MAIN FINDINGS, EDUCATIONAL IMPLICATIONS AND SUGGESTIONS

The present chapter is confined to main findings and conclusions regarding the Intellectual abilities IA (High, Average, and Low), Problem solving abilities PS (High, Average, Low) and the Mathematical aptitude MA of secondary level students. On the basis of the observations in Chapter 3 and the results recorded in Chapter 4, the findings of the study are noted below:

5.1 MAIN FINDINGS:

1. To study the effect of Intellectual Ability (IA) Levels on Mathematical Aptitude (MA) of the students:
   1.1 A significant difference is observed in the mean ‘Numerical Ability’ (NA) scores among students having High, Average and Low Intellectual Ability Level.
   1.2 A significant difference is observed, in the mean ‘Numerical Reasoning’ (NR) scores among students having High, Average and Low IA.
   1.3 A significant difference is observed in the mean ‘Ability to use Symbols’ ‘AUS’ scores, among students having High, Average and Low Intellectual Ability Level.
   1.4 A significant difference is observed in the mean ‘Abstract Reasoning’ scores, among High, Average and Low Intellectual Ability Level of students.
   1.5 A significant difference is observed in the mean ‘Spatial Ability’ (SA) among students having High, Average and Low IA Level.
   1.6 A significant difference is observed in the mean ‘Total Mathematical Aptitude’ (TMA) score among students having High, Average and Low IA level. Thus, it has been established that the different IA levels have a significant impact on the entire dimensions, as well as the ‘TMA’ of an individual, therefore the null Hypothesis - 1 predicting that “There exists
no significant difference between Mathematical Aptitude of students having different Intellectual Ability levels” is completely rejected.

2. **To study the effect of PS Levels on MA of the students:**
   2.1 Study reveals that there exist a significant difference in the mean ‘Numerical Ability’ (NA) scores among students in High, Average and Low Problem Solving Levels.
   2.2 A significant difference exists in the mean ‘Numerical Reasoning’ (NR) scores among students in High, Average and Low Problem Solving Levels.
   2.3 A significant difference exists in the mean ‘Ability to use Symbols’ (AUS) scores among students in High, Average and Low Problem Solving Levels.
   2.4 Study reveals a significant difference in the mean ‘Abstract Reasoning’ (AR) scores among students in High, Average and Low Problem Solving Levels.
   2.5 A significant difference exists in the mean ‘Spatial Ability’ (SA) scores among students in High, Average and Low Problem Solving Levels.
   2.6 A significant difference in the mean ‘Total Mathematical Aptitude’ (TMA) score is observed. This indicates that the different Problem Solving levels create a significant impact on TMA along with its five dimensions (wherein, the ‘AUS’ dimension is significantly affected only by high PS level). Therefore the null Hypothesis - 2 predicting that “there exists no significant difference between Mathematical Aptitudes of students differentiated on the basis of Problem Solving Ability” is completely rejected.

3. **To Study the Impact of Intellectual Ability (IA) and Problem Solving (PS) Ability on the Mathematical Aptitude (MA) of the students:**
   3.1 The study reveals no significant impact of IA and PS ability together on ‘Numerical Ability’ (NA) of students.
3.2 No significant interactional effect of IA and PS ability is observed on the ‘Numerical Reasoning’ dimension of MA.
3.3 The study reveals no significant impact of IA and PS ability on the ‘Ability to use Symbols’ (AUS) of students.
3.4 The study reveals no significant interactional effect of IA and PS ability on the Abstract Reasoning (AR) of students.
3.5 The study reveals no significant interactional effect of IA and PS ability on the ‘Spatial Ability’ (SA) of students.
3.6 The study reveals no significant interactional effect of IA and PS on the ‘Total Mathematical Aptitude (TMA) of students. Therefore the Hypothesis- 3 predicting that “Intellectual Ability and Problem Solving ability together have no significant impact on the generation of Mathematical Aptitude of secondary level students” is completely sustained.

4. To study of impact of gender on Mathematical Aptitude (MA), Intellectual Ability (IA) and Problem Solving Ability (PS) of students:
4.1 The study reveals no significant difference in the ‘Numerical ability’ of boys and girls.
4.2 A significant difference is observed in the ‘Numerical Reasoning’ of boys and girls wherein Boys tends to outperform Girls.
4.3 No significant difference on ‘Ability to use Symbols’ has been traced among boys and girls.
4.4 A significant difference is observed in the ‘Abstract Reasoning’ of Boys and Girls and this difference is in favour of Boys.
4.5 Regarding ‘Spatial Ability’ no significant difference has been traced among boys and girls.
4.6 The study reveals a significant difference among boys and girls on ‘Total Mathematical Aptitude’ (TMA) of secondary level students. This implies that gender plays an important role in determining the MA of the
students wherein the Boys outperforms Girls on their TMA. The overall findings implies that the three dimensions NA, AUS and SA have no significant impact of gender, but gender plays a significant role in determining the TMA along with its two dimension (NR and AR). Thus the sub hypothesis 4.6 that predict that “Boys and Girls would not differ significantly on the Total Mathematical Aptitude of secondary level students” is rejected.

4.7 No significant impact of gender is observed on the ‘Intellectual Ability’ (IA) of boys and girls. Thus the sub hypothesis- 4.7 that predicts that “There is no significant difference in the ‘Intellectual Ability’ of boys and girls” is accepted.

4.8 The study reveals that gender plays a significant role in determining the Problem Solving ability of secondary level students in favor of boys. Therefore, the sub hypothesis 4.8 that predict that “There is no significant difference in the ‘Problem Solving Ability’ (PS) of boys and girls” is rejected.

The overall analysis reveals that gender creates a significant impact on the MA (along with its two dimensions NR and AR) and PS ability of the students which is in favor of boys, but it fails to generate a significant impact on IA and NA, AUS, SA dimensions of MA. Consequently the Hypothesis- 4 that predicts that “There exist no significant impact of gender on variables Mathematical Aptitude, Intellectual Ability and Problem Solving” is partially accepted and partially rejected.

5. To study the impact of different streams on Mathematical Aptitude (MA), Intellectual Ability (IA) and Problem Solving Ability (PS) of students:

5.1 The study reveals a significant difference on the ‘Numerical ability’ (NA) score of students belonging to Science, Commerce and Arts Stream. The NA score is highest for the Science Stream followed by the Commerce
A significant difference on the Numerical Reasoning (NR) score of the students is observed among students belonging different streams. This difference is not significant for Science and Commerce stream but it is significant for Arts stream.

The study reveals a significant difference on the ‘Ability to use Symbols’ (AUS) of students belonging to Science, Commerce and Arts Stream. The Science Stream students score maximum on this ability followed by Commerce stream and then the Arts Stream.

A significant difference is observed on the ‘Abstract Reasoning’ (AR) of the students wherein the Science Stream students score maximum, followed by Commerce Stream and then Arts Stream.

A significant difference is observed on the ‘Spatial Ability’ (SA) of the students wherein the Science Stream students score maximum, followed by Commerce Stream and then Arts Stream.

The study reveals a significant difference on the ‘Total Mathematical Aptitude’ (TMA) of the secondary level students. The Science Stream is found to possess highest MA followed by the Commerce Stream and then the Arts Stream. **This implies that Stream has a significant impact in the generation of TMA of secondary level students and the Sub Hypothesis 5.6 which predicts that “There is no significant difference in the ‘Total Mathematical Aptitude’ of students from different streams” is rejected.**

Stream has a significant impact on the ‘Intellectual Ability’ (IA) of the students. The students of Science Stream possess significantly different IA from the other two streams while the Commerce and Arts Stream students
do not possess any significant difference among themselves. Therefore the Sub Hypothesis 5.7 that predicts that “There is no significant difference in the ‘Intellectual Ability’ of the students from different stream” is rejected.

5.8 Stream has a significant impact on the PS Ability of students. The students of Science Stream possess significantly high PS ability while the Arts and the Commerce Stream have no significant difference on their PS ability. The sub hypothesis 5.8 that predicts that “There is no significant difference in the ‘Problem Solving Ability’ of the students from different stream is rejected.

The findings reveal a significant impact of stream on the Mathematical Aptitude, Intellectual ability and the Problem Solving Ability. However, it was traced that all the three streams created a significant impact on the Mathematical Aptitude, but in the case of Intellectual Ability and Problem Solving Ability, only Science stream is able to create a significant impact. No significant impact is created by the Commerce and the Arts Stream. Still on the basis of overall speculation we can infer that the Hypothesis – 5 that predicts that the “Stream has no significant impact on the Mathematical Aptitude, Intellectual Ability and the Problem Solving Ability of Secondary Level Students” is rejected.

6. To study the impact of different types of schools on Mathematical Aptitude (MA), Intellectual Ability (IA) and Problem Solving Ability (PS) of students:

6.1 The study reveals a significant difference in the ‘Numerical Ability’ (NA) of students belonging to Government and Public school. The NA of Public school students is higher than the Government school students.

6.2 No significant impact is observed on ‘Numerical Reasoning’ (NR) of students belonging to Government and Public school.

6.3 A significant difference is observed in the ‘Ability to use Symbols’ (AUS)
of students belonging to Government and Public Schools. This difference is in favor of Government school students.

6.4 No significant impact is observed on ‘Abstract Reasoning’ (AR) ability of students belonging to Government and Public school.

6.5 A significant difference is observed in the ‘Spatial Ability’ (SA) of students belonging to Government and Public Schools. This difference is in favor of Public school students.

6.6 A significant difference is observed in the ‘Total Mathematical Aptitude’ (TMA) of students belonging to Government and Public Schools. This difference is in favor of Public school students. The sub hypothesis 6.6 that predicts “There is no significant difference in the ‘Total Mathematical Aptitude’ of students from Government and Public School” is rejected.

6.7 A significant difference is observed in the ‘Intellectual Ability’ (IA) of students belonging to Government and Public Schools. This difference is in favor of Public school students. The sub hypothesis 6.7 that predicts “There is no significant difference in the ‘Intellectual Ability’ of students from government and public School” is rejected.

6.8 A significant difference is observed in the ‘Problem Solving’ (PS) Ability of students belonging to Government and Public Schools. This difference is in favor of Public school students. The sub hypothesis 6.8 that predicts “There is no significant difference in the ‘Problem Solving Ability’ of students from government and public School” is rejected.

The finding reveals that the type of school plays a significant role in determining all the three variables under study i.e. Mathematical Aptitude (along with its dimension except NR and AR), Intellectual Ability and Problem Solving Ability. In all the cases the difference is in favor of Public schools students except in case of AUS dimension of MA which is in favor of Government schools. Therefore the Hypothesis - 6 which predicts that “There is no significant difference in the Mathematical Aptitude,
Intellectual Ability and Problem solving of the students when differentiated on the basis of school” is completely rejected.

7. To Study the Inter- Correlation between Mathematical Aptitude (MA), Intellectual Ability (IA) and Problem Solving Ability (PS) of students:

7.1 To study the Correlation of Numerical Ability (NA) with TMA, IA and PS:

NA has highly significant positive correlation ($\rho = 0.80$) with the TMA and a moderate correlation is traced with the other four dimensions. (i.e. $\rho$ (NR) =0.41, $\rho$ (AUS) = 0.41, $\rho$ (AR)= 0.47 and $\rho$ (SA)=0.44). A moderate positive correlation is also traced with IA ($\rho =0.47$) and PS ($\rho = 0.42$).

7.2 To study the Correlation of Numerical Reasoning (NR) with TMA, IA and PS:

NR also exhibit a high positive correlation with TMA (0.64) and a low positive correlation with the other dimension of MA test [AUS, $\rho = 0.35$; AR $\rho =0.32$ and SA $\rho = 0.38$]. A low positive correlation is also shown with IA ($\rho =0.38$) and PS ($\rho =0.24$).

7.3 To study the Correlation of ‘Ability to use Symbols’ (AUS) with TMA, IA and PS:

AUS shows a moderate positive correlation with TMA (0.57) but regarding its other two dimension i.e. AR ($\rho = 0.25$) and SA ($\rho = 0.34$) the correlation is found to be comparatively low but positive. A low positive correlation exist with IA ($\rho =0.30$) and a negligible positive correlation with PS ($\rho =0.19$).

7.4 To study the Correlation of ‘Abstract Reasoning’ (AR) with TMA, IA and PS:

AR has a high positive correlation with TMA ($\rho = 0.76$), while a low positive correlation is shown with SA ($\rho = 0.35$). A moderate positive correlation with IA ($\rho =0.49$) and PS ($\rho =0.47$).
7.5 To study the Correlation of ‘Spatial Ability’ (SA) with TMA, IA and PS: SA shows highly positive correlation with TMA score ($\rho = 0.68$). SA shows a moderate positive correlation with IA ($\rho = 0.44$) and a moderate positive correlation with PS ($\rho = 0.30$).

7.6 To study the Correlation of ‘Total Mathematical Aptitude’ (TMA), IA and PS:

A high positive correlation exist between TMA with IA ($\rho = 0.60$) and a moderately positive correlation exist between TMA and PS ability ($\rho = 0.49$).

Therefore, in the light of above a finding Hypothesis 7 that predicts that “There is no significant correlation between Mathematical Aptitude, Intellectual Ability and Problem Solving Ability” is completely rejected.

The main findings are on the basis of the obtained data. It is very true that the independent variable under consideration i.e. IA and PS ability influence the various dimensions of MA.

Besides this, we also observe that a large part of population falls in the average IA (61.5%) and PS (48.8%) levels. The probable reason for observing this fact may be that Dehradun since ages has been considered an ideal educational centre. Doon School, Welham Girls School, SJA, CJM etc. are the best schools of India. Besides, it has many big Government offices such as FRI, IMA, SURVEY OF INDIA, ORDINANCE FACTORY, DEAL etc. Basically service class people are found to live here. Further it has been a decade now since Dehradun turned into a state capital which led to its rapid progress and technological advancement. The life style has also improved in these cities. Even the rural areas falling between these educational blocks are not extreme rural. Rather they are very much within the periphery of urban areas. That is why the family status of the selected sample is able to provide their children with an enriched and
congenial environment for a favorable development of abilities like IA and PS to the maximum extent.

The results of our study also reveals that for high levels (IA, 33%; PS, 15%) and low levels (IA, 6%; PS, 36%), the pattern of percentage distribution is just reverse for IA and PS, indicating that it is not necessary that high IA level is an assurance for high PS ability, though it may be asset to a certain extent. The Problem Solving behavior involves deliberate, conscious and serious efforts on the part of problem solver. This is also conferred by Faridah, (2004) who found that most students immediately makes attempt to work out the problem without first planning any strategies to do so which resulted only moderate number of students, to solve the mathematical questions.

The present study reveals that different IA and PS levels lay down a significant impact on MA and all its dimensions (except in one case where the low and average PS levels fails to create a significant impact on AUS). Our finding fortifies the fact that Mathematical Aptitude is not merely a skill in solving mathematical problems. Rather, it is an aptitude that embraces any characteristics which predisposes to learning, including the intellectual ability, personality, interest and special skill like problem solving. Thus, we need to emphasize the beauty of mathematics as communication, as reasoning, as mathematical connections, use of pattern, visualization, estimation, approximation etc. The secondary schools needs to create such educational environment that may not restrict to mere dissemination of mathematical laws and formulas rather they must go beyond to generate the ability to connect these laws and modifying existing laws to apply in different situation as per requirement. Thus, it can be said that mathematical aptitude, though a heritable trait yet can be enhanced by indulging in acts related to Intellectual and Problem Solving domain.

The interactional effect of IA and PS on MA and its various
dimensions, was also not found to be significant implying thereby that IA is broader concept incorporating the collection of various mental abilities, while PS is more specialized level of IA, particularly in mathematical domain where the individual attains proficiency in visualizing innovative approaches for sorting out various problematic situations. Consequently there is a little scope for both of these abilities to interact fruitfully. This accounts for the insignificant interactional effect of IA and PS on the TMA and all its five dimensions.

The present research also studies the impact of gender on the three variables under investigation. Boys and girls do not differ significantly on the dimensions like NA, AUS and SA but on the other two dimension i.e. NR, AR and the TMA the difference between boys and girls comes out to be significant in favour of boys. The observation predicts that the aptitude for mathematics is predominant among boys. This may be due to the fact that boys are generally exposed to practical tasks involving use of mental abilities involving thinking and reasoning. Girls for a long time were restricted to household works and were rather bound to be concerned with the tasks involving upbringing of children and attending the needs of family member. During their upbringing no such environment was provided to them that could nurture the abilities concerned with thinking in mathematical domain. Consequently MA of girls lagged behind to a great extent. Gradually the scenario changed and parents were made aware about the need and importance of educating the girl child. This revolutionary vision removed this gender disparity on certain mathematical dimensions like NA, AUS and SA. In the light of above findings we observe that the impact of gender on IA was not found to be significant while for PS it was found to be significant in favour of boys. The reason may be that PS ability requires a more abstract, practical, systematic and objective oriented approach and owing to the kind of exposures usually given to girls in our society it would take them some time to imbibe these abilities to the level of naturalization.
The study also revealed a significant impact of stream on all the five dimensions of MA as well as the IA and PS ability. In case of NR the impact of Arts stream was not found to be significant while the IA and PS ability were found to be significantly affected by Science stream only. The findings indicate that students who opt for science stream generate a systematic perception which enables them to score significantly high on IA and PS scores.

Regarding the type of school the findings of the present study reveals that there was a significant difference between Government and Public school students on the dimensions like NA, AUS, SA as well as the Total Mathematical aptitude (TMA). This indicates the significant impact of environmental factors on the dimensions like NA, AUS, SA and consequently the TMA, specifically in favour of Public schools (except for AUS where the outcome favors the Government schools students). The two dimensions i.e. NR and AR showed no significant difference at all. The reason being that Numerical or Abstract reasoning is an inborn tendency which is exhibited as a consequence of maturation of cognitive abilities and thus the environmental exposure may not tend bring about significant alterations on them. IA and PS ability also sustain a significant difference and this difference is preferably in favor of Public School.

The findings also ascertain a high or a moderate positive correlation between all the variables taken under study i.e. between MA (along with all its five dimensions), IA and PS ability. Eventually, the study reveals that MA is a construct that to some extent sustains an independent existence but is also subjected to environmental influences and hence cannot be defined independent of such interaction. Thus the tasks harnessing IA and PS abilities provide a positive impetus to restructure the MA of an individual.

The role of environmental interventions has also been confirmed by James Flynn according to whom intelligence scores have been shown to have risen quite dramatically in the second half of twentieth century in numerous parts
of the world. Early childhood intervention program, such as Head Start, had met with mixed success, while California Abecedarian project, and have shown persistent gains in cognitive skills, academic test scores and language use. Similarly it has been found that the Polya’s method is successful in inculcating the required problem solving skills in the students, while synthetic methods continued to function at the same levels of effectiveness. Thus, in order to design a special remedial program in mathematics, the extent of aptitude based on individual differences has to be identified. Only then proper diagnosis can be maintained and educational program can be tailored accordingly. Aptitude testing is also essential, so that coaching can be provided to the students in order to improve their chance of succeeding in the various high stakes ability tests.

Factually it has been established that the blossoming mathematical intelligence of a person and the scope that exist in the educational ambience to foster it are largely influenced by the mathematics aptitude. So it now becomes necessary as a teacher to reflect upon these findings and fabricate ways and means to foster these abilities in entirely a new perspective so that no latent mathematical talent remains hidden any more. Entirely new techniques and methods are needed to be devised so that the fear of mathematics may not overshadow this innate potential to flourish to the level of ultimate level of contemplation, and nurture in them a sound IA and PS thereafter. These abilities not only enable him to identify his worth in the forthcoming carrier opportunities but shall also determine his substantial adjustment in the society.

5.2 SUGGESTION FOR FURTHER STUDY

After having some experience in the study, following suggestions were given by the researcher. These suggestions may be helpful to conduct research in the field related to this study as well as to find the variations in the results.
1- Studies on Mathematical Aptitude may be extended to the other educational levels, viz., primary and college levels at district and state levels.

2- The size of the sample can be extended and other sampling techniques can be employed for the further study in order to find the variations in results if any.

3- Studies may be conducted on Mathematical attitude and Mathematical aptitude either independently or in a combined manner at various levels of educational area and other cognitive and psychological factors can be considered like mathematical anxiety, attitude, creativity, achievement, socioeconomic status, academic achievement motivation, job expectancy etc.

4- Studies may be taken up to find out the effect of field independent variables on dependent variables in the cases of controlled and experimental groups as this study has not used any special controlled variables.

5- Studies may be conducted to find the effect of environmental and psychological factors on the inculcation and development of Mathematical attitude and Mathematical Aptitude.

6- Studies about the Mathematical Aptitude possessed by the teaching community may be taken up as this factor has a great role to play in the development of Mathematical attitude and Mathematical Aptitude of students.

7- Studies may be conducted on the use of audio visual teaching aids, laboratory and library facilities in the schools as these have great influence on Attitude and Aptitude of an individual.

8- The teaching models developed for mathematics at secondary level have two noteworthy aspects. Firstly, they emphasizes on a concrete situation in order to validate application of abstract mathematical concepts. Secondly they emphasizes on reinforcement principle in the process. To approve or
disapprove the suggested teaching steps and criteria we need to conduct an active research.

9- Variables other than those studied, which could also directly or indirectly induce Mathematical aptitude could also be studied.

10- The present study used self prepared questionnaire on Mathematical Aptitude. Another standardized questionnaire can also be used to conduct the study in a new perspective.

11- The impact of gender on the three variables can also be studied in different perspectives and an attempt can be made to formulate new contention and generalization regarding the male and female dominated areas in different mathematical, intellectual and problem solving domains. The home conditions in which Indian girls are studying must also be considered in the research studies.

5.3 SUGGESTIONS FOR PARENTS, TEACHERS & FAMILY

1. Parents should not be reluctant to grant freedom of expression to their children. They must try to discover the natural instincts related to numerical domain and provide enriching experience in the form of toys, puzzles, games like building blocks, arranging the colors in a dice, Sudoku, solving puzzles, arranging the missing parts of a painting, playing chess etc.

2. The teachers on the other hand instead of forcing a child to adopt traditional way and schemas of solving a mathematical problem they must encourage them to explore it in a more conducible and expository manner.

3. Mathematical aptitude is a trait that can be nurtured if an enriching environment is facilitated, therefore conscious efforts must be made to develop an integrated curriculum that may foster the development of this trait in all the individuals.

4. The Educators, Mathematicians and Psychologists concerned with the fields of mathematics must organize orientation programs and remedial packages for students who lag behind in this ability. Besides this, the
packages must also be designed to cater the needs of gifted students. Various enrichment programs are needed to be designed in this arena.

5. The concepts of Vedic Mathematics lay down different sutras and identities in a very simplified manner which is analogous to the abstract concepts of Modern mathematics. They cited the simple way to solve complicated calculations based on astronomical science like determining the distance of various celestial bodies and so on. This could be a fascinating experience for child who possesses a distinguished Mathematical Aptitude.

6. Mathematical aptitude is needed to be identified at an early stage, therefore it is a prime responsibility of parents and the educators maintain a strict vigil and design methods to trace the competence of their child, so that early intervention can be provided accordingly.

7. Parents should not impose their authority on their children rather they must pay attention on their progress report, their achievements and praise them liberally and guide them in their areas of difficulties through appropriate and logical methods.

5.4 SUGGESTIONS FOR STUDENTS

1. The students must stop feeling anxious about the concepts and nature of mathematics. Rather they must naturalize the basic and fundamental skills of mathematics.

2. The students must develop a habit to perceive any situation in their day today life with a systematic and analytical approach. This would generate a profound and logical perception to help them identify the variables involved and the kind of relationship that exist between them.

3. While solving a mathematical problem the students must understand the difficulty or the conflict, analyze the situation or content, analyze the goal or possible end of the conflict and suggest and verify available solutions or processes.

4. A child must try to adhere to a heuristic approach in solving mathematical problem. This approach involves, understanding the problem, devising a
plan, carrying out the plan, and looking back.

5. Right guidance from right resources is very encouraging the students must therefore keep themselves acquainted with resources that develop positive attitude in them. These may be in the form of a good mathematics guide, going through mathematical puzzles, quizzes, joining mathematics clubs, attending enrichment programs in mathematics, developing teaching aids or improvised apparatus in mathematics. Adhering to laboratory methods in mathematics not only generates child’s interest but also materializes the abstract concepts of mathematics.

5.5 SUGGESTIONS FOR POLICY MAKERS, ADMINISTRATORS AND EDUCATIONISTS:

1. A program for assessing MA of an individual must be launched at secondary level as this level is very crucial from the carrier perspective of the students.

2. A record of MA of students must be maintained by the school authorities at the secondary level as it would help them in categorizing them and planning a variety of enrichment, educational and guidance programs according to their needs.

3. The school authorities must channelize proper orientation program for the faculty as well as the students so that they are made aware of the latest trends and approaches in a mathematics classroom.

4. The educationists must induce constructive, innovative and practical approaches in mathematics so as to foster a pure mathematical aptitude in the students who dread mathematics as a boring and lifeless subject.

5. The Policy makers must ensure that today’s education need to satisfy the psychological as well as the vocational demands of the child. Therefore accordingly the curriculum must be designed for the students.

6. Updating the curriculum is a continuous process. N.C.E.R.T must thus keep updating its syllabi for secondary and senior secondary stages so as to
make it much more excellent, encouraging and satisfactory as per the needs and demand of modern innovative trends.

7. Teachers’ Guide should be made available in order to integrate content and methodology and teachers’ edition of text books should be made available.

8. Objectives of teaching in language and mathematics should be articulated with the need of teacher and build the vocabulary of teacher in language as well as mathematics.

9. The prevailing Pre service teacher education program content must be revised according to the training needs and future growth of the teachers.

10. An effective mechanism is needed to be devised for coordination, monitoring and the evaluation of the teachers’ performance in the classroom in all the DPEP districts.

11. For the Universal achievement of the minimum essential level of learning our endeavor should be to develop teachers as a resource for mastery level.

12. Besides the cognitive factors the studies have been traced showing that affective and psychomotor factors are also responsible to foster a sound mathematical aptitude. Therefore the provisions should be made by the school authorities to design such programs and activities which shall release the academic pressure of a child, foster in them inter-personal relationships, their adaptability and stress management so that a positive attitude may be inculcated in them.

13. Only the efficient teaching of mathematics by teacher can develop ability in students & encourage them to apply mathematical knowledge in daily life. Thus, the appointment of competent, committed & effective teacher in mathematics is first requirement of all in schools.

14. Group tasks, case studies, problem solving exercises, tutorial classes, conducting action research, guidance and counseling are some of the measures that must be implemented by the school authorities so that the
students falling in all the categories (high, average and low) may be kept involved and progress according to their own pace.

15. Some of the factors that surfaced out to be responsible for underachievement in mathematics are the factors related to school management, curriculum inconsistency, in appropriate mode of transaction, inadequate diagnostic remedial programs and other such variables that are directly under the control of educational system.

5.6 EDUCATIONAL IMPLICATION
1. By identifying the Mathematical Aptitude of students at an early stage will help in utilizing their potentials. The genuine education of the mathematically gifted is inextricably linked to the principle of equity in education because only by acknowledging social equality among all students can sufficient attention be paid to differences in their abilities.

2. The findings of the study have important implication for psychologists, counselors, as well as for educational planners as it would help them to design the course and the curriculum in such a manner that it may not only create a room for diagnosing the students with different mathematical abilities but also cater their needs and interests in a subtle manner.

3. The findings also lays down new avenues to be explored by the educational trainers to improve the ongoing teaching learning process in mathematics in the perspective of problem solving approach.

4. Our findings reveals the need to review certain broad trends that are prevalent in the field of teaching mathematics, and restore them with latest innovative, child oriented and constructive approaches, according to his needs and capabilities. Various self expository approaches must be adhered like, inductive-deductive methods, heuristic methods, analytical-synthetic methods and laboratory methods.
5. The study also reveals that present levels are so constrained that instead of nourishing these mental abilities they create a situation of anxiety and fear to the extent that they are ought to be largely discredited. Such situations can also be handled under some vastly improved system of instruction.

6. The general notion is that the student who fares well in mathematics is exceptionally intelligent in other subjects also. This is not completely true as revealed in our study that high proficiency in mathematical/logical domain of Intellectual Ability is not accountable for high performance in other cognitive abilities.

7. The study reveals that there is a high correlation between MA, IA and PS abilities. It is also revealed that there are many traits that are common among the three variables under study. Thus the findings suggest that conducible classroom situations can be generated to foster these traits and raise the mathematical competence of an individual.

8. The study also presents the panacea to the misconception regarding gender difference in the mathematical abilities. The study establishes that there are certain areas in mathematics where no gender differences have been traced and that males are good in abstract and reasoning abilities while females are good at computational and spatial abilities. Therefore teaching and instructions can be framed considering these aspects.

9. Considering the importance and the relation of mathematical aptitude with problem solving aspect it is very essential to incorporate the teaching of ‘thinking’ in vocational programs, so as to make it possible to teach people to think and solve problem more efficiently.

10. The study also reveals the Intellectual Ability consists of repertoire of concepts and mental operations which synthesize in a new frame of
reference to generate the problem solving. The educationist must therefore introduce the problem in figures to introduce the idea in terms of mental procedures and enable the child to deal with the problem in an electrical engineering module.

11. It is observed that people who are regarded as intelligent often have trouble with simple and new tasks and they are not good at dealing with tasks they have not previously encountered. The integration and coordination among the variables like MA, IA and PS can be a cause to such discrepancies, which the educationist must keep in mind.

12. The study reveals that thinking and Problem solving is a temporary stage on the route to further development, and to understand why that development of Mathematical aptitude is highly susceptible to the development of Intellectual and Problem Solving Ability.

13. The study reveals that a person can be a good problem solver by learning a large repertoire of mental operation organized into procedures. The finding can enable an educationist to design his teaching activities in this perspective.

14. Once the people become efficient at using mental operations, the sequences of operations fade from their consequences until they are no longer aware of using them. Psychologists describe those mental operations as automised or enfolded. Therefore the study reveals that if one has to be an expert he has to enfold certain mental operation.

15. The human memory has some resemblance to descriptions of how computer works. Artificial intelligence has had a very strong influence on theorizing about thinking and its manifestation in problem solving. The study reveals that relationships exist between them and artificial intelligence is a metaphor for thinking about thinking.
16. The findings reveal that Mathematical Aptitude can be nurtured and its level can be varied through conducive environmental situations (as a significant difference was found between Government and public school students.) Therefore efforts must be made on the part of educationist at all levels i.e. planning, execution and evaluation that the students may get adequate experiences to bring out his best.

**Apart from the general suggestions the following Intervention Plan has also been suggested:**

1. Increase the amount of connectedness of mathematics with the daily life.
2. A mathematics teacher must allow the students to relax and enjoy, praise a pupil’s effort and avoid humiliating them on any wrong attempt.
3. Excessive competitiveness in mathematics must be curbed.
4. Students must be motivated to put up new problems.
5. ‘Humanise’ Mathematics by allowing teacher to adopt the latest and innovative approaches based on logical and psychological approaches.
6. ‘Conceptualization’ must be fostered through strategies involving mind mapping, and concept mapping which intends to interrelate mathematics and other areas of knowledge.
7. Generalization and Creative attitude must be promoted through inductive, deductive, laboratory and project based approaches in mathematics. Techniques like Brain Storming and Problem Solving must be adhered.
8. The mathematical problem must be dealt with the following approach:
   - *Problem Awareness*
   - *Problem Understanding*
   - *Collection of relevant information*
   - *Hunch for possible solutions*
   - *Selection of correct Solution*