CHAPTER V

Conclusion, Findings and Suggestion
# CHAPTER V - CONCLUSIONS, FINDINGS & SUGGESTIONS

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CHAPTER V
CONCLUSIONS, FINDINGS & SUGGESTIONS

5.1. INTRODUCTION

Assessment methods and tools are derived from learning objectives and activities. To meet the school or higher education requirements for a specified grade, competency based assessment methods and tools are needed. There is a need for assessment tools which can help teachers to give a better understanding of how to conduct competency based assessment in a complex environment. Assessment activity is often a post script in the teaching and learning experience. It should be pivotal to suit to the learning experience. They should provide opportunities for the application of knowledge, be a place for critical self-reflection and be an opportunity to provide feedback to both teachers and learner.

Creating a Digital Campus as proposed by Sathish Keethinedi & Nihar Pradhan (2012), for the mastery of tasks as proposed by Preetychawla (2010) may be an ideal condition to think of implanting computer Adaptive Test in Indian educational system and yet there are many barriers to cross, to reach that condition. There are many ways to collect assessment data. The most common new technique using computer technology is adaptive testing in which, anticipated information about a student’s response used to select subsequent test item and adapted or tailored to the students estimated ability. This CAT develops their reflective and analytical skills in reviewing their practice. It also involves candidates in decision making, feedback on assessment process. Gillis, & Griffin, (2005). The diagnostic and self-assessment application of computer Adaptive Test in every section will improve the quality without stress says Fredrick, (2012). Graded assessment by Sherridan Maxwell (2012) gives a key credit to formative assessment. But for assessing higher order learning outcomes, learning with
Multiple Choice Question and Multiple Response Question (MRQ) are the most frequently used. Davies (2001), Duke Williams and King (2001) and recently by Lau, Paul Ngee Kiong et. al (2011) propose the necessity of technological assistance and provide sufficient guidelines in construction that are taken care by the researcher during development. The CAT—which is used by the researcher in this research, is an assessment tools used in performance based assessment. It can typically be employed, when a judgment is to be made to evaluate a broad range of activities so that the judgment is more objective than subjective. It provides a clear description at each levels of performance anticipated in the learning process. It shows the quality of the performance. The CAT aims to modernize India’s assessment system, if we evolve a system that enables robust, reliable and impartial assessment and it can be implemented in our education system. Lina Ashar (2012).

The CAT has encompassed the researcher to prepare for stand-alone computers and content enrichment suitable to the principles under pinned in Item Response Theory (IRT) (Swaminathan et. al. 1984). Computer Adaptive Testing involves posing questions of difficulty that depend on the Test taker’s previous responses by which the ability of the testee can be estimated He, Wei et.al. (2008). If a question is answered correctly, the estimate of her/his ability is raised and more difficult question is presented and vice versa. Present work has 450 items with three level of response presented through computer in two parameter of IRT model with internal and external variables to monitor. The functionality of assessment system is limited to a question styles and are readily customerized and flexible nature with limited feedback options. Boyle and O’ Hare (2003); proposed variety of question styles suitable to the students’ standards for Educational and Psychological testing. Zhang, Jinming (2013), procedures for analyses of response data which were found to be useful for setting
norms for item selection and analysis of item quality and provides pedagogic support. The expert team has a combination of subject specialists and evaluation experts. At every stage, appropriate pilot test and statistical analysis were carried out with the suggestions given by the experts’ team. Thus, the content validity and construct validity were assured with technological and subject experts’ suggestions, and the computer adaptation was scientifically carried out. The outcome of the variables, monitor the use of CAT as a vehicle (mode) or means for enhancing interactive role of the test items with test takers are self monitor the outcome and the technology has helped to directed to the required level of items for the next response. It has the additional role as means in evaluating the abilities to face the next higher item.

The CAT’s ability to interact with examinee is inbuilt by organizational property created by the content level, management, design in questioning, discriminative ability and difficulty index of items algorithm of program and platform. Careful planning during preparation and development of test items assured the expected qualities in software development, which can act as catalyst for change and transformation of instruction at the highest level. Bull and McKenna (2001) warn that technical limitations of software and hardware by supporting device have to be compensated by perseverance, knowledge and resilience of test takers. Further, they caution the need for cost and time effectiveness in monitoring. Cultural barrier in importing software has no implication since the locally developed software guidelines in the adaptive systems proposed by Wong, Lung- Hsiang et. al. (2012) provides support. In the present study, the external and internal potentials are assumed to be the enabler for equipping the test taker with ability for interaction which is measured in terms of CAT score and Learning Rate. The following findings listed below give the outcome of the study.
SECTION I

5.2. INFERENCEs AND FINDINGS

The contributions from the research are the inferences and suggestions derived from the analyses. The scientific outcomes should be relevant to the set objectives and either confirm or reject the hypotheses formulated.

5.2.1. Analysis of Dependent and Independent Variables

The Mean Achievement Score (Post test – Pre test) has considerably increased among those learners, who have been effectively influenced by the computer adaptive package and its content. It has been used as one of the indicators of the treatment effect of CAT. The different Educational environment favours CBSE as better and it is obvious that, the difference is because of the effect of the curriculum pattern and the opportunities provided in the schools for concept clarity and may due to the evaluation system they follow as reported by Rajesh Hassija (2012). Also, the performance of students who undergone computer courses are at higher level as compared to their counterparts which infers that the technology aids effective learning. The influence of CAT material or the nature of interaction of the learners with the structured package varies considerably. As a result, it is found that there is considerable level of difference between learners of the different Educational environment and different level of computer knowledge. The nature of the learning environment and the level of technological knowledge offer better potential for concept attainment. It is inferred that the internal factors like Aptitude, Attitude and Technology preference have meaningful impact on the CAT Scores. These are some of the key potentials for individualized learning as proved by the earlier research (Cilliers, 1996; Liu and Che-Hao, 2008; Seery, Michael. 2009). These potentials, along with the interactive learning environment created by the CAT, influence in better CAT performance. The learner’s
speed of interaction with CAT increases, which shows the hidden ability to learn and the likeness of the mode of learning through technology. These hidden potentials influences in learning. The Learning rate of the above and below mean score groups, in terms of internal factors like Aptitude, Attitude, and Technology preference shows that the mean speed of interaction of the below mean group is high, as compared with the above mean group. This shows the CAT’s ability to interact with the below mean group of learners effectively. Thus, CAT has the ability to utilize the hidden potential and enhances the below average learners’ learning ability as reported by Wise, Steven, et. al. (2005), He, Wei, et.al. (2008) and Rast, Phillipe(2011). Thus, such interactive evaluative tool, evaluate the learners’ content knowledge as well as increases the learners’ learning rate, which are the influencing factors assumed to be contributory in the Achievement. There is uniformity in the utilization of CAT material by various categories of learners, as they do not differ in their Response Time; when they interact with CAT. But the internal potentials like Aptitude in Physics and Technology preference shows influence in their Response time with CAT. It is inferred that, the external potentials are less contributive factors than internal potentials for measuring interactivity with CAT. Ability of the learner plays a key role in enhancing the potential for interaction, because high ability estimates of the test takers’ interaction with difficult items increases Response Time. In other words, the type of path the learner had chosen like difficult item or easy item decides the time taken. The results are similar to the earlier studies as reported by Choi, et. al. (1996); Sweygert, Kimberly (2003), Girauld, Gerald (2005) and recently by Matthews (2012).

Attempt is the physical indication of interaction with the test materials. Number of attempts made by the individual while interacting with CAT, provides stronger background for enriching their abilities. Expecting the difference among the learners in
terms of their attempts, the Educational environments and the levels of Computer Knowledge shows variations in their attempts. The high mean attempts of the State Board students during the interaction with CAT material shows that the type of path the learner had chosen was difficult for them. This shows their inability to identify the correct answer from the distractors due to their lack of clear understanding of the concepts in the subject. The low mean attempts of the CBSE students may be due to the better learning opportunities provided by the curriculum pattern for concepts clarity and the evaluation system for remediation by the CBSE school environment, which provides stronger background for measuring and assessing their abilities and potential for learning individually. Similarly, the addition of Aptitude and technology preference, strengthen the content knowledge which decrease the number of attempts. The low interactivity of the high ability examinee infers that they are able to answer most of the questions even in the difficult level itself, which reduces the number of attempts. The students with high Aptitude and Technology preference shows low attempts during the interaction with CAT material, which means that the type of path, the learner had chosen was easy for them, so they have answered most of the questions in the difficult level itself.. The other category with low mean attempt is, students who under gone computer courses. Their low attempt ratio is due to the higher access provision they had towards technology, which improves the correct guessing as reported by We, Huey-Min (2012). It is inferred that the technological awareness influences the testees in choosing the correct response from the distractors and their interactivity with the CAT increases.

5.2.2. Analysis of the Internal and the External Independent Variables

It is inferred that the Aptitude in Physics is considerably high for male examinees and for CBSE students than female examinees and the other board students.
It may be due to their Activity oriented curriculum pattern which increases their Aptitude in Physics. Physics Aptitude provides stronger background for enriching their abilities (Slykhuis, David & Park, John 2006). The addition of technological awareness along with aptitude strengthens or enhances the interacting ability of the testees in Computerized Adaptive Test. These results are similar to findings proved by many other studies (Legree Peter et.al. (1998), DeMars, Christine (1997), Miranda, Roommel (2012). Influence of individualization was studied, and found that it is not a contributive factor which is rather general as observed by many similar studies like, Hounshell P.B & Hill (1989); Kumar, et.al.(1993) and recently by Mullins, Dejana (2011). It is inferred that the internal potential technology preference influences on the nature of learning either positively or negatively, since the CAT, is a testing tool which uses the computer as a working platform. The positive attitudinal character increases the interactivity with CAT and the negative attitudinal character decreases the interactivity with CAT. The male examinees technology preference is more than the female as supported by Mass, Asja (2011). This internal independent variable Technology Preference is one of the important attitudinal parameter for measuring the potentials and the interactivity of the prepared CAT as reported by Pea, Celestine (2012). The mean attitudinal score towards CAT shows that all the category of learners show positive attitude towards CAT. The male and the urban student’s attitude towards CAT score are higher as compared with other learners. This shows their high curiosity, likeness and much familiarity and more access towards computer, which influences in learning through CAT as reported by Liuand Che-Hao (2008); Merlin et.al. (2009). Mohanty (2010).
5.2.3. Analysis of the Dependent Variables and (AM & BM) groups of the Internal Independent Variables

The Internal potentials like Physics Aptitude, Attitude towards Technology and Technology Preference are necessary to empower a learner to face any test and their contribution are expected and are considered for analysis. The above mean potential group shows high CAT scores than the below mean potential group learners. The below mean group learners interactivity with CAT increases their achievement score as supported by earlier research work Mohanty (2010), Wilson, Mary (2012). The CAT’s influence along with the internal potential in them, creates a suitable learning environment and it develops interest and motivates the below mean students, which made them to score high in the achievement mean score (post test). The interactivity of these potentials on CAT score infers that, the high attitudinal group’s performance in CAT is higher by selecting more number of difficult items and scoring high. The below groups interactivity is mostly on the low level items, so they score less. The results of this study concurs with results of earlier works as reported by Cilliers, (1996); Slykhus, David et.al (2006). The interactivity of these potentials with the Learning Rate infers the positive involvement of the learners with the CAT. The higher attitudinal groups’ contribution is expected higher, but their learning rate is not up to the expectation. The observation made for the below mean group of learners shows a specific responding ability, which is created by the CAT environment. Hence, the Learning Rate of the below mean group is higher than their counterparts. This is due to the interacting ability of the CAT package, with the below mean group of learners. This can improve the positive attitude towards learning, which intern increases their performance as observed by Brecht, H, David (2012). Hence, it can be concluded that CAT can improve learning and the weaker students are especially benefited.
SECTION-II

5.2.4. Analysis based on CAT Score, Achievement Mean Score and Learning Rate

The interactivity among the various combinations of variables with respect to Achievement score, CAT score and Learning rate infers that the variables behave independently than collaterally. They never combine to produce a visible influence and hence, they are not contributive. Gender and Locality causes interaction among the learners; when they are observed in terms of Learning Rate. The study also proved that the performance of the rural female is comparatively low in terms of their CAT score. But, their high learning rate clearly indicates that, they are having high hidden potential to learn and achieve more. If technological assistance is provided or if proper learning environment is provided rural female can perform better. This study infers that the female rural children are not given equal opportunities by parents, school and society. So if they are given enough care, encouragement and technological supports in their education, then they perform better than others. Thus the innate potential of the learner can be assessed using CAT. So, the government should take necessary steps to provide equal opportunities to all learners.
SECTION III

5.2.5. Coefficient of Correlation between the dependent Variable and Other Interacting Variables

The correlation study in terms of achievement score infers that the Aptitude in Physics strongly influences in the Achievement mean score. The Attitude towards technology preference, mean CAT score shows a positive inclination with the Achievement mean score. Attempt in the test items is strongly negative (-0.6794) in association with Mean achievement score. It is true that more the attempt, less their ability in responding challenging test items and the inability also leads to careless attempts. Learning Rate is negatively correlated with the Mean achievement score (-0.6354), which means, the learning rate is less for the high achievement scorers. The low learning rate of the high achievers is due to the less interactivity with the CAT package. This may be because; high achievers do not find CAT as their best learning environment, since they are familiar with the concepts. The positive relationship between the Achievement post test score with the CAT score (0.6907) confirms the interactive effect of the CAT on testees; during the process of CAT in Physics concepts. It was also observed by Seery, Michel (2009) Mohanty (2010); Wilson, Mary (2012).

The correlation study in terms of CAT score infers that Technology preference of the learners is positively correlated and is contrary to the Attitude towards CAT, which indicates a mixed feeling of uncertainty among the testees. It infers that, the learners who are not familiar with the use of computers develop confused feelings. In general, the Aptitude in physics has a high positive correlation with the CAT scores (0.8702). When the test situation is more realistic, aptitude can elicit positive attitudes from students to take such challenging test, by the ability created by the computer. It is
strongly felt that science abilities can reflect their general potential to perform better in testing environment. The speed of interaction with the CAT material shows indirect relationship with the CAT scores. CAT score among the weaker students is low but, their learning rate is high, which shows their curiosity in learning is increased by the interactive ability of the prepared CAT package. This in turn increases the number of attempts. The low CAT scorers are motivated to take the challenging test items; which increases their number of attempts. Hence, the attempt is negatively correlated.

The correlation study in terms of learning rate infers that decrease in the Learning rate decreases the number of attempts, which is positively correlated. It is true that the aptitude as measured by Physics Aptitude Test, prepared by the researcher, strongly supports the performance of the testees with the three level item bank, adapted with computer testing; which challenges their interacting ability, but their speed of processing is less when their attempts and the response time are considered. Hence, they are negatively correlated (-0.6595). The learning rate of the high achievers who scores high in the CAT, are likely to show a difference, because of the two factors that operate; one is the potential to learn fast, second is the nature of the path the learner has chosen, on high level items. With respect to the challenging items, the learning time will be higher and so, the speed of interaction will be low which reflects on the learning rate and the negative correlation is a positive support.
SECTION IV

5.2.6. Interactivity between Learning Rate, Cat Score and Post Test Score

The Rate of interaction between the CAT score and Learning Rate in terms of the Achievement post test above mean and below mean groups infer that, CAT score is the result of learners’ ability in Physics concepts. It is the outcome of the total test performance rate of the examinees at the best of abilities by facing the variety of test items. The performance of post test above mean group is directly related to CAT score. The below mean group also possesses enough amount of internal abilities to face items of different levels offered by the CAT. The high amount of interactivity in the testing process of the below mean group by the CAT material shows that the technology mediated educational endeavor helps the underprivileged and empower them to compete with others with equal vigor. The noticeable level of interaction may be because; the ability of the test items has embedded abilities by the virtue of its construction with wide variety of discriminative ability to influence the learner at lower mean group than those at higher level.

The above mean group is better than the below mean group in their CAT score. This may be due to the innate potentials they have. But their speed of interaction with CAT is not up to the expectation. When the above mean and the below mean group in relation to their CAT score are compared with their post test performance, the achievement ratio of the below mean group is higher; when compared with their pre test performance. (Pre Test Mean= 10.3, Post test mean= 27). This may be due to the added opportunities given to the below mean group through the computer mediated evaluation strategy. This computerized adaptive test items presented in CAT package helped to endow the learners with different level of abilities to achieve. High learning Rate needs sufficient amount of internal potential to meet the particular level of ability
demanded by the question bank items. The CAT above mean scorers is relatively low in their learning rate, but their CAT score is high. This infers that the significance of CAT for further learning is less for the above mean CAT scorers, compared to the below mean scorers. The learning rate is high for the CAT below mean groups; this may be due to the high attempts made by the low achievers during the CAT process.

When the Learning Rate above mean and below mean groups interactivity is studied with CAT scores and Achievement post test score; the mean Achievement test score is greater for the Learning rate below mean group and it is less for the above mean group, this is due to the interactive ability of the CAT, which help the low scorers to interact in a better way due to the inbuilt nature of the test items. This innate potential of CAT package favours learning of the less able testees than the high able testees. Similarly The learning Rate has indirect relation with CAT score. Thus, the learning rate is less for the CAT high scorers. This contradictory result clearly infers that the higher ability learners finds it easy to answer even in the challenging items, which decreases the number of attempts, this in turn decreases the learning rate. Hence, it is clearly infers, that the CAT low scorers, high learning rate may be due to their spirit of involvement during the process of CAT, which is greater than the conventional types.
SECTION V

5.2.7. Performance Mapping and Graphical Interpretation

Performance in the higher order items are more, faced by higher achievers than the low ability examinees. The average level performers fluctuate in their responses, between the high and low. The low performers’ responses are mostly at lower level. In low-level item bank, the performance rate is reversed. High achievers choose less number of questions in this level as compared to low ability examinees. The pattern of the graphs reflects the potentials of the test takers in different level of items. The high scoring of the difficult items by the high potential examinees and the high scoring of the Low and easy items by the low potential examinees and the interacting pattern of performance rates of the examinees are clearly indicated by the performance mapping. The interesting observation is the paths of performance that never overlap one another at the pitch of performance rates of the examinees. Even at low or high pitch performances, when the pattern of lines wave up and down there is no overlapping.

Thus, the examinees in general are instigated by the nature of items in the question bank for effective interaction and are influenced by the overall structure, application, appeal and inbuilt qualities of the prepared CAT package. Probably the nature of item presentation through the computer would have been created more freedom and interaction, which in other form may not be available. Hence, there is a distinct pattern of test performance in each of the test takers in terms of the interactive (high and low) level of items from CAT bank that they face. It is believed that when an examinee is administered a test through CAT, it can update the estimate of the examinee’s ability after each item and then that ability estimate can be used in the selection of subsequent items. The easy and hard items are like adding constants to someone’s score. Examinees can be given the items that maximize the information and
expectation levels. The tailored items can result in reduced standard errors for greater precisions.

5.3. DISCUSSION AND SUMMARY

The performance rates of the achievers, at three levels in the CAT in Basic Physics Concepts emerged into definite patterns by their test taking behaviours in terms of nature and the challenges caused on their abilities. The ability estimate fits into uniform pattern when their response behaviour is monitored and represented graphically. The pattern with those who face higher level items shows the high scorers at one end and the low and average scorers occupy the lower end, there will be overlapping in these two scorers but, the average scorers response is little above the low scorers. When the performance of sample was observed under the average level items, the average performer scores high in this level than the low level performers, they scored in considerable level items in this level. In the lower level items, the low performers have a small gain over the average and high level of performance. The low achievers perform their best in the lower level questions. There are marked level of differences, which is followed by the average performers. The Attempts made by the high achievers with the low challenging items are at the lowest than the others.

It may be summarized that the performance style of test takers is unique and distinct. They have a specific pattern of behavioural expression which is believed to be the outward manifestation of the internal potential to the challenging external environmental demands. Physics aptitude, Attitude towards CAT, Technology preference, Educational Environment and computer Knowledge may react and interact with one another to develop an internal test taking environment as intra personal abilities. The wide range of Question bank items in their ability to instigate the examinee and challenge them for interaction. The examinee encounters the challenge
and the outcome of the nature of interaction is revealed as - Achievement Mean Score, Computer Adaptive Test score, and Learning Rate.

5.3.1. Achievement Mean Score

Achievement Mean Score is the Score taken by the testees in the Post test after the refreshing effect of CAT. The interacting ability of the CAT with the testees, can be assessed by the post test performance of testees. The comprehension of items, internal abilities and potentials which interacts between the examinee and the test item depends upon the nature of item and its level of response expectation. The effectiveness of all these factors can be assessed by a post test conducted after the completion of the CAT.

5.3.2. CAT Score

The graded score for each item depends on the ability demand. Ability is the collective potentials of various components. There is a match between these two in interaction which is facilitated by the computer algorithm to its maximum. The free and democratic environment facilitates the total outcome of abilities in the examinee.

5.3.3. Learning Rate

Learning Rate is believed to reflect the kind of interaction of test items with the test taker. Two operational variables in CAT are the number of times the examinee interacts with each question till he/she succeeds to next questions and the total time he/she utilizes for each item. The total number of test takings he/she has performed per question and the Response Time (Seconds/Minutes) are measured as two variables to arrive at a constant for uniformity of assessment.

Learning Rate and CAT score seems to be the companion in arms. The seriousness of learning, comprehending and analysing the question and solving the problem need real time interaction. The speed of solving the problem depends on the
potential of the test taker, the condition in which the testing being carried and the level or the kind of test item. These three factors determine the Learning Rate, which is expressed in real time (Minutes/Hours) and number of mistakes the examinee commits in test taking as represented by units of frame/item. The learning rate is the product of the amount of work done in terms of unit time. In CAT, the work done is equivalent to the interaction with the learning material as units of frames / Minutes. Hence, the learning rate calculated based on classified items, is believed to express his potential for facing challenging items. The performance of the low ability groups, higher learning rate infers that their speed of interaction with the CAT, which shows their curiosity and ability to learn.

As a reliable parameter in studies using computer, the learning rate is found to be an effective measure in establishing the interaction rates of the testees in CAT materials differently according to their ability to interact. Processing speed increases the positive attitude in learning as reported by Rast, philippe (2011). Brecht, H David (2012) observed that the weaker students are much benefited if CAT is used in evaluation. Since, CAT motivates the low Aptitude testees to interact with all the test items without eliminating any items. Thus, more frames are utilized by the low ability scorers, which means higher rate of interaction with CAT materials. This interacting ability of the CAT increases the performance of the testees in future challenging tasks.

5.4. RESULTS CONSOLIDATION

The ‘t’ value reveals the contribution of the variables that contribute for CAT score, Achievement Mean Score and Learning Rate reveals the nature of interaction, level and amount of influence on the different level of Examinees (those who achieve high, average and low). The CAT score is the index of direct outcome of testing which is supported by the finding of Wall Janet (2000) in Technology delivered assessment.
The precautions taken during fabrication of test tool CAT has created the appropriate environment, freedom and user friendly condition to bring out the total abilities from within the test takers for optimal expression and interaction. The ‘F’ values reveal that the level of interaction of variables, stated in the various hypotheses. The tables are consolidated and tools of variables in various combinations and the coefficient of correlation reveals the comparisons of the dependent variables CAT score, Achievement Mean Score and Learning Rate with the other influencing variables.

5.4.1. Interacting Variables

The Five External variables (Level of Education, Locality of the Institution, Gender, Computer knowledge and Educational Environment), analysed for their contributions in CAT, Computer knowledge and Educational Environment appears to provide ability to the test taker for more effective interaction with the test items and help the test takers to achieve higher. The Internal Variables Aptitude in Physics and Technology preference helped to empower the test taker. Under the interaction of all variables that are assumed to contribute or provide optimal conditions for CAT in testing the Examinees, the reliable parameters which reflect effectiveness are CAT score, Achievement Mean Score and Learning rate.

When all the independent variables are compared together for their total contribution in creating a healthy environment for effective interaction, the dependent variables have maximal expression. More the number of related elements necessary of test taking ability, higher is the interaction of them to enhance the examinees potential for higher achievement. It is the product of the quality of technological equipment developed, the level of utilization of the tool for achieving the objectives for which it has been created and the commitment to the process of testing. It is both the man and machine interaction, interface will be perfect only when both are matched and
complement one another. Such an interface is revealed by the high Response Time and the Learning Rate. The technology serves as the means by enhancing the process of interaction than simply a vehicle for transmitting information to the receiver as proposed by Clark R.E. (1983) “Research in media” and Kozma R B (1991) in “learning with media” without stress and it improves quality Fredrick. J (2012)

5.4.2. Interacting Potentials

It is a complex status which is the manifestation of various human factors. The examinees are different in certain areas broadly like Gender, level of education, Locality of the Institution and also differ in their aptitude and attitude. Both internal and external conditions of the examinees interact differently with the external environment which influences the CAT, the platform of reaction. In addition to perseverance, hard work, risk taking ability, positive attitude toward test, desire to face challenges, determination to achieve high and honesty in test taking, knowledge on subject content and recentness with Technology are marked to contribute greatly in enhancing their potential for test taking. Legree, Peter J, Fischi et. al. (1998) envisaged that for computerized adaptive test, the contribution of aptitude is essential for ability estimates. Aptitude increases the ability which in turn contributes to the Academic performance as reported by Cilliers, J. A (1996); Slykhuis., David et.al. (2006)

5.4.3. Interacting Environment

Testing provision bridges the test takers and test in testing Environment. If the examiner wants to realise the testee’s potentials, adequate attention has to be given to offer appropriate environment by removing the threat, fear and anxiety that often associated with testing. User friendly, challenging opportunities will elicit maximal response from the examinee. In CAT care is extended in providing such facilities.
Routing the progress of the learner to various directions, depending on the judgment made on the previous response is automated with the rapid developments in computer technology, measurement theory and by using an adaptive testing strategy. This assessment can be accomplished in less time, with more accurate and reliable result. Estimating examinees ability has become a relatively easier task with the advances in Item Response Theory (IRT) in conjunction with advances in computer. Using each item as a routing test, the examinee is directed to high, average or low level (Reed A. Castle, 1997). Uniform Item exposure control Techniques given by Edwards, Michael. C., et.al. (2012) are given consideration. Automatic scoring system, feedback to motivate are inbuilt in the package to avoid bias and errors as stated by Doebler, Anna (2012); Matthews, K., et.al. (2012)

5.4.4. Influencing potentials with technology

The CAT score, Achievement Mean Score and Learning Rate are the indicators of the effectiveness of CAT, the potentials needed for the examinees are Aptitude in Physics and Technology Preference. It is further followed by the Educational Environment they have studied and the Level of their computer Knowledge. They are found to be more effective when they operate together than in isolation. There is found to be smooth fusion between the external environmental factors and internal potentials of the learners

5.5. DELIMITATIONS

The following are the delimitation of the study,

i. The study was limited to the sixty five students of few selected schools in Madurai District, because each individual have to be provided with provisions for CAT package and the system with other facilities, which has taken a considerable period of time and space.
ii. The demographic variables such as parent’s educational qualification, parent’s salary, previous learning environment, which are essential and can influence the learning, are not considered.

iii. The higher level software technology was not adapted since, the hardware facility available in the institutions were not permitted.

iv. Animations and pictures are not used for the presentation of frames it could have been used in the text in each frame in order to include the component of variety.

v. In built provision for calculating the Learning rate was not programmed in the package.

vi. Among the various potentials, the study is limited to the potentials like Attitude, Aptitude, Technology preference and Individualization.

5.6. SUGGESTIONS FOR FURTHER RESEARCH

The following are the scope for further study,

i. The research finding of this study reveals that the performance of the CBSE students is high in Computer Adaptive Test than the other Boards of students. It may be due to the effect of the CBSE curriculum pattern and the opportunities provided to them in schools. Hence, a study may be conducted to analyze the various components of CBSE curriculum pattern and its effect on Achievement.

ii. The study reveals the influence of Computer knowledge on the learners’ potentials for achievement. Hence, a study may be conducted to find out the computer knowledge of various locality and different educational environment.

iii. The research finding of this study indicates the efficiency of the CAT to utilize the hidden potentials of the learners which is assumed to be contributory in achievement. This lay stress on the research for effective preparation of CAT packages in various subjects.

iv. The respondent belonging to the low achievers group shows high interactivity with the CAT, which shows that the weaker sections of the learners’ perform
better, if suitable learning environment is provided. This prompts a need to undertake research to find possible ways of implementing CAT environment in all schools.

v. The study also infers that the rural female students are not given equal opportunities to aware of technologies. A study based on the opportunities provided to rural female can be undertaken, to enhance the opportunities to the rural female.

5.7. IMPLICATIONS

The nature of learning environment and the influence of technological knowledge influences in their achievement. The nature of curriculum in the CBSE School contributes much in learning challenging tasks as observed by Pea, Celestine H, (2012). It is obvious that, the difference is because of the nature of the curriculum pattern and the difference in opportunities provided in the schools for concept clarity and may due to the different evaluation system they follow. Thus the implementation of proper curriculum should be provided in schools for concept clarity. The internal potential has meaningful impact on the learners’ CAT Scores; hence, the internal potentials like Aptitude, Attitude should be developed in the individuals. Strategies should be developed to enhance these internal potentials in learners.

The refreshing experience on the content through CAT seems to show enhancement in all the different groups of learners in their achievement. This may be because of the learners’ concepts clarity in the subject with individualized, interactive approach of the CAT. Hence, this type of interactive evaluation tools can be used in schools for quality improvement. The internal factors like Physics Aptitude and Technology difference shows significance in their Response Time with CAT. These factor influences in learning independently, and to reach the expected level. This shows that the external variables are not contributive factors for measuring interactivity with
CAT (Guzel, Hatice 2011). But the Aptitude and the Technology preference show noticeable level of influence on Response Time. Hence, the CAT tool, is one of the best individualized tool, which interacts according to the nature of the learners’ internal nature.

Ability of the learner plays a key role in enhancing the potential for interaction, because high ability estimates of the test takers’ interaction with difficult items increases Response Time, in other words, the type of path the learner had chosen like difficult item or easy item decides the time taken as reported by Miller, (1996); Choi, (1996); Swygert, Kimberly, A. (2003) and recently by Matthews, K. (2012). The learners’ response pattern gives a clear description of their ability. Hence, implementing this type of evaluation in schools helps to identify and estimate the ability of the students, which helps to channelize them according to their ability.

Attempt is the physical indication of interaction with the test materials which provides stronger background for enriching their abilities. The ability influences the testees in choosing the correct response from the distractors and their interactivity with the CAT increases. Their speed of interaction with CAT is very high, which shows their hidden ability to learn and the likeness of the mode of learning in terms of Technology. These hidden potentials influences in learning. Thus, introducing such interactive evaluative tool (CAT), in schools help the teachers to evaluate the learner’s content knowledge as well as increases the learner’s learning rate, which are few influencing factors; assumed to be contributed in the Achievement post test.

When the learners interact with the Computer Adaptive Test material, the Below Mean group learners’ speed of interaction is high as compared with the Above Mean group. That means, their speed of interaction with CAT is high which shows the CAT’s ability to interact with the learners. Thus, CAT has the ability to utilize the
hidden potential and enhances the below average learners learning ability (Wise, Steven et. al., 2005). CAT also efficient in remediation as reported by Fehr, Charles, N. et. al., (2012) hoping that it can increases their Mean achievement score.

5.8. CONCLUSION

The Pre-Post test, single group design is justified for control and experimental group, wherein the pre test score reflects the control group and the post test mean achievement score indicates the effect of intervention. Since the sample has homogeneity in age, education and environment the treatment effect of the CAT package is conformed to be equal. Hence, any change in the academic achievement in the reflection of the effectiveness of the CAT package which has the potential to adapt automatically to the learner’s ability level. The other effective determinant in CAT is the Aptitude in physics in the learner. When the aptitude level is high they are motivated to interact at the higher level of difficulty and at a challenging testing situation. The profile of response pattern indicates that those with high aptitude prevail comparatively at a higher level than the others.

The learning rate as proposed by Gabriel is found to be a more reliable indicator of individualized and personalized testing or learning situation. The number of attempts and the response time are the two major operating factors which are considering in arriving at the learning rate. It is more reliable and direct reflection of the learning process or testing. Hence, the researcher is satisfied with the contribution of the developed Computer Adaptive Test package and the learning rate adopted for measurement as two credible contributions to the research work.

In the light of the research findings it is felt that the present evaluation system can be improved by utilizing technology in it, so that the quality of the education system can be improved. ICT has a critical role to play in addressing the key challenges
in education. Thus a ‘digital campus’ is the most effective way to enhance the efficiency of teaching learning and evaluation process. In classroom teaching, a teacher tries to pace with the average students and he ignores the bright and poor students of the class. These problems of T-L can be solved effectively by the use of computer strategy. It incorporates the psychological principles of learning Mohanty K. (2010). The present research work and the current researches in the field of measurement and testing have shown the increased potential of computer adaptive tests. In addition, the recent trends in computer-based learning, and the integration of technology in many schools have created a boost in computer based testing, which will increase further in the future. Effective student self assessment is only useful if, after the self assessment there is opportunity for revision or some other demonstration of improvement CAT-Report conveys to students about their performance, they can use the result of their self assessment for further improvement. (MOSS, C.M. & Brookhart, S.M., 2009) Improving and sustaining quality in education cannot be achieved without explicitly focusing our educational systems and processes. Assessment experience may be stressful students are typically anxious about are examination. The only way we can prepare students for the future is by creating an atmosphere, where they want to do the best for themselves, where they are guided by their natural instincts to excel and achieve, without terrible amount of stress and pressure CAT can assess students without having undergone unnecessary stress as stated by Fredrick’s, J. (2012).

However, computer adaptive testing as well as its advantages and possibilities go a step beyond that. This can be seen from the ever-increasing number of large-scale tests (e.g. GRE, TOEFL) that have become or are becoming adaptive (Papanastasiou, 2001). What need to be done now is the educators, and especially the science educators to start taking advantage of these possibilities, by using computer adaptive testing to
complement their teaching, in combination with the use of computer-based learning in their science classes. However, such steps always need to be taken slowly and wisely to ensure that the assessment procedures are well integrated with the computer based learning process to ensure its maximum effectiveness. This CAT aims to modernize India’s Assessment system Lina Ashar (2012) It is more beneficial if we frame high stakes assessments and our students performance in them in terms of the mastery of tasks rather than their success or failure as a person.