CHAPTER II

REVIEW OF RELATED LITERATURE

Effective research is based on the past knowledge already existing on the topic. By reviewing the related literature the researcher becomes familiar with what is already known and what is still unknown and untested. Study of related literature implies locating, reading and evaluating reports of research as well as reports of casual observation and opinion that are related to the individual’s planned research project. This step helps to eliminate the duplication of what has been done and it also provides useful hypothesis and suggestions for significant investigation. Citing studies that show substantial agreement and shape and define the understanding of existing knowledge in the problem area, provides a background for the research project on hand. It makes the reader aware of the status of the issue (Best-1986).

Jones, (1971) states that a review of related literature brings new insight and helps in the development of the research procedures. Keeping the above mentioned aspects, in this chapter the important available works on students’ perception of scientists are reviewed in order to gain a deep insight into the problem. The researcher reviewed some of the works conducted by different researchers and published in some renowned and reputed research journals and presented below.

Marsh & Gwyneth, A. (1998) studied on ‘Primary children's perception of science and scientists’. In this study, the perceptions of boys and girls in different types of schools were compared, to identify any differences in their perceptions of science and scientists. The schools in the study comprised, mixed state schools, mixed independent schools and single sex independent schools. The children drew a scientist, completed a questionnaire
and performed three scientific tasks to assess their perceptions of science and scientists. The tasks were selected to be of female, male and neutral orientation. The study found that the children's perception of scientists was different from that found by other studies of the perceptions of scientists of younger children, in that more girls are likely to perceive a scientist as being female. This was particularly the case in single sex girls' schools. The children were less positive about scientific experiments than has been found previous studies and in comparison with 11 year old (Year 8) secondary school entrants. The division of the sciences, namely that physics is more of a male subject, appears to still be prevalent, particular amongst boys in boys only schools.

Crofford & Geary Don (2011) studied on Exploring American Indian students’ perceptions, attitudes, and misconceptions of scientists and the nature of science. The purpose of this study is to describe and analyze the perceptions, attitudes, and misconceptions (PAM) that high school American Indian (AI) students possess about scientists and the nature of science. AI is the least represented group in science, technology, engineering, and mathematics (STEM) majors and careers, both proportionally and aggregately. The results of this study may be used as a baseline or "snap shot" to gauge the effectiveness of the current and future initiatives addressing the underrepresentation of AI and other minorities in science, mathematics, engineering, and health care and computer professions. Views on Science-Technology-Society (VOSTS), Draw-A-Scientist Test Checklist (DAST-C), and Views of Nature of Science Questionnaire (VNOS) instruments are used to characterize the perceptions, attitudes, and misconceptions of 133 high school students from a school district in a mid-western state. Based on the analysis of quantitative data, there is no significant difference in students' DAST scores between genders and among different school grades. The analysis shows a significant effect of school grade on students' naive views on science-
technology-society. Also, it shows that those students' views on science-technology-society became less naive and more informed as they progressed through grades. However, results show that merit position score and informed position score were independent of school grade. The results also reveal that there is no significant relationship between school grade and any of the VOSTS positions, which implies that school grade did impact naive position, merit position and informed position of AI students.

Jane, B. Fleer, M. & Gipps, J. (2007) studied on ‘Changing Children’s Views of Science and Scientists through School-based Teaching’. The main purpose of the study are to find out Stereotypical views of scientists portrayed in the media, and how science is currently taught in Australian schools, both contribute to many students not studying science beyond Year 10. Reports on the status of science teaching in primary schools still tend to focus on the individual teacher's lack of confidence and inadequate content knowledge, and the limited resources available to support science teaching. To date few studies have examined how pre-service teachers engage with science content and pedagogy. From a cultural-historical perspective, the data in this study took three forms. Firstly, children's drawings of scientists were collected. Secondly, children's comments about science before and after a teaching sequence in science were documented. Thirdly, pre-service teachers' reflections on the changes in children's views after the teaching sequence in primary classrooms. Data analysis showed that when each child is valued in a communal context, and engages in relevant, hands-on science activities, the children's views of scientists are challenged, with some beginning to see themselves as rudimentary scientists.
Barman, C. R. et al. (1997) studied on ‘Fifth grade students’ perceptions about scientists and how they study and use science’. The study focused on current images that students have of scientists? How do students perceive they study science in school? and Do students perceive they are using science outside of school? To address these questions DAST and Interview Questions were used. The sample size of the study was 117 and percentage method was used for analysis. The study also found that students perceive scientist as white males who do their work in some type of laboratory. It also found that students drew themselves at desks either reading a science book or taking notes, However, these students also indicated that they would prefer to do some type of activity during science and the majority of the students (60%) viewed the use of science outside of school as an extension of their school experiences.

Nuno, J. (1998) studied on ‘Draw a Scientist: Middle School and High School Students’ conceptions about Scientists’. The purpose of the study was to find out how the image of a scientist might differ between male and female students and among students with different levels and types of science courses. The subjects of the study included 348 students in the 6th, 7th, and 8th grade classes insane Pedro, California. DAST was used for data and 11 standard indicators were used for scoring. Once the drawings were scored, the distribution and percent distribution of numbers of standard in average numbers of standard indicators were determined for each gender, grade level, class, and class groupings. One finding of the study was that students draw images strikingly similar to those presented in their science textbooks.

Demirbas, M. (2009) studied on the topic ‘The relationship between the scientist perception and scientific attitudes of science teacher candidates in Turkey: A case study. In this study, the scientist perception of the teacher candidates were explored in terms of
cognitive conception, physical conception, source of conception, the scientists observed in the milieu and the favorite scientist variables. Furthermore, the relation between scientist perception and scientific attitude were assessed by examining the scientific attitudes of the students. In order to identify the scientist perceptions of students, the scale developed by Song and Kim (1999) and to specify their scientific attitudes the scale which was developed by Moore and Foy (1997) and translated into Turkish by the author were used. Both quantitative and qualitative methods were employed in the inquiry. The research comprised a single unit of analysis (an individual, a school, etc.) therefore a holistic single case design was used in the study. Quantitative data were gathered using descriptive survey technique. In the light of the findings of this study, several recommendations were made including the need for leading students towards activities involving the scientific methods and conceptions of the students and the ways of scientists.

Finson, K. D. (2003) has studied on ‘Applicability of the DAST-C to the images of scientists drawn by students of different racial groups’. Since the DAST-C is used in a growing number of studies on students’ perceptions of scientists, the validity of the DAST-C for use with multicultural groups needs to be examined. In this study, drawings were obtained from eighth grade students who were Caucasian, Native American, and African American. Building on this work, Finson, Beaver, and Cramond (1995) developed a checklist (the Draw-A-Scientist Test Checklist, or DAST-C) to use in assessing drawings of scientists. One of the advantages of the checklist was that quantifiable scores for drawings could be derived and, hence, be subject to comparative data analysis. Researchers are finding out that stereotypical images can have specific influences on the shaping of children’s perceptions in science. Of particular concern is the impact of negative or stereotypical images of scientists on the career aspirations of
females and minorities. In this study the drawings were analyzed and scored using the DAST-C. Comparisons of those results showed no significant differences between groups.

Leblebicioghe, G. et al. (2011) studied on the topic ‘The effect of informal and formal interaction between scientists and children at a science camp on their images of scientists’. During this study, a science camp was conducted in Turkey with a team of scientists consisting of elementary science education researchers. They interacted with the children throughout the camp both formally and informally. Twenty-four 6th and 7th grade students participated to the science camp. The science camp was conducted near a forest and big lake, and lasted ten days in July, 2008. The main goal of the science camp program was to introduce the nature of science and scientists. In one session of the science camp, the children’s images of scientists were made explicit through analysis and discussion of their drawings of a scientist, and challenged by introducing them to three non-stereotypical scientists. The camp team consisting of scientists worked and stayed with the children throughout the science camp. Thus, they interacted with the children in formal and informal ways. The change in the children’s images of scientists was researched by applying the Draw a Scientist Test (DAST) (Chambers, 1983) as pre- and post-test. Additionally, all the children were interviewed about their drawings. The only stereotypical images found in the pre-test were being male and slightly older. However, almost equal numbers of male and female scientists were drawn in the post-test, and most of them were middle aged or young. Other stereotypical images of scientists emerged less in the pre-test and decreased in the post-test. In conclusion, the science camp helped the children to realize the human nature of scientists.
She, H.C. (1995) has studied on ‘Elementary and Middle School Students’ image of science and scientists related to current Science Textbooks in Taiwan’. In this study She examined elementary and middle school students' images of science and scientists, with an analysis of how those images may be influenced by science textbooks currently in use in Taiwan. A modified Chambers' Draw-a-Scientist Test (DAST) was administered to a total 289 students from grades 1, 3, 5 and 8. Results showed that upper-grade students drew more indicators (i.e., lab coats, eyeglasses, facial features, research and knowledge symbols, and relevant captions) than did lower-grade students. An analysis of individual drawings revealed an increase in sophistication and complexity according to progressively higher grade levels. It was found that students very often drew images strikingly similar to what their science textbook presented. It implicated that current science textbooks indeed have some degree of influence on students' image of science and scientists.

Shannon, L. (2009) has studied on ‘7th Grade students’ drawings of a scientist. The purpose of this study is to increase the body of knowledge about how students from rural Western North Carolina perceive scientists. In this study, the researcher explored perceptions of scientists made by 7th grade students participating in WCU’s NCMSEN Pre-College Program through the use of the Draw-A-Scientist-Test Checklist (developed by Finson, Beaver & Crammond in 1995) and follow-up interviews. Findings of the study were Pre-College teachers as well as teachers working throughout Western North Carolina can address the negative stereotypes some students have regarding scientists. Teachers can incorporate resources which highlight the scientific innovations of female and non-Caucasian scientists. Teachers can also facilitate activities in which students are engaging in hands-on, inquiry-based study, so that more students see themselves as scientists. By broadening the scope of middle school science experiences, rural
educators may be able to assist students in their journey on the science education pipeline, and better prepare the scientists of tomorrow. Once educators have a better understanding of students’ stereotypical images of scientists, they will better be able to teach Western North Carolina students and prepare them for the science pipeline at an early age.

Sjoberg, S. (2000) has studied on Science and Scientist: The SAS-study. It is a project. This project is an investigation of interests, experiences and perceptions of children in many countries that might be of relevance for the learning of science. The project involves some 30 researchers from 21 countries. Some 9 300 children at the age of 13 have answered the questionnaire. The SAS-study builds on the rationale that science curricula should be meaningful and relevant for children in different cultures, and that the contents of school science needs to be adapted to culture and context. In this study the children in developing countries articulate a much more positive view towards science and technology than children in the richer countries do. Some children in the rich countries (mainly boys) portray the scientist as a cruel and crazy person, while most children in developing countries seem to consider scientists as idols, helpers and heroes. The low interest for learning science and technology expressed by Japanese children is remarkable. Gender differences in learning different topics of science vary among countries, but seem to be higher in the Nordic countries (and in Japan) than in other regions. The study also provides examples to illustrate how different contexts and applications appeal differently to girls and boys.

Bang, E. & Wong, S.S. (2014) has studied on High school students’ stereotypic images of scientists in South Korea. This study explored stereotypical images of scientists held by tenth-grade students at three different gender organized institutions. The three
institutions included an all-male, an all-female, and a co-educational high school located in South Korea. A total of 393 tenth-grade students from these three respective schools participated in a Draw-A-Scientist-Test (DAST), which was designed to reveal students’ perceptions about what scientists look like. After initial assessment of the DAST results, small numbers of students from each school were selected for follow-up focus group interviews. A mixed methods technique was used in order to analyse the DAST scores and data from the transcribed interviews. Quantitative results indicated that the groups from the three different types of schools were significantly different in terms of their stereotypical images of scientists in that the male and female students from the co-ed school had significantly fewer stereotypical images of scientists versus students in the all-male school. Qualitative results from analysis of selected students at the all-male, the all-female, and the co-ed schools corroborated the quantitative findings. Additional discussions address possible ways to improve equitable learning opportunities in South Korea.

Erten, S. et. al. (2013) has studied on Influence of scientific stories on students’ idea about science and scientists. This study was conducted to determine whether a lesson, in which context-based learning approach and scientific stories were used, changed students' (aged 11-12) stereotypical images of science and scientists. Data was collected from two separate sources: Interviews conducted with six students and Draw a Scientist Test (DAST) document that was given to 80 students (before and after the intervention). In the study, context-based learning approach with scientific stories was used as intervention after which a change in students’ ideas about science and scientists was observed. At the end of the study, changes were observed in various categories of stereotypical images of scientists, such as use laboratory tools (test tubes, glass bottles, magnifying glasses, chemicals, etc.), use of technological appliances (computers,
microscopes, telescopes, machines, robots, etc.), scientists who study living things (plants, animals, humans), scientists who study inside a laboratory, scientists who study outdoors (nature, space, etc.). At the same time changes in students’ understanding of nature of science were observed. After the intervention, clues about student ideas such as, there is more than one scientific method, there is no single criteria for doing science, scientists use their imagination in their studies, and scientists’ studies are not limited to one field were observed. In the course of the study, student’s ideas about science changed from a positivist philosophy toward a heuristic philosophy.

Smith, D.F. (2009) has studied on how does culture shape students’ perceptions of scientists? Cross national comparative study of American and Chinese elementary students. This study, however, moves beyond that stereotypic image and examines students’ perceptions of scientists. The purpose of this study is to illustrate that students are influenced not only by the personal images they hold of scientists, but also by cultural impressions and the style of the science courses they experience in school. By combining a contemporary perspective and a creative method of analyzing student perceptions, a theoretical understanding of how students interpret scientists and their work was developed. Elementary school children (N = 1,350) in the United States and China were enrolled in this study, and drawing exercises were utilized to provide new evidence and a fresh perspective regarding the way students perceive scientists. Based on the findings of this research, more American students included the traditional image of a science laboratory with chemicals in their pictorial depictions of scientists, while Chinese students included robots in their drawings. While students in both countries demonstrated misconceptions about scientists, this study identifies those misconceptions as significantly different, yet inherently related, to students’ individual cultures, contrary to previous studies. This study also demonstrates that a child’s environment can be
influenced by their existing culture, and thus learning, or perceiving the role of scientists, can be directly influenced since each classroom is a culture of its own. Finally, this study demonstrates that a child’s sense of who can be a scientist, where scientists work, and what scientists do is influenced by cultural experiences. Today, with fewer students pursuing science careers, these findings are especially noteworthy.

She, H. C. (1998) has studied on Gender and Grade Level Differences in Taiwan Students’ Stereotypes of Science and Scientists. The purpose of this study was to explore student-held images of science and scientists according to gender and grade level and the reasons behind them. A drawing activity and interviews-about-instance on the theme of science and scientists were administered to a total of 297 students (153 male and 144 female students) from three elementary and three middle schools in Taiwan. The results show male students being more strongly influenced by public stereotypes of science and scientists at a younger age compared with female students. However, a significantly larger number of males made a change in accepting non-stereotypical science/scientists images as they increased in age, particularly grade 8 boys. Grade 8 girls were found to be most open to the idea of women working as scientists, yet those same female students were, for the most part, incapable of imagining themselves pursuing a science-related career because of being afraid of being labelled as loo capable when compared with male peers. Throughout this study, it has been demonstrated that parents, peers, and teachers do have impact on the students’ science-related career choice through the influence of students’ views of science and scientists.

Matthews, B. (1996) studied on Gender and Education: Drawing Scientists. Research has indicated that pupils view scientists predominantly as white, male and dressed in laboratory coats. To investigate this belief, pupils in schools, and some postgraduate
certificate in education students, were asked to draw a picture of two scientists. This is a procedure that gives more information about pupils' perceptions than the usual request for pupils to draw one. The results of this study, this paper argues, indicate that the image that pupils have of scientists is changing to show less gender bias, and to be more realistic.

Flick, L. (1990) has studied on ‘Scientist in Residence Program Improving Children's Image of Science and Scientists’. It was investigated the effect of the scientist in residence program to inspire elementary school children with their personal enthusiasm for science. The study described the changes in the students’ image of scientists using the draw–a-scientist test before and after the program.

Chambers, D.W. (1983) first studied on Draw–A-Scientist Test. using the research of the Chambers' purpose was to learn the person's image of a scientist. Chambers was responding to a study done by Mead and Metraux (1957), which showed the image high school students had of scientists. For his test, Chambers used the simple prompt, "Draw a scientist." Given this prompt, 4807 children in grades kindergarten through grade five were administered the DAST. It is also examined influence of population variables (socio-economic class, intelligence, sex, Anglophone/Francophone culture) on formation of the image and stereotype variations which may indicate early development of social/psychological attitudes toward science/technology. Drawings were analyzed for indicators of the image children held of a scientist. Seven major indicator types emerged, e.g. lab coat, eyeglasses, and facial growth of hair. From these indicators, Chambers was able to show that views of scientists varied by age and grade level, and that children held stereotypical views of scientists. Children below second grade included a very low number of indicators or no indicators in their drawings. By second grade, the average
number of indicators included in drawings had more than doubled, with indicator numbers reaching a peak in the highest grade studied, fifth grade. (The average number of indicators fifth grade was 3.26.)

Borg, A. and Bugeja, M. C. (2006) have studied on “Primary Students’ Perception of Scientists in Cartoons.” This research carried out with primary level children in Malta confirms this influence. The country is potentially losing a huge number of scientists. Research methodology adapted so far was the DAST (Draw A Scientist Test) which captures the image of a scientist held but does not support the source of such image. The aim of this study is to investigate the possible influence transmitted through media namely through two particular popular cartoons Dexter and Professor Utonium in The Power Puff Girls. Both these cartoon characters have stereotypic scientists as protagonists. The methodology used was qualitative. Children from Year 4 and Year 5 classes were shown pictures illustrating “Dexter” and “Professor Utonium”. The children interviewed were selected according to their familiarity with the seen cartoon characters. The interviews investigated how much the children thought that these scientists represented real scientists. The research revealed that stereotypic images still persist. Children did not distinguish between the cartoon scientists and real life scientists. Thus it was evident, that media is an active influential medium on children’s views which is encouraging stereotypic discriminations.

Mangion, C. (2006) has studied on “Children’s Perception of the Work of a Scientist”. The current research shows that children develop a stereotypic image of a scientist from an early age. This stereotypic image is usually that of a male, wearing a lab coat while working solitary in a laboratory. Moreover, science educators are concerned about the limited number of students opting for science careers. This study aims to identify the
perception of the work of a scientist held by Maltese students in their fifth year of Primary education, and to investigate how this perception varies across schools and gender. The main research method was the DAST (Drawing a Scientist Test), followed by an interview. Students were also shown pictures of people at work, some scientists, some not and asked whether they think that the person in the picture is a scientist or not and why. The data was collected from 24 students, 12 boys and 12 girls from four different schools. The main perceptions of the work of a scientist identified by students where three: that of a scientist working indoors; in a classroom as a science teacher; or else working in a lab using laboratory equipment. The scientist was usually considered to work on his own. The development of student’s correct views of the work of a scientist is possible by giving students, even in their primary years, the opportunity to meet various scientists of both genders and to discuss their work.

Munro, R. O. (2006) has worked on the topic “Young Children’s Image of a Scientist.” This research shows that children view a scientist as a male, wearing a lab coat, having spiky hair and works in a laboratory. Methods of research used in Malta so far involved mainly the DAST method (Chambers 1983). This just includes drawing a diagram and may not really represent what children believe. The aim of this research is an in-depth study of children’s image of scientists and the source of these ideas. A qualitative approach was adopted, involving a drawing exercise and an interview. Twenty-four interviews were carried out with 5 to 7 year-old children, twelve boys and twelve girls, from four different schools. The main image depicted was that of a solitary, indoor scientist, involved in chemical and technological activities. The image of a female scientist gained popularity, though the male figure still dominated. The drawings show that young children do not have a stereotypical image of a scientist. Very few children drew the scientists wearing a lab coat, wearing glasses and having spiky hair. Despite all
this, several drew the scientist in a laboratory. The interviews show that the children’s image of a scientist is obtained mainly from the media. A large number of children mentioned ‘Dexter’, a cartoon character who is a scientist. The development of primary students’ image of a scientist is possible providing opportunities to meet various scientists of both genders as well as media education.

Spiteri, M. (2006) in his research on children’s image of a scientist shows that children hold a strong stereotypic image of a scientist as a male, wearing a lab coat having unruly hair and a beard or moustache, wearing spectacles and works in a laboratory as early as at the Junior years at primary level. The aim of this research is to provide more in-depth information about what the children in Year 4, Year 5 and Year 6 really think about science and scientists. The main research involved a drawing exercise and a short questionnaire in conjunction with the DAST and an interview. The questionnaires and drawings were administered to ninety (90) students and the interviews were conducted with eighteen (18) students. The typical image depicted was that of a white elderly male working indoors mostly in a laboratory using test tubes and mixing liquids wearing a white coat and eyeglasses doing some sort of research. It was found that representations of female scientists by boys decreased through the years. From this study one would notice that different primary schools give different perceptions to scientists. The DAST may not be as reliable as one should expect since in this study a certain number of students did not keep their stereotype. Students’ view of science and scientist can be improved by exposing students to real scientists of both genders.

Buldue and Mahmet (2006) have studied on “Young Children’s Perceptions of Scientists: A Preliminary Study.” In their study they have utilized children’s drawing in an effort to discern what those perceptions are. Studies assessing perceptions children
have of scientists have shown that children have stereotypical images of scientists. This study aimed to find out if there was a difference in the way 5-8 years old children drew scientists, taking account of age, gender and socio-economic status. For this study a convenience sample of 30 young children was used. Participants included young children from a public elementary school in Ankara, the capital city of Turkey. The researcher work individually with each child who participated in this study in an interview setting. Although each child was asked a set of standard questions, and given a standard set of directions, each interview session was informal enough to allow the researcher to gain additional information about children’s drawing and to clarify any of their responses. During the interview sessions, Children’s responses were noted by the researcher before the children were asked to draw their picture of a scientist. The current study showed stereotypical images drawn by the participants included symbols of research, such as scientific instruments and laboratory equipment of all kinds, and symbols of knowledge, principally books and cabinets, technology and the product of science. An interesting finding of this study was that perception of young children differed due to their age. Children at the age of 8 years drew non-stereotypical scientist images, and they drew more detail than their younger peers. When children were compared in terms of their gender, no significant differences were observed between boys and girls. But none of the boys drew female scientist. While children of parents with lower economic status drew more stereotypical scientist images, children of parents with higher economic status drew different images of scientists, a result which showed us that the scientist perceptions of young children differ with socio-economic status.

Warren (1990) had used the DAST to gauge various factors in students, including career goals, perceptions of scientists at the elementary through high school level (Schibeci & Sorensen, 1983; Flick, 1990), and perception of technology (Hill; 1991). In a study of
differences in stereotypical views of science after a gender-equity intervention program (Huber & Burton, 1995), boys' posttest drawings showed greater movement away from stereotypes than girls' posttest drawings. Finson and Beaver (1994) developed a checklist to assess change in students, using the stereotypes noted in the Chambers' (1983) study.

Symington, D. and Spurling, H. (1990) had recommended and tested the Draw-a-Scientist-Test in revised prompt (DAST-R). They pointed out that students seemed to be drawing what they perceived to be the public stereotype of a scientist, and not necessarily their own perception of a scientist. To remedy this problem, Symington and Spurling tested the effect of a revised prompt, "Do a drawing which tells what you know about scientists and their work." They compared drawings done by children given both sets of prompts. The drawings showed enough differences that these researchers concluded their report with a recommendation that the DAST prompt be critically examined for what it actually was asking the students to draw.

L. Talsma V. L. (1997) has studied on the topic “Changing Images of Scientists in a middle-school Project-Based Science Classroom.” His study reports on part of a larger, ethnographic study in a sixth grade middle school classroom that is attempting to adopt project-based science (Blumenfeld; 1991). One of the emphases of the classroom teacher is that, during the course of the year, the students will be scientists in the classroom. Classroom instruction focused on authentic investigations of the students' environment, role-playing of scientists, and a post-modernist emphasis on how scientists "do" science. This study looks at how this emphasis affected students’ conceptions of scientists over the course of the 1995-96 school years. It was hypothesized that with the strong emphasis of "student as scientist" in the classroom coupled with the post-modernistic approach to science, that students would come to depict scientists with fewer
stereotyped features and more characteristics shared by the student. Preliminary analysis reveals that the hypothesis was partially supported. Over the course the year, students included fewer physical stereotypical features of scientists in their drawings and were more likely to draw a scientist as the same race as their own. Some students also reported that they had based their later drawings on themselves. The study revealed student perceive scientist as male, white, wearing glasses and gloves, working in laboratory, symbol of knowledge, nice personality etc.

Newton, L. D. and Newton, D. P. (1998) in their study on Primary Children’s Conceptions of Science and the Scientist, they have tried to find out the change of perception of scientist among the primary school students of USA after the imposition of National Curriculum order for Science. Past research has shown that children hold images of scientists and their work which fit a stereotype of scientists as male, balding, bespectacled and with a lab-coat, working alone in a chemistry laboratory environment. Recently there has been a suggestion that such images are becoming less stereotypical, at least in the U.K. The major change in science education in the U.K. during this time has been the introduction of a national curriculum. This study revisited primary children’s views after a period of five years, using a common procedure (DAST). During this period all the children had been taught science in line with the requirements of the English and Welsh National Curriculum order for science. They found that perception have not changed significantly over this period of time amongst primary school children, despite the imposition of the National Curriculum. Results indicated that there is still a gender biased stereotype and an unrealistic view of the scientists’ work. The need to analyze carefully and conservatively the data produced by such studies are emphasized and consequences for other countries introducing national curriculum are discussed.
Jones, M. Gail and Melissa, J. Rua (1998) have worked on the topic “Gender differences in student experiences, interests and attitudes toward science and scientist”. The purpose of this study was to examine 6th grade students’ attitudes and experiences related to science. The study involved 437 students who completed a survey designed to elicit students’ perceptions of science and scientists, out of school science experiences, science topics of interest, and characteristics of future jobs. Result showed that for the sample there continue to be significant gender differences in science experiences, attitudes, and perceptions of science courses and careers. Male reported more extra-curricular experiences with a variety of tools such as batteries, electric toys, fuses, microscopes and pulleys. Females reported more experiences with bread-making, knitting, sewing and planting seeds. More male than female students indicated they were interested in atomic bombs, atoms etc. whereas more females reported interest in animal communication, weather and AIDS. In addition when asked about future jobs male and female students responses differed by gender.

Yvonne, Y. H. Fung (2002) has studied on “A Comparative Study of Primary and Secondary School Students’ Images of Scientists”. He administered Draw-A-Scientist Test to 675 Hong Kong Chinese students to explore their images of scientists. The main purposes were to discover any differences across grade levels and between male and female students, and to see if the results were comparable to those found in studies in other parts of the world. As in the findings of earlier research, there was evidence that students developed a more stereotypic image of a scientist with age and that the scientists drawn were predominantly male. It was also noted that some students, though a small percentage, included special captions and comments to express their views of the scientist. While the DAST is a feasible and simple method, future studies should supplement it with interviews for deeper understanding of students' constructs.
Hatzinikita, V. (2009) has recently studied on “Images of the Scientists held by the Educator of Greece.” The research on the image of the scientist, as conceived by non-specialists (such as students and educators), has displayed a series of stereotypical characteristics in their representations of the members of the scientific community and the nature of their activity. The conceptions the educators handle of science and scientists play an important role in the construction of the students’ representations of these matters, as these conceptions form a ‘hidden curriculum’, which affects decisively their teaching practices. In this way, the educators who adopt stereotypical images of the scientists and their activity tend to have a negative impact on the students’ attitude towards science and scientists, which affects the future personal, professional and social choices of the students. The purpose of this study is to explore the images of the scientist as they are depicted in the drawings of educators. In particular, this study aims to explore the extent to which the stereotypical model of the scientist is possessed by the educators and the type of activities considered scientific, according to educators’ sex, represented scientist’s sex and the level of education the educators are employed in. The interest of this study lies in the fact that there are hardly any other pieces of similar research conducted in Greece, although they would be necessary because they could become a decisive first step in designing teachers’ preparation programs (e.g. syllabus and educational material) in a way that the educators could form a more relevant, meaningful and egalitarian image of science and the scientist as well as improve their attitudes towards them. The methodology employed in data collection and analysis is a modified version of the ‘Draw-A-Scientist Test’ (‘DAST’, Chambers, 1983; She, 1998). The DAST was administered to ninety-five (95) educators of primary, secondary and tertiary education and vocational training. Each educator was originally asked to draw a male or female scientist in their workroom before they produced a second drawing representing a
scientist of the opposite sex. The analysis of these drawings shows that the educators hold stereotypical images. Moreover, there are some interesting findings concerning the impact of educators’ sex and level of education they are employed in on the image of the scientist they hold as well as on the type of activities considered scientific.

Song, J. and Kim K. Suk (1999) investigated “How Korean Students See Scientist?” This study investigated five different aspects (mental image, physical image, source of the image, 'scientists around us', and 'my favorite scientist') of Korean students' images of the scientists. The data, quantitative and qualitative, from the responses of a total of 1137 students from three different groups (age 11, 13 and 15) were analyzed to calculate the relative frequencies of some identified patterns of responses and to make comparisons between different genders and different age groups. Korean students generally showed, but to a slightly lesser extent, some stereotypical images of the scientist which were revealed in previous studies. These were influenced more by affective and ethical personal characteristics of the scientist than by their cognitive and gifted abilities. Some noticeable age-related and gender-related differences were also found and discussed.

Narayan, R. et. al. (2009) has conducted a cross cultural comparative analysis involving children from India, South Korea, Turkey and the United States. The name of the topic was “Sculpted by Culture: Students’ Embodied Images of Scientists.” The study investigated children’s perception regarding scientists, the similarities and difference between their stereotypic perceptions of scientists and the cultural factors that contribute to them. The participant pool included students from grades 3 and 7 (120 per grade, per country). Who were administered the Draw-A Scientist-Test (Chambers, 1983). Randomly chosen students were also interviewed using a semi-structured interview protocol. A one-way ANOVA was performed to test for differences among the
four countries. Results revealed some commonalities in the stereotypic perceptions regarding scientists and discussed the “value” placed on science in these countries.

Sussan, C. Losh et. al. (2008) has worked on some methodological Issues with “Draw a Scientist Tests” among young children. In this study children’s stereotypes about scientists have been postulated to affect student science identity and interest in science. Findings from prior studies using “Draw a Scientist Test” Methods suggest that students see scientists as largely white, often unattractive, men; one consequence may be that girls and minority students feel a science career is “not like me”. However, a major shortcoming in prior research is that scholars have asked children to draw only scientists, thus making interpretations of earlier research findings ambiguous. They added other professionals to compare how 616 drawings of teachers, scientists, and veterinarians by 206 elementary school children varied by student gender, ethnicity, and grade. Students made clear distinctions: drawing teachers as most attractive and largely female and scientists as most often male and least attractive. Aspects of the drawing suggest that scientists do have an “image problem” among children. However, large sex differences in the drawings and often unrecognizable gender figures in boys’ pictures lead us to question use of the “Draw a Scientist Test” as a projective test among young children.

Banerjee, P. (2012) has worked on the topic ‘Image of a Scientist’ Among the Secondary School Students. The objectives of the study are –To identify the stereographic images of the students of class Xth about 1. the physical appearances of the scientists, 2. the symbols of research associated with the scientists, 3. the symbol of knowledge associated with the scientists, 4. the products of science, 5. the discipline of study associated with the scientists. This research showed that student think scientists mainly as a male, wearing lab coat, untidy appearance, using test tubes with some chemicals in an indoor
environment etc. The study is qualitative in nature. This is based on the projective technique to reveal the mental images of the secondary class students about the scientists. The population for the study is the total collection of secondary level students. However, a sample of only 240 students of class Xth of schools under Uttar Pradesh Board of Secondary Education was selected by incidental purposive sampling technique.

Tool Used: A check list was used to quantify the information as projected by the learners in their responses to the Draw a Scientist Test. The check list has 26 items grouped under 5 dimensions. Most of the items were taken from Draw-a-Scientist Test (DAST) by Nuno (1998).

PROCEDURE: Students were asked to draw two pictures on the given two sheets of white papers, of what they think a scientist may look like. They were told that (1) the drawings were for a research study and were not going to be evaluated; (2) the pictures may not necessarily be very artistic but should reflect the pupils’ idea about the physical appearance of a scientist and also the objects, environment and activities associated with him with maximum possible details. Approximately 15 minutes were given to draw each image. Drawing two sets of images are expected to provide them the freedom to depict cases like gender, discipline etc. with wider choices.

Finson, K. D. Pedersen, J. E. and Thomas, J. (2006) has studied on “Comparing Science Teaching Styles to students’ perception of scientists”. The purpose of this study was to investigate the relationship between teachers’ teaching styles (on a continuum from didactic to constructivist) and the perceptions their students held about scientists (from stereotypical to non stereotypical). One may hypothesize that constructivist, inquiry-oriented teachers are more likely to have students with perceptions of scientists that are low in their stereotypes. In this study, nine middle grades teachers’ teaching styles were assessed using the Draw-A-Science-Teacher Teaching Test Checklist(DASTT-C) and Many educational researchers seem to concur with the idea that, among other factors, the
teacher's teaching style has some impact on student learning and the perceptions students develop about science learning and the work of scientists. In this study, nine middle grades teachers' teaching styles were assessed using the Draw-a-Science-Teacher-Teaching Test Checklist (DASTT-C) and categorized along a continuum from didactic to inquiry/constructivist in orientation. Students' (n = 339) perceptions of scientists were determined using the Draw-a-Scientist-Test Checklist (DASTC). Teachers' teaching styles and their students' perceptions of scientists were then compared using nonparametric co relational methods. Results showed that no significant correlation existed between the two measures for the population studied. Although the study provides no understanding about when or how relationships developed between teachers' teaching styles and students' perceptions of scientists, trends in the results give rise to some concerns regarding the preparation of future science teachers and the in-service development of practicing teacher.

Huber, R. A. and Burton, G. M. (1995) had studied on “What Do Students Think Scientists Look Like?” The purpose of their study was to determine if there was a gender difference in the way nine to 12’year old students drew scientists before and after their teachers implemented intervention strategies. Rubrics were used to analyze for stereotypic characteristics such as sex of the scientist and the presence of eye glasses, a lab coat, funny hair, a weird smile, wild eyes, facial hair, robotic features, and facial scars. Results indicated that boys held more stereotypic views on pretest drawings than did girls and also demonstrated the most improvement to less stereotypic views as a result of intervention.

Turkmen, H. (2008) had conducted a study entitled ‘Turkish Primary Students’ Perceptions about Scientist and What Factors Affecting the Image of the Scientists’. The
purpose of their study was to analyze image of scientist from drawn picture of scientists using The Draw-a-Scientist Test (DAST) by 5th grade students and to analyze where this image comes from students’ minds in changing Turkish educational perspective. Two hundred eighty seven students from sixteen different primary schools, located in the same city, participated in this study. Like previous studies, the findings generally showed that scientists are male, Caucasians, elderly-aged, working indoors with chemistry. On the contrary, the image of scientists, having glasses and facial hair and/or crazy hair, wearing lab coats, and doing dangerous and secrecy things decreased but smiling scientists and indicator of technology increased in young Turkish students’ drawings. Eventually, stereotypical images of the scientist are a slightly lesser than revealed in previous studies. The impact of science teachers and textbooks has shaped what a scientist is and what a scientist does to young students’ minds. Notwithstanding, the influence of media (movies, magazines, television, etc.) has been pointed to as not significant source of information by students.

Monhardt, R. M. (2003) studied on Navajo children. His study describes data collected from the Draw-a-Scientist Test (DAST) that was administered to 94 Navajo elementary students in grades 4-6 to determine their perceptions toward science and scientists. The DAST is a useful assessment instrument for teachers interested in addressing stereotypes students may hold related to science. A commonly used checklist (DASTC) was used to score student drawings. In looking only at the numerical scores, it would appear that Navajo students generally have a much less stereotypical view of scientists than other populations reported from previous studies. However, a low score on the checklist may actually indicate that a student has no conception whatsoever of what a scientist is. Interviews with individual students were also conducted to clarify items depicted in the drawings. The Navajo student drawings provided additional information unique to this
sample that offers valuable insight into students' perceptions, beliefs, and values. This information may be useful to science educators who are interested in developing a culturally relevant science curriculum for Navajo students.

Koren, P. and Bar, V. (2009) had conducted a comparative study on pupil’s image of the scientist among two communities in Israel. They investigated the image of ‘the scientist’ and its effect on the willingness to be a scientist and to follow a career in science in two different cultural populations of elementary and junior high school pupils in Israel: Hebrew-speaking (secular) pupils \( (N = 390) \) and Arabic-speaking Bedouin pupils \( (N = 185) \). Five different tools were employed in their investigation (naming scientists, pictorial representation of the scientist (‘Draw-a-Scientist-Test’), statements regarding the characteristics of the scientist, reasons for wanting/not wanting or being able/being unable to be scientists, and sources of knowledge regarding the scientist’s image). The image held by Hebrew pupils was similar to those held by western pupils found in previous research, but some details were more elaborate (due to the fact that many different tools were employed here). However, the image held by the Arabic pupils differed from that found in previous research. This image had a strong ethnical trend, with Golden Age Muslim scientists’ names dominating name lists, and drawings of traditional Muslim figures. Another image found in their drawings was of a scientist admired as a teacher, emphasising the Bedouin school’s formal culture. The theory of modernity will be a useful analytical tool to judge the results of the investigation, whether the population is supposed to be (or is close to) a modern population and whether it does not, definitely, fall under this definition (see Methods and Discussion).

Koren, P. & Bar, V. (2009) has studied on ‘perception of the images of scientist by Israeli student teachers from two district communities in Israel: Arabs and Jews’. This is
a comparative study of the image of the scientist held by Israeli Jewish and Arabic student teachers from various backgrounds. The image of female scientists among these groups was also investigated. Five groups of female students (N=500) from four colleges were studied. Traditional tools (DAST) were combined with more informative methods (captions, statements, and free writing) and supplemented by interviews. The stereotypic image of the scientist was found to be a bespectacled male using conventional research equipment, who prefers intellectual occupations for leisure pursuits was perceived by most participants. The image held by the secular Jewish student teachers largely conformed to the Western image of the scientist – a disheveled man working in a laboratory, with few social connections. An image of a scientist as a revered, authoritative teacher or scholar emerged amongst the traditional groups (Bedouin, Orthodox, and Ultra-Orthodox). The image found amongst Arabic student teachers of the North (a moderately traditional group) was unique: a young scientist, using computers, whose work is partially done outside of the laboratory. Among the traditional groups, the female scientist is perceived to be “torn” between her career and tradition. Conclusions from this research and implications for science study and teaching curricula are discussed.

Rubin, E. et. al. (2003) conducted a study in which they investigated the image of scientists held by Israeli pre-service teachers, the majority of whom were female. The population consisted of students belonging to two cultures, Hebrew-speaking and Arabic-speaking. The DAST ('Draw-a-Scientist-Test') tool and other tools, some of which were developed specifically for this research, tested the image of the scientist as perceived by the participants. It was found that the image of the scientist is perceived as predominantly male, a physicist or a chemist, working in a laboratory typical of the eighteenth, nineteenth or the early-twentieth century. Students did not differentiate
between scientists and inventors. Different images were held in the two cultures. Most of the Arabic-speaking students put Classical Islamic scientists near the top of their lists and thought of the scientist as an Arab male, while the Hebrew-speaking students' was as a typical Western male. Recommendations, resulting from the findings, for developing a new learning unit for the purpose of altering stereotypes are suggested.

Christidou, V. and Kouvatas, A. (2013) studied on the topic “Visual self-images of scientists and science in Greece”. In their study they investigates crucial aspects of the visual self-image of Greek scientists and science as exposed in photographic material retrieved from relevant institutions’ websites. In total 971 photos were analysed along dimensions corresponding to the image of scientists and science. Analysis demonstrates ambivalence in Greek scientists’ self-images between traditional stereotypic characteristics and an intention to overcome them. Differences between the self-images of physics, chemistry and biology are determined, as well as between the “masculine” and “feminine” face of science. Implications concerning improvements in science and scientists’ self-images and further research are presented.

Steinke, J. (1997) studied on the topic “A portrait of a woman as a scientist: breaking down barriers created by gender-role stereotypes”. From his study he found that, Educational, attitudinal, and socio-cultural factors create baniers that prevent girls and young women from pursuing opportunities in science. Of these baniers, gender-role stereotypes of science have been cited as a significant obstacle. This research analyses a US television series that counters gender role stereotypes of science. The analysis found the images presented on this series challenge previously reported stereotypes of women scientists shown in the US media by emphasizing the expertise of women scientists, showing alternatives for balancing the demands of their professional and personal lives,
and providing examples of role models who have succeeded in male-dominated fields. The significance of these results are discussed in light of gender schema theory and the need for future research on the effects of women scientist role models on girls’ and young women's interest in science.

Oktay, O. & Eryurt, K. (2012) studied on ‘How High School Students Represent the Images of Scientists in their Minds’. The purpose of the study was to explore high school students’ images towards the physicists. Also this study investigated whether any changes of this images occur among grade levels. For this aim, “Characteristics of a Physicist” questionnaire (CPQ) was developed by the researcher. This questionnaire was completed by 220, 9th and 12th grade high school students. Convenient sampling was drawn from the high schools in Ankaya district of Ankara, Turkey. Quantitative and qualitative analysis were used. Themes and patterns were identified based on students’ responses. Suggestions and implications were also discussed.