CHAPTER II

REVIEW OF RELATED LITERATURE

STUDIES ON THE CHARACTERISTICS OF GIFTEDNESS
Theoretical and empirical works in the concerned area will be a great resource to the researchers, through which one can understand how researchers had approached the concept and what they had come up with. It provides ample stress and foundations to any type of research which is concerned to a specific area. So going through previous literature will be a treasure to bring out the research in a systematic and scientific manner.

The present study is in the area of Mathematical Giftedness, with a view to understand the contributing psychological factors of this phenomena. The investigator has, therefore gone through the studies conducted in the area of giftedness, as the area of Mathematical Giftedness is a less tackled one compared to the general giftedness.

The concept of giftedness has changed itself from the aristocratic connotation to the modern multidimensional approach. One of the most challenging facets of work with gifted is that of identification. Former means of identification of gifted children was by teacher nomination in which the actual definition of gifted becomes "those children who are doing well in school much better than their companions".

A new dimension was given to the concept of giftedness by the development of intelligence test (both verbal and non-verbal) by Binet and
Simon in 1905. Thus the prime identifying technique of teacher judgment has been replaced by standard tests of mental ability. Consequently to this the definitions of gifted changed as "those children who score high on IQ tests".

It is Guilford¹ (1950), the pioneer of researches on creativity - a divergent thinking ability, who put forward a new approach on the education of gifted. Many researchers were of the opinion that when IQ is considered as the sole criterion for the identification of giftedness, about 70 percent of the creative talented youth are missing (Getzels & Jackson,² 1962; Torrence,³ 1962).

Renzulli⁴ (1999), who contributed much to the theory and practice on giftedness, through his 25 years of research in the area evolved the three ring concept of giftedness involving three interacting constructs viz., intelligence, creativity, and task commitment as the necessary condition for giftedness.

Major works done in the area of giftedness are by western researchers and the education of the gifted is very advanced in those countries especially in America. Studies in the field of giftedness collected by the investigator whether western or eastern are presented under the heading "Studies on characteristics of Giftedness".

STUDIES ON THE CHARACTERISTICS OF GIFTEDNESS

The longitudinal study over a period of 40 years conducted by Terman⁵ (1965) is a remarkable one in the field of giftedness. 1,528 children with IQ of 140 or above on Stanford-Binet test were studied in the years
1921, 1928, 1940 and in the middle of 1950's. This study revealed that gifted individuals are healthy, well-rounded, committed, responsible and likable persons. The study also observed that most of the gifted children maintained their positive profile throughout their life.

According to Carroll\textsuperscript{6} (1940), gifted children are characterized by high ability to see relations, make association and adapt abstract principles to concrete situation, originality, early development of self criticism, initiative and independence in thinking. They are superior in traits like desire to know, desire to excel and power to learn.

As reported by Barbe\textsuperscript{7} (1965), Bristow, et al. (1951) observed high degree of insight into problems, the ability to generalize, ability to do mental tasks at a high degree of difficulty and the ability to do abstract thinking as the main characteristics of gifted children.

Cutts and Moseley\textsuperscript{8} (1959), in their study identified the characteristics of bright children as ability to make generalizations, abstract thinking, insight into problems, reasoning, problem solving, speed of learning and completing intellectual tasks, creative ability, persistence, wide range of interests, memory and curiosity.

Terman and Oden\textsuperscript{9} (1959), studied 209 gifted students and 262 non-gifted students (eleven to thirteen years old). Some of the findings of the study are:

i. Gifted children are more interested in school subjects which are most abstract and less interested in more 'practical' subjects than non-gifted children.
ii. The typical gifted child likes active games, plays with tools and machinery, likes the companionship of others and shows no abnormal fondness for study or for solitude.

iii. Gifted boys showed more masculine nature than non-gifted boys at all ages from eight to twelve years, after which there was little difference. Gifted girls tended to be more masculine than the non-gifted at ages eleven, twelve and thirteen.

An unusual interest in number relations was observed in pre-school gifted children by Martinson\(^10\) (1961).

DeHaan\(^11\) (1965), put forward the method of self selection for accelerated learning programs by candidates themselves with the key criterion as motivation of students which is assumed as an important determinant of achievement as ability is.

A study on the pupils of Hunter College Elementary School conducted by Wilson\(^12\) (1965), revealed that general mental ability had a fair degree of relationship (0.45) to the science abilities. It was also found that gifted children tend to be especially interested in science and acquire unusual understanding in that area.

Silverblank\(^13\) (1970) in a study to compare male high school seniors who are talented in mathematics with male high school seniors who are talented in English as to sense of responsibility, level of anxiety, and solidarity, found that no difference exists in the levels of responsibility between male high school seniors talented in Mathematics and those talented in English. No significant difference in the level of anxiety was
observed between the two groups. It was also found that students, talented in English are higher in sociability than Mathematically talented.

Dodson\textsuperscript{14} (1972) in a study to develop a description of 'insightful' mathematical problem solvers, found that a typical successful problem solver will be strong in Mathematics, score high on verbal and general reasoning tests, good at determining spatial relations, able to resist distractions to identify critical elements and disregard irrelevant elements and will be a divergent thinker. Such person will be having low debilitating anxiety, high facilitating anxiety and a positive attitude towards Mathematics.

Hitchfield\textsuperscript{15} (1973) investigated the characteristics of able children on a sample of 125 boys and 113 girls selected based on three criterion - i) high attainment in reading and arithmetic ii) good score on the Goodenough Draw A Man test and iii) parent nomination. The study revealed that higher the children's IQs higher were their divergent thinking scores. The favorite subjects of the most intelligent boys were Mathematics, Art and Science whereas girls liked Art, English and Mathematics.

Dunlap\textsuperscript{16} (1975) reported some characteristics of gifted children as high ability to generalize, to see relationships, to make logical associations and a strong desire to excel. The gifted children were also found to be inaccurate in arithmetic.

The list of characteristics of exceptionally able children from the department of education and science, UK (Hoyle and Wilks,\textsuperscript{17} 1975) include superior powers of reasoning, of dealing with abstractions, of generalizing from specific facts, of seeing into relations and imaginations.
Gifted children are superior in Mathematics particularly in Problem Solving.

L'Abate and Curtis\textsuperscript{18} (1975) reported that gifted children have superior abilities and they learn at a faster pace and solve problems at a more mature level than their agemates do.

Krutetskii\textsuperscript{19} (1976) reported that by a comparatively early age, mathematically gifted children may have developed characteristics of mental activity as an ability to generalize mathematical material, a flexibility of mental processes, a striving to find the easiest and most economical ways to solve problems, an ability to remember generalized relation and reasoning schemes, curtailment of reasoning process and the formation of mathematical perception of the environment.

Kopelman et al.\textsuperscript{20} (1977) based on their experience with gifted secondary students, provided a comprehensive list of characteristics of gifted children. Gifted students are found to be stimulated by problem solving approaches to learning, readily able to induce, deduce and to connect related ideas and are strongly and sincerely motivated toward learning and achieving in science.

Vasantha\textsuperscript{21} (1978) in a study on 70 boys and girls (who qualified the NCERT Science Talent Search Tests) found that 59 percent of the students have friends who want to be scientists. Physics and Mathematics were found to be the most preferred subjects and boys were interested in science but girls selected non science activities at their leisure time. Occupations with science bias and occupations where creative ability may find an expression were preferred by boys and girls.
In an attempt to compare the gifted with non-gifted children, Freeman (1979) found that very high level of intellectual ability was seen with extraordinary good memories, concentration, lively creative activities, excellent school progress and a wide range of interests.

Cropley (1981) reported that gifted achievement depends on a combination of conventional abilities such as good memory, logical thinking, knowledge of facts, accuracy and creative abilities including generating ideas, recognizing alternative possibilities, seeing unexpected combination and having the courage to try the unusual (c.f. Cropley, 1993).

The most obvious characteristic of the gifted in mathematics is a propensity toward quantitative relationships and the use of numbers. They have advanced mental abilities, unusual ability to solve mathematical problems and are capable of abstract thinking (Consuegra, 1982).

John Hopkin University developed an accelerative Mathematics model in 1971 (Pratscher et al., 1982) and the study of mathematically precocious youth (SMPY) focussed to develop a systematic method of identification of able mathematics reasoners, to study the aspects of that ability and to provide appropriate instruction to foster that talent. The study revealed the need to provide opportunity for gifted mathematics reasoners to pursue the study of mathematics beyond the boundaries of the regular school day.

Winnie et al. (1982) found that gifted pupils score more highly on academic self-esteem but get undifferentiated in social and physical domains.
Sternberg and Davidson (1983) in their studies found that the gifted person sees, perceives, notes or ascertains some relations or essential element that the average person does not. More intelligent subjects did better on 'insight' problems than average students. Again it was found that gifted students 'spontaneously combine and integrate' relevant data to solve problems. (c.f. Shaughnessy, 1993).

Nicholls and Miller (1984) reported that high ability students often come to see themselves as competent and thereby have greater achievement motivation whereas less able children often perceive themselves as low in ability and competence and suffer loss of achievement motivation.

Sampat (1984) in a study on intellectually gifted children obtained that gifted children are profusely interested in reading on various subjects and interested in radio programmes and movies.

Stanley (1984) linked motivation to gifted behaviour in the classroom by referring it to the 'academic hunger' of outstandingly able mathematics students.

Studies done by Van Tassel (1985) revealed that academically talented children generally have high academic Self Concept and they show well developed and diversified interests that interweave with school subject preference and future study.

According to Whitmore (1985) gifted behaviour is characterized by highly creative behaviour in production of ideas, things and solutions, aspiration of high standard of achievement and desire to excel.
In an year long research study of 'supernormal' children in China, Zi-Xiu (1985), identified five characteristics of 'supernormal child viz., strong cognitive interests and intellectual curiosity, concentrated attention and good memory; keen perception and power of observation; quick thinking, good comprehension and creativity and confidence, competitiveness and persistence.

In a study conducted by Davidson (1986) more intelligent students did better on 'insight' problems than average students and gifted children spontaneously selected and applied relevant information from insight problems.

Walter and Gardner (1986) by studying famous musicians, exemplary mathematicians and artists found that "crystallizing experiences" dominated in music and prodigious achievement in mathematics but were less clear in the visual arts. By 'crystallizing experience' they means the phenomenon of blending or meshing of innate potential with a field of endeavour which is receptive to the particular skills and abilities of that individual.

Exceptionally able pupils selected for study by Zha (1986) in China exhibited characteristics like curiosity, persistence and self-confidence

In a study on 143 intellectually gifted (IQ greater than 130) and intellectually average students, Barrington and Hendricks (1988) found significant differences between average and gifted students in attitude toward being a scientist, usefulness of science and in knowledge of science.
Miller\textsuperscript{38} (1990) put forward some characteristics and behaviours that may yield important clues in discovering high mathematical talent. These are:

1. An unusually keen awareness of and intense curiosity about numeric information.

2. An unusual quickness in learning, understanding and applying mathematical ideas.

3. A high ability to think and work abstractly and the ability to see mathematical patterns and relationships.

4. An unusual ability to think and work with mathematical problems in flexible, creative ways rather than in a stereotypic fashion.

5. An unusual ability to transfer learning to new, untaught mathematical situation.

He also provided a definition to Mathematically talented/Mathematically gifted/highly able in Mathematics as students whose mathematics ability places them in the top two percent or three percent of the population.

Monson and Fukui\textsuperscript{39} (1991) put forwarded some identifiable characteristics of gifted children for regular classroom teachers. The cognitive characteristics include ability to manipulate abstract symbol system and ability to generate original ideas and love to create. Intellectually gifted children are found to have high level of planning, problem solving and abstract thinking compared to their peers.
Muir and Coyle (1991) examined group difference based on giftedness and achievement in acquisition and generalization of a strategy for solving verbal and figural analogies (N=162). Each of four groups differed significantly in analogy solving accuracy. The high achieving gifted were more spontaneously, frequently and successfully strategic, and were the only group to increase performance at distal transfer.

Corne'll et al. (1992) compared the academic achievement, self-esteem and teacher ratings of 1,114 gifted 2nd and 3rd graders receiving one of 5 types of services for gifted – within regular classrooms, through pull-out resource rooms, ability grouping in separate classes, special schools or no program offerings. Relatively few differences in Self Concept was observed between the groups.

Lubinski and Humphreys (1992) conducted a study on physical and medical correlates of mathematical giftedness and of socio-economic privileges. The sample of the study consisted of 497 male and 508 females (who are gifted) and 647 males and 485 females (with high economic status) in tenth grades. It was found that medical and physical well being to be more highly associated with mathematical giftedness than with socio-economic privileges.

Boyd (1993) reviewing studies conducted in the area of giftedness summarized that, gifted adolescent males are performing much better in some aspects of mathematics than gifted girls. Contrary to earlier speculation that the better performance of males is a result of their higher spatial abilities, it was shown that spatial abilities make only a minor
contribution to mathematical performance, but mathematical reasoning seems much stronger in the gifted boys.

Fredette and Hunter\textsuperscript{44} (1993) reported a case study of a visually gifted eight year old child which illustrates the problems that may be encountered in determining giftedness that is manifested largely through visual process and products. The child's IQ was just below that required for admission to the gifted program in his school. Even though he was admitted to the gifted program after retesting, his unique needs were not satisfied by the educational district. The characteristics of the child's giftedness in ability, personality traits and creativity were explored and the author\textsuperscript{44} conclude that being identified as gifted does not end the problem for this child, whose giftedness lies outside the areas generally nurtured.

Hoge and Renzulli\textsuperscript{45} (1993) conducted a review in the area of giftedness to see whether the Self Concepts of gifted and non-gifted children differ and to explore the effects on Self Concept of labeling a child as gifted and placing the child in special programs. The authors arrived at the conclusion that studies indicate a generally higher academic Self Concept among gifted students.

Pyryt\textsuperscript{46} (1993) re-examined Oden's (1968) comparison of the 100 most and 100 least successful men in the "Genetic Studies of Genius of L.M. Terman et al. (1925-59)" using three predictor variables - IQ, amount of acceleration (AOA) and educational attainment (EA). Results indicated that each of the three variables contributed to the discrimination between the two groups of students. EA was the major discriminator, with AOA and IQ making small contributions to group discrimination.
A qualitative research was conducted by Schack\textsuperscript{17} (1993) to examine how a developmentally appropriate educational programme in the early years can affect the development of gifted children. The research was focused on a multi-age, multi-ability setting with partial implementation of a whole language program, a systematic writing process and with some flexibility in grouping of students. Eleven teachers and approximately 260 students in an upgraded primary school were involved in the study, with three first year and 30 second year students identified as gifted. The study found that gifted children followed a somewhat accelerated curriculum. Teachers felt that there were definite social benefits to integrating the gifted and non-gifted students. The multi-age, multi-ability setting seemed to allow young students not identified as gifted to progress more rapidly than they might have in a traditional graded classroom, as they were exposed to higher level instruction. There was little evidence of the development of creative productivity or multiple intelligence other than linguistic and logical-mathematical.

In an attempt to revise the profiles of children with superior intellectual ability, Wilkinson\textsuperscript{48} (1993) found that bright students excelled in complex reasoning but were not different from average students in their sequential reasoning and visual-spatial perception.

Caropreso and White\textsuperscript{49} (1994) compared the analogical reasoning performance of 55 gifted students with 53 non-identified students and found that gifted students outperformed non-identified students on the geometric analogy task.
Gallagher and De-Lisi (1994) in a study with 25 male and 22 female high school students of high mathematical ability found that females were likely to use conventional problem solving strategies and the use of conventional strategies is associated with negative mathematical attitude.

Interviews with teachers and teacher-completed questionnaires were used by Hunsaker (1994) to examine the interplay between personal and official conceptions of giftedness. The data showed that teachers saw giftedness as greatly varied but having creativity as the common characteristic. While selecting for gifted programs they focussed on classroom performance than creativity.

Kranzler et al. (1994) in their study found that gifted and non-gifted students differ not only in terms of the effectiveness of higher-order or metaprocess but also in terms of speed and efficiency of lower-order cognitive process.

Frame of reference theory (Developed by Marsh in 1990) which proclaims that students made both internal ability comparisons across academic domains and external ability comparisons relative to peers in determining academic self concept was validated by Williams and Montgomery (1994) on a sample of 103 academically able high school students of age 13 to 15 years. Path analysis was used and the influence of both internal comparisons across academic areas and external ability comparisons relative to peers in determining student's self concepts was verified.

Shore et al. (1994) reanalysed the initial data of Douer and Shore's study on the performance of 30 gifted children in solving water-jar
problems by breaking an induced mental set. Gifted student's who failed to form the set made the most errors of any group and less accurate gifted children were found to be deficient in metacognitive knowledge. Gifted children was found to be not always outperforming others on cognitive tasks.

In a study, Cornell et al.\textsuperscript{55} (1995) found that minority students identified for gifted programs scored significantly higher on achievement measures but not different in academic or social Self Concept. But white gifted program students scored significantly higher than non-gifted on achievement and academic and social Self Concepts.

Frasier et al.\textsuperscript{56} (1995) identified ten attributes of giftedness in a study to explore the characteristics of giftedness in minority, language minority and economically disadvantaged student populations and to asses giftedness in these population. The study was conducted on a sample of 262 individuals and the attributes identified are communication skills, imagination, creativity, humour, enquiry, insight, interests, memory, motivation, problem solving and reasoning.

Hannath and Shore\textsuperscript{57} (1995) in their study on learning disabled-gifted children found that the use of metacognitive skills and knowledge is a factor in high levels of performance demonstrated by the academically gifted.

Lea-wood\textsuperscript{58} (1995) examined the self-esteem of gifted and non-gifted Australian adolescent girls. Eightyone gifted and 77 non-gifted student's
enrolled in year 7, 8 and 9 in post primary schools completed the School Form of Coopersmith Self-Esteem Inventory. It was found that non-gifted girls were higher in both total and social self-esteem than the gifted girls.

Luvisi\textsuperscript{59} (1995) in the final report of a three year project in Kentucky to assist teachers in creating an innovative learning environment for gifted and talented primary aged children, emphasized on maintaining or increasing students self esteem and increasing their creative thinking, critical thinking and Problem Solving skills.

Diezmann and Watters\textsuperscript{60} (1996) in a case study of nine year old Australian gifted student analyzed his behaviour in light of theoretical model of giftedness. The described characteristics of gifted include ability to analyze, synthesize and evaluate newly acquired information and decontextualization skills in constructing solution to new problems. The recommended pull-out model for the child includes expanding experiences, establishing a social environment, cognitive apprenticeship, development of affect, cooperative groups and knowledge creation.

In three experiments Jausovec\textsuperscript{61} (1996) studied the differences in EEG alpha Activity between 30 gifted and 30 average individuals. Higher alpha power during information processing displayed by gifted individuals was found to be derived from the non-use of many brain areas not required for the problems at hand.

Jones and Day\textsuperscript{62} (1996) compared research findings on heightened cognitive flexibility in academically gifted children and similar flexibility in social intelligence. It was proposed that social-cognitive flexibility is an
important component of social-intelligence and speculated that a relationship exist between social problem solving and social giftedness.

In a survey to examine educational aspirations and perception of school climate among gifted students at the Maine School of Science and Mathematics, Plucker et al. (1996) found that high ability secondary students attending Magnet School have higher aspirations, than those of general-ability sample. It was also found that Magnet school students appear to perceive a school climate that is supportive and fosters achievement and aspirations to a greater extent than do general ability student attending traditional high schools.

Khire (1997) developed an SOI model to differentiate between type of giftedness and the very highly gifted from the gifted. Greater variety of number of SOI factors as relevant to the type of giftedness is used as a variable of type of giftedness in the model. The levels of giftedness are identified based on composite of 13 SOI scores and intra-individual variation.

Zental et al. (1997) investigated the different characteristics of three boys with giftedness and found that giftedness did confer specific benefits related to talent (free reading, mental mathematics, social skills, memory, creativity) and to liking specific subject areas.

In a study to explore the relationship between Mathematics and English achievement between Mathematics and verbal Self Concept by Zhang et al. (1997) it was found that statistically significant difference exists in the correlation between Mathematics and verbal Self Concept.
High correlation were found to exist between mathematics Self Concept and verbal Self Concept for gifted than for non-gifted students.

Modi et al.\textsuperscript{67} (1998) in a paper presented at the Annual Meeting of the American Educational Research Association reported that the amount of independent reading, enrollment in academic programs, high educational aspirations and time spent on homework are associated with academic talent.

In a study conducted by Freeman\textsuperscript{68} (1999) on 24 musically precocious boys aged 10 to 14, it was found that all participants has had a crystallizing experience, defined as a dramatic event in a person's life that makes inherent giftedness manifest and that it had improved their Self Concept.

Norman et al.\textsuperscript{69} (1999) compared the highly ($N = 74$) and moderately ($N = 163$) gifted adolescents on Self Concept, emotional autonomy and anxiety. Results indicated no significant difference on Self Concept and adjustment.

As the result of 25 years work on giftedness Renzulli\textsuperscript{70} (1999) developed the school wide enrichment model (SEM), the overall mission of which is to escalate the level and quality of learning experiences for any and all students capable of manifesting high levels of performance in any and all areas of curriculum.

To have a comprehensive picture, the major findings of the studies reviewed are given in Table 1.
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Author</th>
<th>Year</th>
<th>Characteristics of Gifted children</th>
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<tbody>
<tr>
<td>1.</td>
<td>Terman</td>
<td>1965</td>
<td>Healthy, well-rounded, committed, responsible and likable</td>
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<tr>
<td>2.</td>
<td>Carrol</td>
<td>1940</td>
<td>High ability to see relation, make association and adapt abstract principles to concrete situations; originality, earlier development of self criticism, initiative, independence in thinking and superior in traits like desire to know, desire to excel and power to learn.</td>
</tr>
<tr>
<td>3.</td>
<td>Bristow, et al.</td>
<td>1951</td>
<td>High degree of insight into problem, ability to generalize, ability to do mental tasks at a high degree of difficulty and the ability to do abstract thinking.</td>
</tr>
<tr>
<td>4.</td>
<td>Cutts &amp; Moseley</td>
<td>1959</td>
<td>Ability to make generalization, abstract thinking, insight into problems, reasoning, problem solving, speed of learning and completing intellectual tasks, creative ability, persistence, wide range of interests, memory and curiosity.</td>
</tr>
<tr>
<td>5.</td>
<td>Terman &amp; Oden</td>
<td>1959</td>
<td>More interested in 'abstract' subjects than practical subjects, likes active games, play with tools and machinery, likes the companionship of others and shows no abnormal fondness for study or for solitude and more masculine nature than non-gifted at certain age level.</td>
</tr>
<tr>
<td>6.</td>
<td>Martinson</td>
<td>1961</td>
<td>Mathematically gifted children show unusual interest in number relations.</td>
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<td>7.</td>
<td>DeHaan</td>
<td>1965</td>
<td>Motivation and ability are important determinant of achievement.</td>
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<td>8.</td>
<td>Wilson</td>
<td>1965</td>
<td>General mental ability, interest in science and unusual understanding in the area.</td>
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</tbody>
</table>
Mathematically talented students are less sociable than talented students in English.

Mathematically gifted are strong in Mathematics, verbal and general reasoning, spatial reasoning, ability to identify critical elements and disregard irrelevant elements; divergent thinking low debilitating anxiety, high facilitating anxiety and a positive attitude towards Matheamtics.

High intelligence, and divergent thinking, Mathematics and arts being the favorite subjects.

High ability to generalize, to see relationships, to make logical associations, a strong desire to excel and inaccurate in arithmetic.

Superior powers of reasoning, of dealing with relations and imagination, and problem solving.

Have superior abilities and learn at a faster pace and solve problems at a more mature level.

Develop characteristics of an ability to generalize mathematical material, a flexibility of mental process easiest and economical ways to solve problems, remember generalized relation and reasoning schemes, curtailment of reasoning process and formation of mathematical perception of the environment.

Stimulated by problem solving approaches to learning, able to induce, deduce and to connect related ideas and motivated toward learning and achieving in science.

Science interest is high for gifted boys than girls. They prefer occupations with science bias and creativity based occupations.
18. Freeman 1979 High level of intellectual ability with extraordinary good memories, concentration, lively creative activities, excellent school progress and a wide range of interests.

19. Copley 1981 Characterised by conventional abilities like good memory, logical thinking etc. and creative abilities like generating ideas, recognizing alternative possibilities etc.

20. Consuegra 1982 Mathematically gifted students show propenosity towards quantitative relationships, use of numbers advanced mental abilities, unusual ability to solve mathematical problems and are capable of abstract thinking.

21. Pratscher et al. 1982 Recommended to teach mathematics beyond the boundaries of the regular school day.

22. Winnie et al. 1982 Better insight problem solving ability, and capable to spontaneously combine and integrate relevant data to solve problem.

23. Sternberg & Davidson 1983 High academic self-esteem but not so in social and physical domains.


26. Stanley 1984 High motivation or 'academic hunger'.

27. Van Tassel 1985 High academic Self Concept, well developed and diversified interests.

28. Whitmore 1985 Highly creative behaviour in producing ideas, things and solutions, aspiration of high standard of achievement and desire to excel.

29. Zi-xiu 1985 Strong cognitive interests and intellectual curiosity, concentrated attention and good memory, keen perception and power of observation, quick thinking, good comprehension and creativity and confidence, competitiveness and persistence.
Better insight problem solving ability. 'Crystalizing experiences' dominated in music and prodigious achievement in Mathematics. Curiosity, persistence and self-confidence. High attitude towards science. Keen awareness and intense curiosity about numeric information, quick in learning, understanding and applying Mathematical ideas, abstract thinking, flexible, creative thinking of solving mathematical problem, transferring of learning to unfamiliar situation. Ability to manipulate abstract symbol system, generate original ideas, high level of planning, problem solving and abstract thinking. High analogy solving ability with more spontaneous, frequent and successful strategy. Relatively few differences in Self Concept between gifted student receiving 5 types of services - within regular classrooms, through pull-out resource rooms, ability grouping in separate classes, special schools or no programme offering. Medical and physical wellbeing. High mathematical reasoning makes gifted boys out perform gifted girls. High in ability, personality traits and creativity. Higher academic Self Concept. Educational attainment, IQ and amount of acceleration as significant contributors to the discrimination of least and most successful men in the "Genetic studies of Genius."
<table>
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<tr>
<th></th>
<th>Author(s)</th>
<th>Year</th>
<th>Summary</th>
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<tbody>
<tr>
<td>43</td>
<td>Schack</td>
<td>1993</td>
<td>Multi-age, multi-ability setting helped to develop linguistic and logical-mathematical creativity.</td>
</tr>
<tr>
<td>44</td>
<td>Wilkinson</td>
<td>1993</td>
<td>Gifted students excel in complex reasoning but not different in sequential reasoning and visual-spatial perception.</td>
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<tr>
<td>45</td>
<td>Caropreso &amp; White</td>
<td>1994</td>
<td>High level performance in geometric analogy task.</td>
</tr>
<tr>
<td>46</td>
<td>Gallaghes &amp; De-Lisi</td>
<td>1994</td>
<td>Highly able girls in mathematics used conventional Problem Solving strategies and this is associated with negative mathematical attitude.</td>
</tr>
<tr>
<td>47</td>
<td>Hunsaker</td>
<td>1994</td>
<td>Teachers consider creativity as the common characteristic of varied types of giftedness.</td>
</tr>
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<td>48</td>
<td>Kranzler et al.</td>
<td>1994</td>
<td>Highly effective in higher-order cognitive process and have high speed and efficiency in lower-order cognitive processes.</td>
</tr>
<tr>
<td>49</td>
<td>Williams &amp; Mehtgomery</td>
<td>1994</td>
<td>Internal comparisons across academic areas and external ability comparisons relative to peers determines Self Concepts of academically able students.</td>
</tr>
<tr>
<td>50</td>
<td>Shore et al.</td>
<td>1994</td>
<td>Gifted students not always out perform others on cognitive tasks.</td>
</tr>
<tr>
<td>51</td>
<td>Cornell et al.</td>
<td>1995</td>
<td>Minority gifted students have high achievement scores but not in academic or social self concept. White gifted students scored significantly higher than non-gifted on achievement and academic and social Self Concepts.</td>
</tr>
<tr>
<td>52</td>
<td>Frasier et al.</td>
<td>1995</td>
<td>High in communication skills, imagination, creativity, humour, enquiry, insight, interests, memory, motivation, problem solving and reasoning.</td>
</tr>
<tr>
<td>53</td>
<td>Hannath &amp; Shore</td>
<td>1995</td>
<td>Use meta cognitive skills and knowledge.</td>
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<td></td>
<td>Author(s)</td>
<td>Year</td>
<td>Description</td>
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<td>54.</td>
<td>Lea-wood</td>
<td>1995</td>
<td>Non-gifted girls have high total and social self-esteem than gifted girls (Self-esteem was measured using school form of Cooper Smith self-esteem Inventory).</td>
</tr>
<tr>
<td>55.</td>
<td>Luvisi</td>
<td>1995</td>
<td>High in self-esteem, creative thinking, critical thinking and problem solving skills.</td>
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<td>56.</td>
<td>Diezmann &amp; Watters</td>
<td>1996</td>
<td>Ability to analyze, synthesize and evaluate newly acquired information and decontextualisation skills in constructing solution to new problems.</td>
</tr>
<tr>
<td>59.</td>
<td>Plucker et al.</td>
<td>1996</td>
<td>Express high aspiration and perceive the school climate as supportive and fostering achievement and aspirations.</td>
</tr>
<tr>
<td>60.</td>
<td>Khire</td>
<td>1997</td>
<td>An SOI model was developed to identify the type of giftedness and the highly gifted from the gifted students.</td>
</tr>
<tr>
<td>61.</td>
<td>Zental et al.</td>
<td>1997</td>
<td>Free reading, mental mathematics, social skills, memory creativity and like specific subject areas.</td>
</tr>
<tr>
<td>62.</td>
<td>Zhang et al.</td>
<td>1997</td>
<td>Mathematics and verbal Self Concept are highly related for gifted students.</td>
</tr>
<tr>
<td>63.</td>
<td>Modi et al.</td>
<td>1998</td>
<td>The amount of independent reading, enrollment in academic programs, high educational aspirations and time spent on home work are associated with academic talent.</td>
</tr>
<tr>
<td>64.</td>
<td>Freeman</td>
<td>1999</td>
<td>Self Concepts of musically precocious children were improved by their crystallizing experiences.</td>
</tr>
<tr>
<td>65.</td>
<td>Rengulli</td>
<td>1999</td>
<td>Developed school wide enrichment model (SEM) to escalate the level and quality of learning experiences of talented children.</td>
</tr>
</tbody>
</table>
Conclusion

Further review of the studies in the area of giftedness thus enabled the investigator to conclude that:

1. Most of the works done in the area of giftedness are western. Only very few studies are reported in the Indian context.

The Survey of Educational Research in India reports that the first study on giftedness in India was appeared only in the second half of 1960's. The education of gifted children is a neglected one and this may be because of the special cultural and economical background of the Indian population and the policies by the Government like universalization of education. Recently the picture has changed and enriching of gifted is the "Mantra" of educationists. The NPE\textsuperscript{70} (1986) thus has stressed that with the large investment in education and the demand for talent and excellence for securing a quality of life, this condition can not be allowed to continue.

2. The area of Mathematical giftedness and the allied factors is less tackled one.

3. Theoretical and practical works on giftedness point out several characteristics of gifted children mainly of cognitive and affective nature.

In this context, the present study of Mathematical Giftedness and the contributing variables is a worthwhile one hoping that the results of the study will contribute much both to theory and practice in education.
References


