CHAPTER III

REVIEW OF RELATED LITERATURE

- **Studies Related to Problem Solving**
- **Studies Related to Mathematical Problem Solving**
- **Studies Related to Problem Creativity**
- **Studies Related to Mathematical Problem Creativity**
- **Studies Related to Discovery Learning**

REVIEW OF RELATED LITERATURE

The review of related literature involves the systematic identification location and analysis of documents containing information related to the research problem. These documents include articles, abstracts, reviews, dissertations, books, other research reports and electronic media. The major purpose of reviewing the literature is to determine what has already been done that relates to the topic. This knowledge not only avoids unintentional duplication, but it also provides the understandings and insights necessary to develop a logical framework into which the topic fits. In other words the review tells the researcher what has been done and, in so doing, also suggests what needs to be done.

Another important function of the literature review is to point out research strategies, specific procedures and measuring instruments that have and have not been found to be productive in investigating the topic. This information will help to avoid other researcher's mistakes and to profit from their experiences.

Being familiar with previous research also facilitates interpretation of the results of the study. The results can be discussed in terms of whether and how they agree with previous findings.

Review of the related literature, besides allowing the researcher to acquaint himself with current knowledge in the field or area in which he is going to conduct his research serves the following purposes. It enables the researcher to define the limits of his field. The knowledge of related literature brings the researcher up to date on the work which others have done and thus to state the objective clearly and concisely. By reviewing the related literature the researcher can avoid unfruitful and useless problem areas. It gives the researcher an understanding of the research

methodology which refers to the way the study is to be conducted. The final and important specific reason for reviewing the related literature is to know about the recommendations of previous researchers listed in their studies for further research.

Here the Investigator had collected studies related to the topic under study and had arranged the studies in the following sections:

i. Studies related to problem solving
ii. Studies related to mathematical problem solving
iii. Studies related to problem creativity
iv. Studies related to mathematical problem creativity
v. Studies related to discovery learning

3.1. STUDIES RELATED TO PROBLEM SOLVING

Van Merrienboer and **Jeroen** (2013) investigated the perspectives on problem solving and instruction. It was found that problem solving should not be limited to well structured problem solving but be extended to real life problem solving. **Tsai et al.** (2012) analyzed visual attention for solving multiple choice science problems. Studies showed that successful problem solvers focused more on relevant factors while unsuccessful problem solvers experienced difficulties in decoding the problem, in recognizing the relevant factors and in self regulating concentration.

Kuo et al. (2012) experimented a hybrid approach to promoting students web based problem solving competence and learning attitude. Results show that middle and low achievement students in the experimental group gained significant

benefits from the hybrid approach in comparison with those who learned with the traditional approach.

Manapure (2011) studied the effect of problem solving method on science teacher trainers for the solution of the environmental problems. It shows that problem solving method improves the scientific operation skills of the science teacher trainees.

Yeung (2010) Studied the impact of problem based learning on a pre-university geography class. Results showed that students could analyse problem statements and presents their understanding systematically but varied considerably in organization, argument and quality of thinking. **Simone** (2008) examined the impact of problem based learning on prospective teachers problem solving abilities. The participants in problem based learning were significantly better in constructing, elaborating, relating their solutions to the problem and using multiple resources than the control group following the traditional approach.

Kumar and **Natrajan** (2007) examined the components of a theoretical problem based learning frame-work adopted by a reform minded tertiary institution in Singapore. It was found that by learning disciplinary content matter through the instructional strategy of solving real life or simulated problem, higher order skills such as critical evaluation and information processing developed in students.

Sungur and **Tekkaya** (2006) investigated the effectiveness of problem based learning and traditional instructional approaches on various facets of students self regulated learning, including motivation and learning strategies. Results revealed that problem based learning students had higher levels of intrinsic

goal orientation, critical thinking, meta-cognitive, self regulation and peer learning compared with control group students.

Sunitha (2004) made a study on effectiveness of problem solving approach on achievements and problem solving ability at higher secondary level. It is concluded that the problem solving approach is more effective than the conventional text book approach. **Basile et al.** (2003) in their study explored problem based learning as a dimension that adds context and framework to coaching & reflection. Implication from the study suggested that problem based learning is a valid process for the enculturation of teacher candidates to schools and to the profession of teaching.

Neo and **Neo** (2001) assessed students problem solving skills and ability to evaluate a website's design, creativity and navigational structure by requiring them to reconstruct and improve an existing website. **Thacker** (1994) compared the performance of introductory physics students on two examination problems. One problem was qualitative and similar to those used in an inquiry approach. The second problem was a typical quantitative problem. Those students enrolled in the inquiry based introductory course performed significantly better than those in the traditional course.

Krulick and **Rudnick** (1993) put forth a set of heuristics that has proven to be successful with students and teachers at all level of instruction, such as 1.Read and think, 2. Explore and plan, 3. Select a strategy, 4. Find an answer and 5. Reflect and extend. **Myres** (1993) studied whether the inquiry based problem solving model supports sustained exploration of a multimedia data base. The result

showed that the discrepant event inquiry approach provided motivation for sustained learning activities.

Mestre (1993) experimented for promoting skilled problem solving behaviour among beginning physics students. For that beginning students were constrained to analyze mechanics problem according to a hierarchical scheme that integrated concepts, principles and procedures. Students increased their reliance on the use of principles in categorizing problems according to similarity of solution and in writing qualitative explanations of physical situations. In a study **Faux** (1992) investigated the extent of relationship among creative thinking, critical thinking, intelligence and problem solving ability. It was found that critical thinking and intelligence have relation with problem solving ability.

Germann (1991) found that the directed inquiry approach is effective in learning science process skills and scientific problem solving. **Ashalatha** (1990) in a study of problem solving ability in biology of high average and low creative secondary school pupils found that there are differences in the problem solving ability in biology between high average and low creative secondary school pupils.

An experimental study conducted by **Rekha** (1988) reveals that the piagetian model of teaching is effective for the development of problem solving ability in secondary school students. **Kilpatrick** (1987) discussed and suggested that by drawing students attention to the reformulating process and given practices in it, the students can improve problem solving performance.

Penner and **Voss** (1983) compared the problem solving processes of experts and non experts and the results indicated that experts did not use a one solution process, rather, their processes differed with respect to problem

decomposition into sub problems and in the way they chose to represent the problem statement. **Sivadasan** and **Rajagopalan** (1982) compared problem solving approach with text book approach in student achievement in high school science and reported that the problem solving approach seems to be better than text book approach in realizing the objectives, knowledge and skills in problem solving only. But the text book approach is found superior for the attainment of the objective comprehension.

3.2. STUDIES RELATED TO MATHEMATICAL PROBLEM SOLVING

Tingley (2012) conducted a study using Talking Aloud Partner Problem Solving (TAPPS) which is a teaching learning strategy has increased the speed and effectiveness of partner problem solving, has little to do with the monitor and much to do with the problem solvers own behaviour. **Joanne** and **Donna** (2012) conducted a naturalistic study of executive function and mathematical problem solving. Students progress in problem solving when they engage in a conscious appraisal of the problem. **Maire et al.** (2012) experimented cognitive correlates of math skills on third grade students. Results showed that verbal reasoning and verbal concepts were most consistently associated with math knowing and problem solving domains.

Rupley, **Margaret** and **Robert** (2012) studied the effects of reading and enhanced word problem solving. Results stressed that teachers need to think less about students deriving an answer and more in terms of facilitating students application of the cognitive components of reading and mathematics. **Voyer** (2011) in the study of performance in mathematical problem solving as a function of comprehension and arithmetic skills found that pupils who give greater

importance to situational information in a problem have greater success in solving the problem.

Craig and **Tracy** (2011) investigated categorization and analysis of explanatory writing in mathematics. The scheme successfully observed positive changes over the experimental period in students level of engagement with the mathematical material.

Fernandez, **Anthony** and **Kochler** (2011) experimented on mathematics teachers circle around problem solving. Math teachers circles were developed with the aim of establishing a culture of problem solving among middle school mathematics teachers. The culture could then be carried back into these teachers classrooms.

Romberg (2010) studied wiltrocks influence on mathematics education. Instruction should involve the stimulation for a student store of relevant background experiences in relation to information to be learned so that they can construct meaning from it. **Ali** (2010) in his study on the effect of using problem solving method in teaching mathematics on the achievement of mathematics students found that there was significant difference between the effectiveness of traditional teaching method and problem solving method in teaching of mathematics at elementary level.

Behare (2009) in his study of problem solving skills in mathematics learning investigated cognitive skills in solving mathematical problems of learner at the terminal stage of elementary education. It revealed that those who can verbalize the process of solution are better at solving problems. **Mohanty** (2009) studied the effect of cognitive and meta-cognitive strategy instruction on the

mathematical problem solving of elementary school students with learning disabilities. The intervention programme has been found to have a significant positive effect on the mathematical problem solving of students with learning disabilities.

Gandhi and **Varma** (2007) studied self regulated learning in mathematics through some pedagogic strategies. Results show that mathematics teachers who incorporate self regulation techniques in their daily lesson contribute to make the students lifelong learners by using their cognitive skills and strategies. The study done by **Chung** and **Tam** (2005) examined the effects of different approaches to teaching learners with mild intellectual abilities to solve mathematical word problem. Students presented with worked example and cognitive strategy instruction solved more problems correctly and outperformed students presented with conventional instruction in both immediate and delayed tests.

The study by **Cass et al.** (2003) evaluated effects of manipulative instruction on perimeter and area problem solving performance of high school students with learning disabilities in mathematics. Students rapidly acquired the problem solving skills, maintain these skills over a two month period, and transferred the skills to a paper-and-pencil problem solving format. **Sayed** (2002) experimented on the effectiveness of problem posing strategies on prospective mathematics teachers problem solving performance. The results of this study showed that the performance of student teachers improved overall when using problem posing strategies.

Mevarech (1999) compared the effects of three co-operative learning environments on Israeli seventh grader's mathematical problem solving. Results

indicated that students exposed to meta-cognitive training significantly outperformed their counter parts who received strategy instruction, who in turn significantly outperformed students who received no teaching. An experimental study conducted by **Oladunni** (1998) focuses on the effects of the application of two problem solving techniques meta-cognitive and heuristic on the achievement of students in the computation of creative mathematics problems. Results indicate that there was a significant difference in the achievement of experimental and control groups.

Dash (1996) focused his study on effects of instructional strategy using self learning activity sheets on the problem solving behaviour of class III children leading to mastery level performance. Instructions through self learning activities using heuristic strategies not only developed the problem solving ability of class III children but also increased their tendency to engage deeply in general mathematical activities. **Silver** and **Cai** (1993) found a strong positive relationship between problem posing and problem solving performance.

Reeves (1987) in his booklet illustrates some ways to teach different problem solving strategies to elementary school students. It concentrates on methods involving, 1. Working background, 2. Using a table, chart or list to organize information, 3. Drawing diagrams, 4. The searching and recognition of patterns and 5. Guessing, checking and revising. **Wilson** (1978) investigated relationships between mathematical problem solving performance and intellectual abilities. Study concluded that seven talent cognitive abilities underlie the test batteries that were studied and that these are the same for boys and girls.

Lestre (1978) in a study over fourth and fifth grade students to find out the strategies used by them to solve problem found that most students had difficulty in retaining and coordinating multiple conditions present in a problem. Trial and error was the most prevalent behaviour found in students. **Meyer** (1969) concluded that though pre requisite mathematical concepts and skills are related to problem solving success, knowledge of these concepts and skills is not sufficient for successful problem solving.

3.3. STUDIES RELATED TO PROBLEM CREATIVITY

Chung et al. (2013) conducted a case study on the emergence of student creativity in class room settings. The three types of student creativity emerging in the teaching and learning process found in this research were a) heuristic creativity, b) interpretive creativity and c) integrative creativity. **Martin et al.** (2012) conducted a study on conceptions of creativity and relations with judges intelligence and personality. Results show that with both methods first one consists of analysing adjectives that are associated by naive judges and the second one consists of predicting the evaluation of creative level of advertisements by naive judges. Results show that with both methods originality is always the most characteristic dimension of creativity.

Basantia and **Panda** (2010) conducted an experimental study to examine the effect of Multi-dimensional Activity based Integrated approach (MAI) over traditional method of teaching in developing creative abilities of elementary school children. Multi dimensional activity based integrated approach is suitable for development of creative abilities in all context areas of social studies. **Kashyap** (2006) in his study creativity in design education stressed that the

traditional learning by doing methodology has to be complemented with learning by thinking as well.

Mohanty (2005) synthesized the research findings related to creativity and their effect in developing curricular implications for social studies. Findings revealed that creativity can be developed if adequate training strategies are provided. **Muneyoshi** (2004) researched how teachers use creative problem solving in the classroom. According to the results of the research, the use of creative problem solving in the classrooms raised their motivation and self-confidence, provided positive attitudes towards learning and problem solving, helped students become more enthusiastic and active in learning.

Scott, Leitz and **Mumford** (2004) emphasized that creativity programmes have an important effect on performance, attitude and behaviours, especially on divergent thinking and problem solving. **Puccio** (1994) examined the efficiency of creative problem solving training with the primary school students. The study showed that the students could apply creative problem solving in real problems and different levels.

Shack (1993) researched the effects of creative problem solving programme on skillful students. The students in the experimental group compared to control group made considerable improvements in problem solving skills, but no significant difference in skills level was found. **Singh** (1992) conducted a comparative study of scientific creativity, problem solving and risk taking in tribal and urban students. The major findings reveal that urban students were significantly better than the tribal students in fluency, flexibility and originality.

Jawaharlal (1990) made a study on evolving educational programmes for fostering creativity among primary school children. The students had enhancement in creative abilities such as fluency, flexibility and originality when they were taught through specially prepared creative programmes. **Cramond**, **Martin** and **Shaw** (1990), researched the generalizibility of creative problem solving in the real life. The results showed that the students transferring rates of problem solving skills after learning creative problem solving through transferring strategies are higher.

Tripathi and **Shukla** (1990) studied on the development of instructional material for promoting creativity and its effectiveness. The training programmes did not show any significant gains in terms of originality scores which are so crucial to creativity. **Baer** (1988) researched the long-term effects of creative problem solving training. In every test applied after six months, experimental group outscored the control group very significantly which shows creative problem solving skills are not forgotten even after six months. Similarly the experimental group showed significant rises in the test after six, months.

The study conducted by **Mishra** (1985) revealed that the new ways of thinking about things lead us to the production of new ideas and new inventions. The starting point for creative thinking is problem solving. **Jairial** (1980) conducted an experimental study in the training of non-verbal creativity. Significant differences were reported on fluency, flexibility and originality dimensions of creativity in favour of experimental group children. **Nirpharake** (1977) trained the teachers to teach pupil on the following four principles a) cognition or perception b) divergent production c) evaluation and appreciation d)

creative problem solving. He reported significant gains among experimental group children on creativity.

Bell (1974) developed a teaching model based on creative problem solving procedure fostering creativity among elementary school children. This model was found effective in developing creative thinking abilities. Programme instruction as a method of instruction for the development of creative thinking abilities has been reported by **Parnes** and **Meadow** (1959). Associative thinking as one of the teaching strategies that develop original ideas has been reported by **Maltzman** (1958). The experimental groups showed gain in the post association test.

The impetus to the developmental aspects of creative production stems from **Bartlett** (1958), **Taylor et al.** (1958) and the works of **Torrance** (1960), **Parnes** (1962), **Osborn** (1963), **Rusch**, **Denny** and **Ives** (1965), **Olten** (1967) and others on creative problem solving. They regarded thinking abilities as intellectual skills that can be developed through deliberate procedures.

3.4. STUDIES RELATED TO MATHEMATICAL PROBLEM CREATIVITY

Van Harpen et al. (2013) investigated relationship between students mathematical problem posing abilities and their mathematical content knowledge. This study claims that mathematical problem posing activities are helpful in developing creative approaches to mathematics. **Singer et al.** (2013) studied on problem solving and its implications in designing problem posing tasks. This study offers insights for more effective teaching and can be used in problem posing and problem analysis in order to devise questions more relevant for deep learning.

Kritzer and **Karen** (2011) in their study on math in Reley's world found that teachers should encourage their students to ask questions and should guide them towards figuring out the answers for themselves. **Sandy** (2011) experimented on understanding the nature of stumbling blocks in teaching inquiry lesson. This study recommends that teacher educators focus novice teacher preparation in giving pedagogically meaningful explanation that bridge mathematical context to students thinking.

Shikha and **Asthana** (2008) investigated on the effectiveness of instructional material on thinking skill of classification in terms of students achievement and relations at middle school level. Instructional material was found to be significantly effective in terms of achievement and development of thinking skill of classification of the students. **Sheffield** (2005) explored the importance of mathematical creativity and the use of some creative techniques and their application to mathematical context. He suggested a model of a heuristic to encourage students to pose and solve problems creatively. Using these students might create, original solutions or insights, rules, principles and generalizations, new algorithms, new questions and problems and new mathematical models. Further he suggested strategies for enhancing mathematical creativity.

Singh (2000) in his study of mathematical creative thinking among adolescents has found that quality and quantity of mathematical creative thinking were significantly related to each other. **Sood** (1999) has found fluency to be significantly correlated with mathematical achievement of students of residential schools and significant difference were found between the residential and non residential school students. **Sastry** (1998) presented mathematical creativity in a

different direction. Problem creating ability to create mathematical problem taking clue from given data. This was expressed through the scores on three factors, namely fluency, flexibility and originality.

On creativity, **Thampuratty** and **Devi** (1994) have found that creativity as whole has a substantial significant correlation with high achievement in mathematics. **Biswal** (1988) had studied creativity in mathematics as a function of study habits (SHM) and pupils perception of teachers impression about their performance in mathematics (PPTIM). It was found that pupils creativity in mathematics was a linear function of each of the variables SHM and PPPTIM. He reported significant relationship between study habits, pupils perception of teachers impression about their performance in mathematics and mathematical creativity.

Singh (1986) examined the relation between mathematical creativity and achievement in mathematics and found no significant scores. Further he reported that males were not constantly superior to females on any dimensions as well as on total mathematical creativity scores. **Singh** (1985) developed a specially designed strategy to teach mathematics creativity. The results of this study showed a significant effect on the development of mathematical creativity among elementary school children. **Vora** (1984) studied the impact of Divergent Thinking Programme in Mathematics (DTPM) in creative levels of the children of classes VII and VIII. He reported that the experimental group proved superior in the components of creativity after taking the programme.

In a study **Pandey** (1979) reported that indirect teacher behaviour developed mathematical creativity. **Kruetski** (1976) argues that mere mastery of

mathematical material is not a sufficient criterion for mathematical giftedness, but needs to be extended to an independent creative mastery of mathematics under the conditions of instructions. **Valee** (1975) suggests that it is important to stress intuition and reasoned guessing in mathematics teaching as it is too stress, since both logic and instructions are necessary in Creative mathematics.

Maxwell (1974) conducted an experimental study on secondary school students. She reported that high divergent thinkers show fewer generalizations in solving the problem than their counter parts. **Baur** (1970) have compared conventional classes in mathematics for teachers with more open ended creativity oriental classes. He reported that the performance of prospective teachers on mathematical creativity test can be improved by an appropriate teaching programme emphasizing divergent thinking.

Carpenter (1962) in a work on nature and essence of creativity asserts that teachers lack of attention arrests creativity development in a specific area. In a comprehensive study **Carleton** (1959) analyzed the teachings of fourteen famous mathematicians and reported that these mathematicians as teachers were enthusiastic and personally interested in their students, providing them with many opportunities for personal initiative and development of individual responsibility.

3.5. Studies Related to Discovery Learning

Abrahamson and **Dor** (2012) in their study Discovery reconceived product before process found that student discovery of mathematical concepts is viewed as their guided heuristic semiotic aligning of the product of analysis process with informal inference from naively seeing situations. **Andrew** and

Diana (2012) experimented on the role of the scientific discovery narrative in middle school science education. Studies shows that students exposed to the scientific discovery narrative performed significantly better on both immediate and delayed outcome measures.

Tim and **Karima** (2012) conducted a study on the effects of Polya's heuristic diary writing on children's problem solving. Analysis of students response indicated that most students showed improvement in their solution strategies. Students writing about their thinking pattern are beneficial for developing their problem solving skills. **Naomi et al.** (2011) studied on does discovery based instruction enhance learning? Analysis revealed that outcomes were favourable for enhanced discovery when compared to other forms of instruction. The findings suggested that unassisted discovery does not benefit learners, where as feedback, worked examples, scaffolding and elicited examples do.

Smitha and **Manjula** (2011) made a study on the relative effectiveness of inquiry training model and guided discovery learning on critical thinking of secondary school students. The study revealed that inquiry training model and guided discovery learning were equally effective in developing critical thinking in students and they were better than the conventional lecture demonstration method. **Spronken, Rachel** and **Walker** (2010) on their study, can inquiry based learning, strengthen the links between teaching and disciplinary research showed that if teachers are aiming for strong links between teaching and research they should adopt an open, discovery-oriented, inquiry-based approach.

Cotic and **Zuljan** (2009) advanced a problem based instruction model to find out whether the students who received problem based instruction would show greater ability in solving difficult mathematical problems compared to the control group. Conclusions reveal that students who were taught through the experimental method solved more difficult mathematical problems compared to the control group. **Williams** and **Sreed** (2009) in their action research project examined the effect of mathematics journaling on mathematics problem solving skills of second graders. The conclusions revealed that mathematics journaling is an effective strategy to improve and enhance the understanding of mathematical problem solving skills.

Ayodhya (2007) disclosed that the Polya's heuristic approach is more effective than the conventional method in developing problem solving skills. **Kroes** and **Van** (2002) reported that both the math intervention, guided versus structured instruction, improved more than the students of the regular instruction and guided instruction appeared to be more effective for low performing students than structured instruction and especially for those students in regular education. **Namita** (2000) found discovery method to be better than expository method of teaching mathematics.

Alleman and **Brophy** (1992) conducted researches with college students by asking them to report memorable kindergarten through eighth grade social studies activities. Students remembered more of what they learned in discovery learning activities than traditional activities. **Shankaranarayanan** (1990) has found that guided discovery learning is always better than learning under reception conditions. **Kulik et al.** (1990) showed that mastery learning programmes have

positive effects in the examination performance of students in colleges, high schools and the upper grades in elementary schools. **Rao** (1986) investigated the relative effectiveness of guided discovery and expository approach in the teaching of mathematics. In this study, except in the case of girls significant differences were not found.

Bhalwanker (1985) made a study of the effects of "Expository and Guided discovery" methods in the teaching of mathematics. In the case of students of low and average intelligence the guided discovery method was more effective. **Yadav** (1984) studied on the effectiveness of mastering of learning strategies in the teaching of mathematics. Learning strategies used in the study are similar to the heuristic questions raised in research and to Polya's questions. The effect of the mastery learning strategies in the achievement of mathematics was found to be significantly higher than the control group.

Miyan (1982) found that the guided discovery method was most effective in developing originality as compared with tell and do and pure discovery method. In a study conducted by **Hardy** (1967), the students learning the principles of archaeology and anthropology through the discovery method of an archaeological dig were better organizers of information, more active in the task of learning, than those who were taught in a traditional lecture method.

Wilson (1967) compared the wanted given approach with the action sequence approach. The experimental study revealed that the students who were made to ask the questions performed significantly better than the students who followed the action sequence method. **Ashton** (1962) in her study of the effectiveness of heuristic methods in problem solving in ninth grade algebra made

a direct application of Polya's suggestions. Students using heuristic method showed better problem solving skills than those who were taught by text book method.

CONCLUSION

The review of related studies is a crucial aspect of the planning of the study and the time spent such a way for conducting a survey invariably is a wise investment. It is actually a forerunner for the research worker and showed the way to proceed. Thus, the Investigator searched different types of studies and reports related to the topic. Review of related literature helped a lot in developing a wider prospective of the variables selected for the study. It also helped the investigator to have an extensive information on the topic problem solving and problem creating ability in mathematics.

The different outcomes of problem solving method were obtained through the review. Decades of research shows that students progress in mathematical problem solving when they engage in a conscious appraisal of the problem. Researches related to discovery learning showed that students writing about their thinking pattern are helpful for developing their problem solving skills. Studies related to problem creativity revealed that creativity can be developed if adequate training strategies are provided. Researches under mathematical problem creativity claim that mathematical problem posing activities are helpful in developing creative approaches to mathematics. It also showed that mathematical problem creativity can be obtained through the scores on three factors namely fluency, flexibility and originality.

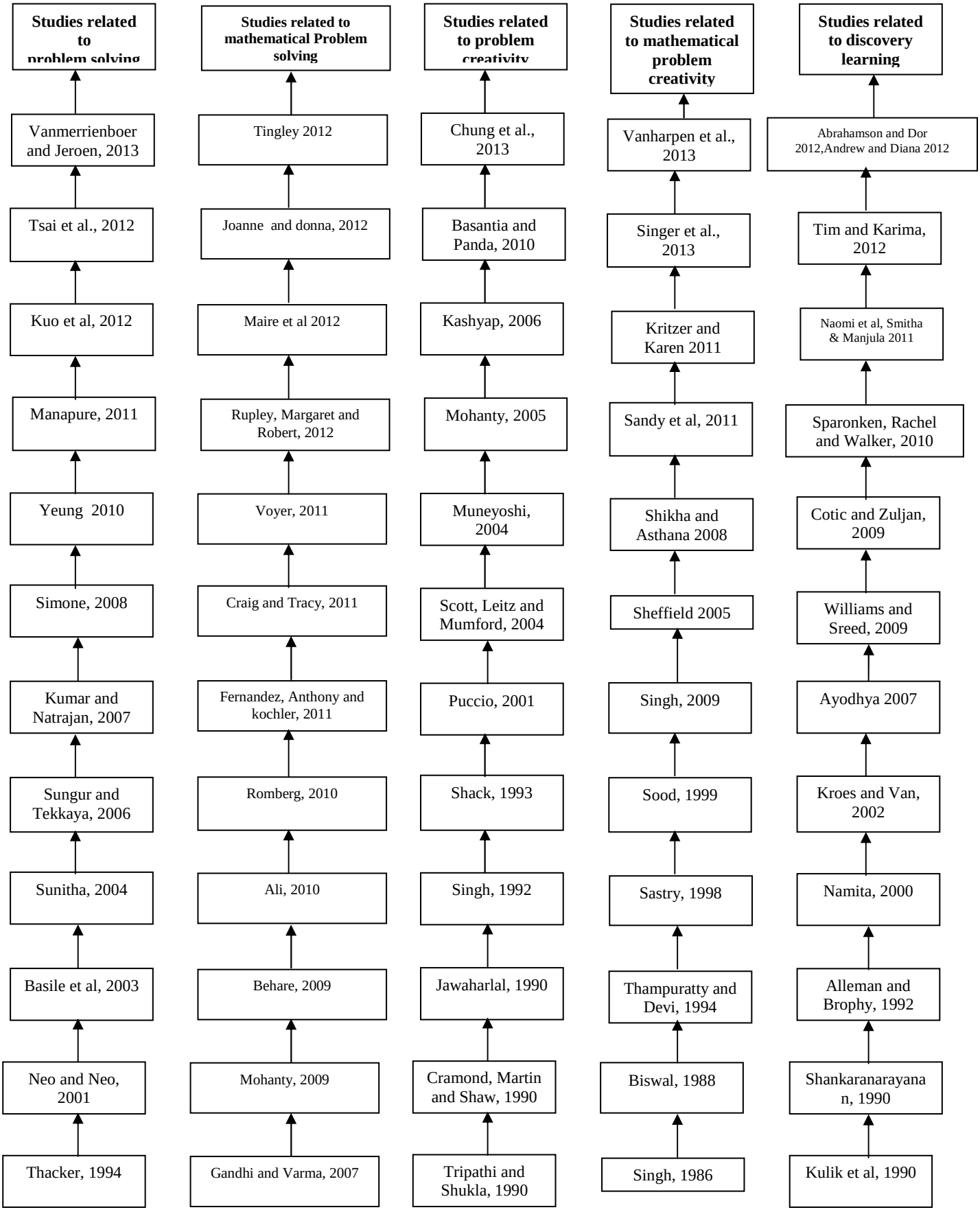
Studies conducted by **Tim and Karima** (2012), **Ayodhya** (2007), **Kroes** and **Van** (2002), **Yadav** (1984) point out the following facts related to Polya's approach on problem solving ability. The findings suggested that unassisted discovery does not benefit learners, whereas feedback, worked examples and elicited examples do. Mastering of learning strategies in the teaching of mathematics through Polya's approach improved the performance of the students.

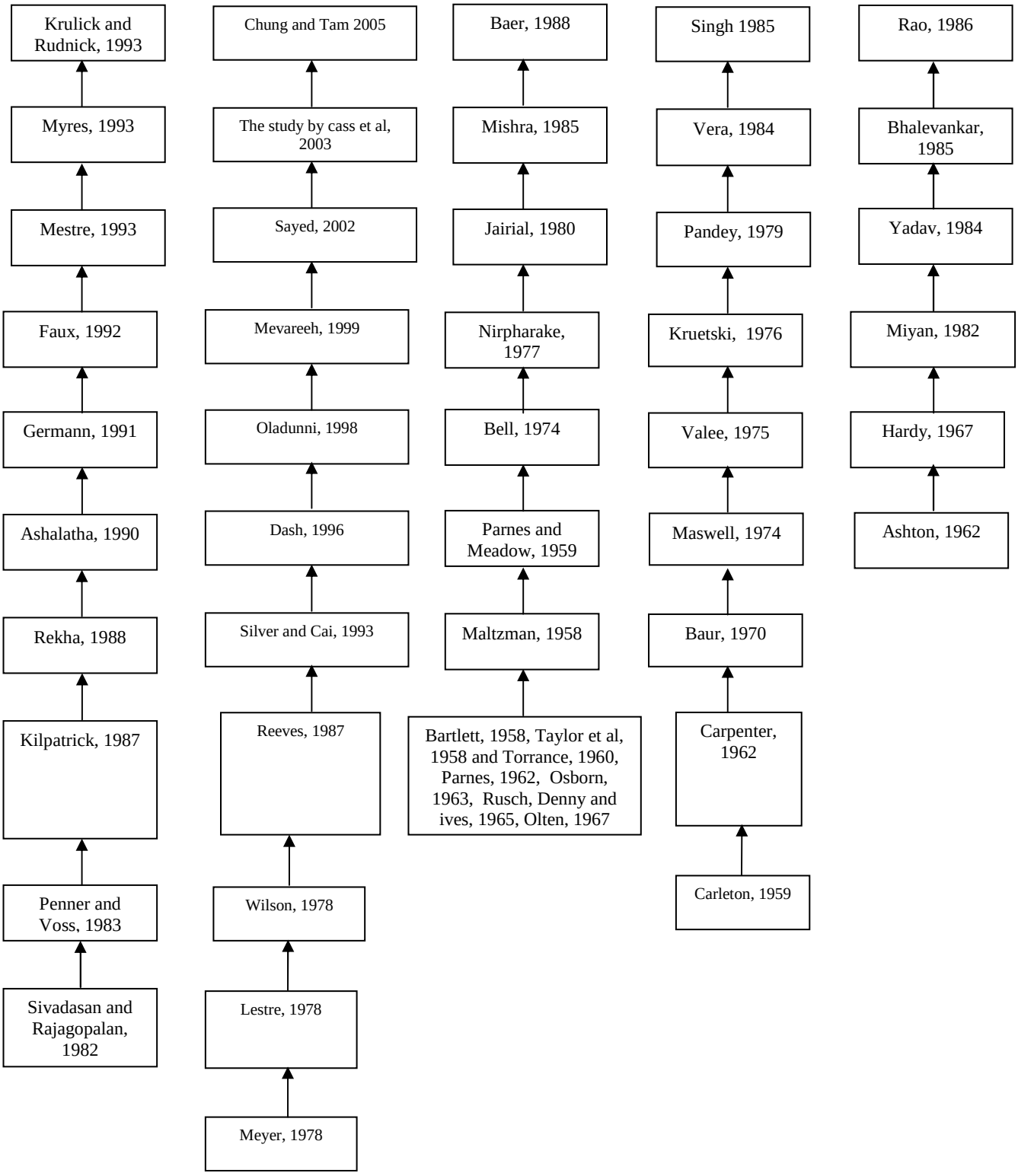
Studies of **Joanne** and **Donna** (2012), **Rupley**, **Margaret** and **Robert** (2012), **Voyer** (2012), **Gandhi** and **Varma** (2007) pointed out the need for some pedagogic strategies. Still conclusively it is realized that Polya's approach can bring everlasting and enduring changes in the problem solving ability of the pupils.

The findings regarding the enhancement of problem creating ability is supported by the results of previous studies conducted by **Chung et al.** (2013), **Kashyap** (2006), Mohanty (2005), **Tripathi** and **Shukla** (1990) and **Mishra** (1985).

As per the reflections of the studies cited above and as per the review of all other studies mentioned above, the Investigator was really inspired and decided to do further work in this area and planned to carry out the study to see whether the approach developed by Polya is really effective in enhancing the mathematical problem solving and problem creating ability of the pupils. Thus, review helped the Investigator in identifying the problem. It made possible for the Investigator to know about the significance of the problem, frame proper hypotheses, select appropriate methods and design and execute it properly.

TIMELINE CHART

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