CHAPTER VI

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6.1 INTRODUCTION

This chapter interprets the findings from the data derived and also provides the suggestions, recommendations and the conclusion of the study from the systematical analyse of various factors governing the classroom learning process of the prospective teachers.

6.2 STATEMENT OF THE PROBLEM

In pursuit of quality, educators are continuously engaged in a process of finding opportunities for improvement of the learning process, the quality of learning experiences and the way education is delivered. A special focus can be made on the use of the basic quality tools by educators to solve problems and to improve the quality of the learning process in courses at higher education institutions particularly in the teacher education. By profoundly ascertaining this assumption, the present investigation has been carried out under the title ‘‘Impact of six sigma – DMAIC approach in learning the concepts of ICT education by secondary teacher trainees’’

6.3 VARIABLES OF THE STUDY

The independent variable of the study is the teaching methodology. The dependent variables were

1. The learning deficiencies and
2. The learning achievement of the students was assessed in terms of Defects per million opportunities (DPMO), process sigma, Field Through put Yield (FTY), Rolled Through put Yield (RTY) and yield rate (%).

6.4 OBJECTIVES OF THE STUDY

The following objectives were framed for the present study.
1. To implement the six sigma DMAIC concept in the teaching – learning process.

2. To measure the DPMO values (Defects per Million opportunities), sigma mean, FTY (Field Throughput yield) of the deficiency factors, RTY (Rolled throughput Yield) of achievement test score and percentage yield values in the Control group (self-learning group) at the pretest (pre sigma), intermediate test level (interim sigma) and posttest (terminal sigma) level of learning.

3. To measure the sigma mean, Field Throughput Yield (FTY) of the deficiency factors, Rolled Throughput Yield (RTY) of achievement test score and percentage yield values of the Experimental group I (traditional teaching group) at the pretest (pre sigma), intermediate test level (interim sigma) and posttest (terminal sigma) level of learning.

4. To measure the sigma mean, Field Throughput Yield (FTY) of the deficiency factors, Rolled Throughput Yield (RTY) of achievement test score and percentage yield values of the Experimental group II (ICT group) at the pretest (pre sigma), intermediate test level (interim sigma) and posttest (terminal sigma) level of learning.

5. To measure the process capability and Cp index value of the control group, traditional teaching group and ICT group at posttest (terminal sigma) level.

6. To check whether the achievement test score falls within the specification limit or not in the control chart of the Control group, Traditional teaching group and ICT group at posttest (terminal sigma) level.
7. To find the significant difference among the three groups Control group (self-learning group), Experimental group I (traditional teaching group) and Experimental group II (ICT group) at the pre – test level, post – test level with regard to achievement test.

8. To find the significant relationship between the RTY and DPMO value of the three groups Control group (self-learning group), Experimental group I (traditional teaching group) and Experimental group II (ICT group) at the post – test level with regard to achievement test.

6.5 HYPOTHESES OF THE STUDY

Based on the objectives and variables, the following hypotheses were framed for the current study.

1. There is no significant difference between the self- learning group, traditional teaching group and ICT group at the pre-test (pre sigma), interim test (interim sigma) and post-test (terminal sigma) levels of learning the ICT concepts in terms of Defects per Million opportunities (DPMO) in the class room learning deficiencies

2. There is no significant difference between the self- learning group, traditional teaching group and ICT group at the pre-test (pre sigma), interim test (interim sigma) and post-test (terminal sigma) levels of learning the ICT concepts in terms of process sigma values in the class room learning deficiencies

3. There is no significant difference between the self- learning group, traditional teaching group and ICT group at the pre-test (pre sigma), interim test (interim sigma) and post-test (terminal sigma) levels of
learning the ICT concepts in terms of Field Through Put Yield (FTY) values in the classroom learning deficiencies

4. There is no significant difference between the self-learning group, traditional teaching group and ICT group at the pre-test (pre sigma), interim test (interim sigma) and post-test (terminal sigma) levels of learning the ICT concepts in terms of percentage of process outcome values in the classroom learning deficiencies

5. There is no significant difference between the self-learning group, traditional teaching group and ICT group at the pre-test (pre sigma), interim test (interim sigma) and post-test (terminal sigma) levels of learning the ICT concepts in terms of Defects per Million opportunities (DPMO) in the achievement test.

6. There is no significant difference between the self-learning group, traditional teaching group and ICT group at the pre-test (pre sigma), interim test (interim sigma) and post-test (terminal sigma) levels of learning the ICT concepts in terms of process sigma values in the achievement test.

7. There is no significant difference between the self-learning group, traditional teaching group and ICT group at the pre-test (pre sigma), interim test (interim sigma) and post-test (terminal sigma) levels of learning the ICT concepts in terms of Rolled Throughput Yield (RTY) values in the achievement test.

8. There is no significant difference between the self-learning group, traditional teaching group and ICT group at the pre-test (pre sigma), interim test (interim sigma) and post-test (terminal sigma) levels of
learning the ICT concepts in terms of percentage of process outcome values in the achievement test.

9. The post-test (terminal sigma) achievement test scoring of the self-learning group does not fall within the specification limits of p-control chart.

10. The post-test (terminal sigma) achievement test scoring of the traditional teaching group does not fall within the specification limits of p-control chart.

11. The post-test (terminal sigma) achievement test scoring of the ICT group does not fall within the specification limits of p-control chart.

12. The process capability (Cpk value) do not attain the maximum value of 1.5 in the self-learning group, traditional teaching group and ICT group at post-test (terminal sigma) level of achievement in learning the ICT concepts.

13. The process capability index value (Cp index) do not attain the maximum value of one in the self-learning group, traditional teaching group and ICT group at post-test (terminal sigma) level of achievement in learning the ICT concepts.

14. The ICT learning strategy is not effective in improving the post-test (terminal sigma) level of the achievement test in ICT concepts.

15. There is no significant mean difference among the self-learning group, traditional teaching group and ICT group in the intermediate level (interim sigma) level of the achievement test.

16. There is no significant mean difference among the self-learning group, traditional teaching group and ICT group in the post-test (terminal sigma) level of the achievement test.
17. There is no significant relationship exists between the DPMO and RTY mean values of three sigma levels of the ICT group based on the achievement test.

18. There is no significant relationship exists between the DPMO an RTY mean values of the three sigma levels of the traditional teaching group based on the achievement test.

19. There is no significant relationship exists between the DPMO an RTY mean values of the three sigma levels of the self-learning group based on the achievement test.

6.6 METHODOLOGY

6.6.1 Methods

Six sigma based experimental method was adopted in the study. It is included the posttest and pretest equivalent group experimental strategy and the following modified design of experiment was employed.

Pre - test level - Treatment – interim test level - Treatment – posttest level.

6.6.2 Population of the study

The prospective teachers of the Tirunelveli district and Thoothukudi district of Tamilnadu were selected as the population of the study

6.6.3 Sample of the study

Thirty student teachers were selected in each group through the purposive cluster sampling technique and the sampling distribution is given below:

1. The sample of 30 student teachers of the 2010 – 11 batch were selected as Control group (Self-Learning group) from the St. Antony college of Education, Mannarpuram, Tirunelveli District, Tamil Nadu.
2. The sample of 30 student teachers of the 2010 – 11 batch were selected as Experimental Group I (Traditional Teaching group) from the Dr. Sivanthi Aditanar college of Education, Tiruchendur, Thoothukudi District, Tamil Nadu.

3. The sample of 30 student teachers of the 2011 – 12 batch were selected as Experimental Group II (ICT group) from the Dr.Sivanthi Aditanar college of Education, Tiruchendur, Thoothukudi District, Tamil Nadu.

6.6.4 Tools

The tools used for the present study were of the following

1. The IQ test questionnaire constructed and validated by the investigator.

2. Learning Deficiency scale (LDS) – constructed and validated by the investigator

3. Achievement test in ICT – constructed and validated by the investigator

6.7 DATA ANALYSIS

The present study includes the following data analysis.

A. The descriptive data analysis – six sigma DMAIC based process impact analysis

B. The differential data analysis – 1. Analysing significant difference in DPMO, FTY, Sigma value, RTY (achievement test).

2. Effect size analysis.

3. Gain score analysis

4. ANOVA analysis.

5. Correlation analysis.
6.8 FINDINGS

The findings given below were results of the data analysis.

1. There is a significant difference between the self-learning group, traditional teaching group and ICT group at the pre-test (pre sigma), interim test (interim sigma) and post-test (terminal sigma) levels of learning the ICT concepts in terms of Defects per Million opportunities (DPMO) in the classroom learning deficiencies.

2. There is a significant difference between the self-learning group, traditional teaching group and ICT group at the pre-test (pre sigma), interim test (interim sigma) and post-test (terminal sigma) levels of learning the ICT concepts in terms of process sigma values in the classroom learning deficiencies.

3. There is a significant difference between the self-learning group, traditional teaching group and ICT group at the pre-test (pre sigma), interim test (interim sigma) and post-test (terminal sigma) levels of learning the ICT concepts in terms of Field Through Put (FTY) values in the classroom learning deficiencies.

4. There is a significant difference between the self-learning group, traditional teaching group and ICT group at the pre-test (pre sigma), interim test (interim sigma) and post-test (terminal sigma) levels of learning the ICT concepts in terms of percentage of process outcome values in the classroom learning deficiencies.

5. There is a significant difference between the self-learning group, traditional teaching group and ICT group at the pre-test (pre sigma), interim test (interim sigma) and post-test (terminal sigma) levels of
learning the ICT concepts in terms of Defects per Million opportunities (DPMO) in the achievement test.

6. There is a significant difference between the self-learning group, traditional teaching group and ICT group at the pre-test (pre sigma), interim test (interim sigma) and post-test (terminal sigma) levels of learning the ICT concepts in terms of process sigma values in the achievement test.

7. There is a significant difference between the self-learning group, traditional teaching group and ICT group at the pre-test (pre sigma), interim test (interim sigma) and post-test (terminal sigma) levels of learning the ICT concepts in terms of Rolled Throughput Yield (RTY) values in the achievement test.

8. There is a significant difference between the self-learning group, traditional teaching group and ICT group at the pre-test (pre sigma), interim test (interim sigma) and post-test (terminal sigma) levels of learning the ICT concepts in terms of percentage of process outcome values in the achievement test.

9. The post-test (terminal) achievement test scoring of the self-learning group fall within the specification limits of p-control chart.

10. The post-test (terminal) achievement test scoring of the traditional teaching group fall within the specification limits of p-control chart.

11. The post-test (terminal) achievement test scoring of the ICT group fall within the specification limits of p-control chart.
12. The process capability (Cpk value) did not attain the maximum value of 1.0 in the self-learning group, traditional teaching group and ICT group at post-test (terminal) level of achievement in learning the ICT concepts.

13. The process capability index value (Cp index) did not attain the maximum value of 1.0 in the self-learning group, traditional teaching group and ICT group at post-test (terminal) level of achievement in learning the ICT concepts.

14. The ICT learning strategy is effective in improving the post-test (terminal) level of the achievement test in ICT concepts in the three groups.

15. There is a significant mean difference among the self-learning group, traditional group and ICT group in the intermediate level (interim sigma) level of the achievement test.

   Among the three groups the sigma mean of the ICT group was better in than traditional and control group in which the sigma mean was lower than the other two groups at the intermediate level (interim sigma) level.

16. There is a significant mean difference among the self-learning group, traditional group and ICT group in the post-test level (terminal sigma) level of the achievement test.

   Among the three groups the sigma mean of the ICT group was better in than traditional and self-learning group in which the sigma mean was lower than the other two groups at the intermediate level (interim sigma) level.

   The Anova analysis reveals that in the digital content based teaching to the ICT group has not only eliminated the learning setbacks but also it is making pertinent learning.
There was an initial level struggle in learning the concepts of the ICT which has been analysed in the pre-test level of the three groups as the concepts of ICT are newly learned but in the interim test and in the post-test level the groups greatly differ in the achievement. This might be due to the learning strategies which are adopted in the three groups.

17. There is a significant negative relationship exists between the DPMO and RTY mean values of three sigma levels of the ICT group based on the achievement test.

Due to the modified technology based teaching factor, the Defects per Million opportunities (DPMO) of the achievement test was reduced to the greater level and hence the Rolled Throughput Yield of the ICT group was increased.

In this correlation analysis the DPMO (Defects Per Million Opportunities) and RTY value of the ICT test score are negatively related to each other and hence it is depicted that these two values are indirectly proportionate to each other which is meant that the reduction of the DPMO increases the RTY value of the ICT group at three sigma levels. The prospective teachers of this group have gained more test score as their defectful learning was decreased at all stages of learning.

18. There is a significant negative relationship exists between the DPMO and RTY mean values of the three groups of the traditional teaching group based on the achievement test.

Due to the teaching factor, the test DPMO was reduced to the greater level and hence the Rolled Throughput Yield of the Traditional teaching group was increased.
In this correlation analysis the DPMO (Defects Per Million Opportunities) and RTY value of the traditional teaching test score are negatively related to each other and hence it is depicted that these two values are indirectly proportionate to each other. It is meant that the reduction of the DPMO increases the RTY value of the Traditional teaching group at three sigma levels. Although, the teaching has decreased the learning deficiencies of the Traditional teaching group the RTY value is lesser than the ICT group.

19. There is a significant negative relationship exists between the DPMO an RTY mean values of the three sigma levels of the self-learning group based on the achievement test.

Due to the self – learning factor, the test DPMO was reduced to certain level and hence the Rolled Throughput Yield of the control group was increased. In this correlation analysis the DPMO (Defects Per Million Opportunities) and RTY value of the control group test score are negatively related to each other and hence it is depicted that these two values are indirectly proportionate to each other which is meant the reduction of the DPMO increases the RTY value of the control group at three sigma levels. Although, the self – learning has decreased the learning deficiencies in the control group at the terminal sigma level, the RTY value is lesser than the ICT group and traditional teaching group.

6.9 DISCUSSION OF RESULTS WITH RESULTS OF OTHER RELATED STUDIES

The results of the present study (Impact of six sigma – DMAIC approach in learning the concepts of ICT Education by Secondary Teacher Trainees) is discussed with the results of the other related studies.
This study reveals that application of Six Sigma methods can help in identifying the deficiencies in learning the ICT concepts. It is in concurrence with the results of Kuldeep Nagi and Srisakdi Charmonman (2010) who reported that Six Sigma methods can help in analysing the reasons for the lack of activity during the course of studies and it gives a clear identification of instructional problems collected through data.

This study reveals that Six Sigma based DMAIC technique can improve the quality learning process of the secondary teacher trainees. It is in concurrence with the findings of Chlaidze & I. Linde (2006) who reported that the Six Sigma pertains to improving the quality of matter taught, the character generated of the students, and the quality of study and student’s life. They have also measured the Lecture quality and the quality of learning materials. Their research work treated DMAIC, one of the sequences of the Six Sigma methodology, and provided an overview of the statistical toolkit for improving the teaching quality.

The current study reveal that the control chart can show the common cause for variation in the achievement tests formed due to the lack of cognitive, reading, note taking and writing strategies. It is concurrence with the findings of Mirko Savic (2006) who indicated that a control chart can reduce the common cause variation which is usually a student's responsibility, for instance, poor preparation for exams, concentration, tiredness, etc. Further, they have stated that, a control chart can reduce our chances of making possible errors.

The present study established the strategies to eliminate the learning defects by the control chart in teacher education. It is in concurrence with the results of the Durga Prasad, Venkata Subbaiah and G.Padmavathi (2012) who
proved that the control chart help to monitor the processes in the engineering education system.

The current study asserts that the RTY value of achievement test is influenced by the various psycho – somatic factors. It is in concurrence with the findings of Keith Hargrove and Legand Burge (2002) who affirmed that the RTY value of retention of Engineering students is influenced by financial aid, faculty – student relations and by academic preparations which are most prevalent.

6.10 CONCLUSION AND EDUCATIONAL IMPLICATIONS OF THE STUDY

Educational implications of the study

As a result of research experiences with Six Sigma methods, the present study reveals the two paradigms of its implications.

Six Sigma is a new strategy in the academic management and innovation for quality survival: It is for quality survival of an academic institution in this 21st century, which implies three things: statistical measurement, new academic management strategy and quality culture.

- It provides a means of doing things right the first time and to work smarter by using data information. It also provides an atmosphere for solving many CTQ (critical-to-quality) problems through team efforts.
- Six sigma provides a scientific and statistical basis for quality assessment for all educational processes through measurement of quality levels among all processes and interprets how good a process is. Through this information, top-level management learns what path to follow to achieve process innovation and customer satisfaction. Six sigma provides efficient manpower cultivation and utilization. It employs a “belt system” in which
the levels of mastery are classified as green belt, black belt, master black belt and champion.

- This present study proved that the incorporation of quality tools can bring the tremendous results by reducing the defective factors, if any, newly arises.

Lastly, Six Sigma provides flexibility in the new millennium of 3Cs, which are:

- Change: Higher level changeability of teacher educative programs
- Customer: student community is shifted to customer of knowledge work with high demand
- Competition: Competition in quality and productivity of entire academics as the pace of change during the last decade has been unprecedented, and the speed of change in this new millennium is perhaps faster than ever before.

The following are the overview of quality learning environments experienced by the academic six sigma researches.

- This kind of research establishes a high degree of trust and respect between students and teacher. A successful learning environment must be learner-centred, knowledge centred, assessment-centred and community centred. It gives assurance to make both learner and mentors are committed to the successful learning.

- This research provides a self-inducement for faculty to enable the student in eliminating the defects if any, caused while learning. The goal of the academic six sigma research is to provide an environment that will
encourage and challenge students to live up to their potential and become self-growers.

- This research seeks the student and the mentor to receive feedback regularly by using assessment on a consistent and timely basis. This research brings the self-assessment for students to improve their performance.

- This research measure and document the progress and growth of both faculty and students. The learning environment must include records that document growth and track the progress that has been made. Students and teachers need to see evidence that demonstrates that their performance is improving or diminishing.

- It creates a collaborative learning space - While the learning space in which we teach is often not under our control, whenever possible faculty should communicate to administrator’s plans for their ideal classroom.

- This is especially important when renovations are being planned. For instance, the round tables, rolling chairs, functional workstations, and state-of-the-art projection equipment enhance the learning environment.

**Conclusion**

Indeed, it is concluded that this study has initiated an earnest attempt of making the process improvement by implementing the DMAIC approach in teacher education. This standardized process improvement methodology will bring the correctness of all the levels of the teacher educative activities and its utility is essentially required in this present juncture because of the following perspectives:
In this global context, Teacher quality, teacher learning, and teacher improvement are viewed as the prime foci of researchers, policy makers, program designners, implementers, and valuators. In both developing and industrialized countries, teachers are considered to be the most responsible personalities for various remarkable social practices.

The prospective teachers will become reflective practitioners who use active-learning approaches in their respective classrooms, where their students learn through problem solving, critical dialogue, inquiry, and the use of higher-order thinking skills so the prospective teachers must learn to enhance the entire academic performances which directly influence the national growth.

6.11 RECOMMENDATIONS

Based on the theoretical assumptions the following recommendations are made:

To the teaching community

As this new approach may foster the self – assessment and may bring the tremendous academic performance, the teachers may learn this method to develop the professional competency by implementing the quality practices like six sigma.

To the student community

The prospective teachers need to develop the insight for higher order learning by eliminating the undesirable features in learning. The learning must be internalised so each learner must have the inner focus to develop the self – analytic and self – criticism through the positive approach. The learner must be self – identifier of all the setbacks / draw backs /defects pertaining to learning, the predominant force in harnessing their academic life.
To the parents

The parental care is an essential factor which governs the potential space for learning and their effort minimises the possible occurrences of learning defects. The inward inquiry of the learning process might be at the hands of the parents and hence they must provide the resourceful environment which is the prime task of the every parents.

To the academic institutions

Since the six sigma application is intended for quality deployment, the academic institutions can implement this method to foster the earnest educational practices on which the entire national progress sustains. The prevailing analytical study shows that the incorporation of six sigma practice will yield the fruitful results in all forms.

To the nodal agencies

The six sigma is being realised as a panacea in educational process by various nodal agencies like NAAC and Baldridge of USA and hence it high time for the nodal agencies and for the educational institutions to implement this new method of overall performance. The accreditation process can be transformed by implementing six sigma based measurement system so as to enable to analyse the process outcome accurately in the academic institutions.

6.12 THE SCOPE FOR FURTHER STUDY

Based on the research outcome of the present investigation, the suggestions for further study are noted as below:

1. Since the present day social structure has immense potential for the value based knowledge of prospective teachers, the value system of present day
teacher education programs can be studied by six sigma methods for further enhancement of the programs

2. Additionally, DMAIC based modelling techniques to predict and evaluate the bottom-line impacts of various schemes are needed in the teacher educative process as the application of DMAIC approach has broader applicability and improved prediction accuracy. The future research can focus on this modelling.

3. The six sigma DMAIC approach based analysis of the curricular transactional process of the professional courses can be conducted so as to improve entire academic process performance level by reducing academic defects.

4. The impact of market economy based academic structure of the present day is the crucial factor which may directly influence the entire academic process of all the courses and this can be effectively analysed.

5. The adverse socio-political influences on education can also be studied at all levels of the education by six sigma based quality tools so that the negative influences can be identified and be eliminated for making the corrective mechanism.

6. The comparative analysis can also be carried out with that of the foreign institutional process so that the present quality indicators can be further fostered.

7. The public investment on education can be studied on par with the academic outcome of the all the courses of the study and this study may have the determination to check whether the educative process is a real change agent of the best life.