Bölcsészdoktori Disszertáció

INTERDISCIPLINARY LEARNING IN GIFTED STUDENTS' CLASSES,

AN EDUCATIONAL EXPERIMENT IN A HIGH SCHOOL

WINTER SHOSHANA

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EÖTVÖS LORAND UNIVERSITY, FACULTY OF ART

PH.D. SCHOOL OF EDUCATION

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Abstract

The aim of the present research is to examine the impact of interdisciplinary curricula described in the present research over the attitudes of gifted students regarding school, the class, and the teachers, and the attitudes of students regarding interdisciplinary curricula, challenges to their thinking that the programs provide, and attitudes towards the program itself. The interdisciplinary curricula reflects the spirit of the time by allowing each student to express his unique manners of thought and fulfill his needs for challenges.

Relevant literature relates to several theoretical issues, including: Educational Frameworks for the Gifted, Attributes of the New Era, Innovation in Teaching and Needs when Teaching the Gifted, Who is the Desirable Teacher? and Interdisciplinary Programs, as presented by educational researchers and theoreticians.

The literature review shows that there is no single method or one uniform framework for educating gifted students. There are a variety of options for morning studies and a wide variety of options for enrichment. Many studies examine the advantages and disadvantages of learning in the classroom versus learning in enrichment frameworks. There is no consensus among researchers regarding the preferred academic framework for gifted students providing a response to all of their needs.

The literature shows that the new era is characterized by continual change. The creation of a flexible organizational structure may provide a response to frequent changes. Like other organizations, schools are going through a process of organizational change through the use of information technologies and more. In educating the gifted, emphasis is placed on understanding their special manners of thought, their need for challenges, and cultivating understanding for complex thought methods among gifted students.

The vision of the Gifted Students' Department in Israel in this new era discusses shared excursions of teachers and students to unknown realms

A quantitative methodology was employed, supplemented by qualitative observations. data was collected and analyzed by means of interviews and statistical tools in order to examine the attitudes of gifted students towards the research variables.

The results indicate that the school as an organization can respond to the needs of the Gifted students, and create a more challenging way of learning, with the aid of an interdisciplinary program. This learning

method satisfies the intellectual needs of gifted students and has a positive impact over their attitudes towards all of the entities within the school. Particularly positive attitudes were found regarding teachers who teach these programs.

The results confirm the hypothesis that a school that suits itself to the attributes of the new era can satisfy the intellectual needs of gifted students within school walls and not only with the aid of experts from academia or external entities, and in this way can improve the attitudes of gifted students towards the school in which they learn.

It is my hope that the system outlined in this research will be of value to other schools as well.

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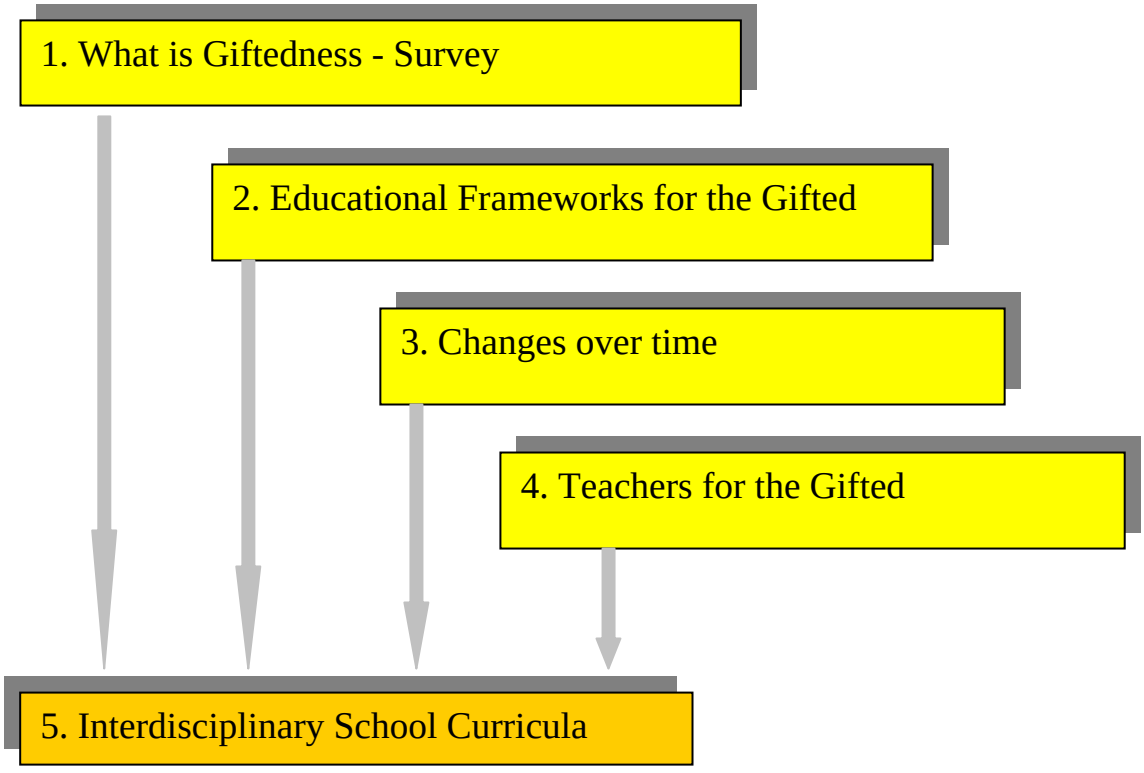
Educational Sociology - Literature Review

The present chapter will provide a short survey of the definition of giftedness and how it has changed with the addition of research throughout the years. I will then relate to the official educational policy in Israel, which emphasizes integration of students, and provide a description of frameworks for gifted children which have developed both in keeping with and in opposition to official educational philosophy. I will then move on to describe trends in educational innovation and how these are expressed in teaching the gifted in general, and in Israel today, at the end of the 20th century and the beginning of the new millennium.

The many approaches that exist today towards education of gifted children testifies to the fact that there is not one single leading approach. Attempts to cope with the many innovative approaches have created local solutions. Each school operates based on its outlook and understanding, relating to innovative trends and attributes of the new era. The following will be a short survey of the attributes of this new era, and what innovation and renewal in education are. I will describe a number of the new leading and central approaches in teaching gifted children, and what needs these approaches satisfy. Furthermore, I will relate to curricula for gifted students, interdisciplinary learning, and of course, teachers who teach the gifted, and the impact of their training over the quality of teaching.

The following figure illustrates this:

Figure 1: The Structure of the Chapter



What is Giftedness - A Survey

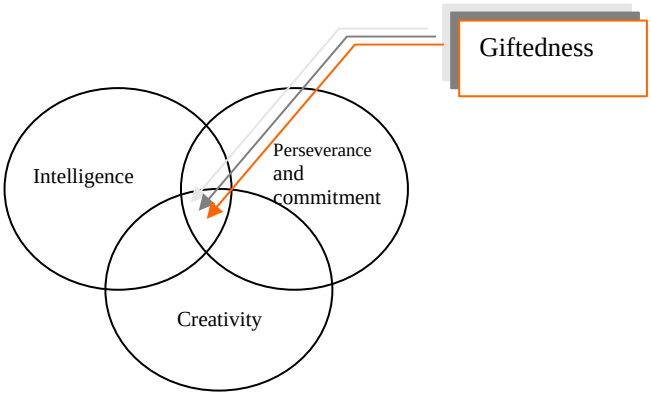
A short historical survey of the 20th century regarding the issue of giftedness, shows that the first definition of the concept of giftedness was provided through the research conducted by Terman (1925). Terman, who broke the perception of genius = crazy, summarized his research in five volumes, each of which dealt with a different period of the life of the gifted adolescent. Terman determined giftedness as a high level of intelligence determined through the use of intelligence tests. Many studies that followed Terman's in this same era, based their definition of giftedness on level of intelligence.

In the 1970s, the American psychologist, Marlend, headed a Congressional committee to examine the issue of nurturing the gifted. Marlend added new dimensions to the definition of giftedness. According to his definition, giftedness involves multiple talents. In addition to intelligence - general intellectual ability and a specific academic tendency, it was also necessary to relate to creative thought and special talents, which could be social leadership, artistic talent and psycho-motor talent. Marlend's approach contains a number of advantages: 1) it defines giftedness as a variety of talents; 2) talents can be defined and measured; 3) it allows identification of the gifted and consolidation of programs satisfying the needs of the population. Today, Marlend's approach is the accepted one (Marlend, 1971), as it involves intelligence, special talent and creativity. In the United States it is the official definition of the American Education Department, which provides gifted and talented students who have passed specific tests, with services and activities not provided generally by the school.

Among the additional bricks added to expand the concept of giftedness, it is important to note Gardner and Renzulli.

Renzulli (1978) argued that giftedness is an interaction between three clusters of criteria: 1) high cognitive ability; 2) the ability to persevere in tasks until completion; 3) creativity - expressed in cognitive flexibility. Cognitive flexibility is expressed through identification of problems, creating ideas, new products and originality in applying ideas to solve problems. Renzulli described this model as a Three Ring Concept of intersecting rings:

Figure 2: The Three Ring Concept



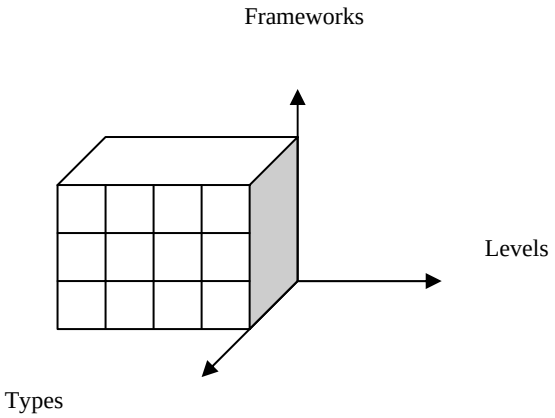
According to Renzulli, giftedness is the existence of all three conditions together, i.e., the intersection of the three rings. Furthermore, the gifted individual must be above his age group by one standard deviation in all three of the criteria, and be in at least the 98th percentile in at least one of these areas.

Gardner (1983) identified six separate intelligences: Verbal, logical-mathematical, spatial, musical-physical-kinesthetic, interpersonal, and intra-personal. According to Gardner, when the individual begins to develop these intelligences, it is reflected in biological potential, like good hearing, sense of rhythm, coordination, etc. Later it is in use of different systems of symbols, written and visual. The separate intelligences create basic abilities for various functions within society and culture.

The literature lists many more theories, of which I will mention three:

The Four Component theory by Haensl, Reynolds & Nash (1986) attributes four components to giftedness: consolidation, circumstances, conflict and commitment (a component mentioned by Renzulli also). Roberta Milgram (1989) constructed a different model for the description of giftedness. She describes giftedness using a cube with four levels, four types and three frameworks. The levels are: profound giftedness, moderate giftedness, mid-giftedness and non-giftedness. The types are: high general intelligence, intellectual skill, original thinking and specific creative talent. The frameworks are: the home, the school and the community

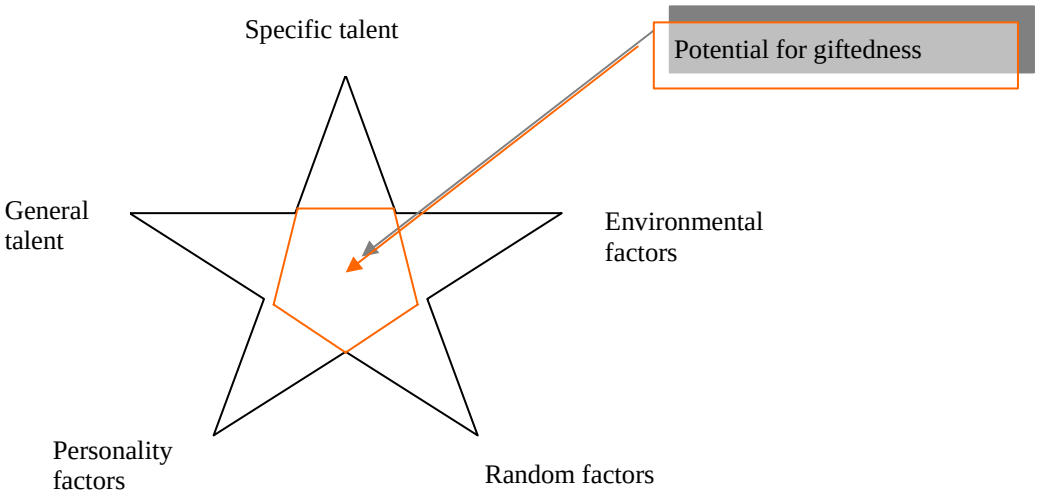
Figure 3: The Milgram Giftedness Model



All of the combinations describing giftedness according to this model equal 48, which emphasizes the great variety between students defined as gifted.

Tannenbaum's giftedness model (1983) belongs to the psycho-social approach. According to this approach as in multi-dimensional approaches like Renzulli's described above, there are five psycho-social factors. All of the factors together signify the potential for giftedness. The factors representing the potential for giftedness according to Tannenbaum are: general ability, specific talent, personality factors, environmental factors, and random factors. Tannenbaum's giftedness model can be represented by a star. The common area of the five points of the star signifies the potential for giftedness.

Figure 4: Tannenbaum's Giftedness Model



It should be noted that intellectual excellence may be measured and identified using tests (Goldring, Milgram & Chen, 1998). The approach at the basis of the study and the cultivation of excellent intellectual ability among children is the normative-statistical approach (Ziv, 1990). Statistics allow describing the abilities of every individual in comparison to others. The intellectual ability of the population is measured using psychometric test results that are distributed according to a normal curve. The three upper percentages of the curve are defined as gifted. In a draft document presented to the Israeli Ministry of Education by the committee headed by Professor Nevo (2004) the gifted are defined as the upper percentile of the population each year, assuming they also fulfill the criteria of motivation and creativity.

The many existing theories show how varied giftedness is and how little of giftedness is measurable.

In conclusion:

There is no single definition of giftedness. Over the past decade a number of definitions have been constructed, based on research, expanding upon the concept of giftedness, beyond pure intellectual ability. In the United States, Marlend's definition is accepted, that giftedness is multi-talented and connects intellectual ability, special talent and creativity all together.

Educational Frameworks for Gifted Students

Integration versus Separation

The Israeli educational system is based on the principles of academic and social integration as accepted within egalitarian social perceptions. The concept of giftedness is connected with elitist outlooks. In Israeli it has also taken on an ethnic ring, as IQ testing has shown a higher representation of males from Western ethnic groups. This is one of the reasons that may explain why no efforts were made to formulate policies regarding the gifted until the 1970s (Goldring, Milgram & Chen, 1988). Goldring, Milgram & Chen list further reasons for this:

Lowering of level: Concern that removing gifted children from integrated classes will lead to a decline in the average level of the class.

Distancing children who serve as an example: The lack of gifted children in a class will lower or cancel out the vital positive group within the class.

Chain reactions: Gifted students leaving for unique and separate frameworks will lead to a chain reaction causing other talented students to leave the school also, particularly if they belong to the established social stratum.

Change in center of educational-therapeutic gravity: Concern that talented students want to leave the school will lead the school administration and teachers to change the focus of action and distribution of resources to benefit the gifted so that they stay. This will lead to neglect of the weaker stratum, towards whom integration is aimed.

Homogenization and decline in inter-racial relations: There is concern that if the more established children leave the school and only the mediocre to weak stratum remains this will increase ethnic issues. The richer schools will contain mainly children from Western backgrounds, and poorer schools will include mostly children of Oriental origins.

Teachers leaving: The normal teacher will prefer teaching children of a higher academic level.

However, those supporting the creation of unique frameworks for the gifted contradict each one of the arguments raised above.

Regarding the lowering of level argument: 1) The percentage of gifted students removed from classes is so small that there really is no lowering of the academic level. 2) The gifted student learning in the regular class does not fulfill his potential and therefore he becomes a disruptive influence in the class because of his frustration.

Regarding the argument of distancing children who serve as an example: there are talented and diligent children in every class who are not gifted. These students are a positive role model even more effectively, as they invest in preparing their lessons and make more effort than gifted students in order to achieve.

Regarding the chain reaction argument: Goldring, Milgram & Chen argue that there are empirical findings that this has not occurred in any of the cities which have established special classes for the gifted. When gifted students leave the class, the academic and social situations of the talented and mediocre students improve. Therefore it is doubtful that they would like to be back in educational frameworks with gifted students.

Regarding the argument of changing the academic-therapeutic center of gravity: Researchers argue that integrative schools already pay a great deal of attention to the higher strata when dividing classes into levels based on ability. Even in development towns, in integrative schools, there are unique programs for better students in order to prevent them from "running away".

Regarding the argument of homogenization and undermining ethnic relations: Here to no empirical observations supporting this argument have been found.

Regarding the final argument regarding teachers leaving: According to Goldring, Milgram & Chen, most teachers who teach the gifted are not teachers who teach in regular schools or who teach students of neglected areas, but rather teachers with a broader education and of higher standing. Therefore there is no expected impact related to teachers trying to get away and teach the gifted instead.

As previously mentioned, the outlook towards education in Israel is an egalitarian outlook, but this harms the populations on both peripheries. There is more and more of a need to care for these populations on the edge in unique educational frameworks.

Educational Frameworks

Since the 1980s, special programs for the gifted have begun operating in various frameworks and through various and sundry organizations. These programs aim to provide a unique education to gifted students. These arrangements are called "Delivery Systems" by Goldring, Milgram & Chen (1989). These frameworks are totally different from one another and come in a number of formats, beginning with dormitories and ending with complementary afternoon education. Furthermore, a number of special classes have been constructed for gifted students.

Goldring, Milgram & Chen classify educational frameworks in Israel into 11 delivery systems that may be divided into two main groups: alternative systems and complementary systems.

The alternative systems are systems in which the curriculum for the gifted students takes an entire day of studies and is a full alternative to the regular study hours. This group includes:

1. Special schools operating as dormitories, such as the Boyer School and the School of Sciences and Arts in Jerusalem.

2. Special full day schools for children with high academic abilities and high academic achievements, such as the "Reali" school in Haifa.

3. Specialty high level schools (Magnetic schools) aimed towards students with high academic abilities in a specific subject or having special skills in music and art, such as the Telma Yellin school in Givatayim. These schools accept students from the entire region.

4. Special classes for the gifted operating full time within regular schools, such as: Municipal School D in Tel Aviv and the school that is the subject of the current research.

5. Special classes on a part-time basis with students "taken out". In these schools the gifted students learn in heterogeneous classes but are "taken out" to separate classes for part of their studies. Sometimes they are taken out to classes that are not physically in the student's school but rather in another school in the area, as is done in the Gifted Students' School in Kfar Tabor.

6. The gifted student studies in a regular school in a regular class with the aid of a teacher with special skills in individual teaching of the gifted, such as the elementary school and junior high school in Yavneh.

In her article, Burg expands upon the fourth possibility of the alternative system described by Goldring, Milgram & Chen, i.e. classes for gifted students operating in regular schools.

There are ten high schools in which special classes exist for the gifted, she says. There are three interchangeable ways of conducting this program (Burg, 1984).

1. Topics and subject matter which are prescribed for higher grade pupils in regular classes are taught in lower grades in these special classes.

2. The regular curriculum of the Ministry of Education and Culture which is compulsory for all students in regular classes is taught in special classes, with more insight and depth.

3. Special curricula which include some elements of the regular curriculum and additional topics not prescribed by the Ministry of Education and Culture.

It should be noted that the school that is the topic of the present research belongs to the second category. With the addition of the interdisciplinary programs that will be discussed below, the school also adds itself to category 3.

Complementary Frameworks

Complementary frameworks include five models as will be detailed below, and are offered to gifted students in addition to their regular schooling.

1. Registration to university and high school simultaneously.

2. Clubs in colleges and universities aimed at children of high intelligence.

3. Afternoon classes at colleges and universities for students with specific skills that provide enrichment and advancement.

4. Classes and clubs offered publicly or municipally.

5. Afternoon classes in a private framework such as classes offered by Erica Landau.

The Richardson Report (Cox, Daniel & Boston) mainly compares between classes for the gifted in regular schools and classes that receive students who are "taken out". They argue that the "taking out" program aimed at satisfying complementary needs, positions the student in two frameworks and therefore provides a "partial solution to a multi-faceted problem". The report generated by Goldring, Milgram & Chen (1989) argues that full alternative frameworks are more effective from the standpoint of academic achievements, and more financially feasible. However, they raise arguments presented by those in opposition: distance from home, detachment from friends in the neighborhood, the possibility of developing low self perception because they are only average students among all other gifted students, lowered levels of classes that the gifted students leave, harm caused to integration, etc.

To date, there has been no unequivocal determination regarding the contribution of unique homogeneous classes for the gifted.

Landau argues that the child must be raised with average children at least until age 12 because he will have to live in this world in the future (Landau, 1990). On the other hand, Ben Shlomo argues that in gifted classes the student encounters other children similar to him and even

better than him which prevents pride and conceitedness (Ben Shlomo, 1992). Clark adds that gifted children need to learn with others who challenge them and therefore it is best if most of their studies be in special classes (Clark, 1988). Wooldiff reinforces this argument saying that the gifted child should have contact with other children who are more likely to accept and understand him (Wooldiff, 1977).

Chen (1997) recommends integrating gifted children in regular classes and having a weekly meeting in gifted classes to learn three semester classes, allowing broader interaction: both with the students in the regular class in the regular school framework and with other gifted students in weekly meetings. The weekly meetings can make up for the boredom experienced in the regular class. Filling in the missing material on the day that the students are not in school allows additional interaction with students in the regular class. This solution is similar to the approach taken by Landau.

In any case, Chen notes that the cost of enrichment always falls on the parents.

On the other hand, Shlier and Shield (1996) surveyed attitudes of students in gifted students' classes versus those learning one day in gifted programs and found high satisfaction in both groups. However, those who studied in special classes all week were more satisfied. Attitudes of gifted students in this group towards the openness of teachers and level of study in the class were also higher than those of students who studied in one weekly day of enrichment.

The Ministry of Education continues its policy of integration and equality, but identifies these marginal populations: There is a department handling the weaker populations and a department for the other extreme - gifted and talented students. These exceptional populations have been referred to more appropriate frameworks more and more, over recent years.

In conclusion:

The Israeli educational system is integrative. In recent years emphasis has been placed on providing a response to populations on the fringes, among them the gifted.

There are a variety of options for morning studies and a wide variety of options for enrichment. Many studies examine the advantages and disadvantages of learning in the classroom versus learning in enrichment frameworks. There is no consensus among researchers regarding the preferred academic framework for gifted students providing a response to all of their needs.

Changes Over Time

The many definitions of giftedness that have been constructed over the years are a result of studies conducted regarding the characteristics of this population. Together with these studies, there is additional information regarding the intellectual, emotional and social needs of gifted students. At the same time, with the rapid development of technology at the end of the previous millennium and the beginning of the new millennium, new research based knowledge has been added regarding the nature of the era in which we live. The impact of new trends within "knowledge culture" and technological developments have been expressed in methods of teaching the gifted student population also. It is necessary to be familiar with the attributes of the era and teaching methods for the gifted that have developed during this time frame.

Attributes of the New Era

Change as a Value

The era in which we live, the "information era", is not the continuation of the past, and cannot be constructed based on the past. Our era is characterized by continual change (Toffler, 1977). Sometimes changes are the goal, an alternative to stability and permanency, which are perceived to be a state of being frozen in place (Porter, 1977).

The literature emphasizes changes as the main attribute of the beginning of the 21st century. Hammer and Champy (1993) argue that actually, change has become permanent. Change is the normal state. Bennis (1977) argues that the leaders of tomorrow will need to create an environment that encourages change, not as a necessity but as an opportunity. Tomorrow's leaders will be tested in their ability to diagnose a need for change and to suit themselves to changes. Tom Peters (1994) feels that the rapid and wild rate of change will continue forever, and it is necessary to continually act to reinvent.

In a world in which continual change has become a value, a reality is created that requires the individual to be involved, to initiate, to innovate and to continually adapt.

Knowledge and Command of Information as a Value

"In our era, scientific and technological knowledge are the most important economic asset…" (Harari Committee, 1992). Society is moving from mechanical industry to knowledge and information industry, where brain power is taking the place of mechanical work. All types of science are leading to new technologies stemming from the direction taken by human

knowledge, based on computer assistance, and drawn from knowledge not experience (Toffler, 1992).

In order to maintain any sort of advantage over others, it is necessary to have the skill to obtain information in real time. Analysis, classification and organization of knowledge will lead to gaining social, cultural and economic advantages (Kennedy, 1993).

Knowledge has become an important value. On the other hand, new technologies, i.e. computers and the internet, increase accessibility, and cause a flood of knowledge, creating a need to organize and disseminate it. New electronic communication networks are developing, allowing analysis of data **connecting between concepts**, constructing systems to draw conclusions, and processing data, and as such, new and more original information is created (Toffler, 1992).

The fact that the importance of human knowledge has gone up a level also affects the educational system and reinforces the need for the educational system to become organized towards changes in all sectors of society. As Chen stated: "The educational system, whose main concern is the mutual relations between the single student and public knowledge which has accumulated within culture and society, cannot continue to ignore the social revolution fed from new information technologies" (Chen, 1999).

The many and rapid changes that are occurring are seen in the structure of organizations that must function in a constantly changing world full of contradictions: centralizing and decentralizing at the same time, growing to become more flexible or becoming smaller to become more flexible, acting to develop the individual and to develop team work at the same time, delegating responsibility but maintaining a core that coordinates all activities.

Handy (1977) sees flexibility of the organization and its ability to change as one of the cornerstones of the contemporary organization. Rigid and uniform organizational structure must make way for a flexible organizational structure that is able to change and reconstruct in a manner allowing the individual to innovate and renew, so that the organization may satisfy the needs of its clients.

Peters (1994) considers organizational innovation as changing existing structures and mixing them together. It involves the creation of new teams: pairs, triads, etc, which will create symbiosis with clients. Above all, change must be continual.

According to Senjey (1995) teams within the organization must continually learn, develop tasks and develop innovative and suitable actions.

The new organization allows the individual to be empowered (Peters, 1994) thanks to his relative advantage within the organization, his initiative and his degree of creativity on one hand, and his ability to fit in with the team and consider the entire system, on the other hand.

Educational Innovation

In order to respond to these problems and coordinate schools with the challenges of the 21st century, many innovations have been proposed (Sarason, 1990; Sizer, 1984, 1985; Aviram, 1995). There is no consensus among researchers regarding the point at which change must begin at school. Chen argues that the central instrument for change in relations between the student and knowledge is use of information technology (Chen, 1995). Other proposals include beginning with change of the organizational structure or organizational culture of the school, such as the roles of the teacher in the new era, training and advanced training, and division of time (Silberstein, 1991; Sheran & Shahar, 1990; Goodlad, 1991; Sarason, 1993).

Postman, who discussed "gods who let us down", emphasizes the need for an updated definition of school goals (Postman, 1998). Sizer argues that the difficulty is in the large number of subjects, and therefore it is necessary to learn fewer subjects but rather emphasize focusing on specific study tracks. He presents the "Atlas" project as a model for a high school that incorporates all of the attributes of the community (Sizer, 1993).

Educational innovation and renewal are two concepts whose definitions are hazy and unclear. Bamberger argues that they are difficult to define because they depend on culture, situation and research paradigm (Bamberger, 1991). Innovation in education may be found in many contexts, beginning with application of new methods and technologies in education (Chen, 1995a), via processes of reconstruction (Sheran, Shahar & Levin, 1998), or even establishment of innovative schools (Tobin, 1997). Tobin's definition for educational innovation is: "The input, procedures and products that differ from the existing standard and affect educational action". Emphasis is on methods of action that differ from the norm, including innovative application of new ideas, such as investigative learning as presented by Dewey at the beginning of the previous century.

According to Tobin, innovations are the result of a process which begins with leadership based on a rationale and a vision. Leadership must be formative leadership, with charisma and inspiration, personal attention to those involved, and creativity in problem solving. These forms of behavior are expressed in mechanisms for implementing the vision and creating a common language, to overcome opposition and motivate

followers to create new schemes of operation. These schemes organize division of labor, coordinate schedules, and apply innovations within the daily life of the organization.

Innovation in Teaching and Needs when Teaching the Gifted

It is not only in general schools have innovations been proposed, but a number of models have also been constructed in specific relation to gifted students. Renzulli (1994) discusses schools for nurturing talents and proposes integrating school frameworks with organizational components for the creation of new subject matter and methods of assessment in school. This connection will emphasize aspects such as teaching and learning for the purposes of lengthwise and widthwise enrichment, use of different techniques to suit curricula to different students, and use of a portfolio for assessing students.

These schools will contain components such as: Enrichment clusters for areas of content and a variety of differential learning options to enrich knowledge and delve into areas of interest, both in special groups and in programs suited to individuals. Gardner (1993) relates to methods for applying the theory of multiple intelligences in school, but his work concerns elementary school. Rachmel (1998) the manager of the Department for the Gifted in the Ministry of Education proposed an experimental program for nurturing the gifted in schools in which the class studies 41 hours per week. The program is based on Renzulli's enrichment program (Renzulli, 1994) and additional approaches. According to Rachmel, students with greater abilities will develop their hidden potential only in an environment that provides appropriate challenges and allows them to work on their own level and at their personal rate. Gifted students must develop higher order reasoning skills that they will required later on. A number of attributes of the proposed program are:

a. Choosing content and processes according to the problem and the product that the student chooses to produce. According to Tishman, Perkins & Jay (1996), preferable an open problem that has no unique solution and having implications regarding many areas of knowledge is preferable.

b. The student asks the questions and searches for the solutions to his questions. The learner is a problem finder, problem solver and creative producer.

c. The teacher/expert: the role of the teacher is not just to teach but to coordinate and direct, to be experts in the field and provide information sources.

d. Personal mentor for the student: Zorman (1993a, 1993b) states that people who have obtained unusual achievements have been accompanied by personal mentors. These mentors may be more advanced students (Prillman & Richardson, 1989) or professionals (Davalos & Haensley, 1997; Goh & Goh, 1996; Zorman, 1993b).

e. Access to computerized information sources.

f. A flexible framework that takes into consideration the resources of the school, institutes of higher education and research institutes in the environs, the possibility for constructing a personal schedule for the students. Maker (1982) and Van Tassel-Baska (1988) discuss the need to cultivate understanding of complex thought methods among the gifted. Regarding teachers, these must be carefully chosen. Various studies conducted in the United States (Arlin, 1993 ; Arnold, 1995; Bloom, 1995; Parker, 1996; Landvogt, 2000) have outlined a number of ideal teacher attributes, such as: broad and in-depth knowledge in the subject matter; a passion for their area of expertise and enjoyment of teaching; understanding the developmental psychology of gifted students and familiarity with different definitions of giftedness; willingness to take risks and try new methods; and sharing the learning process with the students.

In their articles, Shore & Kanevsky (1993) quote research that indicates that gifted students have unique thought traits, and therefore it is not sufficient to group them in special classes or in special enrichment lessons, but there is a need for **unique curricula**. The following are only a few of the main attributes that separate the thinking of the gifted student from that of the regular child:

Memory and broad base of knowledge: gifted children have more knowledge than their peers, but the difference is not only in this -- their knowledge is also more well organized such that connections between pieces of information are more clear to them, and new knowledge that is acquired is immediately and easily connected to previous knowledge.

Processes of controlling thought: Gifted students are more aware of their thought processes and use meta-cognition more readily - control over thinking processes aimed to improve their function. This meta-cognitive ability helps in processes of transmitting thinking skills from one field to another such as applying mathematical reasoning to a literary problem, and vice versa.

Procedural knowledge: gifted children know how to explain how they reach a solution or why they chose a certain method of solving a problem.

Flexibility: Among gifted students it has been found that they have two types of greater flexibility of thought:

- Representing the problem in various ways: Gifted children know how to represent a problem in a number of parallel manners.
- Changing strategies as necessary: during the problem solving process gifted children are more open to the possibility of changing strategy when one is proven to be ineffective.

Preference for complexity: Gifted students have been found to prefer more complex problems that are a bigger challenge.

The conclusions that can be drawn are that the difference between gifted children and other students in all areas related to thought, are not just quantitative, but also qualitative. Gifted students think differently, not just faster. Therefore, according to the authors of the article, methods for educating the gifted based on acceleration (learning the regular material but in a shorter period of time) do not satisfy the needs of gifted students because this provides only a quantitative solution, while the need is for a qualitative solution. Curricula that satisfy the needs of gifted students will be **curricula that consider the unique manners of thought** of the students, and therefore use teaching methods that differ from those accepted in regular education. Plucker & McIntier (1996) reinforce the argument that students with greater abilities **need challenges**. According to them, the main factor behind the lack of challenge is a lack of appropriate differentiation from the regular curriculum, that has declined greatly in its level of difficulty in recent years. Kirst (1982) estimates that the level of difficulty of texts had declined at least two levels. Plucker and McIntier add that a lack of challenge from the standpoint of students with higher abilities can be the main reason for them to lose their **positive attitude towards school**. According to Feldhusen & Kroll (1991), "gifted students who are not challenged with appropriate study material and appropriate teaching strategies lose their motivation to learn and become students who do not fulfill their potential". Plucker & McIntier add, when they lack challenge the students use either the strategy of selective attention or selective effort to maintain satisfactory levels of interest and challenge in their studies.

They present a number of cases that describe how gifted students create challenges for themselves or alleviate boredom in class. An example of setting challenges is: Jenny decides to "try to set challenges in classes (that are not difficult enough". She attempts to see how many problems she can answer correctly or how many question she could answer. An example of alleviating boredom - selective attention: During a 45 minute lesson in natural sciences, the student wrote a note to a friend, answered a friend's

question, joked with another student, prepared a project for the next lesson, read his textbook, but was the first one to raise his hand and answer the teacher's question. He went back to his other activities, but when another question was asked, he raised his hand immediately.

What is interesting in the research by Plucker & McIntier are the many statements of students testifying that they prefer participating in activities with adults, particularly with their teachers.

It is important to mention the vision of the Ministry of Education regarding gifted students. I was a partner in a team of school principals writing the vision of the department according to the viewpoint of the school. As it was consolidated the vision focused on breakthroughs: teachers and students leaving the realm of the known together, in school processes and products, both pertaining to teachers and to students.

In conclusion:

The new era is characterized by continual change. The creation of a flexible organizational structure may provide a response to frequent changes. Like other organizations, schools are going through a process of organizational change through the use of information technologies and more. In educating the gifted, emphasis is placed on understanding their special manners of thought, their need for challenges, and cultivating understanding for complex thought methods among gifted students. The vision of the Gifted Students' Department in Israel in this new era discusses shared excursions of teachers and students to unknown realms.

Teachers for the Gifted

Who is the Desirable Teacher?

To date, there are no guidelines or any defined policy for the choice of teachers to teach gifted students. Principals of schools that operate gifted students' classes have learned over the years which teachers are suitable for teaching the gifted.

A number of years ago, at a convention of the Gifted Students' Department in Israel, a seminar was dedicated to the topic: "Does the Gifted Student Need a Gifted Teacher?", in an attempt to characterize the most appropriate teacher for teaching gifted students. In a lecture by Schulman (1999) he asked: "What does it mean for a teacher to be gifted, and are special gifts needed in teachers to teach students who are gifted".

He states that he remembers teachers who affected him and their main opinions inspired him and puzzled him for many years. He argues that interactions among the scientific, the practical and the moral are absolutely necessary aspects of the work of teachers.

He adds: "I would argue that the essential character of giftedness in teachers is associated not with their initial state, but with their development of capacity to learn. They must learn from their own experience, vicariously from the experiences of others, and from new concepts and ideas. In turn, they must learn to connect what they learn back to their ongoing practice and experience".

At the same convention, Mevarech (1999) spoke about the quality of teaching saying, "I must quote Ben Blum who discussed "quality of teaching"". Mevarech added that quality of teaching contains four components: 1) correct diagnostic ability of learning (what the child does not now know to this point); 2) ability to explain; 3) corrective feedback to allow the student to correct learning and attain command of the material; 4) motivation component, self image, etc., which a good teacher must also cultivate.

Mevarech adds, "When Blum spoke about the good teacher, he compared between the teacher and the sports coach, who also must actually perform diagnosis, provide feedback, and provide instructions for improvement".

In the United States, a number of literature surveys have been conducted dedicated to the attributes and skills of good teachers for gifted students (Bishop, 1968; Feldhusen, 1985; Feldhusen & Hansen, 1987, 1988; Hansen & Feldhusen, 1992; Haltgren & Seeley, 1982; Maker, 1975; Seeley, 1979; Sisk, 1975). These surveys indicate that the most important characteristics of teachers for gifted students are flexibility, excitement,

self confidence, high intelligence, broad cultural background, suiting assessment methods to the unique needs of the gifted student, in depth understanding of developmental psychology of gifted children from a cognitive, social and emotional standpoint, and the **ability to cultivate thought and high level problem solving**. Above, I mentioned additional attributes: broad knowledge in an area of expertise, love (passion) for their area of expertise and enjoyment of teaching, **suiting work methods and curricula to the unique needs of gifted students and their learning styles and thought methods, and willingness to take risks and attempt varied methods to share the learning process with the students**.

In their research of teachers, Hansen & Feldhusen (1994) focused on three elements: psychological attributes, teaching skills, and programs for training teachers of gifted children. They also note that one of the most important attributes of a teacher is emotional structure. The teacher's emotional structure is the most powerful force behind effective teaching. A teacher who feels threatened in light of students' intellectual abilities cannot achieve a reasonable teaching level, nor can a teacher who lacks flexibility or who has limited knowledge.

Within the framework of a survey conducted in Israel, Goldring, Milgram & Chen (1989) found that personal interest in gifted students is perceived as the most important factor, while other factors - academic degree, education in pedagogy, work experience with the gifted, and special training, were all assessed to be equally important. Two central criteria were raised in considerations behind choosing teachers: one relates to the personality of the teacher and the other to his education and expertise. The teacher's personality was described in terms of flexibility, openness, and lack of conventionality in areas of teaching. This description is in keeping with the studies conducted in the U.S. cited above. Meckstroth (1987) argues that despite the fact that the teachers have lower intellectual abilities than their gifted students, they manage to motivate them through the force of their personality, broad education and artistic teaching.

The list of attributes required of teachers is long and varied, but what do the teachers have to face? Can they learn how to cope with the demands of gifted students?

zorman, Rachmel & Shaked (2004) note that the main difficulties that teachers of gifted students must cope with in Israel are:

- Coping with the label of giftedness in school and the community.
- The disparity between rapid cognitive development and age appropriate emotional development.

- Gifted students' insistence on delving only into issues that interest them.
- Continually searching for topics containing levels of thought more complex than what is generally studied in the classroom.
- Lack of accepting authority as automatically understood, i.e., a critical approach toward teachers and parents, demanding explanations and proofs of problems or demands.
- Difficulty creating social ties with peers.
- Difficulty in coordinating learning styles.

These difficulties have raised a need for special training for teachers of gifted students, and not only random advanced training courses.

Teacher Training

Only recently have basic principles for gifted students' teachers' training programs been determined in Israel (Zorman, Rachmel & Shaked, 2004). The program is based on four main stages: 1) familiarity with theoretical issues in teaching the gifted; 2) familiarity with experience in the field; 3) formulating and consolidating work methods that are suited to the target population; 4) practical guided experience and reflection.

Earlier studies on teacher training indicate that teachers who have been trained can identify gifted children more readily than untrained teachers (Borland, 1978; Jacobs, 1972). Teachers who have been trained use teaching methods that they did not previously have knowledge of (Gallagher, Ascher & Jenne, 1967). Hanninan (1988) found more significant differences between teachers who had been especially trained and teachers who were not trained for teaching the gifted. Teachers who had been trained: 1) allowed their students more responsibility for their learning; 2) delved more deeply into activities; 3) used a broader theoretical base; 4) emphasized uniqueness; 5) used more resources outside of the classroom; 6) provided specific ideas for student activities; 7) expanded on areas of interest of the students beyond the regular curriculum; and 8) connected between study topics and other issues, more frequently than teachers who did not receive special training.

Hansen & Feldhusen (1994) argue that teachers who have been especially trained in the field of educating the gifted, develop a positive atmosphere in the class, emphasize high order thinking skills, and hold more discussions. In their research conclusions they cite that teacher training allows the development of skills among teachers, skills necessary for

effective teaching. These skills are preferable over general teaching experience.

In conclusion:

The many studies that have been conducted regarding the image of desirable teachers for gifted students indicate a number of desirable attributes: personal interest, flexibility, excitement, self confidence, high level intelligence, broad cultural background, suiting assessment methods to unique needs of gifted students, in depth understanding of developmental psychology of gifted children from a cognitive, emotional and emotional standpoint, the ability to cultivate thought and high level problem solving. Other attributes mentioned above are: broad in depth knowledge in an area of expertise, passion for the field of expertise and enjoyment of teaching, suiting work methods and curricula to the unique needs of gifted students and their learning style and style of thought, and willingness to take risks and try varied methods to share the learning process with students.

Curricula and Interdisciplinary Programs

"Real world problems cannot be clearly classified… an artist who does not understand science and technology cannot participate as a conscious citizen in modern society. A scientist who does not consider the aesthetic, moral and financial results of his work cannot either" (Root-Bernstein, 1987, pg. 21). Root-Bernstein argues that one must actually teach in an interdisciplinary manner. Kaplan (1986) and Hayes-Jacobs (1989) offers an interdisciplinary model of general subjects .Heaney (1997) presents a model combining science and literature. Vars & Rakow (1993) suggest to reorganizes the curriculum, Make connections and create fusion between number of topics.

Passow (1986) argues that one must allow gifted students to fulfill their potential by including four aspects in every curriculum:

- Consumption of knowledge: the formal curriculum allows this.
- Creation of knowledge: special programs composed of information, skills and insights.
- Empowering personal abilities.
- Enrichment.

When constructing a unique curriculum for the gifted, it is necessary to relate to a number of main indices (Zorman, Rachmel & Shaked, 2004). The first is setting aims and goals. Postman (1998) also says that innovation begins with a renewed definition of aims. The second - is learning strategies. The third is social and emotional dimensions. The fourth is relating to learning as an integral part of coping in life.

Van Tassel-Baska (1995) addresses to five learning models among gifted students:

The content skills model.

The process/product research model.

The epistemological concept model.

The integration model for gifted students.

The research model.

Among the models presented by Van Tassel-Baska, I feel it is important to emphasize and detail the epistemological concept model and the integration model. These two models emphasize the advantages of interdisciplinary learning.

The epistemological concept model. This model discusses exposure of students to interdisciplinary topics and principles. Van Tassel-Baska feels that this model is suitable for the gifted population for a number of reasons: **A gifted child has an exceptional ability to see and understand mutual relationships**. The program provides an **intellectual framework that exists in more than one field of content**. It exposes the student to many ideas that are not made possible in the regular curriculum. It provides the student with a base for understanding creative and intellectual processes through his active involvement in the creative process. The model also provides the ability to combine emotional and cognitive aims: discussions awaken emotions. The response to arts involves aesthetic evaluation. Learning the main forms of literature creates a structure for self identity.

The integration model for gifted students. This model integrates a number of topics on an accelerated level. It develops in depth investigative skills in areas of content that interest the student, and exposes students to central ideas that are common **to a number of areas of content.**

The Interdisciplinary Program at School

The topic of the advantages of interdisciplinary learning has been a concern of mine for a long time, and has become stronger the longer I have taught gifted students' classes. My basic assumptions before beginning this path in the school framework stemmed from intuitions based on familiarity with gifted classes in my school in which I taught physics. The connection to and support of the research literature came only after I began working with a group of teachers. The basic assumptions that I presented to my colleagues were:

- Gifted students and their teachers require stimulation beyond the routine of school, within school walls.
- Interdisciplinary thought is the apex of innovation in the hi-tech world and world of academics, and from my standpoint is a central building block in cultivating **creativity**.
- **Interdisciplinary thinking** which is typical of the gifted population, deviates beyond accepted frames of thought, is aimed towards higher level thought, and attempts to merge different areas of knowledge to achieve new insights.
- The interdisciplinary program encourages **personal choice**, allows the gifted student to clarify and become familiar with his own areas of interest, increases his **motivation to learn** and his **estimation and positive attitudes towards the school**.

- The vision of the department focuses on breakthroughs - going out into unknown realms in processes and products, both for teachers and students. This vision allows us, at the school, to break out of accepted frameworks, or more properly, fixated frameworks, by not pre-defining the entire process of expected products, and by creating flexible and changeable frameworks.

A steering committee was created in my school to reexamine the aims of the gifted class study track, teaching methods, the available enrichment programs in the gifted classes of the school, and methods of enrichment.

Postman emphasizes the need for redefining the aims of schools (Postman, 1998). The steering committee found that it was necessary to redefine the aims of the gifted students' study tracks by looking at the needs of the school and the students.

Among the aims defined regarding the needs of the school, what stood out was the aim of increasing the positive attitudes of gifted students towards school and the teaching staff. Therefore the team recommended increasing the involvement of the teaching staff in providing enrichment for the students and creating enrichment programs within the school walls.

Among the aims defined regarding the students, the following are worth noting:

1) Increasing/emphasizing the uniqueness of the curriculum of the gifted students' class compared to the regular class to provide the students with higher abilities and the challenges that they require (Plucker & McIntier, 1996); developing high order thought among the students, also with the assistance of curricula learned based on the instructions of the Ministry of Education (Maker, 1982; Van Tassel-Baska, 1988).

2) Creating curricula in the school that **consider the special ways of thought** of the gifted, and therefore use teaching methods that differ from those accepted in regular education (Shore & Kanevsky, 1993).

The steering committed pointed out that learning in the classes until then had been based mainly on the study material dictated by the Ministry of Education, with the teacher making as great an effort as possible to interest the students in the study topics.

The recommendation was to construct an interdisciplinary program as a possible solution to achieve the goals. According to Senjey (1995) teams within an organization are very important for organizational learning, and developing new and suitable tasks and activities. Therefore all of the subject coordinators and the administrative staff, about 30 individuals, went through a year-long advanced training course in interdisciplinary learning.

The staff proposed the epistemological concept model as described by Van Tassel-Baska (1995). This model discusses the exposure of students to **interdisciplinary topics and principles**, which provide an **intellectual framework that does not exist in only one field of content**. The model also provides a context for combining emotional and cognitive aims.

The interdisciplinary program that was created was "Science and Regime". The key question was: What is the impact of type of regime over the development of science. The point of departure was the regime of Ancient Greece and the development of science at that time. The program combined three areas of knowledge: History, Chemistry and Physics. However, as the vision of the department had anticipated, we were leaving to an unknown realm. Peters (1994) who was not familiar with our school, was able to "describe" what happened next: Peter saw innovation of an organization in changing and mixing existing structures: the creation of new teams: pairs and triads, etc, who created symbiosis with clients. And this is actually what happened: teachers in different areas of content asked to joint at certain possible points of contact. The Bible teacher contacted the History teacher regarding points of contact with types of regimes. The Literature teacher discovered a number of points of contact with the Chemistry and Physics teachers. The circle of activity expanded into pairs or triads of teachers who worked throughout the school year in the class. The name of the program was changed to "Science, Regime and Culture of Israel and Other Nations", to allow connection with other teachers. This integrated program allowed including enrichment lectures.

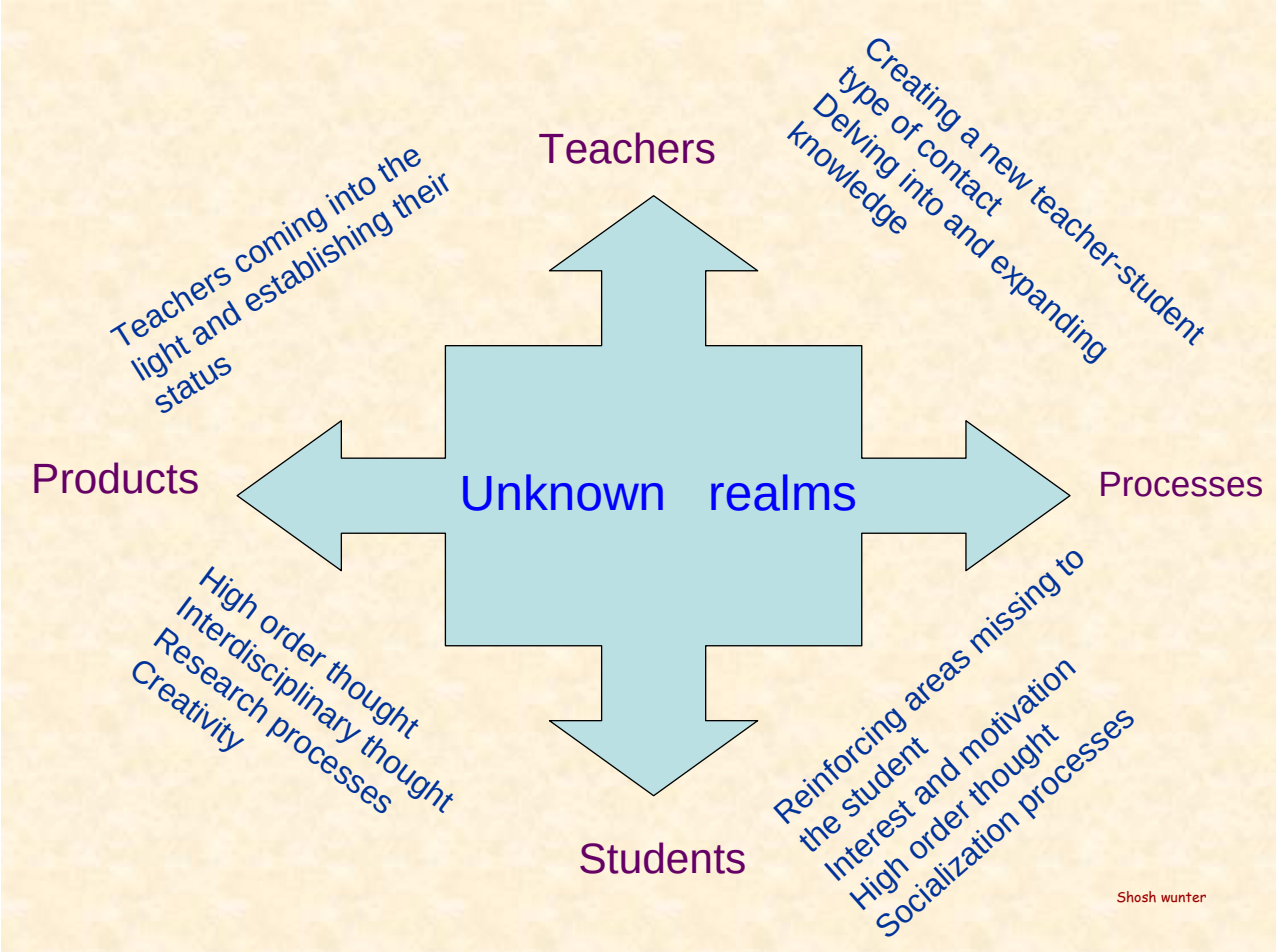
Previously, the enrichment program for the students was based on horizontal enrichment and in-depth enrichment. Horizontal enrichment was expressed in a variety of lectures and seminars held on topics not learned in school but that were part of research topics. Most of the enrichment was held outside of the school in specific days, provided by academic entities.

In depth enrichment generally included learning in academic institutes, mainly during the afternoon hours. A very small number of the students had been studying for their Bachelors degrees or for the purposes of personal enrichment.

As the program was implemented, various lecturers were brought in during homeroom lessons at the school, and the class teachers, and not only the homeroom teacher, were able to participate. The lectures were mainly on the topic of Ethics and Morals, a connection that was related to all of the areas of knowledge being taught in the class.

Our "clients", the gifted students, were "drawn in" to a different type of learning, which we also observed in the products. The "profits" of the program for the teachers and the students are presented in the following illustration:

Figure 5: Profits



Later, a number of interdisciplinary programs were constructed within the school that took into consideration the needs of gifted students and also the existing teaching force. Bennis (1977) argues that it is necessary to create an environment that encourages change not as a necessity but as an opportunity. The school also saw the opportunity for creating changes. The various programs that were written aimed to satisfy the current needs of the school in addition to the needs of the teachers and the students

which had been previously identified. The new programs that were written used other models of innovative learning.

The programs that were constructed may be classified into two types:

1) Enrichment programs connected to a syllabus - integration of learning material beyond the obligatory material of the Ministry of Education curriculum.

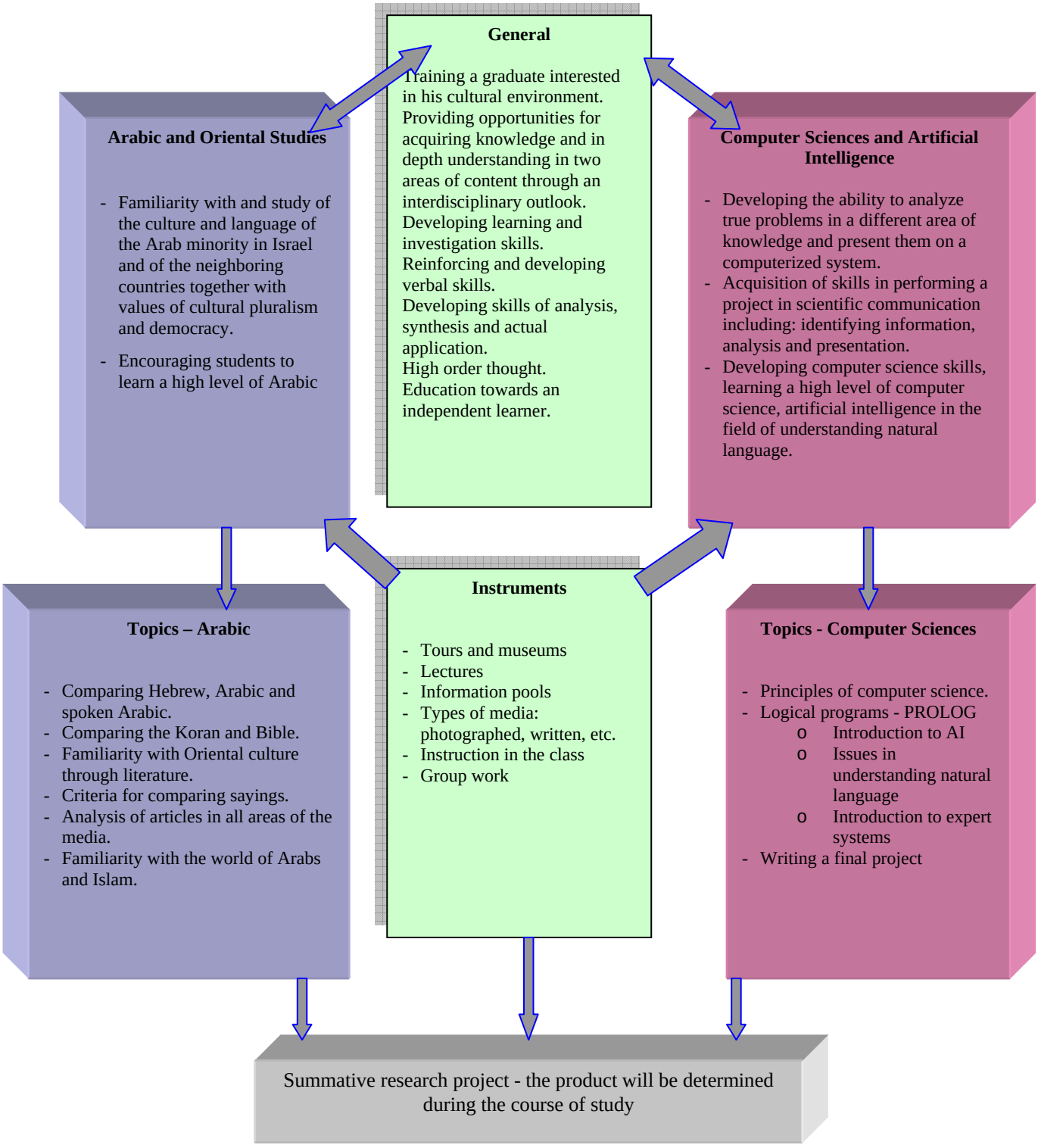
2) Programs based on the syllabus of the Ministry of Education in conjunction with the authorization of the supervisors and coordinators of each discipline - delving into and expanding on the topics that are learned.

The program often combined seemingly opposing areas of knowledge such as Physics and Literature (Root-Bernstein, 1987, pg. 21), Arabic and Computer Sciences, and sometimes included complementary subjects such as History and Literature, to create a challenge, and raise the order of thought, both among the teachers and the students.

I will present one sample interdisciplinary program that was constructed based on Van Tassel-Baska's (1995) integration model. This model combines topics on an **accelerated level**, developing **in depth investigative skills** in areas of interest to the students, and **exposing students to main ideas that are common to different areas of content.** The program was called "Arabic and Computer Sciences - Developing a Prototype for Learning Language". Arabic is a language, and computer sciences also deal with language, a technological language. Each area of knowledge represents a different culture. This program is based on the syllabus of the Ministry of Education but goes far beyond it, and was authorized by the relevant supervisors. It was recognized for the purposes of matriculation examinations in Arabic and as a final project in Artificial Intelligence.

The rationale behind the construction of the interdisciplinary program is presented in the following illustration:

Figure 6: Rationale of the Integrative Program "Prototype for Learning a Language" (According to the Integration Model of Van Tassel-Baska)



In conclusion:

"Real world problems cannot be clearly classified.." (Root-Bernstein, 1987)

The literature research shows some models of curricula and interdisciplinary programs which integrates a number of topics. Interdisciplinary programs allow gifted students to fulfill their potential**:** A gifted child has an exceptional ability to see and understand mutual relationships. The program provides an intellectual framework that exists in more than one field of content. It exposes the student to many ideas that are not made possible in the regular curriculum. It provides the student with a base for understanding creative and intellectual processes through his active involvement in the creative process. The model also provides the ability to combine emotional and cognitive aims: discussions awaken emotions. The response to arts involves aesthetic evaluation. Learning the main forms of literature creates a structure for self identity. (Van Tassel-Baska, 1995)

A number of interdisciplinary programs were constructed within the school that took into consideration the needs of gifted students and also the existing teaching force.

Methodology

The Research Aim

In recent years, gifted students have been acknowledged as a unique population to be nurtured and catered to. Nurturing giftedness at various ages is conducted within different frameworks, one of which is the gifted students' class.

This type of class exists in a large high school in the center of Israel. It caters to gifted students at three age levels: 10th, 11th and 12th grades. These unique classes have been operating successfully, i.e., both parents and students are satisfied, and the drop-out rate is zero.

Students who enroll in the gifted students' class previously studied in regular classes in various schools. More often than not, they are anxious and have a number of questions, such as:

- Will it be better for me to study in the regular class and just remain at the top of my class?
- Will I be able to function in a class full of students whose abilities are as high as mine?
- Will I be able to bear being labeled gifted?
- **What else can this class add to my development?**
- **Will I be able to do things that interest me but are not included in the regular school curriculum**?

The policy of the school is currently under review. The educational staff is reexamining its policy:

- Shall we emphasize the enrichment program? In what fields?
- Shall we accelerate the students' study pace?
- How can we maintain the balance between the gifted classes and the regular classes that exist in our comprehensive school?

It is important to understand that there are large differences between students who are defined as gifted. Students come from different backgrounds, some even new immigrants. How is it possible to create a class framework capable of fulfilling the expectations of gifted students, despite these differences?

Furthermore, is the framework that seems to be successful during high school, actually effective after graduation? Over the past few years, various interdisciplinary curricula have been written for gifted students' classes, in which teachers of different subjects were involved. Some of

these curricula were written with the assistance of university scholars and experts in the field.

The literature review shows that there is no single method or one uniform framework for educating gifted students. Innovation and renewal in teaching gifted students is expressed only in one facet of academization, and even in this case, it is outside of school walls. There have been local responses on various levels to the need for renewal and change within the schools themselves.

From among all of the difficulties existing within the educational system today, I intend to focus on one aspect of teaching gifted students' classes, which is the relevance and attractiveness of these classes to the gifted student.

The aim of the present research is to examine the impact of interdisciplinary curricula described in the present research over the attitudes of gifted students regarding school, the class, and the teachers, and the attitudes of students regarding interdisciplinary curricula, challenges to their thinking that the programs provide, and attitudes towards the program itself.

As far as teachers are concerned, the aims of the present research have been to have teachers continue their training, to challenge them and expose them to other areas of knowledge studied in school, and thus create a greater deal of teacher involvement both in school and as regards the gifted students.

The Research Questions

1. Do interdisciplinary curricula in gifted students' classes change the students' attitudes to a more positive view of their school experience?
2. What, if any, kinds of changes occur among teachers who teach gifted curricula?
3. Does the school's policy change according to gifted students' needs? Are interdisciplinary programs compatible with gifted students' study pace?

The Research Population - School, Students, and Teachers

The School

The school that participated in the present research is a comprehensive high school in the center of Israel. The school includes three grade levels:

tenth, eleventh, and twelfth grades. For each grade level, there is one gifted students' class.

This class exists throughout the three years of high school study, and may therefore be considered as a rigid class framework, although in actuality, the students study within this class framework for only some of the compulsory classes, and some study in mixed groups for other subjects or in classes of other study levels.

The Students

The students arrive at the gifted students' class in tenth grade after passing the Karni Institute test, which has been chosen by the Ministry of Education for screening purposes. The students also must pass a personal interview so the staff may understand his background.

Most of the students come from the city in which the school is situated, and a small number come from nearby towns. It should be noted that most of the students have previously studied in enrichment frameworks for gifted children once weekly, or have taken various university courses. Only a small minority of the students are first diagnosed at this stage of their studies.

The research population included approximately 100 students studying in gifted students' classes in four different classes of the school that was studied.

Each class of students participated in one specific program in the study.

The Teachers

Most of the teachers in the school are veteran teachers with twenty years of experience or more. Recently a number of young teachers have joined the school, mainly in areas of knowledge that did not exist in the school before, such as Earth Sciences, Art, and Jewish Philosophy. All of the teachers who participate in the interdisciplinary curricula are veteran teachers who have taught gifted students' classes in the past, aside from one teacher.

The teachers have been through various advanced training courses over the years in order to become familiar with the gifted student population and their emotional and academic needs. The one teacher who had not previously taught in the gifted students' class, and the youngest teacher, had been trained for two years in university to teach gifted students' classes.

A Description of the Research

In the school that was studied, the students learned the regular Ministry of Education curriculum in their gifted students' classes. The students learn only some of the compulsory subjects in this class framework: History, Literature, Language and Civics. In tenth grade, they also study sciences: Physics, Biology, and Chemistry, within the gifted framework. Math and English are studied by these students based on their individual academic levels, in mixed classes with other students. It should be noted, that regarding math, in recent years, there is a trend toward teaching math for matriculation examinations within the university framework, and taking early testing.

In eleventh grade, the students pick the subjects that they would like to learn about on a more expanded basis. One subject that most of the students choose is studied within the framework of the gifted class (in recent years physics has been studied in this framework. One or two more subjects are learned in mixed groups. Only gifted students have the option of studying three expanded subjects.

Furthermore, the gifted students receive enrichment lectures in various areas of study outside of the school, usually at a university in a nearby city.

As mentioned in the literature review, the interdisciplinary curricula were constructed to vary teaching in the class, to allow the students to feel that there is experiential learning within school walls, and not only outside of school; to challenge the students' thinking by creating complex problems (Shor and Kavensky, 1993) within the framework of school lessons; to provide expression to flexible thought patterns of the students; and to construct the ability to connect between compulsory topics according to the Ministry of Education curriculum. All this is done in order to improve the attitudes and satisfaction of students of the gifted class towards the school, the class, and their teachers, and to help them view school as a place of study that provides them with the challenges they expect. The school is not attempting to replace the institutes in which these students receive enrichment, but rather to be one of many sources of enrichment.

Each program in the present research was accompanied by an attitude questionnaire for the students and interviews for the teachers.

First Program - Alice in Wonderland

Program framework - Tenth grade, compulsory

The first interdisciplinary program, Alice in Wonderland, was constructed by a literature teacher and a physics teacher (myself) in the gifted students' class, based on areas of knowledge defined by the Ministry of Education for students in tenth grade. The book *Alice in Wonderland* is studied by students in this grade in their literature studies of the fantasy genre. In physics the students learned the topic of geometric optics and concepts of real objects, imaginary objects, etc.

The aim of the interdisciplinary lesson was to discuss the issue of: reality and imagination in literature and science (physics). The goals of the program at this stage were: learning in a different fashion, creating the opportunity for thinking that is not part of daily reality, multi-directional thinking, and creating stimuli for research and coping with complex problems. This was based on the epistemological program developed by Van Tassel-Baska (1995).

The Course of Studies

At the beginning of the year, the students studied the two subjects of Literature and Physics separately in order to learn background, basic concepts and insights related to each discipline.

In the second stage, the teachers entered the lessons simultaneously, to raise the topic of discussion dealing with reality and imagination in literature and science. The first question raised was: To what other areas of knowledge could the book be connected? Possibilities such as psychology, art and others that were raised by the class were listed on the board. One of the students realized that the physics teacher did not come to the lesson for no reason, and therefore said "Physics". Then the question was asked: Does physics appear in Alice in Wonderland? The fact that the author of the book, Lewis Carroll was a mathematician, led the children to search for physics in the story.

The students broke down into groups predetermined by the teacher, to examine situations in the book in which physically possible or impossible situations were described.

I order to answer the research question, the students were allowed use of the rich school library and the physics laboratories from which the students could ask for any (existing) equipment that would be necessary to perform an experiment. For example:

Alice falls through the rabbit hole opening and closing drawers on her way down. The fall is described in the book as slow. A body falling under the

influence of gravity will fall 5 meters in the first second, and 20 meters in the second. The explanation that the students raised after looking in the library is that perhaps Alice's dress served as a parachute, which slowed her rate of fall. The students prepared and performed an experiment testing the rate of fall of objects with and without a cloth parachute.

After the students completed their investigation work, they came together again with the two teachers. In the forum, the results of each group were presented. In conclusion, the class decided that one should not ignore physical aspects in art.

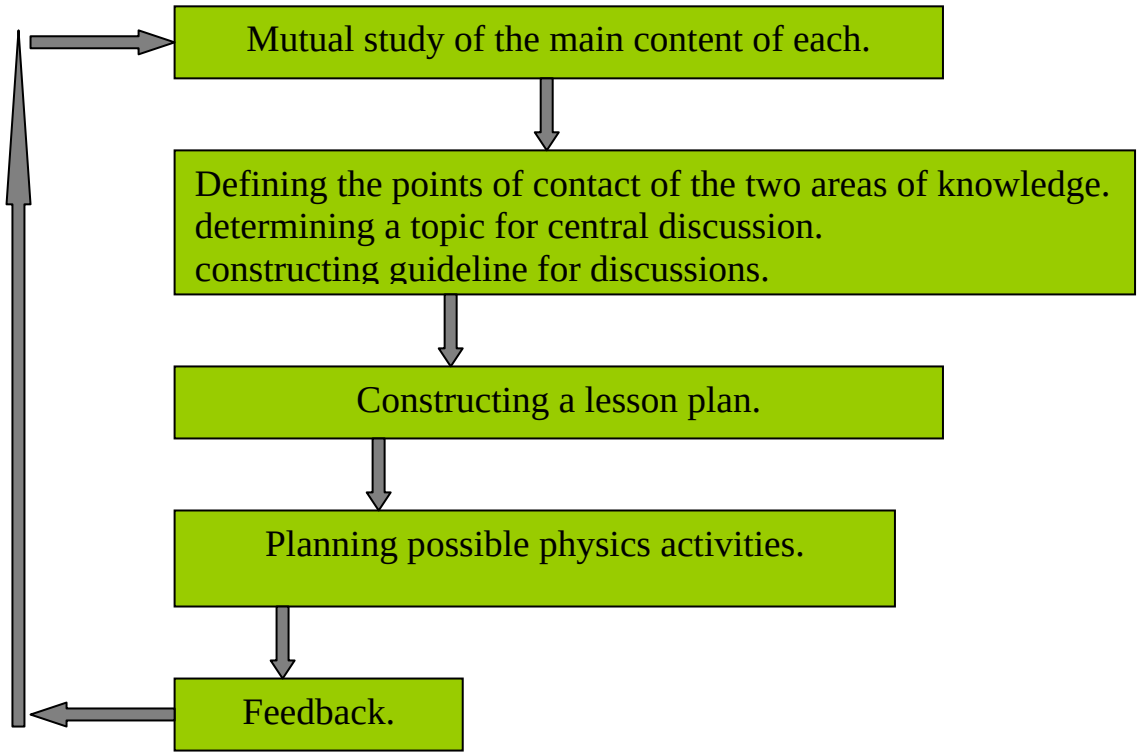
From there, the discussion went back to the original question - what can be said about reality and imagination in physics, and what is reality or imagination in literature?

The next assignment given to the students was: to read at least one book from the genre (fantasy) and relate to the "physics" within it (Question 10 on the attitude questionnaire).

The Teachers

The dynamics of the teachers' work is described in the following figure:

Figure 7: The Dynamics of the Teacher's Work



Finally, an attitude questionnaire was distributed to the students, and an interview of the teachers was conducted.

Second Program - Science, Regime, and Culture

Program framework - Tenth grade, compulsory

The program was "born" when Dr. Oved Kedem, of Weitzman Institute showed the researcher a series of Educational Television films, for which he served as an academic adviser. I went to the pedagogical coordinator who is a history teacher, and together we created a proposal for a broader program that would include more teachers from other areas of knowledge.

The program is based on the syllabus of the existing curricula for History, Bible, Chemistry, Physics, and Literature, with special and new emphasis placed on the connection between the development of all types of science and culture and between political regime and social and national attributes of societies in which they have developed.

An hour was added to the school schedule in order to expand upon the issues of moral topics involved in the development of science within modern society, and truth and lies in the media.

Teaching methods that were used within the framework of this program:

1. Learning based on Educational Television films.

2. Learning combining History and Plastic Art, and History and Cinema.

3. Combined Science and Humanities lessons.

4. Academic seminars and university lectures by content experts.

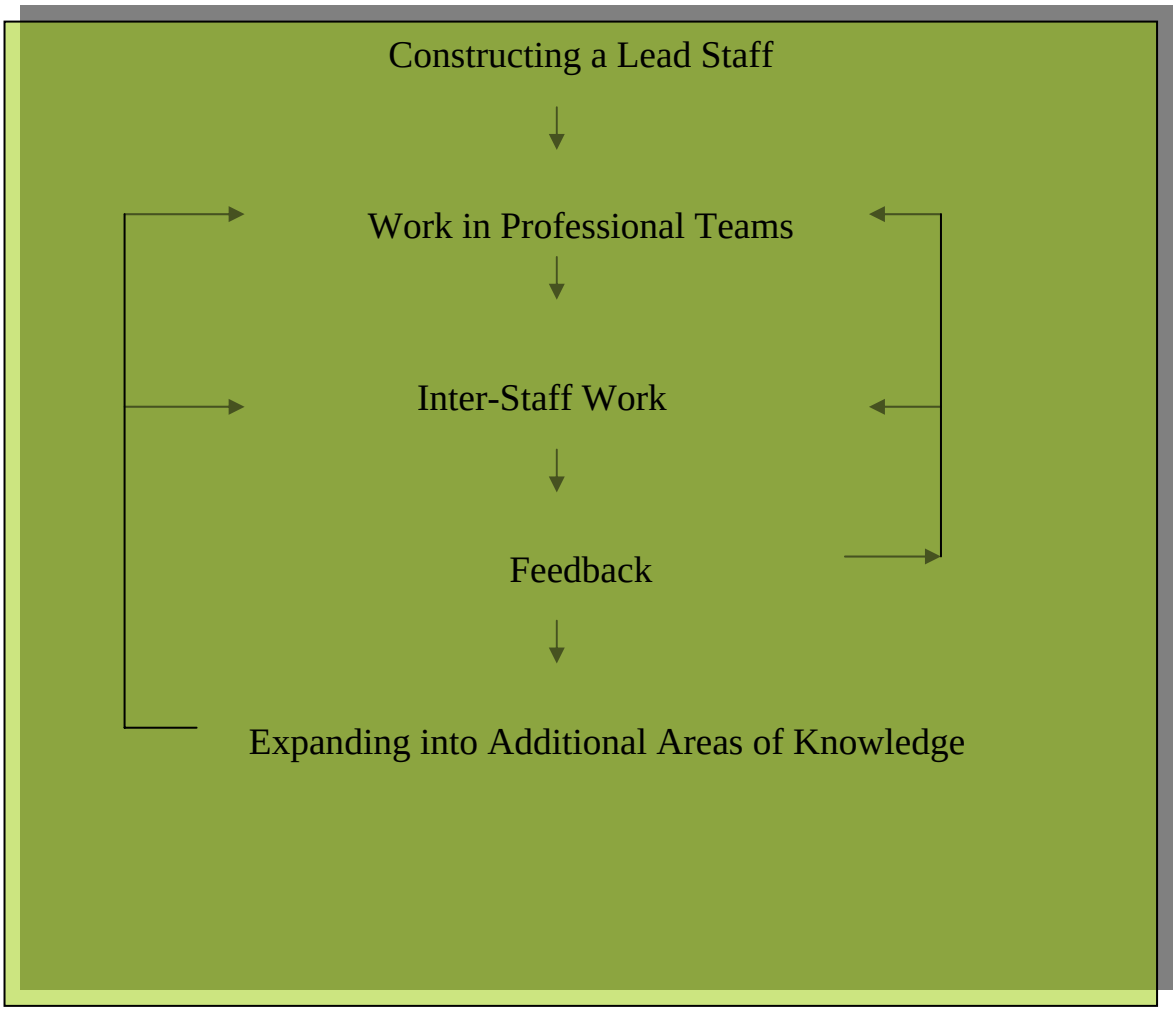
5. Writing a research paper on various correlations between the touch of a regime and culture, based on the student's choice, writing a paper connecting between science and other areas of content.

The following are a number of examples of the interdisciplinary activities that were held:

- Common lessons in Chemistry, Physics and History - based on films from the Educational Television series "Final for Now", discussing the connection between the development of science and era-based contexts.
- Common lessons in History and Bible - discussing and comparatively analyzing regimes of biblical times and Greek society. Discussion of freedom of thought and art: Elijah versus Socrates; the individual versus the government.

- Common lessons in Physics and Literature - Krylov's fables and how they touch on scientific problems; the fantasy genre as a literary and scientific text.
- Common lessons in History and Literature - the problematic of the individual and the government in Greek tragedies.

Figure 8: The Teachers' Work Plan



All the teachers in the school participated in advanced training and heard lectures on the following subjects: Sources of Scientific Thought, Socrates and Plato, Art in Classical Greece, Judaism and Hellenism, Judaism and Democracy, Medieval Science, Art of the Renaissance, The Scientific

Revolution, Biosociology, Darwinism and it's Moral Implications, and Science - Mysticism and Morals.

The program echoed through the teachers' room and among the students. Additional teachers asked to be connected with the topic. The study circle was expanded to two additional tenth grade classes, and other areas of knowledge were added. The program is now called: Science, Regime and Culture in Israel and other Nations.

The students were given an attitude questionnaire. Interviews were conducted with the teachers.

Third Program - Developing and Operating a Prototype for Interdisciplinary Study of Language (Arabic) and Computer Science (AI)

Program framework - Eleventh grade, elective

The third program was constructed when it became apparent to the researcher, as the principal, that the students in the gifted class were not choosing to study Arabic, despite their positive approach to the subject. The Arab language teaching staff and myself assumed that the low image of language studies versus scientific studies was the reason for this. I recommended connecting the study of Arabic to computer sciences and artificial intelligence, and found partners for brainstorming which raised ideas regarding the fields of knowledge, preparing for an experiment in the field.

The program allows students with various study orientations - humanistic and languages on one hand, and sciences on the other hand, to expand their horizons and cultivate the humanistic side among science oriented students, and vice versa. This is reminiscent of the statement by Root-Bernstein (1987).

The aims of the program: developing a prototype for learning an interdisciplinary subject delving into the topic of language study and culture, through advanced computer science methods and artificial intelligence.

Furthermore, the program helps develop an independent learner who also knows how to work in a group, developing meta-skills for work on computers.

The students study Arabic and Arab culture using innovative methods, develop independent projects in the field of Arab language, culture and Middle East studies, and combine them all together.

The aims of the Arab studies staff -

- Familiarity with and the study of the language and culture of the Arab minority in Israel and of neighboring countries, combined with the values of cultural pluralism and democracy.
- Encouraging students to learn a high level of Arabic.

The aims of the computer science and artificial intelligence staff:

- Developing the ability to analyze true problems in a different field of knowledge and present it through a computerized system.
- Acquisition of skills in performing a project in the field of scientific communications including identification of knowledge, and its analysis and presentation.
- Developing analysis, synthesis and actual application skills.

This is in keeping with Rahmel who discusses developing high order thought (Rahmel, 1998), and in keeping with Bloom (1956).

The program was constructed with the academic consultation of Professor Shweika of Bar Ilan University, and was called "The Prototype for Learning Languages", as both Arabic and computer sciences are languages. At the end of the program, the students were asked to create a common product.

The product that was planned by the group was a "thinking dictionary", that, while reading new texts, analyzes the words and enriches itself. Each group took on construction of a different part of sentence analysis through the computer. This product requires connecting between concepts, a system of conclusions, and the creation of new and original information (Toffler, 1992).

Stage 1 - First year

Training teachers and creating the integrated program.

Basic training in Arabic and computer sciences and familiarity with the rationale behind the program.

Second year

Increased study of Arabic and Islamic studies along with the study of computer sciences based on the guidelines of the academic consultant. Consolidation of a summarizing integrative project.

The program was also recognized by the supervisors of the Ministry of Education in the fields of Arabic and Computer Sciences. The students who studied both subjects were given a bonus in that the product could be examined as both an Artificial Intelligence project with a grade, and as

part of the oral examination in Arabic, providing the student with another grade.

It is important to note:

1. Despite preparation, the teachers learned part of the material along with the students (see the vision of the gifted children's department - teachers and student will take each other to unknown regions).
2. The gifted students and the teacher were "drawn into" the summarizing project while finding creative solutions to problems that were not planned for. Some of the students continued their project within their military service in the Intelligence Corps.

An attitude questionnaire was distributed to the students. Interviews were held with both the students and the teachers.

Fourth Program - Physics in Art

Program framework - Tenth grade, compulsory

Art is not a compulsory subject. This subject is only studied by students who choose to take it. The gifted class students cannot study in the art class and therefore the researcher considered a different way to include art studies in the class, in a manner that would allow the students' to express their unique methods of reasoning. The program was called Physics in Art.

In this program, work was done according to Renzuilli's (1977) three stage enrichment model and his model for reorganization of teaching (Renzulli, 1994), regarding the role of the teacher as a content expert and as a mentor and trainer for the student.

The topic for discussion that was chosen was: reflecting life/reality. How is this expressed in physics and art? Physics reflects life through laws, and mathematical rules while art is free of chains.

The students participated in a number of sessions on introduction to art, which also included a trip to a museum. The content expert emphasized the history of art, different art schools, how a work of art is appreciated, etc.

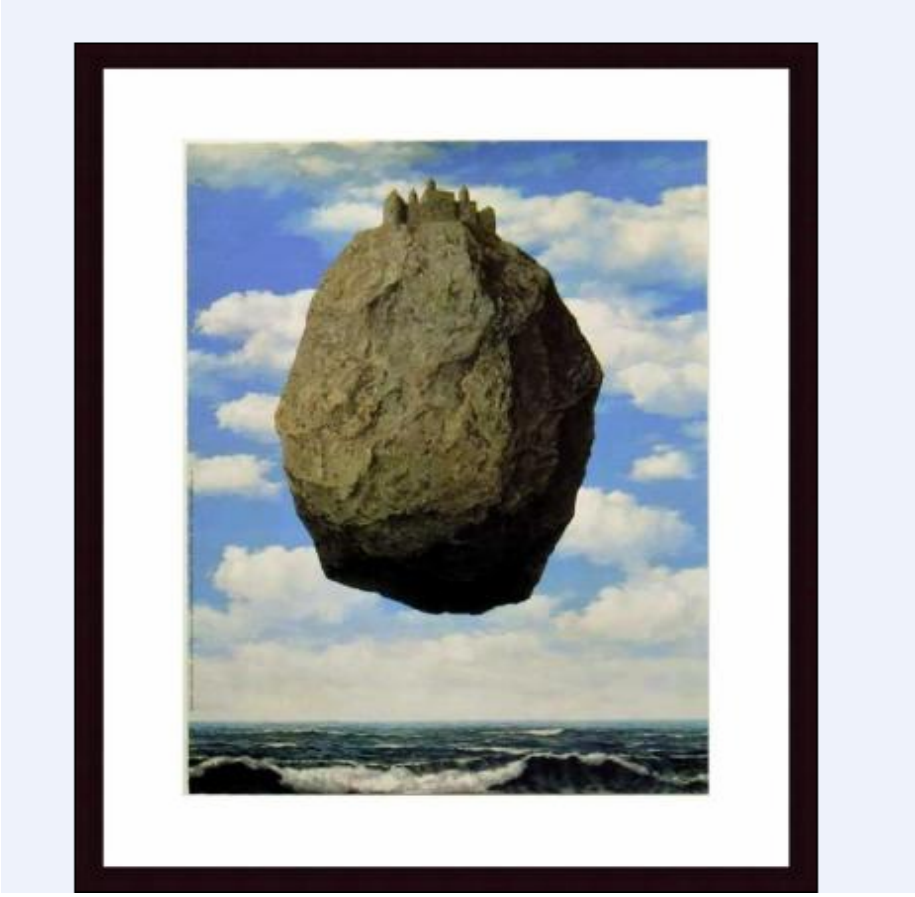
In the second stage, the students were divided into groups of their own choosing. They chose a work of art that they wanted to investigate both from the artistic and physical aspects. Each research process was accompanied by mentors who could help the students. There were also

coaches, various teachers within the school, who were at hand to provide advice to students upon request.

For example:

One group chose the painting by Magritte: "Castle in the Pyrenees".

Figure 9 : "Castle in the Pyrenees"



The group studied the artist, the period, and the school of art to which the artist belonged. They studied the idea that the artist was interested in expressing in this specific painting. The groups met with the art teacher in the library. It was immediately clear that this painting was not physically realistic. After consulting with me, the students raised a number of hypotheses under which such a situation could exist: One possibility was that the floating boulder was a huge magnet that was being repelled by the magnetism of the earth. A second possibility that was raised was that it is possible that there are propellers on the hidden side of the painting allowing the boulder to float. I referred the students to sources of

information on the subject of flight, particularly helicopters, to understand the principles of propellers and the lifting force that they create. The option of magnetic force was also tested by learning the topic of forces (gravity, electrical force, and magnetic force), and performing a laboratory experiment.

In the final stage, the students were asked to present their own product: how they would have expressed and implemented the same idea that the artist was interested in expressing.

The above mentioned group chose to paint. They contended that Magritte's picture expressed his childhood fears, and therefore they painted a picture of rain, darkness and lightning on a pastoral background.

The students presented their products to the forum and a discussion was held of the chosen topic.

Questionnaires were distributed to the students and interviews were held with the students and the teacher.

The Research Method and Research Variables

The present research is based upon both questionnaires and personal interviews, i.e., the research results will be analyzed both quantitatively and qualitatively.

The statistical results of the questionnaires will be interpolated with the interview results.

The research variables are the six categories of questions that were tested for each of the various programs. The following is an itemization of the categories of questions that will be tested. Each category represents one of the research variables.

For the first question: Do interdisciplinary curricula in gifted students' classes change the students' attitudes to a more positive view of their school experience?

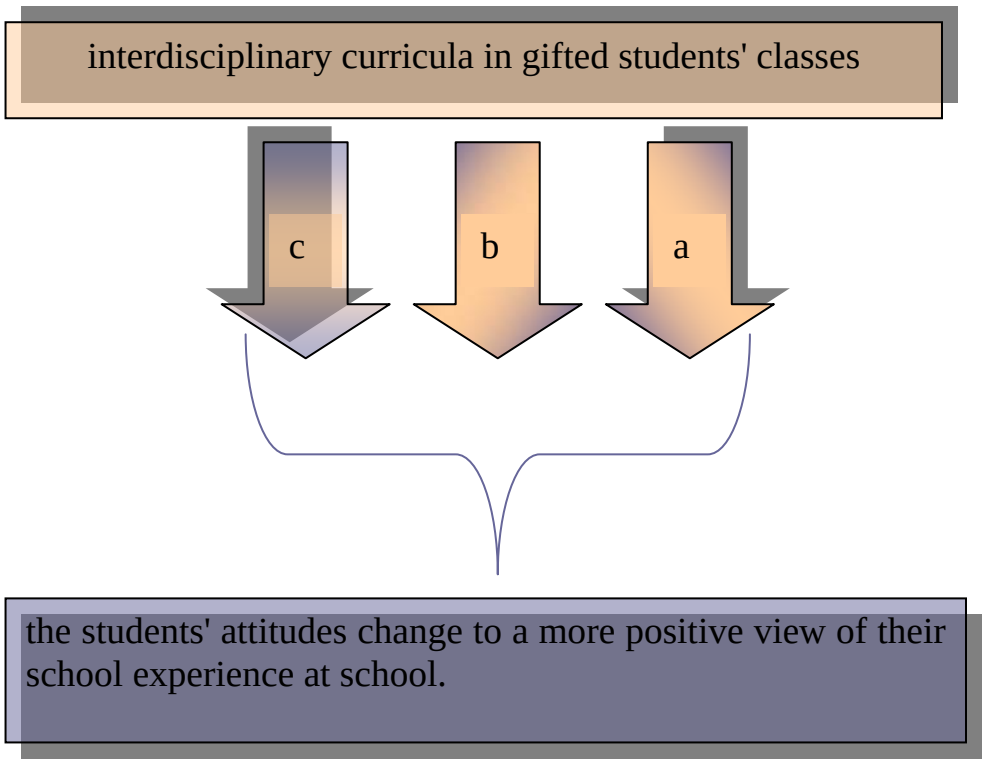
Three categories were created:

a. The impact of interdisciplinary learning over attitudes towards school.

b. The impact of interdisciplinary learning over attitudes towards the class.

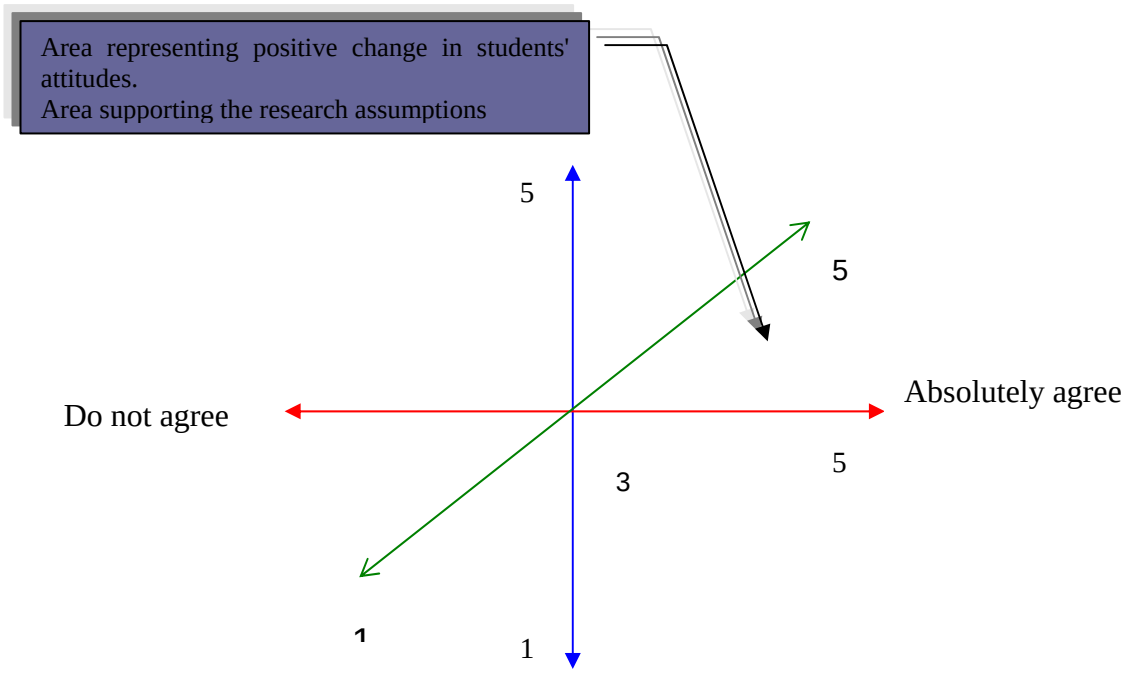
c. The impact of interdisciplinary learning over attitudes towards teachers.

Figure 10: The Correlation Between the Research Variables and the First Research Question



If we construct a three dimensional graph in which each of the categories being tested, representing the research variables, defines one axis, only points in the area of the first quadrant, will, from my standpoint, indicate a positive change in the students' attitudes. The research assumption is that interdisciplinary learning affects the attitudes of the students in all of the components that define the school experience. Therefore only a situation in which all of the research variables indicate positive attitudes and a high degree of agreement, can testify to success.

Figure 11: When does the Research Assumption Exist?



For the second question: What, if any, kinds of changes occur among teachers who teach gifted curricula?

Interviews were held with the teachers.

For the third question: Does the school's policy change according to gifted students' needs? Are interdisciplinary programs compatible with gifted students' study pace?

Three categories were created:

d. Attitudes regarding interdisciplinary learning.

e. Attitudes regarding the need for challenging learning.

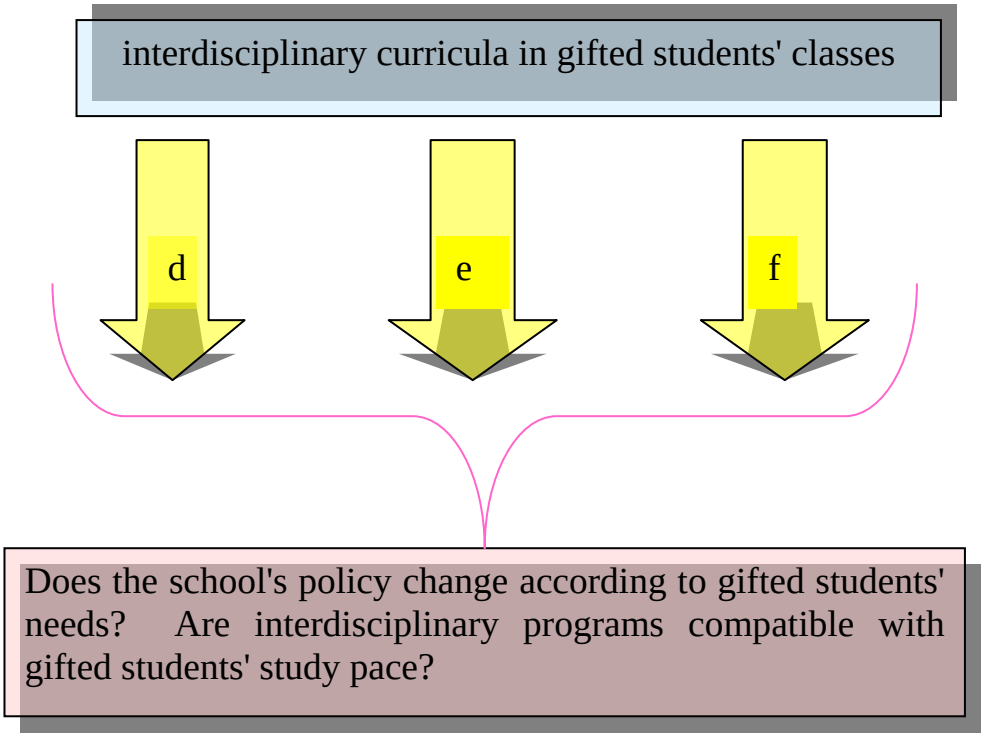
f. Attitudes regarding the specific program.

The sixth category has two goals: the first goal, the approach of the students and their assessment of the program does in fact teach us if the program satisfied their needs. Weighting this category with the two previous categories answers the third research question. The second goal, which is unstated, is to test each program on its own from the viewpoint of the students, so that this information can be used for my edification and

that of the teachers in order to perhaps identify components that were not considered in our meetings.

Here too, it is possible to create a diagram similar to the one above, describing the correlation between the interdisciplinary programs, the research variables (categories being tested) and the research question.

Figure 12: The Correlation between the Third Research Question and the Research Variables



The present research will provide data regarding all six research variables and the interviews held with the teachers.

Data Gathering and Research Methods

In order to test the research questions, questionnaires were distributed to the students in each class.

The research was supported by qualitative observations of the system, interviews with a number of students, interviews with teachers regarding the attitudes on the interdisciplinary programs, and a case study of a number of students and teachers. (Tzabar-Ben Yehoshua, 1995, Nevo 1989).

The Research Relevance

The research is relevant based on the fact that field research into education towards excellence and curricular organization in the high school gifted class, may assist the construction of a gifted class model suited to the ages being studied.

The Research Findings and Analysis of the Findings

The interdisciplinary programs were implemented in different years and with different classes, i.e., the student population differed for each program. Alice in Wonderland, Science and Regime, and Physics in Art were part of the tenth grade academic schedule. Arabic and Computer Sciences: Prototype for Learning Language , was a two year elective course for eleventh and twelfth grades. But in this program only some of the students in the class were participants, and a number of students dropped out because of the overload of work and the number of hours that was dedicated to this program each year - at least 10 hours per week.

At the end of each program an attitude questionnaire was distributed and interviews were conducted to learn about the impact of the various programs over the students' attitudes. Attitudes were divided into six categories based on the research questions, as detailed in the previous chapter.

The Categories:

a. The impact of interdisciplinary learning over attitudes towards school.

b. The impact of interdisciplinary learning over attitudes towards the class.

c. The impact of interdisciplinary learning over attitudes towards teachers.

d. Attitudes regarding interdisciplinary learning.

e. Attitudes regarding the need for challenging learning.

f. Attitudes regarding the specific program.

In the first stage, the average of the responses to each question in the questionnaire was calculated. Then the reliability was tested according to Alpha calculations.

For the question testing attitudes regarding teachers, only the average of each questionnaire was tested.

In the second stage, the variance between the questionnaires for each one of the research questions was tested, based on the predetermined categories.

Alice in Wonderland

Table 1: Attitude Questionnaire - Alice in Wonderland

Circle the answer with which you agree. Please note 5 denotes "absolutely agree", and 1 denotes "do not agree":

		Absolutely agree				Do not agree
1	Interdisciplinary study is a waste of time that we could be dedicating to progress in our academic material	5	4	3	2	1
2	Combining physics and literature at first seemed impossible to me.	5	4	3	2	1
3	I was an active partner in planning and conducting the experiment	5	4	3	2	1
4	It would have been worthwhile to expand and include other subjects in the interdisciplinary learning also.	5	4	3	2	1
5	The school should prepare us for matriculation exams in the shortest and most effective manner, without additions and enrichment.	5	4	3	2	1
6	The school should initiate curricula that will cause students to be interested in the study material.	5	4	3	2	1
7	Interdisciplinary studies allow us to think multidirectionally.	5	4	3	2	1
8	It is more interesting in school when we don't just stick with material for tests.	5	4	3	2	1
9	The attractiveness of the school grows the more varied our class curricula are.	5	4	3	2	1
10	I read at least one more book and thought about the physics in it.	5	4	3	2	1
11	It is necessary to develop multidirectional thought abilities at a young age.	5	4	3	2	1
12	It is important to be able to connect between different areas of knowledge.	5	4	3	2	1
13	I told my friends/family about the interdisciplinary program in our class.	5	4	3	2	1
14	The interdisciplinary program allows me the opportunity to think differently than day to day thought.	5	4	3	2	1
15	The interdisciplinary program was a new way for me to learn.	5	4	3	2	1
16	Every person must focus on one area with no connection to other subjects. That's the only way to achieve.	5	4	3	2	1
17	My esteem for the teachers grows when they manage to interest me in topics that are beyond the required study material.	5	4	3	2	1
18	My esteem for the school rises when it manages to combine	5	4	3	2	1

	activities and other studies beyond the course material.					
19	My group's summary project was a challenge to my thinking.	5	4	3	2	1
20	The project helped me express my abilities.	5	4	3	2	1
21	The work method of the interdisciplinary program allowed me to meet more students in the class with areas of interest similar to mine.	5	4	3	2	1
22	Our class' curriculum is one of the reasons to recommend to others to study in the class.	5	4	3	2	1
23	Work in groups lowers competition in the class.	5	4	3	2	1
24	I enjoyed the need to go to the library and search for appropriate information.	5	4	3	2	1

Table 2: Classification of Questions

Questionnaire	Negative Items	Classification into categories
Alice in Wonderland	1,5,16	A - 5,6,8,9,18 B - 9,22,13 C - 17 D - 1,4,7,11,12,14 E - 3,14,19,24 F - 3,10,19,20

A. The Impact of Interdisciplinary Study Over Attitudes Towards School

Simple Statistics

Variable	N	Mean
ALIZ5	28	4.32143
ALIZ6	28	4.67857
ALIZ8	28	4.35714
ALIZ9	28	4.42857
ALIZ18	28	4.35714

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.832755

Alpha > 0.7

There was agreement regarding all of the questions testing attitudes regarding school. The average of the values of all of the questions is over 4. In Question 6, that argues that the school must initiate curricula that will cause students to be interested, over 90% of the class students expressed agreement.

It should be noted that Question 5 was a negative item. The value appearing in the table is the reversed value - presented as a positive question.

In testing the reliability, an Alpha greater than 0.7 was achieved, which is the determining value, i.e., the responses were reliable.

B. The Impact of Interdisciplinary Study Over Attitudes Towards The Class

Simple Statistics

Variable	N	Mean
ALIZ9	28	4.42857
ALIZ13	28	3.75000
ALIZ22	28	4.53571

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.856638

Alpha > 0.7

Calculation of Alpha shows reliability. The average of the students' responses to Questions 9 and 22 are definitely high. Question 13 requests that the children state if they told their friends or family about the interdisciplinary program in the school. The assumption is that generally excitement leads people to speak about a subject, but one must consider that in the gifted students' class, there are students who are quite introverted that do not tend to share every experience at home. Therefore

and average of 3.75 for this question, or translated into percentages, 75% who spoke about the topic at home, testifies to a degree of impact. Regarding Question 22 which asks if the class curriculum is a reason to recommend that others join the class, was a very significant datum for me. Over 90% of the class students expressed full agreement.

C. The Impact of Interdisciplinary Study Over Attitudes Towards Teachers

Variable	N	Mean
ALIZ17	28	4.679

In this category, only one question was asked as a direct question regarding the impact of the program over estimation of teachers. This answer is also unequivocal. An average of 4.67 out of 5, i.e. over 93% of the class students expressed absolute agreement.

D. Attitudes Regarding Interdisciplinary Learning

Simple Statistics

Variable	N	Mean
ALIZ1	28	4.07143
ALIZ4	28	3.64286
ALIZ7	28	4.46429
ALIZ11	28	4.17857
ALIZ12	28	4.42857
ALIZ14	28	4.07143

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.904624

Alpha > 0.7

Calculation of Alpha shows a high level of reliability for the questions in this category. The students' average is lower than the previous categories, but still definitely high. The average was lowered because of Question 4: "It is worthwhile to expand and combine interdisciplinary studies in other subjects also". Here there is agreement of over 70%. It is possible that

the lack of agreement of the others stems from a lack of ability to see how additional areas of knowledge could be added, or from the belief that the current context is sufficient.

E. Attitudes Regarding the Need for Challenging Learning

Simple Statistics

Variable	N	Mean
ALIZ3	28	4.14286
ALIZ14	28	4.07143
ALIZ19	28	4.32143
ALIZ24	28	4.07143

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.864611

Alpha > 0.7

Here too, the reliability test shows an Alpha of 0.86, which is greater than 0.7. The average students' response is over 4, and therefore expresses agreement that the class students need challenging learning. One must remember that the student population of the class is varied, with varied areas of interest, and varied definitions for challenging learning. Therefore, an average response of over 4 is definitely a signal and a statement regarding this need. Question 3 examines if the student was an active partner in planning and performing the experiment. This datum indicates that most of the class students took an active part, despite, as mentioned above, the variety within the class population.

F. Attitudes Regarding the Specific Program

Simple Statistics

Variable	N	Mean
ALIZ3	28	4.14286
ALIZ10	28	4.75000
ALIZ19	28	4.32143
ALIZ20	28	3.53571

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.845329

Alpha > 0.7

In this category, the intention was to see the attitude towards the specific program, Alice in Wonderland. An indication regarding the success of the program was found in the number of students who read at least one other book and related to the physics in it. The book is not required reading and the students were asked to read in their free time, in addition to other books that they are required to read for their Literature lessons. The finding that 95% of the students in the class read at least one more book shows the degree of impact that this program had over the students. Question 20 examined how much the project helped the student express his abilities. The relatively low average could be a result of the fact that work was conducted in groups. It is clear that individual work provides more opportunity for individual expression. Another explanation for this result could be that these two areas of knowledge are not a given student's strong areas.

Reliability testing here too, showed that Alpha is greater than 0.7.

From the Interviews

The Literature Teacher:

"I enjoyed it".

"I thought we had a weak connection. I did not imagine how much physics could be learned from the book".

"Do you know of any science fiction books that it is worthwhile for me to read?".

"I planned to bring in a psychologist later to speak about Alice's size change and connect this to adolescence and self image. Do you think we could find a connection there also?"

The Students:

"It was fun".

"Finally something different. It reminded me of the activities at Weitzman Institute".

"We argued about how to do the experiment. It was good that the lab technician gave us advice".

"Teacher, did you read *Through the Looking Glass*? Maybe you can give us a lesson on "time". Can time move backward also?

Two years ago, a student called me, and introduced herself as a student who was required to prepare a certain project. She remembered that her brother learned with me and told her about the Alice in Wonderland program. She asked if I could please give her reading material, and perhaps sit with her, and this was more than five years after her brother had graduated high school!!

Arabic and Computer Science - Prototype for Learning Language

Table 3: Attitude Questionnaire - Arabic and Computer Science - Prototype for learning Language

Circle the answer with which you agree. Please note 5 denotes "absolutely agree", and 1 denotes "do not agree":

		Absolutely agree				Do not agree
1	Interdisciplinary study is a waste of time that we could be dedicating to progress in our academic material	5	4	3	2	1
2	Combining Arabic and Computer Science at first seemed impossible to me.	5	4	3	2	1
3	I chose the interdisciplinary program mainly because of the benefit to me in the matriculation exam.	5	4	3	2	1
4	It would have been worthwhile to expand and include other subjects in the interdisciplinary learning also.	5	4	3	2	1
5	The school should prepare us for matriculation exams in the shortest and most effective manner, without additions and enrichment.	5	4	3	2	1
6	The school should initiate curricula that will cause students to be interested in the study material.	5	4	3	2	1
7	Interdisciplinary studies allow us to think multidirectionally.	5	4	3	2	1
8	It is more interesting in school when we don't just stick with material for tests.	5	4	3	2	1
9	The attractiveness of the school grows the more varied our class curricula are.	5	4	3	2	1
10	It is necessary to develop multidirectional thought abilities at a	5	4	3	2	1

	young age.	
11	It is important to be able to connect between different areas of knowledge.	5 4 3 2 1
12	I told my friends/family about the interdisciplinary program in our class.	5 4 3 2 1
13	The interdisciplinary program allows me the opportunity to think differently than day to day thought.	5 4 3 2 1
14	The interdisciplinary program was a new way for me to learn.	5 4 3 2 1
15	Every person must focus on one area with no connection to other subjects. That's the only way to achieve.	5 4 3 2 1
16	My esteem for the teachers grows when they manage to interest me in topics that are beyond the required study material.	5 4 3 2 1
17	My esteem for the school rises when it manages to combine activities and other studies beyond the course material.	5 4 3 2 1
18	My group's summary project was a challenge to my thinking.	5 4 3 2 1
19	The project helped me express my abilities.	5 4 3 2 1
20	The work method of the interdisciplinary program allowed me to meet more students in the class with areas of interest similar to mine.	5 4 3 2 1
21	I was proud to be a partner in a unique program in Israel	5 4 3 2 1
22	Our class' curriculum is one of the reasons to recommend to others to study in the class.	5 4 3 2 1
23	Work in groups lowers competition in the class.	5 4 3 2 1
24	I am going to recommend that my class chose the project next year.	5 4 3 2 1

Table 4: Classification of Questions

Questionnaire	Negative Items	Classification into categories
Arabic and Computer Science	1,5,16	A -8,9,18 B - 13,23 C - 17 D - 1,4,7,12,16 E - 14,19 F - 10,20,22

A. The Impact of Interdisciplinary Study Over Attitudes Towards School

Simple Statistics

Variable	N	Mean
ARAB8	18	4.27778
ARAB9	18	4.72222
ARAB18	18	4.55556

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.775685

Alpha > 0.7

The average value in this category is above 4. The highest value was achieved in Question 9, which argues that the school's attractiveness grows the more varied the class' curriculum is. More than 950% of the students expressed absolute agreement with this statement. Question 18, which also discusses greater esteem for the school when it combines activities and studies beyond the regular curriculum, also achieved the full agreement of over 90% of the class students. The reliability test for this category indicates an Alpha greater than 0.7

B. The Impact of Interdisciplinary Study Over Attitudes Towards The Class

Simple Statistics

Variable	N	Mean
ARAB13	17	4.47059
ARAB23	18	4.72222

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.736011

Alpha > 0.7

Testing Alpha indicates a reliability in this category of Alpha greater than 0.7.

In this category there is full agreement regarding the impact of interdisciplinary learning over positive attitudes towards the class.

C. The Impact of Interdisciplinary Study Over Attitudes Towards Teachers

Variable	N	Mean

The very high average regarding the impact of interdisciplinary learning over attitudes towards teachers, apparently stems from the high degree of teacher involvement with the students and the common learning that were often required.

D. Attitudes Regarding Interdisciplinary Learning

Simple Statistics

Variable	N	Mean
ARAB1	18	4.77778
ARAB4	18	3.61111
ARAB7	18	4.61111
ARAB12	18	4.94444
ARAB16	18	4.94444

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.770631

Alpha > 0.7

Questions 1 and 16 are formulated negatively in the questionnaire. The value appearing in the table is the reversed value, i.e., after making the questions positive. The value lower than 4 in Question 4 may be explained if we remember that some students dropped out of the final project.

E. Attitudes Regarding the Need for Challenging Learning

Simple Statistics

Variable	N	Mean
ARAB14	17	4.47059
ARAB19	18	4.88889

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.483221

Alpha < 0.7

The average response in this category is definitely high and testifies to full agreement.

However, the Alpha test shows a lack of reliability in this category. The low Alpha value may stem from the small number of students in the group, such that any deviation has a significant impact over the Alpha value.

F. Attitudes Regarding the Specific Program

Simple Statistics

Variable	N	Mean
ARAB10	17	4.70588
ARAB20	17	4.41176
ARAB22	17	4.47059

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.664835

Alpha ~ 0.7

Here too, the value of the averages for the questions is very high, testifying to agreement regarding the quality of the program. The Alpha value is less than 0.7, but quite close. It is possible that the fact that a certain student did not answer the questions is what caused this result.

From the Interviews

The Computer Science Teacher:

"I think that we learned more than we taught".

"It was really a challenge because PROLOG did not allow us the possibility of working with Arabic letters and we had to find ways around it and come up with solutions".

"Now I understand how hard it is to actually analyze on a computer. A full sentence is really an achievement".

"It is clear that we were naïve when we agreed to the hours you allotted. Actually we sat with the students in the lab at night also".

The Arabic Teachers:

"I am euphoric. I never dreamt of such a product".

"When you discussed the connection with computer sciences and artificial intelligence I didn't really understand what you were getting at, but I trusted you. It superseded of my expectations."

"Just think, because of the project we have Arabic keyboards in the school now that I use in other classes. It was worth it, no?"

"The army is willing to give us more lectures for free next year".

"It doesn't matter how many hours we put in, look what it did for our study track!"

The Students:

"The fact that we are going together as a group to continue the project says it all, no? We will come back and encourage other students to join the project".

Science Regime and Culture

Table 5: Attitude Questionnaire - Interdisciplinary Program - Science Regime and Culture

Circle the answer with which you agree. Please note 5 denotes "absolutely agree", and 1 denotes "do not agree":

		Absolutely agree				Do not agree
1	Interdisciplinary study is a waste of time that we could be dedicating to progress in our academic material	5	4	3	2	1
2	The combined classes with the history teacher and science teacher were very interesting..	5	4	3	2	1
3	It would have been worthwhile to expand and include other subjects in the interdisciplinary learning also.	5	4	3	2	1
4	The school should prepare us for matriculation exams in the shortest and most effective manner, without additions and enrichment.	5	4	3	2	1
5	The school should initiate curricula that will cause students to be interested in the study material.	5	4	3	2	1
6	Interdisciplinary studies allow us to think multidirectionally.	5	4	3	2	1
7	It is more interesting in school when we don't just stick with material for tests.	5	4	3	2	1
8	The attractiveness of the school grows the more varied our class curricula are.	5	4	3	2	1
9	It is necessary to develop multidirectional thought abilities at a young age.	5	4	3	2	1
10	It is important to be able to connect between different areas of knowledge.	5	4	3	2	1
11	I told my friends/family about the interdisciplinary program in our class.	5	4	3	2	1
12	The interdisciplinary program allows me the opportunity to think differently than day to day thought.	5	4	3	2	1
13	The interdisciplinary program was a new way for me to learn.	5	4	3	2	1
14	Every person must focus on one area with no connection to other subjects. That's the only way to achieve.	5	4	3	2	1
15	My esteem for the teachers grows when they manage to interest me in topics that are beyond the required study material.	5	4	3	2	1
16	My esteem for the school rises when it manages to combine activities and other studies beyond the course material.	5	4	3	2	1
17	My group's summary project was a challenge to my thinking.	5	4	3	2	1

18	The project helped me express my abilities.	5	4	3	2	1
19	The work method of the interdisciplinary program allowed me to meet more students in the class with areas of interest similar to mine.	5	4	3	2	1
20	I liked doing the "Thoughtful Experiments"	5	4	3	2	1
21	Our class' curriculum is one of the reasons to recommend to others to study in the class.	5	4	3	2	1
22	Work in groups lowers competition in the class.	5	4	3	2	1

Table 6: Classification of Questions

Questionnaire	Negative Items	Classification into categories
Science and Regime Science=**MADA**	1,4,14	A - 7,16 B - 11,19,21,22 C - 15 D - 3,4,6,10,12,14 E - 5,17,20 F - 2,11,13,18

A. The Impact of Interdisciplinary Study Over Attitudes Towards School

Simple Statistics

Variable	N	Mean
MADA7	28	4.60714
MADA16	28	4.67857

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.638158

Alpha < 0.7

The averages of the responses in this category express agreement with the statements. In Question 16, 93% of the students expressed full agreement with the statement that esteem for the school rose when the school

manages to include activities and studies beyond the course material. Testing of reliability, however, was not 0.7, but was quite close.

B. The Impact of Interdisciplinary Study Over Attitudes Towards The Class

Simple Statistics

Variable	N	Mean
MADA11	28	4.21429
MADA19	28	3.42857
MADA21	28	4.46429
MADA22	28	3.60714

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.831001

Alpha > 0.7

The reliability of this category is beyond doubt. Examination of the response averages indicates satisfaction within the class. Question 21, in which the average response was 4.46, shows that the students agree to recommend the class to others, because of the curriculum.

C. The Impact of Interdisciplinary Study Over Attitudes Towards Teachers

Variable	N	Mean
MADA15	28	4.786

The statistical datum of average responses indicates a positive impact of the interdisciplinary program over attitudes towards teachers. More teachers were involved in this program than in the other programs, and therefore this piece of information is very important, because it indicates that it is not based on one or two individual teachers who have a close relationship with students. The high average shows that the response includes teachers in general.

D. Attitudes Regarding Interdisciplinary Learning

Simple Statistics

Variable	N	Mean
MADA3	28	3.96429
MADA4	28	4.67857
MADA6	28	4.46429
MADA10	28	4.92857
MADA12	28	4.60714
MADA14	28	4.82143

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.746077

Alpha > 0.7

Testing of reliability indicates that this category is well within the limits, and Alpha is greater than 0.7.

Question 4 is formulated negatively in the students' attitude questionnaire. The data above show the corrected value.

It is important to see that students strongly oppose learning without enrichment. One may see the interesting correlation between Questions 6 and 12. Question 6 is a general statement which states that interdisciplinary studies allow multidirectional thought. In Question 12, the students testify that in the program they were able to think differently than in day to day life. There is a fit between what the students consider correct and what the students experienced in the program.

E. Attitudes Regarding the Need for Challenging Learning

Simple Statistics

Variable	N	Mean
MADA17	28	4.53571
MADA20	28	4.42857

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.730038

Alpha > 0.7

This criterion fulfills the reliability test, as Alpha is greater than 0.7. Attitude towards the need for cognitive challenge is also very high. The questionnaire average runs between agreement and absolute agreement.

F. Attitudes Regarding the Specific Program

Simple Statistics

Variable	N	Mean
MADA2	28	4.60714
MADA11	28	4.21429
MADA13	28	4.10714
MADA18	28	3.89286

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.694562

Alpha ~ 0.7

The Alpha value for this category is very close to 0.7, and therefore this category will be considered reliable.

There is full agreement in item 2, which relates to combined History and Science lessons as interesting lessons. There is slightly lower agreement in item 18, which stated that the project allowed the student to express his personal abilities.

From the Interviews

The History Teacher:

"I have dreamt of such a program for a long time. Ancient Greece can be connected to so many things. When you spoke to me about the development of science, I immediately knew what direction to move in".

The Bible Teacher:

"This is how learning should be! I always tell the young teachers that you don't have to read and interpret every word of the Bible in the class. Let the kids work. We the teachers must develop ideas, find topics related to current events also. I am very happy for the opportunity you gave us to do something different." The Bible teacher is also a regional instructor for Bible teachers.

The Literature Teacher:

"I sat down with the staff to search for texts and books in the curriculum, that we may have set aside in recent years, to connect with the program. I think that it was good for the staff. It was like shaking the dust off a pile that you haven't touched in a long time and finding exactly what you were looking for".

"We had a good meeting with the physics staff, even though we discussed literature more".

The Chemistry Teacher:

"Finally, chemistry and physics are working together and not competing over students".

The Students:

"It was good that we didn't know ahead of time which teacher would be connected with which teacher. I was always a bit of a surprise".

"I liked the assignments that you gave us in physics, like how to explain something like a Greek scientist or a modern scientist. There was a lot of laughter in the group".

"What, you don't really teach like this every year?"

Physics in Art

Table 7: Attitude Questionnaire - Physics in Art

Circle the answer with which you agree. Please note 5 denotes "absolutely agree", and 1 denotes "do not agree":

		Absolutely agree				Do not agree
1	Interdisciplinary study is a waste of time that we could be dedicating to progress in our academic material	5	4	3	2	1
2	I feel that I learned to look at works of art differently.	5	4	3	2	1
3	I am more interested in interdisciplinary learning	5	4	3	2	1
4	It would have been worthwhile to expand and include other subjects in the interdisciplinary learning also.	5	4	3	2	1
5	The school should prepare us for matriculation exams in the shortest and most effective manner, without additions and enrichment.	5	4	3	2	1
6	The school should initiate curricula that will cause students to be interested in the study material.	5	4	3	2	1
7	Interdisciplinary studies allow us to think multidirectionally.	5	4	3	2	1
8	It is more interesting in school when we don't just stick with material for tests.	5	4	3	2	1
9	The attractiveness of the school grows the more varied our class curricula are.	5	4	3	2	1
10	It is necessary to develop multidirectional thought abilities at a young age.	5	4	3	2	1
11	It is important to be able to connect between different areas of knowledge.	5	4	3	2	1
12	I told my friends/family about the interdisciplinary program in our class.	5	4	3	2	1
13	The interdisciplinary program allows me the opportunity to think differently than day to day thought.	5	4	3	2	1
14	The interdisciplinary program was a new way for me to learn.	5	4	3	2	1
15	Every person must focus on one area with no connection to other subjects. That's the only way to achieve.	5	4	3	2	1
16	My esteem for the teachers grows when they manage to interest me in topics that are beyond the required study material.	5	4	3	2	1
17	My esteem for the school rises when it manages to combine activities and other studies beyond the course material.	5	4	3	2	1
18	My group's summary project was a challenge to my thinking.	5	4	3	2	1

19	The project helped me express my abilities.	5	4	3	2	1
20	The work method of the interdisciplinary program allowed me to meet more students in the class with areas of interest similar to mine.	5	4	3	2	1
21	I enjoyed working with the mentor, the coach and others to do my final project.	5	4	3	2	1
22	Our class' curriculum is one of the reasons to recommend to others to study in the class.	5	4	3	2	1
23	Work in groups lowers competition in the class.	5	4	3	2	1

Table 8: Classification of Questions

Questionnaire	Negative Items	Classification into categories
Physics in Art Art = **OMAN**	1,5,15	A - 8,17 B - 9,12,20,22, 23 C - 16 D - 1,4,6.7,11,15 E - 13,18 F - 14,21

A. The Impact of Interdisciplinary Study Over Attitudes Towards School

Simple Statistics

Variable	N	Mean
OMAN8	27	4.07407
OMAN17	28	3.89362

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.838728

Alpha > 0.7

Calculation of Alpha indicates that this category is reliable. The average response to the questions is near 4, i.e., there is agreement that the

interdisciplinary program has a positive impact over attitudes towards school. Nevertheless, the average is lower than on other questionnaires. This will be seen more clearly in the analysis of variance between the questionnaires.

B. The Impact of Interdisciplinary Study Over Attitudes Towards The Class

Simple Statistics

Variable	N	Mean
OMAN9	27	4.07407
OMAN12	26	3.88462
OMAN20	26	3.46154
OMAN22	27	4.03704
OMAN23	26	3.23077

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.872899

Alpha > 0.7

As in the previous category, here too, this category is reliable, it is possible to see that the average response to the questions is near 4. The conclusion is that there is agreement that the interdisciplinary program has a positive impact on attitudes of students toward the class. The statement with the lowest average value was number 23 (3.23). Item 23 relates to working in groups as lowering competition in the class. Statement 20 is concerned with the possibility of meeting more students in the class with similar areas of interest. This statement is also low in relation to others, with an average response of 3.4.

C. The Impact of Interdisciplinary Study Over Attitudes Towards Teachers

Variable	N	Mean	Std Dev
OMAN16	28	4.107	0.832

The average response in this questionnaire regarding teachers is over 4. There is agreement regarding this statement.

D. Attitudes Regarding Interdisciplinary Learning

Simple Statistics

Variable	N	Mean
OMAN1	27	3.70370
OMAN4	27	3.29630
OMAN6	28	4.53571
OMAN7	27	4.03704
OMAN11	27	4.25926

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.735099

Alpha > 0.7

For this criterion, the average response to the questions indicates that attitudes towards interdisciplinary learning is positive. This category is reliable, as Alpha is greater than 0.7. We see that the average response to questions is lower than on other questionnaires for this category.

E. Attitudes Regarding the Need for Challenging Learning

Simple Statistics

Variable	N	Mean
OMAN13	27	3.48148
OMAN18	26	3.84615

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.693545

Alpha ~ 0.7

Alpha is very close to 0.7, and it may therefore be assumed that the criterion is reliable. The averages of 3.48 in item 13 and 3.84 in item 18 indicate agreement that is not overwhelming. Discussion of this fact follows in the next chapter.

F. Attitudes Regarding the Specific Program

Simple Statistics

Variable	N	Mean
OMAN14	27	3.77778
OMAN21	27	3.07407

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.828358

Alpha > 0.7

Reliability for this criterion is high, but there is a low level of agreement in the questionnaire items. Item 21 relates to working with the mentor and the coach, which apparently has a great deal of impact over attitudes regarding the other criteria in this program.

From the Interviews

The Art Teacher:

"Actually, I did not see the entire picture in front of me. I also have not taught a gifted students' class before, and I based myself on regular lessons in introduction to art that I give in my own class. I should have gone into each subject in a different manner, apparently."

"Maybe I should have prepared a larger pool of pictures, although they actually chose good things. "A Bar at the Folies-Bergère" by Manet can be looked at for hours, trying to understand what is happening…Also "A Castle in the Pyrenees" by Magritte is a very strong picture to research".

"Not many students came to consult with me, apparently they got help at home".

"Next time it will be more powerful, you'll see".

The Students:

"The correct way to teach is transmission of the material by the teachers in an interesting manner - the lesson must begin from there".

"What did we get out of the program? We found out that the museum gift shop has amazing posters. Last week we went to buy pictures for our room".

"I actually enjoyed the part where we had to determine if the picture is realistic or not. We even had arguments at home about it".

"It's a shame that we had to do the work in our free time. If you had given us time in class for it I would have treated it more seriously".

Variance Between the Questionnaires Regarding the Six Attitudes

After examination of the results of the criteria and their components in the various questionnaires, it is worthwhile to examine the variance between the criteria according to the various programs.

A. The Impact of Interdisciplinary Study Over Attitudes Towards School

The GLM Procedure

Class Level Information

Class	Levels	Values
SUBJ	4	ALISA ARAB MADA OMANUT

Number of observations 102

Dependent Variable: INFSCH

Source	DF	Sum of Squares	Mean Square	F Value
Model	3	6.13183422	2.04394474	5.55
Error	98	36.10446208	0.36841288	
Corrected Total	101	42.23629630		

Source	Pr > F
Model	0.0015

Duncan Grouping	Mean	N	SUBJ
A	4.6429	28	MADA
A			
A	4.5185	18	ARAB
A			
A	4.4286	28	ALISA
B	4.0119	28	OMANUT

One may see that in the first three programs: Alice, Arabic and Computer Science, and Science and Regime, there is an equal degree of impact over students' attitudes towards school. The impact of the Art and Physics program over attitudes was smaller.

B. The Impact of Interdisciplinary Study Over Attitudes Towards The Class

The GLM Procedure

Dependent Variable: INFCLS

Source	DF	Sum of Squares	Mean Square	F Value
Model	3	9.35268348	3.11756116	6.66
Error	97	45.39206349	0.46795942	
Corrected Total	100	54.74474697		

Source	Pr > F
Model	0.0004

Duncan Grouping		Mean	N	SUBJ
	A	4.6111	18	ARAB
	A			
B	A	4.2381	28	ALISA
B				
B	C	3.9286	28	MADA
	C			
	C	3.7500	27	OMANUT

This situation is more interesting.

The impact over attitudes towards the class in the Arabic and Alice in Wonderland programs was similar (A). A fit was found between the impact of Alice in Wonderland and the Science program (B), but the impact over students' attitudes regarding the class within the Science and Regime class was similar to the impact of the Art program (C).

C. The Impact of Interdisciplinary Study Over Attitudes Towards Teachers

The GLM Procedure

Dependent Variable: INFTCH

Source	DF	Sum of Squares	Mean Square	F Value
Model	3	9.42810458	3.14270153	8.26
Error	98	37.27777778	0.38038549	
Corrected Total	101	46.70588235		

Source	Pr > F
Model	<.0001

Duncan Grouping	Mean	N	SUBJ
A	4.8889	18	ARAB
A			
A	4.7857	28	MADA
A			
A	4.6786	28	ALISA
B	4.1071	28	OMANUT

As in the first instance, the Art program had a smaller impact than the other programs over the attitudes of the students towards the teachers. It creates a separate group that is not in correlation with the other programs.

D. Attitudes Regarding Interdisciplinary Learning

The GLM Procedure

Dependent Variable: ATTMUL

Source	DF	Sum of Squares	Mean Square	F Value
Model	3	6.75463196	2.25154399	7.63
Error	98	28.91757937	0.29507734	
Corrected Total	101	35.67221133		

Source	Pr > F
Model	0.0001

Duncan Grouping	Mean	N	SUBJ
A	4.5778	18	ARAB
A			
A	4.5774	28	MADA
B	4.1429	28	ALISA
B			
B	4.0000	28	OMANUT

Here we see two groups of attitudes. The Arabic program and the Science program created the same impact over attitudes regarding interdisciplinary learning. The Alice in Wonderland program and the Art program had a smaller impact over students' attitudes.

E. Attitudes Regarding the Need for Challenging Learning

Dependent Variable: ATTCHL

Source	DF	Sum of Squares	Mean Square	F Value
Model	3	14.36365757	4.78788586	11.76
Error	97	39.47792659	0.40698893	
Corrected Total	100	53.84158416		

Source	Pr > F
Model	<.0001

Duncan Grouping	Mean	N	SUBJ
A	4.6944	18	ARAB
A B A	4.4821	28	MADA
B B	4.1518	28	ALISA
C	3.6667	27	OMANUT

The Arabic program and the Science program express the same attitudes regarding the need for challenging learning and make up one group (A). The science program and the Alice in Wonderland program can be a group (B) that describes the same attitudes regarding the need for challenging learning. The art program is not similar to any of the other programs and is the lowest in expressing the need for challenging learning.

F. Attitudes Regarding the Specific Program

The GLM Procedure

Dependent Variable: ATTSPE

Source	DF	Sum of Squares	Mean Square	F Value
Model	3	15.62553260	5.20851087	12.34
Error	96	40.50530073	0.42193022	
Corrected Total	99	56.13083333		

Source	Pr > F
Model	<.0001

Duncan Grouping	Mean	N	SUBJ
A	4.5294	17	ARAB
A			
A	4.2054	28	MADA
A			
A	4.1875	28	ALISA
B	3.4259	27	OMANUT

The art program here too, is a separate group based on the students' attitudes towards the specific program. One may see that there is a large disparity between the averages of the other three programs and that of the Art program.

Discussion and Conclusions

An initial examination of the results in the previous chapter indicates satisfaction and positive attitudes among the students towards the school. This issue is highly important because, as presented previously, many students have concerns regarding attending the gifted students' class, the label that is applied to them, the variety of learning methods, the degree of interest they will have in studies, the educational challenge at hand, and coping with other gifted students after being used to being the only gifted ones in their classes, without any competition regarding academic achievements with other gifted students like them.

The interdisciplinary programs that were constructed in the school aimed to provide a response to the students and their teachers, with a desire for an important product, i.e., improved positive attitudes towards the school.

We will address the results pertaining to the central research question of the present dissertation:

Do interdisciplinary curricula in gifted students' classes change the students' attitudes to a more positive view of their experience?

This issue was tested by division into three categories of questions which together, comprise attitudes towards the issue that was the subject of the study. As previously itemized, the categories are:

The impact of interdisciplinary learning over attitudes towards school (INFSCH).

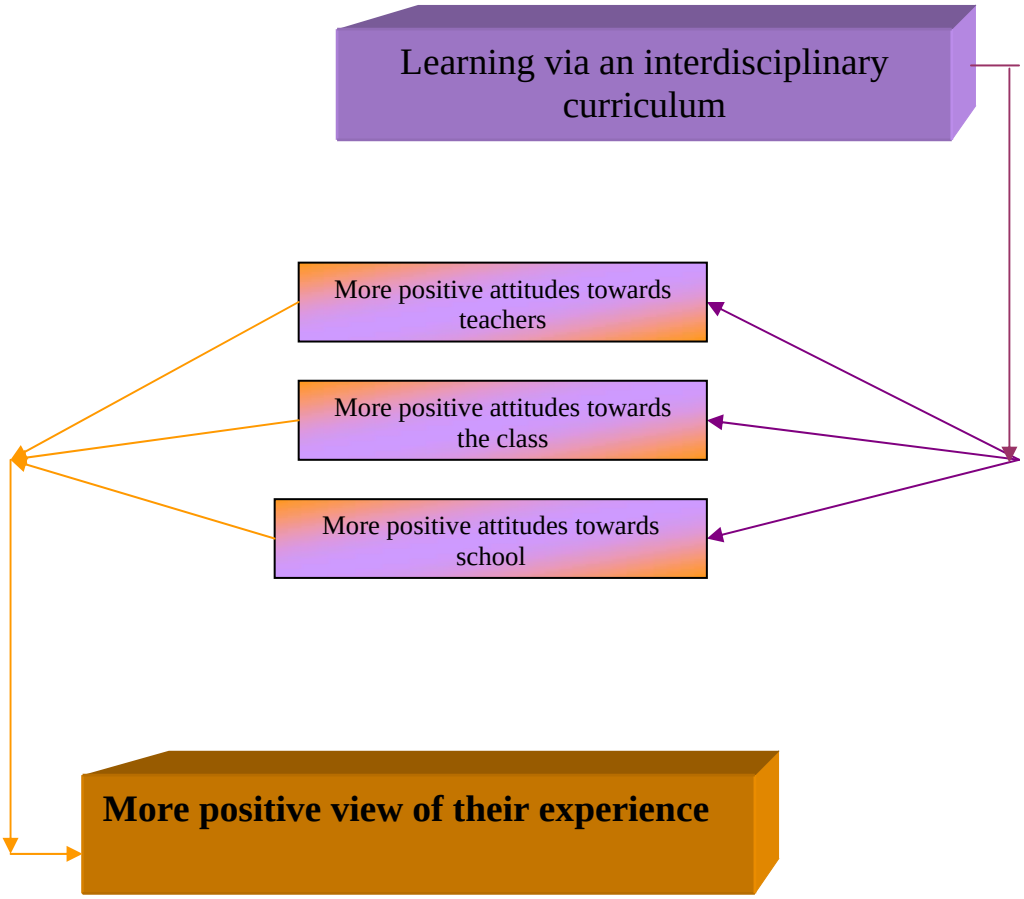
The impact of interdisciplinary learning over attitudes towards the class (INFCLS).

The impact of interdisciplinary learning over attitudes towards teachers (INFTCH).

In all four programs in which attitudes towards school were examined, agreement to full agreement were found.

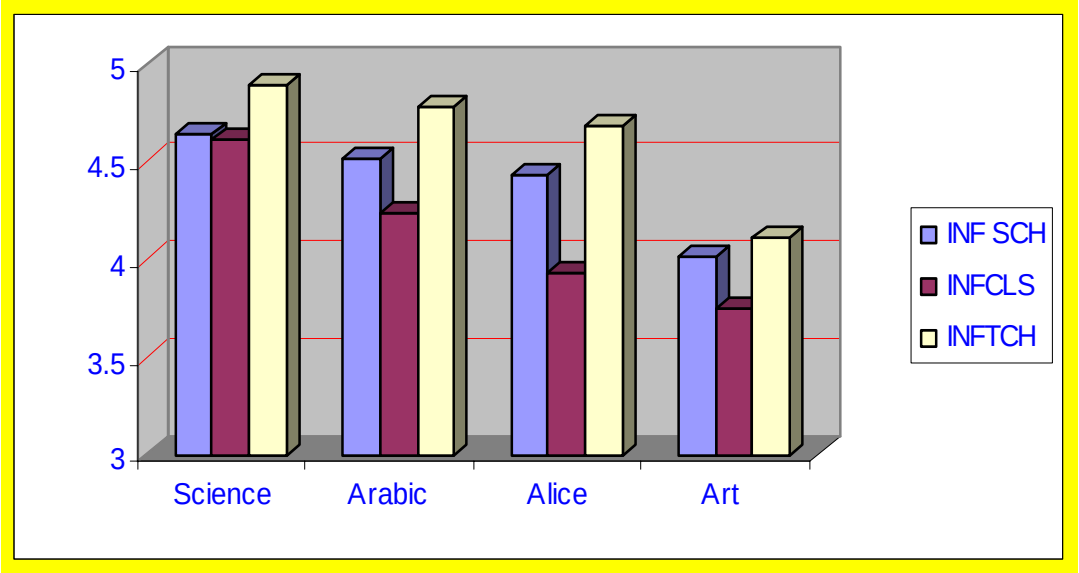
The correlation between the research question, the categories derived and the conclusions can be illustrated as follows:

Figure 13: Learning Via an Interdisciplinary Curriculum



The results of the statistical analysis can be presented using a graph that shows the results on the measurement scale between 1 - **don't agree** to 5 - **absolutely agree**

Graph 1: Attitudes of Students Towards School according to the Different Interdisciplinary Programs



*Note that the graph begins at 3. This is the middle of the attitude scale and therefore averages above 3 indicate positive attitudes of agreement. The upper end of he scale, 5, represents absolute agreement.

The positive attitudes towards school are expressed by the fact that no category showed a value lower than or equal to three.

When addressing each of the categories comprising attitudes towards school there are differences between them: The most positive attitudes in each curriculum that was studied were in attitudes towards teachers. Then came attitudes towards school, followed by attitudes towards the class.

From my standpoint, this datum represents a significant achievement. Until now, most of the value that the students placed was on external lecturers and people of academy who provided enrichment to the students. The teachers had been part of the school experience and were labeled by the students as a "necessary evil", necessary to get through school assignments and matriculation examinations.

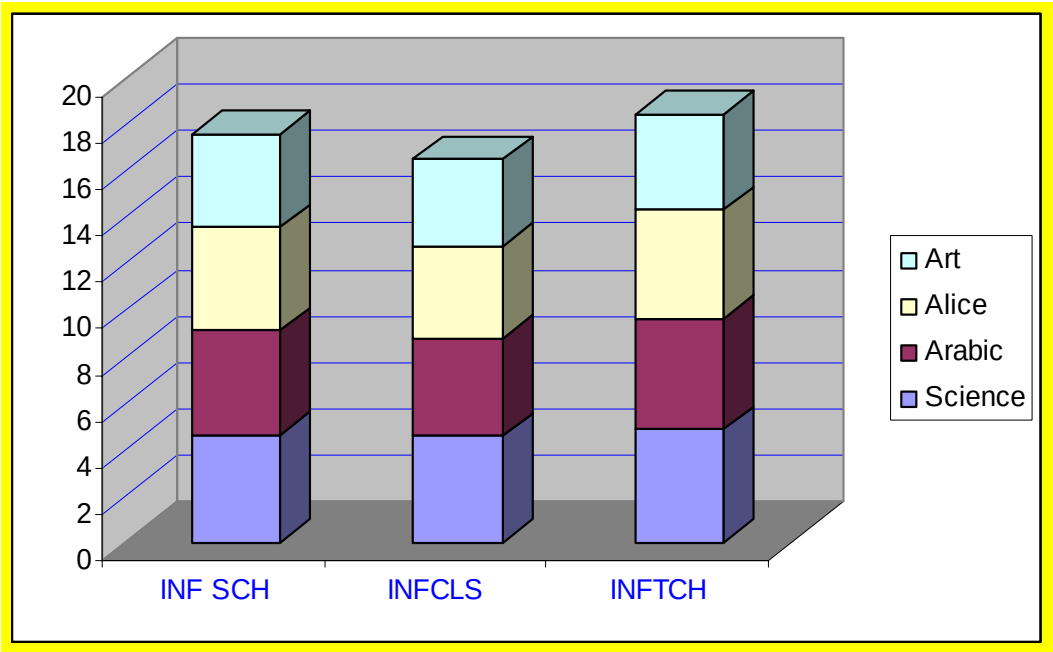
The interdisciplinary programs "highlighted" the teachers. They allowed teachers to be more clearly seen and to show abilities that are not expressed in their regular daily teaching, expanding their dialogue with the students (Plucker & McIntier, 1996).

Improved positive attitudes towards the class shows a positive improvement in attitudes, but is lower than the other two categories. One

may see that the interdisciplinary programs contributed to improving attitudes towards the class. The interdisciplinary programs placed emphasis on high level thinking, intellectual challenge and multidirectional thinking. A byproduct of the program is the interaction that occurs between the students in the class. We see that in the Science, Regime and Culture program, the relatively high attitudes regarding the class stem from the long term interaction over the course of the year and the many areas of study, allowing a variety of meetings between the students. This result regarding attitudes towards the class may be improved if, in future programs, we also emphasize social interaction which may be created during the class, particularly during group work. The interdisciplinary programs that were constructed placed the need for intellectual challenge and thought as a priority before the social need.

The accumulated impact of all four programs in the various categories can be examined in the following graph:

Graph 2: Cumulative Impact of the Programs over the Three Categories



This graph allows us to clearly see the impact of each interdisciplinary program in each one of the categories that examine the research question. The maximum value of the cumulative contribution in all four programs is 20. The maximal value for each category is:

4 (types of programs) x 5 (maximal value, i.e. "absolutely agree") = 20

When examining the cumulative contribution in each of the four programs we see that the largest cumulative impact is in the category of teachers, and the smallest cumulative impact is the category addressing the class.

The graph allows the following conclusions, reinforcing the previous conclusions:

1. All three categories that comprise the response to the main research question present the same trend of a **very positive** attitude, and clearly show that the interdisciplinary program has a positive impact over students' attitudes and approach towards school.

Therefore according to the model described in Figure 6, the main research question is supported and it may be said that the interdisciplinary programs have a substantial positive impact over attitudes of students regarding their school experience.

2. The differences between the responses to the three components that examine the research question are not large. There is a clear trend towards positive attitudes in all three components.

3. Among the three categories studied, comprising the response to the main research question, one may see that the interdisciplinary programs have a very large impact over positive attitudes towards teachers who teach the students.

This section may be summarized as follows:

In response to the main research question, a trend was found towards a **very positive** attitude, clearly showing that the interdisciplinary programs had a very substantial impact over positive attitudes of students regarding their approach to the school.

The impact of the programs over positive attitudes towards the teachers teaching the program is the most prominent.

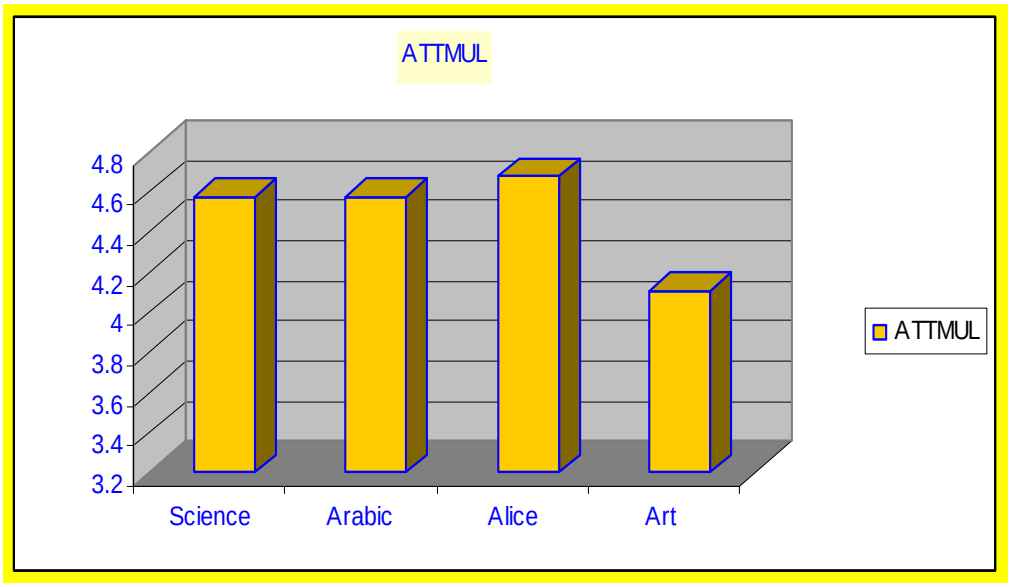
Additional questions which were examined in the present dissertation dealt with providing a response to the needs of the gifted student population in our school through unique interdisciplinary programs:

Does the school's policy change according to gifted students' needs?

Are interdisciplinary programs compatible with gifted students' study pace?

First we will address the first category of questions that examined attitudes of students regarding interdisciplinary learning (ATTMUL). Positive attitudes in the series of question in this category will testify that this learning method satisfies the students' needs in the classroom and in their lessons.

Graph 3: Attitudes Regarding Interdisciplinary Learning



The graph indicates that in all four programs, there is positive agreement regarding this learning method. The values are all above four, and therefore express absolute agreement regarding the interdisciplinary learning method. The lowest value, which was also above four, was received in the Physics in Art program. This datum will be addressed below, in the discussion on the differences between the programs.

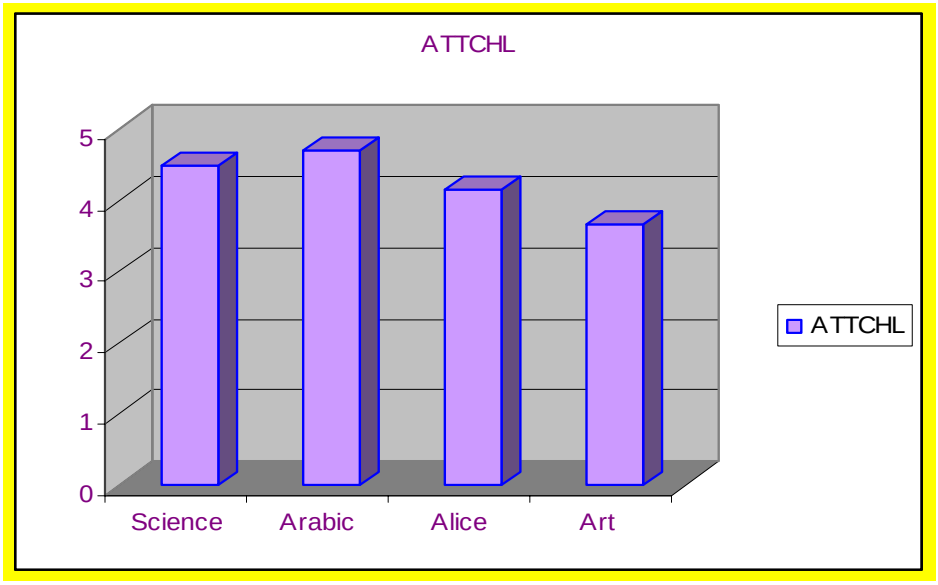
The high values of agreement regarding the learning method indicate that interdisciplinary programs satisfy the students' needs. This need was indicated in the study done by Shore & Kanevsky (1993), who argue that gifted students have unique ways of thinking, and therefore they may not just be grouped in special classes or enrichment lessons. **There is also a need for unique curricula for them.** They discussed transferring thinking skills from field to field, such as applying mathematical reasoning to a literary problem and vice versa. There is no doubt that the interdisciplinary program applies these types of skills.

It is also important to mention what was stated by Van Tassel-Baska (1995) in her description of the epistemological program: **A gifted child has extraordinary abilities to see and understand mutual connections.** The program provides an **intellectual framework that does not exist in a single area of content**, exposing the student to many ideas that are not possible in the accepted curriculum, and providing the student with the basis for understanding the creative and intellectual process through involving him actively in the creative process.

The school programs that were constructed as interdisciplinary programs, definitely encourage seeing mutual relationships between different areas of content, and create intellectual stimuli that do not exist in one single area of content.

In order to asses the challenge that the interdisciplinary programs provided, the following graph consolidates the responses of the students in this category:

Graph 4: Attitudes Regarding the Need for Challenging Learning



Our aim was to examine the students' attitudes regarding the need for a challenge. The graph above indicates the responses of the students regarding the degree of challenge provided by the various programs. A student in a regular class would not necessarily agree with the term "challenge" but would have testified to the degree of difficulty of the assignments.

The fact that the students in the gifted students' class in fact identified the challenge and addressed its degree, already testifies to their need for a challenge. Therefore, it remains to examine if the programs in fact satisfied this need. The challenge for the student is integration of high level thought with the ability to see and understand mutual connections and the use of reasoning skills over a range of areas.

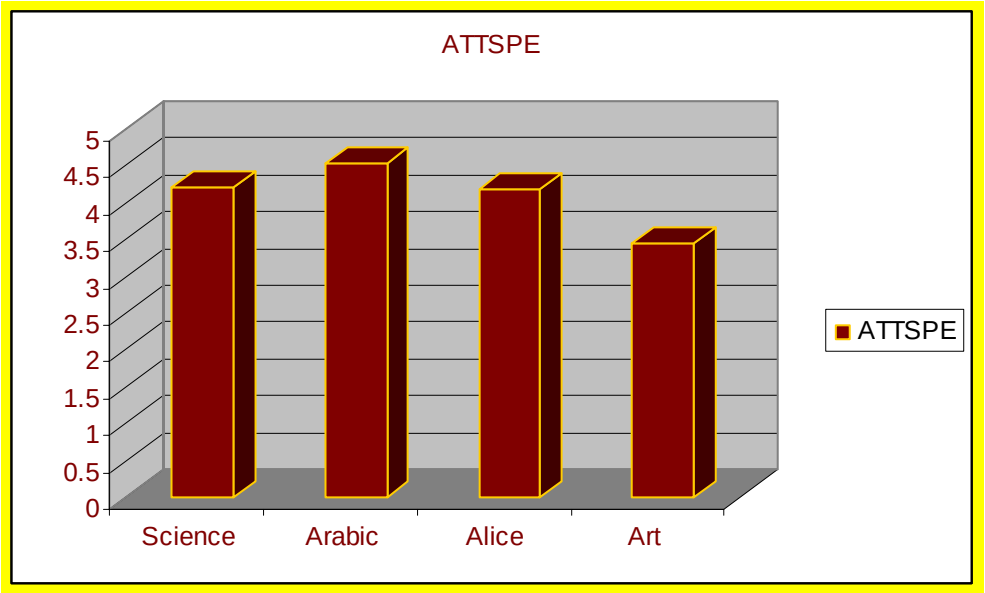
One may see that all of the programs provided a higher than average cognitive challenge. The highest value was attributed to the Arabic and Computer Science program. It is possible that the fact that there still are unresolved issues that still must be added to and developed created a feeling of continual challenge and therefore the level of challenge in this program was estimated to be high. The particularly high level of thought necessary to develop the final project also increased the challenge. The Physics in Art program provided a challenge to the students but one can see that the effect is lower than the other programs. In the other two programs the degree of agreement was rated four and above, testifying, similarly to the Arabic and Computer Science program , that the students

experienced a learning level that satisfied their unique needs, and was a challenge to them.

The last category of questions addressed the programs themselves. This category is very important for my edification and that of the teachers involved in writing the various curricula, in addition to all of the other information that was extracted from the questionnaires.

First we will examine the students' attitudes regarding the specific programs.

Graph 5: Students' Attitudes Regarding the Specific Programs



One sees that the interdisciplinary programs implemented by the school were positively assessed by the students. The high values of agreement testify to the quality of the programs and also to the need of these students to learn in his fashion. Despite the cynicism typical of gifted students at this age (for example, this typical cynical answer: "What did we get out of the program? We found out that the museum gift shop has amazing posters. Last week we went to buy pictures for our rooms"), the responses that were received on the written questionnaires testify to the students' satisfaction with the various programs.

The Arabic and Computer Science program received the highest assessment. The two programs, Alice in Wonderland and Science, Regime and Culture", received similarly high assessments. The Physics in Art program was also positively assessed, although not as highly as the other three programs. The differences between the programs may also be

seen in the statistical analysis of the previous chapter, which I will address in the following section which discusses the variance between the programs.

This section may be summarized as follows:

1. There is absolute agreement among the students regarding the interdisciplinary study method. This method satisfied the need for a special type of curriculum that satisfies the academic needs typical of the gifted student population.

2. All of the programs provided a cognitive challenge. The challenge for the students was integration of high level thought with the ability to see and understand mutual correlations and transfer of reasoning skills from one field to another.

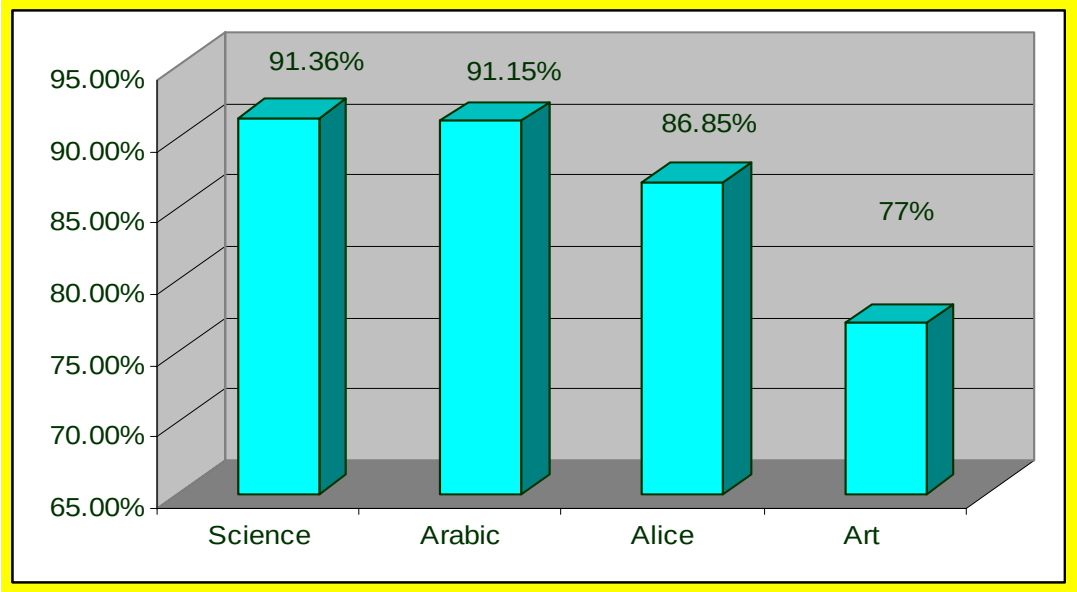
3. The interdisciplinary programs at the school that were examined were positively assessed by the students.

Variance Between the Different Programs

In order to achieve a general picture regarding the variance between the programs, I took the cumulative impact of each of the criteria that were examined in each of the programs and translated them into percentages. The following graph presents a clear picture regarding the sum total of the impacts of the criteria for each program, translated into percentages.

The variance analysis between the programs, as presented in the previous chapter, attempted to attribute the programs to groups that were equal regarding the degree of impact of each variable. The following is a summary of all of the data in one table as described below:

Graph 6: Sum Total of the Impacts of the Criteria on Each Program, Translated into Percentages



The graph indicates clearly that the Physics in Art program is exceptional compared to the other programs. This stood out previously in the analysis of the various criteria. The interdisciplinary programs: Science, Regime and Culture, Arabic and Computer Sciences are dominant in the scope of impact of the criteria. Alice in Wonderland is close to the two leading programs, and the impact on students' attitudes is much more significant than in the final program.

A more in-depth look at the criteria that were tested in each program, as depicted in the summarizing table below, shows that the distribution in the previous graph is not unequivocal:

Table 9: Variance Between Programs - Comparison of Criteria by Duncan Grouping

	SCH	CLS	TCH	MUL	CHL	SPE
Science	A	A	A	A	A	A
Arabic	A	A B	A	A	A B	A
Alice	A	B C	A	B	B	A
Art	B	C	B	B	C	B

The analysis of the degree of impact of each of the programs in the various criteria was presented in cross sections above. Nevertheless, it is important to examine the table which highlights a number of attributes of the various programs:

1. The Science, Regime and Culture program has the largest positive impact over the attitudes of students in all of the criteria that were tested.
2. The program combining Arabic, Computer Sciences and Artificial Intelligence has the largest positive impact over students' attitudes in most of the criteria that were tested. In two criteria, it is on the borderline fitting into a B order program, i.e., regarding the degree of impact over attitudes toward the class and the degree of challenge. Since only some students in the class studied in this program, it is clear that the connection with the entire class is weaker than the connection with students within the limited group. Regarding challenge, it is possible that the fact that the teachers took part in the tasks decreased the challenge for the children in a minor fashion. Another possible explanation is the fact that the study groups included choice students, who define level of difficulty and challenge differently than we would.
3. The Alice in Wonderland program, combining Literature and Physics, is equal in its degree of influence over positive attitudes of students to that of the previous two programs in three of the categories: school, teachers, and the specific program. Positive attitudes towards interdisciplinary programs and degree of challenge are similar to those of the second group. The impact over positive attitudes of students towards the class are similar to programs in Group B, but also close enough to values in Group C. It is possible that the relatively short amount of time that was dedicated to this program within the framework of class studies, or the fact that choice of work groups was

not made by the students themselves, led to low level interaction among the class members, leading to the lower level of attitude.

4. The Physics in Art program had less of an impact over positive attitudes of students than the other programs in the criteria that were tested. It is important to note: This interdisciplinary program had a positive impact over students' attitudes. Even if this had been the only program offered by the school, we would see an improvement in students' attitudes. Relative to the other programs that were implemented and assessed in the school, it only had the least impact, mainly in the fields of attitude towards the class and degree of challenge.

I now address the possible factors, dependent on the school and not the students, which may have created this variance between the programs.

a. Scope of hours of the program

The two leading programs which present the most positive attitudes towards the school are: Science, Regime and Culture and Arabic and Computer Sciences. These two programs were programs that spread over a large number of yours within the weekly school schedule for the students. Science and Regime was part of Physics, Chemistry, and History lessons, and additional hours spend on the topic of discussions on ethics and morals. In total this program entailed **more than** 10 hours per week. The program was constructed as a teaching approach towards the class so that teachers from other disciplines could connect at various points, as actually happened. Apparently the students liked this: " It was good that we didn't know ahead of time which teacher would be connected with which teacher. It was always a bit of a surprise".

These various connections increased the number of weekly study hours during which the students were exposed to higher order cognitive processes, intellectually challenging assignments, research work in varying groups, and varied assessment methods. The advanced training provided to all of the teachers in the school had an impact both over the teachers' room and the students, as all of the teachers spoke in the same terms and could create interdisciplinary dialogue with the students.

The Arabic and Computer Sciences program was similar. The program was allotted over ten weekly hours: 5 hours of computer sciences and 6 hours of Arabic studies, with an additional three hours regarding familiarity with the world and culture of Islam. The weight of the program was a significant part of each student's weekly schedule.

The Alice in Wonderland program and the Physics in Art program were based on a relatively small number of study hours. In addition to the

hours in the class, the students worked outside of the classroom. These hours were used for group work on assignments, but without the assistance of teachers unless the students required help. So the total number of hours within the regular school schedule was smaller than that of the previous two programs. Apparently the number of weekly hours meeting with the teachers also had an impact over students' attitudes.

If we look at the distribution of the programs according to the Duncan Groupings, the Alice in Wonderland program is close to the Science and Regime and the Arabic and Computer Science programs (A), and only the Physics and Art class is classified as Group B. The explanation is apparently the type of teachers, which will be addressed below.

b. Work Groups/ Coach and Mentor

Another difference between the two programs which may provide an explanation is group work. Grossman, Rodgers & Moor (1988) consider problem solving in a group as "innovation in action". They argue that this method allows fulfilling creative abilities that are hidden in groups. They argue: "Individuals are creators, the group provides stimuli to encourage ideas". The group can increase the individual's creative ability. They add that creative thinking is a way of life. When one begins to think this way, he continues, searching for new opportunities and making discoveries that are unexpected.

In the Arabic and Computer Science program, work in the group is what pushed the program forward. Creative thought was an ongoing process because finding a solution to one stage led to searching for a solution to the next stage, and so forth. The Science, Regime and Culture program also emphasized group work throughout the year. Each study unit created by the teachers also created work groups and caused the students to group themselves differently to come up with solutions. In the Alice in Wonderland program, students were divided into groups of 5-6, predetermined by the teachers and homeroom teacher, based on previous familiarity with the students. The Physics in Art program worked based on a different concept based on Renzulli's theory. In this program the student was provided with a personal coach and mentor. It is possible that it was necessary to provide a better and more in-depth explanation, because students are familiar with the group work method, and are less familiar with the opportunities involved in working with a personal coach and mentor.

c. Teachers

As previously noted, the teacher population of the school is mainly composed of veteran teachers with years of experience, both in the gifted students' classes and in the regular classes. In recent years, some of the

veteran teachers have been retiring and are being replaced by young teachers. My aim, as principal, was to accept new teachers as gradually as possible, to allow them to connect to the school traditions, with the aid of the veteran teachers.

The three programs: Alice in Wonderland, Science Regime and Culture, and Arabic and Computer Sciences, were written and taught in the classes by experienced veteran teachers who had taught gifted students before. I have no doubt that the veteran teachers' teaching experience and work experience in general, and their specific experience teaching gifted students had a substantial impact over the success of the programs. This is in contrast to Hansen & Feldhusen (1994) who argue that training is preferable over teaching experience. The fourth program, Physics in Art was constructed by me and the Art teacher. I have no doubt that much was invested in our mutual study of these two areas of content and finding possible connections. My experience in constructing the previous programs, together with my familiarity with the class, led us to the conclusion that we should focus mainly on the history of art with emphasis on painting and sculpture. It should be noted that the Art study track is fairly new in our school. The teacher who coordinates this study track studied in a two year university course on the subject of teaching gifted students. Nevertheless, he had never previously taught a gifted students' class in our school. In my conversation with him at the end of the program, he admitted that he was not familiar with the population, its ways of thinking and the level of challenge that he should have provided. Therefore his part in providing the students assignments lacked cognitive challenge, as he put it:

"Actually, I did not see the entire picture in front of me. I also have not taught a gifted students' class before, and I based myself on regular lessons in introduction to art that I give in my own class. I should have gone into each subject in a different manner, apparently."

I feel that training does not provide **all the tools** necessary to a teacher, unless he has previous experience with the population and is therefore cognizant of their needs.

I have no doubt that teacher training is important. Training provides tools and reinforces teachers, but certain attributes mentioned by the researchers above are no less important: excitement, self confidence, and high level of intelligence. The results of this dissertation reinforce the research conducted by Goldring, Milgram & Chen (1989) who found that personal interest in gifted students is perceived as the most important factor, while other factors - academic degree, pedagogical education, work experience with the gifted, and special training, are assessed to be equally important.

The teacher himself argued that if he was given another opportunity he would know how to change his part to create more interest and provide the students with a challenge. However, and in all fairness, it also be mentioned that the work method determined for the program was different than those of the other programs. The teacher was very willing to serve as a mentor or coach for any students who desired. As previously mentioned, the students did not ask for much help.

The interdisciplinary programs constructed by the teachers contributed greatly to higher self esteem of the teachers themselves, as seen in their comments.

Satisfaction:

The Literature Teacher:

"I enjoyed it".

The History Teacher:

"I have dreamt of such a program for a long time. Ancient Greece can be connected to so many things. When you spoke to me about the development of science, I immediately knew what direction to move in".

The Arabic Teachers:

"I am euphoric. I never dreamt of such a product".

Intellectual Challenge:

The Computer Science Teacher:

"I think that we learned more than we taught".

"It was really a challenge because PROLOG did not allow us the possibility of working with Arabic letters and we had to find ways around it and come up with solutions".

The Literature Teacher:

"I thought we had a weak connection. I did not imagine how much physics could be learned from the book".

"Now I understand how hard it is to actually analyze on a computer. A full sentence is really an achievement".

A Change from Routine:

The Bible Teacher:

"This is how learning should be! I always tell the young teachers that you don't have to read and interpret every word of the Bible in the class. Let the kids work. We the teachers must develop ideas, find topics related to

current events also. I am very happy for the opportunity you gave us to do something different."

The Literature Teacher:

"I sat down with the staff to search for texts and books in the curriculum, that we may have set aside in recent years, to connect with the program. I think that it was good for the staff. It was like shaking the dust off a pile that you haven't touched in a long time and finding exactly what you were looking for".

Confidence in their Status and Greater Esteem of Students:

The Arabic Teachers:

"It doesn't matter how many hours we put in, look what it did for our study track!"

A Student:

"Teacher, did you read *Through the Looking Glass*? Maybe you can give us a lesson on "time". Can time move backward also?

"Finally something different. It reminded me of the activities at Weitzman Institute".

Team Work:

"We had a good meeting with the physics staff, even though we discussed literature more".

"Finally, chemistry and physics are working together and not competing over students".

"Do you know of any science fiction books that it is worthwhile for me to read".

The satisfaction, intellectual challenge, change from routine, feeling of self worth, feeling of security in their status and greater esteem by students, and team work are the factors that prevent teacher burnout, motivate teachers to initiate, to take responsibility and to "think out of the box".

The interdisciplinary programs helped place the school teachers in a more respected position, which broadcasts outwards onto the quality of the students' learning, their behavior and their attitudes towards teachers specifically and the school in general. Today, in the teachers' room, there is greater willingness to try new things and new programs even if the path or the product are not predefined. There is willingness to learn in action.

In summary of this section:

The interdisciplinary programs that were constructed for the gifted students' classes and were implemented by the teachers in the school, had a very strong impact over students' positive attitudes towards the school. These programs substantially satisfied the needs of gifted students, their need for challenging learning, high order thought and connections between disciplines, which are typical of the thought patterns of gifted children. The programs empowered the teachers both as regards the students' attitudes towards them and as regards their own self worth.

Conclusion

The beginning of the process within the school that was studied was a re-definition of goals (Postman, 1998), and writing educational aims within the "teachers' room", while developing a continually learning teachers' room model (Ezer, 1986). Emphasis was placed on **understanding the needs of gifted students** in the context of the current era. Addressing the current era is expressed in both the fact that the teaching staff understands that a rigid organizational structure must make way for a flexible structure that is able to change and be reconstructed allowing the provision of a response to students' needs (Handy, 1977).

The attributes of the new era as expressed by Handy - creating groups and dissolving them according to need and interest (Handy, 1977), and Sanjay - teams for learning and organization (Sanjay, 1995) are expressed in the daily life of the school, through the construction of interdisciplinary programs by different teacher groups. Curricula were written that combine a number of disciplines with interconnected ideas (Sizer, 1984, 1993) with mixed teams that changed according to subject. Most of the school curricula combined information technology as a mediator between the individual student and cumulative public knowledge (Chen, 1999), and provided a solution to the intellectual needs of gifted students and their unique manner of thought (Shore & Kanevsky, 1993).

The impact of the interdisciplinary programs in the gifted students' track within the school system may be summarized as follows:

The interdisciplinary programs that were constructed for students in the gifted students' classes and were transmitted by the school's teachers, had a very substantial impact over students' positive attitudes towards the school.

These programs very considerably satisfied the needs of the gifted students, challenging their learning, providing high order thinking, and connecting between disciplines, which are typical of the way of thought of gifted students.

These programs empowered the teachers both as regards attitudes of students towards them and their own self worth.

What, then, is the innovation of this dissertation, since educational theories for teaching gifted students, considering their special needs, how to write an appropriate curriculum, and the attributes of desired teachers for the gifted are all familiar theories that have been applied in many schools over the years?

Much of the innovation is in going beyond the level of written proposals. In cases where there are applications made, there is not always follow-up or an examination of the results, documentation, and/or the drawing of conclusions.

The interdisciplinary programs described throughout this dissertation which present a different method of teaching a curriculum, include all three of the following components:

An educational perception anchored in existing theories regarding innovation.

This outlook is processed and translated into an **operative program** that suits teaching methods to the gifted student population, providing this population with an intellectual framework that exists not only in one area of content, exposing the student to many ideas that are not possible in regular curricula. It provides the student with a basis for understanding the creative and intellectual process, through his active involvement in the creative process.

This takes place in special classes in a regular high school.

And finally, there is an **examination** of the applicability of the idea and its correctness.

Recommendations - Additional Directions in Research

1. It would be worthwhile to conduct a comparative study between two schools having similar background data, in which one does not use an interdisciplinary program, to reinforce the findings.
2. What happens to teachers over time? Does work with gifted students impact their work methods in other classes?
3. Does learning using "interdisciplinary programs" help the gifted student develop his ability to connect between subjects, beyond his studies in high school?

In conclusion:

Much has been written about the degree of burnout involved in the school principal's job. As a principal, the "interdisciplinary program" allowed me the opportunity to "go on an educational adventure", together with the teaching staff and the students. This was an adventure of new discoveries, and the more we advanced, the broader our options became. Did we discover new abilities within ourselves? Hidden abilities? The entire staff is not involved to the same degree, but the fact that there were enough "brave" teachers to "took up the gauntlet" and were true partners with me

in thought and action, gave me a feeling of value, satisfaction and a desire to continue.

The number of students who take the gifted students test and who want to learn in our classes, which was not used as a measure of success in this dissertation, but definitely is a measure of the success of our school, is continually rising.

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Abstract

The aim of the present research is to examine the impact of interdisciplinary curricula described in the present research over the attitudes of gifted students regarding school, the class, and the teachers, and the attitudes of students regarding interdisciplinary curricula and challenges to their thinking that the programs provide. Relevant literature relates to several theoretical issues, including: Educational Frameworks for the Gifted, Attributes of the New Era, Innovation in Teaching and Needs when Teaching the Gifted, and Interdisciplinary Programs, as presented by educational researchers and theoreticians.

The literature review shows that there is no single method or one uniform framework for educating gifted students. There are a variety of options for morning studies and a wide variety of options for enrichment. Many studies examine the advantages and disadvantages of learning in the classroom versus learning in enrichment frameworks. There is no consensus among researchers regarding the preferred academic framework for gifted students providing a response to all of their needs.

The literature shows that the new era is characterized by continual change. The creation of a flexible organizational structure may provide a response to frequent changes. In educating the gifted, emphasis is placed on understanding their special manners of thought, their need for challenges, and cultivating understanding for complex thought methods among gifted students.

A quantitative methodology was employed, supplemented by qualitative observations. data was collected and analyzed by means of interviews and statistical tools in order to examine the attitudes of gifted students towards the research variables.

The results indicate that the school as an organization can respond to the needs of the Gifted students, and create a more challenging way of learning, with the aid of an interdisciplinary program. This learning method satisfies the intellectual needs of gifted students and has a positive impact over their attitudes towards all of the entities within the school. Particularly positive attitudes were found regarding teachers who teach these programs.

The results confirm the hypothesis that a school that suits itself to the attributes of the new era can satisfy the intellectual needs of gifted students within school walls and not only with the aid of experts from academia or external entities, and in this way can improve the attitudes of gifted students towards the school in which they learn.

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Abstract

There is no single definition of giftedness. Over the past decade a number of definitions have been constructed, based on research, expanding upon the concept of giftedness, beyond pure intellectual ability. In the United States, Marlend's definition is accepted, that giftedness is multi-talented and connects intellectual ability, special talent and creativity all together.