and are reported in the below chart.

**Measures of Central Tendency of variability of the two achievement tests.**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Index</th>
<th>Test-I</th>
<th>Test-II</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mean</td>
<td>43.86</td>
<td>44.13</td>
</tr>
<tr>
<td>2.</td>
<td>Median</td>
<td>40.13</td>
<td>40.13</td>
</tr>
<tr>
<td>3.</td>
<td>S.D.</td>
<td>11.5</td>
<td>13.13</td>
</tr>
<tr>
<td>4.</td>
<td>Q.D.</td>
<td>9.07</td>
<td>9.62</td>
</tr>
</tbody>
</table>

The mean, median and Q.D. of the two test are similar but the S.D. of the second test is a little higher.

**Reliability of the test**

Reliability of the test was calculated by the parallel form method.

Since the two parallel forms of the test were administered on two different occasions for the same set of sample (sample being 400 IX standard students), the two sets of scores were subjected to calculation of coefficient of correlation. The calculated value of coefficient of correlation of 0.81 shows that the tests are reliable this reliability coefficient of stability.

**Validity of the test**

1. Content Validity: Since the test was constructed specifically for IX standards ad the content was taken from IX standard science-I text too, so the test has content validity.
2. Concurrent validity: In this method some 100 students out of 400 students sample were randomly selected. The Science-I (Physics and Chemistry) marks of the annual examination of the above students was correlated with the test scores. The coefficient of correlation of 0.58 was found to be significant (generally the validity coefficient of above 0.5 considered as acceptable). This shows that the test is valid. The two forms of achievement tests (parallel forms) were reliable and valid, so they could be used with confidence in the final data collection. Out of two sets (parallel form) one set was used as a pre-test and the other was used as post-test. The same were given in the Appendix-C and D.

3.8.3) Student Rating of Teaching Effectiveness Scale (SROTES).

This scale was developed by Dr. Shashikala Deshpande, Professor Department of Education, Karnatak University, Dharwad published by Roopa, Psychological Centre, Varanasi 2001. (This scale is used for the present study with a kind consent of the author). This scale is also known as SORTES. The author developed a low-inference Rating Scale based on a comprehensive review. Variables showed consisting correlation with measures of teaching effectiveness. They were;

i) Socio-Emotional Climate   ii) Competency
iii) Communication    iv) Business like behaviour
v) Class-room management    vi) Clarity
She prepared initially total of 128 statements. Which were all low inference items with emphasis on actual classroom behaviours of teachers. After editing a total of 98 items were selected. These were administered in two forms A and B. Each consisting of 49 items to 2 samples of 200 students separately. The students had to rate teachers on a five point scale. Form-A had 22 positive items and 27 negative items and Form-B had 34 positive and 15 negative items respectively.

**Area wise distribution of items of Students Rating Scale in the Tryout and Final form**

**Item Analysis**

Item analysis was conducted following the procedure adopted by Edwards for Likert Attitude Scale (Edwards, 1969, p. 54). One hundred and sixty completed protocols each of Form A and Form B were considered. The top 25% and the bottom 25% of 160, which is 40 highest scoring and lowest protocols were considered. Only 5 t-values in Form A and 7 t-values in Form B failed to reach significance levels. However, on further examination, it was found that the mean of the low group for many of the items was high. Therefore only those items which had means of the low group less than 3.2 and 3.25 in Form A and Form B respectively were selected. The final form of the Rating Scale had 42 items, twenty from Form A and 22 from Form B.
Reliability of the Rating Scale

The final form of the rating scale was administered to 200 students. The corrected split-half reliability coefficients for Form A, Form B and for the combined forms were 0.65, 0.88 and 0.77 respectively. Therefore, the Rating Scale has moderately high reliability.

The reliability of the scale was determined on another sample with \( N = 250 \). The split-half reliability coefficient was found to be 0.8446 is highly significant. The cronbach alpha for the full scale was found to be 0.8059.

Area-wise serial numbers of favourable and unfavourable items

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Area</th>
<th>Serial numbers</th>
<th>No. of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Socio-emotional climate</td>
<td>F* 7, 25, 36, 42 UF** 9, 13, 15, 17, 19, 35, 40</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Competence</td>
<td>F 2, 29, 30, 41 UF 31</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Communication</td>
<td>F 8, 21 UF 4, 33</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Systematic/Business like behaviour</td>
<td>F - UF 3, 20, 28, 39</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Classroom Management</td>
<td>F - UF 1, 5, 6, 12, 27, 37</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>Clarity</td>
<td>F - UF 11</td>
<td>--</td>
</tr>
<tr>
<td>7</td>
<td>Structure</td>
<td>F 24 UF 14</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Warmth</td>
<td>F 10, 26 UF 16, 18, 2</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Enthusiasm</td>
<td>F -- UF 22, 32</td>
<td>--</td>
</tr>
<tr>
<td>10</td>
<td>Opportunity to learn</td>
<td>F 34, 38 UF --</td>
<td>2</td>
</tr>
</tbody>
</table>

* F - Favourable
** UF - Unfavourable

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Reliability

Internal consistency of the scale was ascertained by determining the coefficient of correlation among the ten areas of the scale as well as between each area and the total score. From Table No. 3, it can be observed that only nine out of 55 correlations were not significant at the 0.05 level. All the coefficients between each area and the total score were found to be significant at the 0.01 level ranging from 0.2988 to 0.8929.

Validity

The scale has content validity as the method of selection of items was almost completely based upon research findings.

Further, in a study relating student rating with student achievement, it was found that student ratings were positively correlated with student achievement (Deshpande, 1990). Hence the scale appears to have acceptable validity.

The final form of SORTES was translated into Kannada by Dr. Shashikala Deshpande and Dr. Fransina. The same was used for the present study.

The final form of the SORTES both in Kannada and English Versions are given in the Appendix-E.
3.8.4) Attitude Scale towards Science.

Attitude of the Students

The term ‘Attitude’ is defined by Freeman (1965) as “A predispositional readiness to respond to certain situations, persons, objectives or ideas in a consistent manner, which has been learnt and has become one’s typical mode of response”.

It is a tendency to react in a certain way towards a designated class of stimuli. These are the ways in which an individual thinks feels and acts. Attitude always arouses one's feelings and emotions. Attitude ranges from Positive extreme to Negative extreme. Attitudes vary in the amount of positiveness or negativeness.

Students Attitude towards Science

It is a tendency to react in a certain way towards a science subject. These are the ways in which an individual or students things feels and acts towards Science. The Attitude towards Science always arouses one's feelings and emotions towards science and it also shows the likes and dislike towards science subject.

Mann (1980) studied that the personality factors like, attitude and adjustment towards science subject largely contributed towards the total academic attainment of the students.

Kumar Yogesh. (1989), Studied a comparative study of adjustment, attitude, interest and level of aspirations about Science subject of the tribal and non-tribal students of the secondary level. The study yielded
the results like attitude and adjustment towards science subject are the main predictors of the total academic achievement.

Gupta (1989) studied causes of failure of the students in science and mathematics. The variables considered were intelligence and personality factor like, introversion and extroversion and attitude of the students. The results indicated that, large number of failure was mainly due to low attitude and high extroversion of the students. Intelligence was also found very less amongst most of the students.

Rajan (1990) studied the causes of low achievement of students in science subject at the secondary level. The study included the personality variables like intelligence, introversion and extraversion, attitude and SES of the students. It was found that, the personality factors like introversion and extraversion were equally responsible for low achievement like intelligence and the low attitude students achieved low and high attitude students achieved well in examination. Hence, it is clear that, the variables like attitude towards science directly affect the academic achievement of the students. Hence, the investigator planned to construct the high school students' science attitude scale.

Dr. Fransina and Dr. Shashikala Deshpande developed an students science attitude scale (SAS) for high school students in Kannada. The same was used by the investigator.
Description of the Tool

The high school students science attitude scale developed by Dr. Fransina initially consisted of 50 items about the attitude of the students towards;

a) Science as a subject.
b) Science as a essential aspect of life.
c) Science teachers and Headmasters.
d) Study of Science subject.
e) Science teaching methods and laboratory work.
f) Science reference books and Encyclopedias
g) Science and modernity in life.
h) Correlation of science with other subjects.
i) Science subject and philosophy.
j) Science club activities.

After consultation with the experts the rating scale was reframed according to the suggestions. The SAS was subjected to initial tryout to the set of 100 students studying in 3 secondary school of Dharwad. After the item analysis some of 40 items remained for the final form.

Validity of the Rating Scale

The content validity -- Since the Rating Scale was constructed to know the attitude of the High School Students towards Science subject. Hence, it has both content and constructs validity.
**Reliability of the Rating Scale**

The internal consistency of the rating scale was established by test and retest method. The test was given to the same set of 100 students at different interval of time. Both the observation was correlated. This was found to be 0.7831 which is significant at 0.05 level of significance. Hence, the tool is said to be reliable.

The final form of the Rating Scale is given in the Appendix-F.

**3.9) Sample and Sampling Procedure**

The sample for the study is usually drawn from the population related to the problem of the study. In the present case the high school students and teachers are to be involved. Hence, the sample is drawn from the High Schools.

There are three types of secondary schools established in Karnataka State. They are;

- ii) Aided Secondary Schools (Rural and Urban).
- iii) Un-aided Secondary Schools (Rural and Urban).

The investigator chosen randomly the above three types of schools in the Dharwad and Belgaum Districts.
Sample of Teacher and Students

<table>
<thead>
<tr>
<th>Types</th>
<th>No. of Schools</th>
<th>Sc.Area</th>
<th>Teachers</th>
<th>Students IXA,IXB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Government</td>
<td>10</td>
<td>Urban</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Schools</td>
<td>10</td>
<td>Rural</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Aided</td>
<td>10</td>
<td>Urban</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Schools</td>
<td>10</td>
<td>Rural</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Un-Aided</td>
<td>10</td>
<td>Urban</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Schools</td>
<td>10</td>
<td>Rural</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

The above schools are randomly chosen. Hence, there are 60 schools (30 Urban and 30 Rural) 240 teachers and 1200 students studying in IX standard taught by the respective selected teachers who are involved in the present study. From each class three students (above average, average and below average) were also selected to rate each teacher. Thus stratified random sampling technique was used to select the teachers and random sampling technique was used to select the students.

3.10) Procedure of Data Collection

The data collection for the present study was done in four stages. The first stage of data collection was done with the help of student rating of teacher effectiveness. For this purpose three students from each class
of each school (above average, average, below average) were trained to observe the teachers. Then the teacher effectiveness rating scale developed by Dr. Shashikala Deshpande (SORTES) was given to the selected students for rating. Each teacher teaching Science subject was rated by the selected three students in each of the class belongs to selected schools. The average score of three students is the perceived effectiveness of the teacher who taught the subject.

The Junior Eysenck Personality Inventory which is known as JPI was administered to the students with proper instructions. The responses of the students were noted separately as high and low extraverts and high and low neurotics.

The selected students were also given the attitude towards science or Students Attitude towards Science Questionnaire (SAS) for knowing the attitudes of the students towards various aspects of science subject. The attitudes were rated as high, moderate and low.

Finally the students were given the achievement test in Science constructed by the investigator.

3.11) Statistical Techniques Used

The purpose of the study was to investigate the main effects and the interaction effects of three independent variables viz., students personality, students attitude towards science, teachers teaching effectiveness on the independent variables that is academic achievement
of the students in science. As there were three independent variables, it was decided to use three way analysis of variance (ANOVA). In order to find out the main and interaction effects.

Secondly if the treatment group differ significantly, it will not be clear from the findings that which of the comparison of the treatment group differ significantly in terms of their effect on academic achievement variable. Hence, to know these, multiple comparisons of means of all the treatment groups was carried out using Scheffe's test (1959).

These statistical techniques were also used in order to study the interaction effect in case of sub samples like, male teachers, female teachers with higher qualification and minimum qualification, teachers with higher teaching experience and lower teaching experience. The analyses of the data were carried out in pursuance of the objectives of the study as well as the research hypothesis.