

CHAPTER 3

DESIGN OF THE STUDY

3.1 Introduction

The chapter on Reviews of Related Research gave a concrete finding that Critical Thinking is an important and significant area that education needs to transact upon to the students. Education is the most potent tool that can make the citizenry rich in its intellect and that intellect can be used in various aspects like research, education, employment, society, business and overall community in general. The review of related research established the fact that Critical Thinking is an under-researched area and needs to be taken forward for further research. It also is being known from the reviews of research that not much research is done on student teachers. Student teachers can act as a link between students and Critical Thinking. This aspect can explicitly be a part of teacher training program curriculum so that student teachers get an opportunity to practice this in their fields. Review of Research also provides an insight that there is not much research work done on Paul's Model of Critical Thinking in Indian Context. This model seems significant for enhancing Critical Thinking as mentioned and found in the review of related literature. It also provides further understanding of what kind of tools and techniques are used in the research for Critical Thinking. The tools are few and even if there are; they are expensive to use and practically difficult to procure. Furthermore, the earlier chapter also gives a concrete insight into the methodologies that can be adopted to find out its effectiveness.

Thus, this chapter includes the tools and techniques used for data collection for the research. This chapter also emphasizes on the process in which the data was collected for the research. This study basically aims to see the effectiveness of the intervention program. The data was collected qualitatively and quantitatively. This was collected through various sources as mentioned in the below mentioned literature.

The intervention program in this research was aimed at improving Critical Thinking skills for student teachers.

3.2 Statement Of The Problem

“Developing Implementing and Assessing an Intervention Program based On Paulian Approach to Critical Thinking for student teachers of Vadodara”

3.3 Research Questions

- 1) What is the need of Critical Thinking as a subject in Teacher Training program in the present context?
- 2) What should be the design and the package for developing Critical Thinking in the student teachers based on the approach?
- 3) How can Paul’s approach to Critical Thinking prove to be effective in training student teachers for improving Critical Thinking skills in the Indian Context?
- 4) What will be the Change in the level of Critical Thinking among student teachers’ after the implementation of the package?
- 5) What is the impact of the intervention program in various domains of life on the student teachers’?

3.4 Objectives:

- 1) To develop an intervention program of Critical Thinking for the student teachers of Vadodara.
- 2) To implement the developed program of Critical Thinking on the student teachers of Vadodara.
- 3) To study the effectiveness of the implemented program on the student teachers of Vadodara.

3.5 Hypothesis

H1: There will be no significant difference between Pre-Post test scores of the Student teachers in terms of Standards of Critical Thinking and Elements of Reasoning at 0.05 level of significance (Standardized test)

H2: There will be no significant difference between Pre-Post test scores of the Student teachers in terms of Purpose, Questions, Information, Concepts and ideas,

Assumptions, Inference, Implications, Point of view, Clarity, Accuracy, Precision and Relevancy at 0.05 level of significance

H3: There will be no significant difference between the Pre-Post test scores of the Student teachers in terms of Intellectual traits of Mind at 0.05 level of significance (Situation test)

H4: There will be no significant difference between the pre-post test scores of the student teachers in terms of Intellectual Humility, Intellectual Integrity, Intellectual Empathy, Intellectual Perseverance, Intellectual Courage, Confidence in Reason and Integrated situation at 0.05 level of significance

3.6 Explanation Of The Terms

- 1) Critical Thinking: Refers to the development of skills through various strategies evolved in the intervention program and assessing the skills with parameters of standards of thinking, elements of reasoning and intellectual traits.
- 2) Developing and training the student teachers: Development of the package for developing Critical Thinking of student teachers so that they are trained to use the same in teaching the subject content.
- 3) Assessing the Effectiveness: Effectiveness in terms of change in scores of student teachers in Analysis of Article Test used for Standards of thinking and Elements of Reasoning and Situation Test for Intellectual Traits of Mind. Qualitatively it is assessed through Case studies, Focus Group discussion and descriptive feedback.
- 4) Standards of Critical Thinking: Clarity, accuracy, precision, relevancy, significance, depth, breadth and logicalness.
- 5) Elements of reasoning: Purpose, Questions, Information, Assumptions, Inference, Implications, Point of view and Concepts and Ideas.
- 6) Intellectual Traits of Mind: Intellectual Humility, Intellectual Integrity, Intellectual Empathy, Intellectual Autonomy, Confidence in Reason, Intellectual Courage, Intellectual Perseverance.

3.7 Operationalization Of The Term

Critical Thinking is measured on the basis of three components that is (1) Elements of Reasoning, (2) Standards of Thinking and (3) Intellectual Traits of Mind.

Elements of Reasoning and Standards of Thinking is measured through Standardised Test i.e. Analysis of Article Test and Intellectual Traits of Mind is measured through Situation Test.

- 1) Elements of Reasoning was marked on the basis of ability to seek purpose, clarify questions, examine significant facts, data, proofs and evidences, infer from the facts, think on implications and point of view.
- 2) Standards of Thinking was marked on the basis of: ability to achieve clarity, accuracy, precision and relevancy
- 3) The Intellectual Traits of Mind was marked on the basis of ability to think with Intellectual empathy, Intellectual courage, Intellectual humility, Confidence in reason, Intellectual Integrity, Ego-centrism and Socio-centrism.

In the Present study the assessment of Standards of thinking and Elements of reasoning was done through Analysis of the Article Test. The Intellectual Traits were assessed through Situation test.

3.7.1 Pilot Study

The researcher found it very important to conduct a pilot study as it will give the researcher important pointers to construct the intervention program and support the further study. The pilot study for this research was implemented on Student teachers of the academic year 2016-18. This sample was selected based on the commutation time that would be involved in implementing the pilot study, the regular work schedule of the researcher, the requirement of close observation of the sample and regular time slot allotted into the timetable with one credit being given for the same. Further, it was conducted in a setting similar to the main study. This batch was one unit of B.Ed program that is Fifty students, since three students had left the program, one unit comprised Forty Seven students. Effectiveness was considered in

terms of thirty percent of the intervention program implemented on the Student teachers along with the pre-test and post-test which not only yielded positive results but also gave insights into the modifications that could be considered for the intervention program.

The objective of the pilot study was to check whether the students were able to comprehend the activities undertaken in the intervention program. It was also meant to understand the gaps that may lie in the intervention program as well as to check on with the researcher made test. Further, it was meant to check the students participation and response to the intervention program.

Implementation: The researcher while implementing the program paid attention to the strategies and activities conducted. The pilot sample was also closely observed for the assessment as well. There were also certain discussions that took place after the intervention program to see how things were moving while implementing the same. Even a written feedback was taken from the participants to know on this.

Some of the points that emerged out of the discussion and written feedback from the student teachers were: Critical Thinking was an interesting course that they encountered. The application had a close association with their lives as the student teachers could foresee its application in academic and personal life. The student teachers opined that the intervention program needed to have more activities for the same so that it can be made more interesting and can be related with lives. The vocabulary of Critical Thinking is bit difficult to understand so concepts need to be recapitulated and even the time allotted for the intervention program should be increased. So the researcher did the following modifications: The intervention program comprised more of discussions and activities. It also included real life examples so that students would be able to relate to it.

After the implementation of pilot study the expert and guide from the committee suggested a need to track the thought process of the students through diaries that can be kept by each student teacher. This Intellectual Journal will have journal entries to be posted after every significant area of the model is completed to see the application of it and also to understand how student teachers are able to apply

the learning from the classes. The intervention program was improvised and modified with reference to the above points so that it can be implemented on 2017-19 batch of 47 student teachers.

3.7.2 Research Design

The researcher aimed at developing an intervention program for Critical Thinking. The research design was pre-post-test single group design and experimental in nature. The design was selected by keeping in mind that only two English Medium Universities are available for implementation. The researcher also could see the practical difficulty associated with the implementation and length of the program of Fifty hours and therefore decided to implement the program on student teachers of Navrachana University (Nuv) as she is pursuing her Ph.D. from the same and is faculty with the university. The study was administered on one group on which the developed instructional strategy was implemented. The study involved collection of quantitative and qualitative data. Thus, study involved mixed method research. Before applying Mixed Method Research following questions were taken into consideration from a procedural perspective:

- How do Multiple case studies following from journal entries, focus group discussion with student teachers and descriptive feedback help to explain phenomena of quantitative data accumulated in the achievement scores?

Alternatively, from a content orientation perspective the questions asked were:

- How do the themes emerging from the qualitative data help to explain the process of the intervention and its impact on various domains on life?
- To what extent and in what ways do qualitative data from journal writing and focus group discussion with student teachers serve to contribute to a more comprehensive and nuanced understanding of this predicting relationship between critical thinking intervention program and academic achievement scores, via integrative mixed methods analysis?
- Rationale for Selecting Mixed Method for the present study.

- The basic purpose of choosing this method was to build findings based on both Quantitative and Qualitative data, also to provide for synergy and strength that this design would provide for the study (Gay, 2015).
- Mixed Methods would also provide for broader perspectives and triangulation for the study and that is why this research method was selected. Here in this research, the researcher also intended on getting precise and detailed information on ‘why and how’ the students performed well/ not so well on statistical tests 12 (Creswell, 2012).
- The design therefore used was ‘Explanatory Research Design’ as it would provide for in depth information on statistical results.
- What is the impact of the Intervention Program in various domains of life on the Student teachers? This was always a question that remained unanswered in the investigators mind and was very rarely answered by many researches.
- This made a path for drafting this research question into the thesis.
- Also, the below mentioned question helped the researcher to think on Mixed Method Research that is: How can qualitative data follow up and make the researcher understand the background of statistical results?

3.7.3 Variables of the study

There are two types of variables involved in the present study (i) independent and (ii) dependent variable: Independent variable is the developed intervention program by the researcher on Critical Thinking. Dependent variables in this study are the scores on various items such as standards of thought, elements of reasoning and intellectual traits of Critical Thinking in the present study. This variables are tested through analysis of article test of 100 marks which is a standardized test.

Effectiveness in terms of intellectual traits is checked through situation test of 130 marks. This test consisted of thirteen questions each of ten marks. Also qualitative analysis in terms of development of thought process and to triangulate the scores of the above the analysis of journal entries/diary work is done. Also selected case studies, focus group discussion and descriptive feedback was part of qualitative analysis

The following were the ways in which objectives of this research were met

- 1) ***To Develop an intervention program for the student teachers of NUV:*** To develop a final intervention program it was required that this should be first tested on a sample so for the first objective an intervention program of 50 hours was made to be implemented for 47 student teachers of Navrachana University. This was a pilot program that was implemented before an actual intervention is designed and tested on sample of student teachers. This intervention program was modified as per the expert's suggestions and suggestive points that came up during pilot session. The pedagogy that was used in the intervention program was based on research reviews and the nature of Critical Thinking. The nature of Critical Thinking requires questioning and reflection as basic tools to enhance Critical Thinking abilities. According to the research reviews Critical Thinking is difficult to be transacted (Williamgham, 2007) and the strategies are not known and are limited (Gibson, 2007 as cited in Balcaen, 2011). Further, Pedagogy to transact Critical Thinking in a coherent way is also lacking (Balcaen, 2011). Also, asking challenging questions, background knowledge, Criteria for judgement, CT vocabulary, thinking strategies, habits of mind and assessing for thinking can help enhance Critical Thinking. According to NCERT in its Education for values in Schools document- A framework observes that strategies that can be adopted to develop Critical Thinking can be Reflective practice, discussion, questioning, role plays, anecdotes, value clarification, group activities and development of fundamental values like love cooperation, group singing, stories and silent sitting before the class begins. Case study pedagogy (Mcdade 1995 as cited in Yang, 2005.), cooperative learning (Cooper 1995 as cited in Yang, C.), Socratic Questioning (Paul, 1995; Yang, 2005) are effective for Critical Thinking. Thus this study uses reflective journal for the basic construct of Critical Thinking i.e. reflective journal and posting daily entries in the journal. Further, this study used Socratic questioning, role plays, articles, situations, real life examples and discussion for the purpose of transacting the content. The intervention program was designed based on the following aspects in the lesson plan preparation: Conceptual background, objectives, name of the activity planned, time duration, procedure, facilitation of the teacher

- 2) ***To implement the intervention program for the student teachers of Nav:***
 The intervention program was implemented on 50 student teachers of Navrachana University of 2017-19 batch. This was implemented for 50 sessions/hours. It was implemented in the period beginning from July 2018 to November 2018. A complete semester was used to execute the above intervention program with few extra sessions that can be accommodated on weekends. It also was extended into the next semester as it required few more sessions to cover the model. While implementing the intervention student teachers were asked to post the application of the theory into their respective Intellectual Journal in the form of journal entries. The journal entries were posted by the student teachers after significant portion was completed in the classes. Feedback was given on the entries posted and a track was kept so that student mapping can be done. Also the students were asked to post assignments based on significant portion discussed.
- 3) ***To assess its effectiveness:*** To assess the effectiveness of the intervention program on Critical Thinking, quantitative tool of t-test was employed for both the tests. To triangulate, qualitative data was collected and analysed based on journal entries, focus group discussion and case studies of sample that improved significantly on the tests.
- 4) ***Population of the study:*** : The population comprised all the Student teachers of Bachelors of Education Program (English Medium) of Vadodara city for the Academic year 2017-19. There are two English Medium Teacher Education programs undertaken in Vadodara. One of the Bachelor of Education programs is run by Maharaja Sayajirao University of Baroda that is managed and controlled by the state government. Another teacher education program is run by Navrachana University which is established under Gujarat State government Act. Thus, all English medium teacher education institutions comprising of two years of Bachelor of Education Program of Vadodara for the Academic year 2017-19 are considered to be a population in this research study. The population of this study comprised of all the student teachers of the Bachelors of Education programme of 'Vadodara City' for the academic year 2017-18.
- 5) ***Selection of Sample and Sampling Design:*** The sample of the study for this research for the academic year 2017-19 was carefully selected by the

researcher from the above population specified. Navrachana University's Teacher Education Program has been selected as a sample for the research study due to the following reasons:

- For close observation of student teachers while the experiment is in progress.
- The flexibility that was shown by the administration to make changes in the curriculum and accommodate this course explicitly in it as well as in the timetable offered to the students.
- The practical difficulty associated with the implementation and length of the program of Fifty hours and it required collection of qualitative as well as quantitative data
- Proximity and immediacy of conducting the classes for the researcher as the researcher works in the university and it would have been difficult to administer the program for one complete semester at any other teacher education program/ workplace
- Permission that was received to access the facilities of the school for the purpose of implementation of the intervention program for one complete semester that is for 50 hours.

Criteria for Sampling Technique for the research study:

- The sampling technique that was used for the present study that was implemented for the academic year 2017-19 was the Purposive Sampling technique. This judgement sampling was done based on intent of the researcher to see that this sample becomes representative of the population (Gay, 2015). Also, the researcher's experience with the university helped to select the sample that was based on general acceptability of the sample (student teachers) to accept new and innovative ways of teaching along with the other parameters mentioned below. This technique was used for the present study keeping in view the duration of the intervention program of fifty hours, the qualitative and quantitative data that was required to be collected through journal entries of the case studies, focus group discussion to be conducted, achievement tests

and descriptive feedback to be undertaken. This data that was collected for the purpose of research was required to be kept confidential. Further, this sampling technique supported the researcher to follow up the sample for various requirements of the study and as the study evolved. This acted as a strength for the researcher and a great amount of time could be given to the study. This also allowed the researcher to work on the gaps that would emerge while the intervention was in progress. This does imply a large amount of work and control involved by the researcher but without proper disciplining, rigorous work and close observation for data collection reliable results may not have been generated. Also, it was a very specific study planned for a very specific population. The student teachers that come for the B.Ed. program are also given admission based on criteria decided for admission to this B.Ed. program by National Council of Teacher Education.

3.8 The Tools for the present study

The present study is an intervention study aimed at enhancing Critical Thinking on sampled student teachers. The investigator has reviewed the available tools developed by other researchers in order to study Critical Thinking for her respective study she developed two tools and use one standardized tool

- 1) Achievement test: In order to study the impact of intervention program on sampled teachers the researcher designed two tests that focused on the following sections
 - i. **Situation test:** This test was prepared by the researcher and was validated by the experts. As the model comprehensively involves intellectual traits to be used with various situations. A test containing thirteen situations was prepared. Each situation had at least two to three questions to answer. The situations were randomly allotted to the individual traits. Further it also involved barriers to Critical Thinking in the situation test. This also involved student teachers to analyze the situation and identify the trait that is significantly used or lacked in the situation. The test also comprised of one comprehensive situation that involved more than one trait to understand

whether the students were able to understand and assess situation that involves multiple traits in it. This test involved 13 situations. Each situation carried 10 marks. The last situation involved compilation of all the traits together. Approximately three hours were devoted to the completion of the test to the student teachers.

Steps followed in the preparation of achievement test

The researcher for the purpose of study could identify that the Standardized Test assesses Standards of Thinking and Elements of Reasoning and does not assess the Traits of mind. So, the researcher decided to test the component of Traits of mind through any test that may be available for the purposes. Since the researcher could not find any test available for use for the Intellectual Traits of mind, decided to construct the test for the testing purpose.

- 1) First, the Traits were identified so that they can be included in the test. 2. Then, this suggestion was discussed in the review meet of the researcher and it was decided to design situations that can be included in the test.
- 2) The researcher then identified the aspects/criteria based on which the test can be designed.
- 3) The aspects like the 'what constitutes a specific trait', how can it be incorporated in the situation, what can be the questions that can be constructed for the specific situation of the trait were outlined.
- 4) The situation test was constructed and along with the intervention program the test was given for validation purposes to the experts from the field.
- 5) The situation test was tried out on the pilot group of 2016-18 batch.
- 6) The suggestions of the experts and the suggestions from the pilot group were incorporated in the situation test. The experts provided their suggestions on content, language and type of questions that can be asked from the situation. It was suggested by the experts that questions can be asked based on higher order thinking. The researcher modified the questions accordingly.
- 7) Final test was implemented on sample of the study for the academic year 2017-19.

Variables for Situation Test: Total seven traits and two barriers to thinking were evaluated and scored from the situation test that was developed by the researcher.

- Intellectual Humility: It means acute awareness of one's own ignorance. It may be beliefs, assumptions, lack of knowledge in a particular situation that is exhibited by a person. The scoring was done based on: Identify the trait, Elaborate on the trait, Relate and justify the trait to the particular situation, Present their point of view with reasoning for that particular situation
- Intellectual Courage: It means accepting and understanding others persons point of view, ideas even when it is painful to do so. The scoring was done based on: Identify the trait, Elaborate on the trait, Relate and justify the trait to the particular situation, Present their point of view with reasoning for that particular situation
- Intellectual Empathy: It means putting oneself in the place of others on a routine basis. The scoring was done based on: Identify the trait, Elaborate on the trait, Relate and justify the trait to the particular situation, Present their point of view with reasoning for that particular situation
- Intellectual Integrity: It means practicing what one advocates for others. The scoring was done based on: Identify the trait, Elaborate on the trait, Relate and justify the trait to the particular situation, Present their point of view with reasoning for that particular situation
- Intellectual Perseverance: It means to work one's way through intellectual complexities despite frustrations inherent in the task. The scoring was done based on: Identify the trait, Elaborate on the trait, Relate and justify the trait to the particular situation, Present their point of view with reasoning for that particular situation
- Confidence in Reason: It means moved by reasoning based on data, facts and proofs. The scoring was done based on: Identify the trait, Elaborate on the trait, Relate and justify the trait to the particular situation, Present their point of view with reasoning for that particular situation
- Intellectual Autonomy: It means views are reasonably given by evidence. The scoring was done based on: Identify the trait, Elaborate on the trait,

Relate and justify the trait to the particular situation, Present their point of view with reasoning for that particular situation

- Sociocentrism: it means when someone gets influenced by group thinking. The scoring was done based on: Identify the trait, Elaborate on the trait, Relate and justify the trait to the particular situation, Present their point of view with reasoning for that particular situation
- Egocentrism: It means intelligently pursuing their own goals without considering the rights and needs of others. The scoring was done based on: Identify the trait, Elaborate on the trait, Relate and justify the trait to the particular situation, Present their point of view with reasoning for that particular situation.

Standardized Critical Thinking essay test: This test was used for assessing standards of thinking as well as elements of reasoning. It consisted of twelve questions in which 8 questions were considered for elements of reasoning and four questions were from standards of thinking. The standard time allotted to the students was two hours. This test is also known as Critical Thinking Essay test which requires students to analyze an article. The pre-post-test consisted of same article for analysis as this will give a fair idea of how much change precisely has happened from pre- answers to the post-answers. Following threats to Internal Validity of the test were considered: Four major variables that can affect Testing is History, Maturation, Testing and Instrumentation (Gay, 2015; Kahn 2006). History refers to any other event that may affect the test performance of the students. It was carefully examined that no subject in the B.Ed. program dealt with components of Critical Thinking directly. Further, the test results were produced because of the concerted efforts of the researcher (Gay, 2015). The concepts covered in the Critical Thinking Intervention Program were unique to this intervention and the testing was done based on this. The study was undertaken in the entire semester like any other course that was specifically allotted in the timetable. This provided the researcher to implement the Intervention Program rigorously and regularly. Regarding the threat of Pretesting, it was seen that pre-test may affect the Student teacher's performance on a second test, regardless of the experimental treatment. In order to control this threat, before

conducting a pre-test no such instruction or hints were given to the Student teacher's that they are going to be tested second time with the same test contents. Knowingly, the Student teachers were not allowed to bring or take any material at the time of pre-test. Also, the test comprised on descriptive situations that didn't allow the students to guess any answers. Further, CT is a process skill that allowed the students to process their thoughts with the consideration of Intellectual traits of mind rather than outcome of it.

The Quasi-Experimental design for data collection and analysis.

The design is mentioned below:

Pre-test	Treatment	Post-test
O	X	O

- 2) Journal Entries: The data of the cases was collected from intellectual journal kept over the period of intervention. The researcher had to read and re-read the data to comprehend the data so that the analysis can be done accurately. The patterns in the data were noted down. The patterns of initial data helped to develop initial codes and thus the data was reduced to meaningful form. Initial codes from each case were developed to a Master List. This master list led to form the Inductive Categories. These inductive categories were enumerated. The member checking was done with the case so as to preserve the validity and credibility of the data
- i. Description of the case: An overall description of the case along with the subjects chosen as electives for the Bachelor of education (B.Ed.) program was given.
 - ii. Journal entries from Intellectual Journal: Intellectual Journal was kept by the student teachers. The entries in this journal were made at the end of significant portion that was completed in the class. These were recorded by the students for the application done of the theory and activities done inside the class. This was done keeping in mind that students must apply what they have understood in the classes. This also helped them to take the significant ideas of the classes out in the real life. This was done consciously as it was mandatory for the students to write these logs. This was also done with the purpose of reflection on their thinking process. It

also made the researcher understand whether the concepts discussed in the class were understood by the students

- iii. **Researcher's Observation:** Every entry was carefully analysed by the researcher and one observation was written at the end of the entry.
 - iv. **Final Journal Entry:** This entry involved students to self- assess themselves in terms of where do they stand in terms of development of Critical Thinking. An account was written by each student that involved the format given by the researcher
 - v. **Mapping of Students 'Thinking:** The student thinking process was mapped using Standards of Thinking so as to understand the development of the thought process during the intervention program.
- 3) **Focus Group Discussion:** A focus group discussion was conducted with the students that were seven in number. These students were randomly selected. They were chosen when they had a free class and others did not have one. Points kept in mind while conducting the discussion: The objectives of the discussion along with certain key questions that can be discussed in the session were identified. The specific topic of interest was discussed with student teachers of similar backgrounds. The discussion was guided by the facilitator. The facilitator i.e. the researcher helped in generating an inquiry into the group. The discussion was live and general. This discussion was conducted with primary objective of whether critical thinking skills have developed based on the aspects of Paul's model to critical thinking. What are the different areas in which CT has helped these student teachers in academic and personal life. This discussion was conducted with seven students for an hour. The researcher probed for answers wherever it was possible. The way in which it was analyzed was: The researcher heard the interview several times to analyze the dialogue that happened between the researcher and the focus group. After the initial analyses of the general themes/ initial codes, broad themes were inferred
- 4) **Descriptive feedback:** Feedback was taken from the student teachers with reference to specific questions for the purpose of understanding overall working of the intervention program. The questions asked were: significant pointers that helped from the program, pointers that did not help and support the student teachers from the intervention program and the improvements needed in the conduction of it.

3.9 The Concepts of Credibility, Reliability, Conformability and transferability were used to judge the trustworthiness of the qualitative data: Credibility

For triangulation, data was collected from various sources i.e. journal that was kept by the students for their application of critical thinking in academic and personal life, focus group discussion that the researcher conducted and the descriptive feedback that was taken, helped the researcher to crosscheck the findings emerging from case study for valuable purpose. Member checks were done for the interpretation that was arrived at from the profile studies. For example the students were asked to read the interpretation arrived at so that authenticity is maintained. The profile samples were also asked to evaluate themselves of how do they see themselves before and after the implementation program.

Transferability:

Transferability was achieved through selection of best i.e. highest and the lowest improvement scores so that range is observed for the difference.

Dependability:

Different data collection methods and different data collection sources were used in the study. The data collection sources and findings were reviewed by the experts and professors in the committee. The research was closely supervised by the major professors involved in the research review committee.

Conformability

It was achieved through the triangulation technique. The data was presented in a way that audience can understand the relevance and context.

3.10 Implementation plan for 15 weeks

Week One: Introduction to the course; introduction to the concept of Critical Thinking

- Assignment1: How do you conceptualize critical thinking?

- Assignment 2: Based on the story put the traits of the three characters.

Reflect on which character do you like the most and why?

- Journal Entry 1: Apply the characters of Sam, Fran and Nancy in real life

Week Two: Introduction to the Standards of Thinking

- •Assignment 1: Elaborate on each standard in your own words
- •Assignment 2: Elaborate, illustrate and exemplify thinking for clarity purpose

Week Three: Intellectual Standards (continued)

- •Assignment: read the article on slow and fast thinking
- •Assignment 2: elaborate on the standard in your own words
- •Journal Entry 2: apply the standards of thinking in academic and personal life.

Week Four: Introduction to the Elements of Reasoning

- Assignment 1: briefly elaborate on each element of reasoning
- Assignment 2: elaborate on primary and secondary purpose of assembly and write questions
- Journal Entry 3: Apply elements of reasoning in real life

Week Five: Thinking through the concept of the course through elements of reasoning

Week Six: Thinking and reasoning Within the discipline

Week Five: Logic of the course

- Assignment: Analyze the purpose of the subject

Week Six: Logic of the Discipline

Week Seven: Thinking through the Logic of the Textbook

- Assignment: Framing Logic of the textbook. For ex. Purpose of the textbook, questions that the textbook asks, information it uses

Week Eight: Introduction to Intellectual Virtues

- Intellectual Humility: Explain any situation wherein you have confronted or felt threatened about views/expressions/opinion of a group or individual.
- Intellectual Empathy: Construct a viewpoint when you have had an argument with someone and then provide for – Overview of the situation, my perspective, other person's perspective, reflections
- Intellectual Integrity: Recognize the fact of awareness of a situation when you don't have intellectual integrity
- Journal Entry 4: Apply the traits of mind in academic and personal life

Week Nine: Introduction to Intellectual Virtues (continued)

- Intellectual Perseverance: Give an example wherein you have acted on the basis of intellectual perseverance.
- Confidence in Reason and Intellectual Autonomy: Can you go back in the life and see where the problems have been seen in your thinking process? Note down the reasons for not improving in the situation
- Journal Entry 5: Apply the traits of mind in academic and personal life

Week Ten: Introduction to Instinctive Self-interest as a Barrier to Critical Thinking

- Assignment: carefully examine the situation and note down the observations

Week Eleven: Introduction to Innate Socio-centricity as a barrier to Critical Thinking

- Apply the knowledge of socio-centrism and its characteristics through a role play
- Journal Entry 6: catch yourself in the acts of implementing barriers and reflect on the improvement in thinking

Week Twelve: Thinking and reasoning through the logic of the article

Week Thirteen: Introduction to Socratic Questioning

- Assignment: make a Socratic questioning script

Week Fourteen: Distinguish Between Inferences and Assumption

Week Fifteen: Finding out the juncture of development from the literature provided.

- Final journal entry 7- stages of development, barrier to development and reflections

3.11 Standardized Tool

Paul's Model as a standardized tool based on which intervention program will be made. The techniques that would be used would consist of Socratic questioning, discussions, self assessment, reading articles etc.

3.12 The process of data collection

3.13 Table 1

Table 1 Date collection Procedure

Step	Developmental Stage
1	The development of intervention program with thoughtful consideration of relevant examples and activities related to content.

- 2 The further validation of the package with the Pre-Post test for the assessment by the expert and the modification according to the suggestion
- 3 The administration of the pre-test on pilot group
- 4 The administration and implementation of the package on pilot group
- 5 The administration of the post-test on pilot group
- 6 Feedback on the same
- 7 Modifications based on feedback and researchers observations to improvise the intervention program
- 8 Actual implementation of the intervention
- 9 Administration of pre-test 1
- 10 Administration of pre-test 2
- 11 Administration of the intervention
- 12 Administration of Post-test 1
- 13 Administration of Post-test 2
- 14 Overall Students perception about the intervention program and the reseracher in the form of feedback
- 15 Focus group discussion
- 16 Case studies of 11 student teachers
- 17 Students mapping

3.13.1 The process of data analysis

The data will be collected through the pre and post-test of experimental group and was analyzed quantitatively and qualitatively with further clarifications. The researcher has used 't' test for data analysis of quantitative data . In this research, a pre-test was administered to a group of samples. This was the initial test. After the initial test, the intervention designed by the researcher was administered on the sample followed by administration of post-test to the same sample. To compare the means of two test of scores that are directly related with each other, t test for dependant means was used. This test is a t-test or paired samples 't' test. It is also known as repeated measures. The dependent t-test (also called the paired t-test or paired-samples t test) compares the means of two related groups to determine whether

there is a statistically significant difference between these means. This indicates that the same participants were present in both the groups and were tested more than once. This also means that each participant was measured on two occasions on the same dependant variable.

For further clarity on sample and its normal distribution, the investigator used the Shapiro Wilk Test to check whether the sample was normally distributed or not. The scores on the initial achievement test proved that the sample is normally distributed. The following was found when this test was used to check whether the sample is normally distributed or not. P-value was found to be 0.136705 and W value was found to be 0.963260. This meant that it is in the 95% critical value accepted range: [0.9524: 1.0000] and that the data is normally distributed.

The Qualitative data was analyzed using Content Analysis. Themes and Coding techniques were used for analyzing the data of the research. The Broad question that helped to reach to Mixed Method Research is, "How can qualitative data follow up and make the researcher understand the background of statistical results"?

The steps in process of conducting a Mixed Method study was:

- 1) Determining whether the present context and institutional setting was feasible for such a design.
- 2) Identifying Rationale for conducting such a research and choosing this design.
- 3) Finding the type of Design based on the aim of the Research work.
- 4) Developing Research Questions for this design.
- 5) Collection of Quantitative and Qualitative data.
- 6) Analysis of data respectively.
- 7) Compilation of the Research Work.

The following were the phases in which the Qualitative data and specifically Multiple Case Studies were analyzed.

- Phase One: Decontextualisation-The data obtained from various sources was read and re-read to make sense of it. Before the data can

be broken into meaningful units, a lot of thinking went in understanding which paragraphs and constellations of sentences can produce a meaning associated with research questions associated with the study. Individual themes were generated from case. Themes emerged inductively as the Case progressed.

- Phase Two: Recontextualization –The text was again re-read to list out the final broad themes from the individual cases. The unnecessary data of the cases from Journal entries was kept away to keep the relevancy of the themes generated with the research question under consideration.
- Phase Three: Condensation and Creating Themes: The meaningful themes emerging from each case were condensed to bring it into integrative themes that can be meaningfully arranged. There was a lot of moving back and forth to come out with broad integrative outcomes that the researcher reached out from the study. Member checking was also part of this phase.
- Phase Four: Compilation- The essence of the studied phenomena was found out. Appropriate running text and quotations were placed to ensure the authenticity of information. Depending on the number of times of occurrences of the themes they were progressively arranged and presented in the integrative positive outcomes.

Organization of Cases in the present study:

- Brief Background of the Case
- Identifying Paragraphs and sentences of the Journal Entries (Seven) of Case studies that relate to the research aim (Exemplar Quotes were stated)
- Researcher’s Observation for the Journal Entries posted by the Student teacher
- Self-Assessment of the Case
- Major themes emerging from the Case
- Consolidation of the Case

- Integrated positive outcomes from Multiple Case studies once all were analyzed
- Finale Mapping of thinking Process over a period of Intervention Program based on Standards of Thinking

There are 11 Case studies chosen and presented in the Study:

Two cases of analysis of article test who showed significant difference in the test scores and two cases who showed least improvement in the test scores.

Two cases that showed significant improvement in situation test and two cases (the student teacher didn't submit the record so only one is considered) that showed least improvement in the test scores.

Two cases who have explicitly shown improvement in the way they think from researcher's point of view.

Two cases who showed improvement in the both the tests. These cases have been chosen based on expert's advice. The student teachers who improved the most have shown significant difference in dealing with their thoughts.

Student teachers who performed the least in the scores have been taken up to study their profiles as they would contribute to developing the understanding of how they advanced through the Intellectual (diary) writing and what was lacking in terms of development. There is a thoughtful consideration of cases that performed poorly so as to clearly see the gap that remained in terms of developing the thought process.

Two cases who have performed best across both the tests have been chosen as they overall did well and the researcher wanted to understand the qualitative development of these participants.

Steps Used for Focus Group Discussion:

1. The data was heard and reheard for making the sense of it.
2. The relevant data was reduced to meaningful units and was quoted into research for authentic value that it creates in the study.

3. These meaningful units were categorized as themes for better understanding.
4. A final consolidation of all the themes was done in the form of interpretation of the focus group discussion.

Steps Used for Descriptive Feedback:

1. The data was read and reduced to meaningful units.
2. The sensible meaningful units were then organized into a cluster of holistic understanding from the question.
3. The compilation of the units based on the research questions was done.