

**Eötvös Loránd University, Faculty of Art
Ph.D. School of Education**

**The Riddle as a Learning and
Educational Tool**

HAIT SHAHAM

Consultant: Prof. Pa'l Volgyesy, Ph.d.

2007

Bölcsészdoktori Disszertáció

**The Riddle as a Learning and
Educational Tool**

HAIT SHAHAM

Consultant: Prof. Pa'l Volgyesy, Ph.d.

2007

Acknowledgments

I would like to take this opportunity to thank –

Prof. Pa'l Volgyesy, Ph.d., for his guidance, assistance, and commentary in the different phases of the research.

Dr. Yehuda Shwartz, for his help and support as he guided me skillfully and devotedly.

Dr. Keren Or Chen for her help in the coping with the statistical data.

Dan Chamizer, the riddle master, for the windows he opened for me in many areas and foremost for his patience and personal, warm, and sympathetic attitude.

My parents, who supported and encouraged me throughout.

My children, Mor, Omri, Shani, and Raz, for their understanding, dedication, love, and unqualified support.

My beloved husband, Ilan, who was my partner in this too, for his support, encouragement, and help – without him I would not have arrived at my destination.

Table of Contents

LIST OF TABLES	IV
LIST OF FIGURES	VII
ABSTRACT	VIII
1. INTRODUCTION	1
2. REVIEW OF THE LITERATURE	6
2.1 The Gifted and Talented Child	6
2.2 Thinking Styles	15
<i>2.2.1 Types of Thinking Styles</i>	<i>15</i>
<i>2.2.2 Factors that Influence the Styles of Thinking</i>	<i>21</i>
<i>2.2.3 Styles of Thinking in the School, in Research, and in Theory</i>	<i>24</i>
2.3 The Student's Perception of the Learning Environment	28
<i>2.3.1 The Learning Environment</i>	<i>28</i>
<i>2.3.2 Online Learning Environment</i>	<i>31</i>
<i>2.3.3 Resources Management</i>	<i>39</i>
<i>2.3.4 The Teacher's Support</i>	<i>40</i>
<i>2.3.5 Learning Climate Causes Learning Involvement</i>	<i>44</i>
<i>2.3.6 Interest Inducing Teaching and Motivation to Learn</i>	<i>47</i>
<i>2.3.7 Characteristics of an Innovative Learning Environment</i>	<i>49</i>
2.4 The Chamizer Method in Education	54
2.5 The Research Hypotheses	60
3. THE RESEARCH METHODOLOGY	62
3.1 The Research Design	62
3.2 The Research Population	62
3.3 The Research Sample	63

3.4 The Research Process	64
3.5 The Research Variables	66
3.6 The Research Instruments	67
<i>3.6.1 The Student's Perception of the Learning Environment Questionnaire</i>	<i>68</i>
<i>3.6.2 The Style of Thinking Questionnaire</i>	<i>68</i>
<i>3.6.3 Validity of the Research Instrument</i>	<i>69</i>
4. THE RESEARCH FINDINGS	70
4.1 Descriptive Statistics	70
4.2 Examination of the Research Hypotheses	75
4.3 Prediction of the Student's Achievements by the Thinking Style and Background Variables with the Mediation of the Perception of the Learning Environment	86
5. DISCUSSION AND ANALYSIS	93
5.1 Perception of the Learning Environment	95
5.2 Perception of the Thinking Style	101
5.3 The Relationship between Thinking Style and Learning Perception and Achievements	105
5.4 Summary and Conclusions	123
5.5 The Research Limitations	130
5.6 Recommendations	131
<i>5.6.1 Recommendations for Further Research</i>	<i>132</i>
<i>5.6.2 Applicative Recommendations</i>	<i>132</i>
6. PERSONAL REFLECTION	136
BIBLIOGRAPHY	139

APPENDICES	150
Appendix Number 1: The Model of Sternberg (1996)	150
Appendix Number 2: Further Information on the Chamizer Method	151
Appendix Number 3: Permission Letter to Principals	154
Appendix Number 4: The Research Questionnaire	155
Appendix Number 5: Division of the Questionnaire Items into Elements of the Learning Environment	159
Appendix Number 6: Division of the Questionnaire Items into the Thinking Styles	160

List of Tables

Table Number 1	Styles of Thinking and Methods of Teaching	24
Table Number 2	Operational Definition of the Demographic Research Variables	64
Table Number 3	Operational Definitions of the Research Variables	65
Table Number 4	Background Variables of the Research Sample and the Two Learning Environments	68
Table Number 5	Descriptive Statistics of the Dimensions of Styles of Thinking in the Entire Sample	69
Table Number 6	Perception of the Styles of Thinking by the Students in the Two Learning Environments	70
Table Number 7	Descriptive Statistics of the Perception of the Learning Environment by the Student in the Entire Sample	70
Table Number 8	Perception of the Learning Environment by the Students in the Two Learning Environments	71
Table Number 9	Achievements of the Students in the Entire Sample and in the Different Learning Environments	72
Table Number 10	Differences in the Achievements according to Age, Gender, and Native Language	73
Table Number 11	The Relationship between the Dimensions of Styles of Thinking and the Achievements in the Entire Sample and in the Two Learning Environments Separately	74
Table Number 12	Coefficients of the Regression for the Prediction of the Achievements among the Students of the Traditional Schools	75

Table Number 13	Relationship between the Dimensions and Variable of the Student's Perception of His Learning Environment and His Achievements in the Entire Sample and in the Two Learning Environments Separately	76
Table Number 14	Coefficients of the Regression for the Prediction of Achievements in the General Sample	77
Table Number 15	Coefficients of the Regression for the Prediction of Achievements among the Students of the Gordon Center	78
Table Number 16	Correlations between the Expression of the Style of Thinking and the Perception of the Learning Environment in the Entire Sample	79
Table Number 17	Correlations between Perception of the Learning Environment and Expression of Style of Thinking among Students in the Regular Schools	79
Table Number 18	Correlations between Perception of the Learning Environment and Expression of Style of Thinking among Students in the Gordon Center	80
Table Number 19	Means and Standard Deviations of the Dimensions of the Perception of the Learning Environment on the Different Levels of the Child's Age and Learning Environment	81
Table Number 20	Means and Standard Deviations of the Dimensions of the Perception of Learning Environment on the Different Levels of the Child's Gender	82

Table Number 21	Means and Standard Deviations of the Dimensions of the Perception of the Learning Environment on the Different Levels of the Child's Native Language and Learning Environment	83
Table Number 22	Stepwise Regression to Examine the Impact of the Background Variables on the Student's Achievements in the Mediation of the Perception of the Learning Environment	85
Table Number 23	Stepwise Regression to Examine the Impact of the Dimensions of the Thinking Style on the Student's Level of Achievements with the Mediation of the Learning Environment among Students of Traditional Schools	86
Table Number 24	Stepwise Regression to Examine the Impact of the Dimensions of the Thinking Style on the Student's Level of Achievements with the Mediation of the Learning Environment among Students of the Gordon Center	87

List of Figures

Figure Number 1	Impact of the Native Language on the Perception of the Social Climate on the Different Levels of the Learning Environment	84
Figure Number 2	Paths Analysis Describing the Structural Relations between the Research Variables – Reference to Each Learning Environment Separately	89

Abstract

The primary objective of the present research study is to examine the implications of the implementation of an innovative program for the creation of learning stimulation in a challenging environment, through riddles, on the perception of the learning experience in its different aspects.

Previous research studies maintain that in a different learning environment the students' achievements will be different. One of the goals of the present research study is to examine whether an identical challenging environment creates different or similar results among a population of children with difference in their intelligence level, or in a focused manner, between the achievements of gifted and talented students and students in the traditional learning environment.

The program investigated in the present research was developed by the Intel Corporation with the collaboration of the father of riddles in Israel, Mr. Dan Chamizer, and it is called the Chamizer challenges method in education. This program provides students with activity in original and innovative methods and the learning of broad topics based on broad knowledge realms. This goal includes the following sub-goals:

1. To evaluate the Chamizer challenges method program as an impetus for cognitive development that crosses curriculum as a strategy of thinking-focused teaching in any learning framework. In a more focused manner, the goal is to examine the contribution of the learning environment to the promotion of achievements and motivation among students in a traditional class as well as among students who are gifted and talented; the presence of differences in achievements of groups of students; the fact that the learning environment mediates between thinking styles and demographic and personal data and the students' achievements.
2. To evaluate the applicative ability of the model of Sternberg in the learning environment of gifted and talented students and students who are not gifted and talented.

3. To develop and validate an instrument for the evaluation of the Chamizer challenges method as an enigmatic universal tool (in regards to the students' achievements in both groups).
4. To examine the intervention of the background characteristics, learning, and thinking styles as an explanation of the achievements of the students who attempted in the challenging learning environment the Chamizer challenges method.

The Research Hypotheses

1. The background characteristics of the students influence their achievements. A difference will be found among the students in their achievements. These differences will be expressed in the comparison among the students according to age, gender, native language, and study framework.
2. The student's style of thinking influences his achievements. A relationship will be found between the degree to which the student uses each one of the thinking styles and the level of his achievements.
3. The student's perception of the learning environment influences his achievements. A relationship will be found between his evaluation of the learning environment (according to all its different elements) and his level of achievements.
4. A relationship will be found between the student's evaluation of the dimensions of the learning environment and the level of expression of the different thinking styles.
5. The background characteristics of students do not influence their evaluation of the learning environment. Hence, differences will **not** be found among the students in the evaluation of the learning according to age, gender, native language, and learning framework.
6. The relationship between the student's background variables and the styles of thinking that he expresses and his level of achievements will be mediated by his degree of evaluation of the learning environment.

The main aspects that are reviewed in the present research study are as follows:

- The gifted and talented student in comparison to the student in the traditional environment: recognition of the cognitive, personal, and social characteristics so that it is possible to cultivate a unique program.
- Aspects of thinking styles – Researchers believe that the types of intelligences and thinking styles exist in all people but the existence is expressed differently, since they appear in every person at a different intensity. The different ‘dosage’ of intelligences and thinking styles in people is expressed in the difference among the learners. According to Sternberg, the person’s exposure to certain concepts depends greatly on the environment. On the basis of Sternberg’s assessment and from the thirteen thinking styles he listed (1977), the present research study chose to address six thinking styles:
 - Internal thinking style: The person with this style is defined by Sternberg (1995) as a person who is focused on his inner self and who likes to work and learn alone.
 - External thinking style: The person with this style is defined by Sternberg (1995) as having a high awareness of other people. He likes to work and learn with others and is even dependent upon them.
 - Liberal thinking style: The person with this style is defined by Sternberg (1995) as open to doing things in new ways and as challenging the conventions.
 - Conservative thinking style: The person with this style is defined by Sternberg (1995, in Shany and Nachmias, 2001) as a person who likes to do things in the conservative and comfortable ways.
 - Local thinking style: The person with this style is defined by Sternberg (1995) as coping with tasks, seeing the picture in its littlest details, using concrete examples, and not tending to see the global picture.

- Executive thinking style: The person with this style is defined by Sternberg (1995, in Shany and Nachmias, 2001) as acting according to instructions and directives, preferring predetermined problems and situations. He prefers to work in the group and likes to be the doer.
- The learning environment: The element of the student's perception of the environment included social climate, learning climate, motivation to learn, resources management, and teacher's support.
- Challenging learning environment: The Chamizer challenges program creates one the one hand a personal/group goal-oriented learning process and on the other hand coping with situations of competition and working with riddles.

The **research population** consists of two groups of students from two different learning frameworks:

- Students who learn in traditional schools that expressed willingness to implement the Chamizer challenges method in education in the framework of their curricula (a total of 79 students).
- Students who learn in the Gordon center for gifted and talented children (a total of 161 students).

The **research instrument** of the present research study was a questionnaire. The collection of the data was accomplished using questionnaires that measured the variables and were based on previous research studies on the topic of thinking styles (Sternberg, 1977) and learning environments (Ben Zakan, 2000). In addition, demographic data were collected as well as evidence on the students' achievements in the solving of the riddles.

The **research process** of the present research study was as follows. In the traditional schools, the activity was incorporated in the classes in group work under the teacher's leadership through joint brainstorming as a part of the process of the structuring of the solution. In the Gordon center, the riddles are conveyed to the students in two ways. In the first way, the riddles are on the homepage of the Gordon Center. (Every participant in the center is entitled to enter the Gordon Center Internet site by password.) In

the second way, the riddle was copied and distributed to every student in the course separately. The process of the structuring of the solution for the riddle is characterized at the Gordon Center as individual and/or dyadic work.

The **research method** of the present research study is based on the methodology of a correlative comparative survey.

The **research findings** indicate that the implementation of the *Chamizer* challenges program was found to have the potential for generalization in different learning environments (traditional / Gordon Center for gifted and talented children). This finding depends on the student's perception of the learning environment as such that cultivates a social and learning climate, motivation to learn, opportunities for management abilities, and resources – all with the teacher's support and cultivation of reciprocity and teamwork in the solution of the riddles.

The **research limitations** of the present research study relate to the sample size and to the correlative research method, without manipulation, and therefore it is not possible to prove relations of cause and effect. In addition, it should be noted that the research was conducted in the State of Israel and did not examine different cultures and/or countries.

Recommendations for further research can be made as a result of the present research. These include examination of additional variables of native language, parental education, date of immigration, etc. It is also recommended to investigate a larger and more diverse sample (additional variables) through which it is possible to examine different population sectors that represent the phenomenon in the student population (native language, parental education, date of immigration, etc.)

From the **applied perspective**, it is recommended to assimilate this program into other frameworks. For the program to ensure success, it is recommended to develop a training program for those who accompany the program – the teachers, the school principals, and the other role-holders.

1. Introduction

The present research study, which addresses the topic of changes and innovations in education, sees the importance of the development of a challenging learning environment as developing coping processes (for instance, with a riddle) and enigmatic reality – as a natural and effective way of the assimilation of the development of values and information. Coping with thinking challenges, as with the example of riddles, has steadily increasing representation in science, society, and the media and it also serves as a basis of the reciprocal activity among people in the different media channels in Israel and around the world (Arbel, 1990).

Many resources have been invested in the past decade with the goal of developing the abilities of students as well as the integration of technology, computers, in the teaching and learning process of many content realms in the educational system in Israel. These efforts included the direction of resources to the development of computerized instruments and educational software programs, intensive training of teachers, and even changes in the curricula.

Despite all these efforts, it appears that the new potential is far from being fully exploited. According to the modern educational approaches, teaching should focus on the creation of opportunities for the development of learning abilities through active learning. These opportunities should include the potential to develop thinking through diverse tasks and through the adjustment of learning styles to thinking styles.

The challenge in the realization of thought-challenging environments is not to aim at one exclusive solution but rather at activities that like riddles and thinking games, to differentiate from repetition exercises, do not have a predefined recipe for solution. Logic riddles can present the learner with a new situation, unknown to him, which stimulates his imagination, inspires his thinking and his senses, and thus they create for him a challenge for a creative solution, when he has the motivation and desire to produce appropriate achievements.

Learning based on a challenging program such as riddles constitutes strategies for pre-professional education, when the goal is literacy and not only knowledge in certain disciplines (Shwartz, 1977).

The mathematician Beno Arbel (1990) presents the statements of the English Mathematician John Leithwood who speaks of the ‘Good Joke’. A riddle is better than a dozen mediocre exercises and it is easier to understand a riddle than to understand a problem.

Foya (1961) in his book *How To Solve* notes that a great discovery may solve a large problem but the nucleus of a discovery is in the solution of every problem. Foya (1961) asserts that if the teacher has his students practice routine actions, then he represses their interest, delays the development of their thinking, and misses out on learning opportunities. However, if the teacher stimulates their curiosity, when he presents them with riddles that have solutions within their reach, then he plants the seeds of independent thinking as they acquire the instruments for this.

Hence, the contribution of the way of producing new knowledge arises. Socrates, in his conversations with the slave, showed that by asking questions it is possible to learn almost anything. Asking questions is the foundation stone in the educational process. Much more than frontal description, asking questions involves the learner’s processing mind and not only their absorbing mind. Solving riddles, as found in the kit developed by Dan Chamizer, a riddle manufacturer, educator, and creator of new learning methods, creates a unique and thought-challenging learning situation. Chamizer entwines logic riddles in diverse fields of knowledge to create challenges – a unique learning experience. The questions are both difficult and simple. It is possible to work on them for a short period of time or for a long period of time, individually or in groups, for pleasure or for a prize. The Chamizer method creates a personal learning method that involves the learners’ processing mind. The process has dual value: on the one hand, true goal-oriented engagement in the content realm and on the other hand, general engagement, multidisciplinary, with problem processing, improvisation, individual’s work with a team, coping in competitive situations, etc.

The goal and uniqueness of the Chamizer method are to acquire and assimilate knowledge, values, and essence related to any topics, situations, and interests in non-accepted ways that were intended to inspire interest, creativity, curiosity, and competitive enthusiasm. The method aspires to identify learning through

research as a modular process; in other words, it is possible to work at different opportunities for depth on parts from the whole process as well as the riddle (the problem) that faces the students will have meaning for him. This process helps the teacher in that he builds in the students thinking skills and possibility to use thinking styles for the solution of the riddle (Zohar, 2007).

Traditional teaching focuses on the transfer of corpuses of knowledge from the teacher to the student. The student's main role is to absorb these corpuses of knowledge and learn them by rote. In the traditional teaching process, the student is passive. In contrast, teaching through research focuses on the process in which the student is active. The role of the researching student is to search for responses to questions through the use of higher thinking skills and the structuring of knowledge. The main role of the teacher who focuses on teaching through research is not to convey knowledge but to initiate opportunities for learning and to direct their course. In the transition from traditional teaching to teaching and learning through inquiry, the teacher changes from a source of knowledge to an instructor of the processes of knowledge acquisition.

In the present reality, when fields change rapidly and knowledge is renewing all the time, it is impossible to rely on the traditional method of the inculcation of learning. Other strategies are necessary for educational training and learning, which allow the learners to experience the flow of activities and accumulate knowledge through experience.

The present research study examined the student's perception and personal knowledge in regards to his pattern of thinking, motivation, and learning strategies. A pattern of thinking is a constellation of thinking styles. Sternberg (1995) proposes a detailed schema for the characterization of thinking styles that can be summed up into two inclusive patterns for the characterization of a person as a creator or a performer. A person who judges something while he works or as a part of his studies or who determines frameworks has a creating pattern of thinking, while a person who performs things as they were determined by others has an executive pattern of thinking. The schema proposed by Sternberg is comprised of thirteen styles of thinking, which

encompass how the person thinks in regards to his world. Sternberg maintains that there is a relationship between the styles of thinking that comprise the thinking pattern and the type of task at which the student will succeed in expressing himself in the best possible way. Hence, he suggests giving a possibility of a variety of tasks to evaluate the student's achievements and not to force upon him only one type of task. In this context, the Chamizer challenges program was incorporated as an alternative method to the annual curriculum and proposes additional evaluation of achievements to what exists in the schools today.

In addition to and on the basis of the arguments that different background characteristics can predict different achievements (Sternberg, 1995, in Shany and Nachmias, 2001), the present research study examines the impact of the students' background characteristics on the achievements in the solving of riddles. The implications of the style of thinking are examined in two study frameworks on achievements in solving riddles. The pattern of thinking as an independent variable is based on the styles of thinking model of Sternberg (1977) (see chapter 2.2) and includes six styles of thinking (of thirteen proposed by Sternberg): local, performance, internalized, externalized, liberal, and conservative. The content of the statements was specifically adjusted to the thinking style of the Chamizer challenges.

The **uniqueness of the research study** lies in that it combines a methodology for the research of the students' perception of the learning environment in the framework of the Gordon school and a traditional class (see chapter 2.3), which comprise the learning environment. There are five variables: learning climate, social climate, teacher's support, motivation to learn (in other words, the motivation is a factor that motivates the student in his studies and in his performance of the tasks and it influences his choice of the learning strategies; Pokay and Blumenfeld, 1990), and resources management – how the student organizes the material and his learning environment, how he supervises the learning process to achieve the goal in his studies.

An environment that enables the use of resources, a teacher who invests in his students, teaching that inspires interest and the desire to learn – this is a learning environment that encourages and

allows learners to choose and crystallized the appropriate action model and to adopt it in changing situations.

The goals of the present research study are as follows:

1. To evaluate the Chamizer challenges method program as an impetus for cognitive development that crosses curricula as a strategy of thinking focused teaching in any schooling framework. In a more focused manner, the goal is to examine: (A) the contribution of the learning environment to the promotion of achievements and motivation among students in the traditional class as well among gifted and talented students; (B) the presence of differences in the achievements of the groups of students; and (C) the fact that the learning environment mediates between the thinking styles and demographic and personal data and the students' achievements.
2. To evaluate the applicative ability of the model of Sternberg in the learning frameworks of gifted and talented students and students who are not gifted.
3. To develop and validate an instrument for the evaluation of the method – Chamizer challenges – as an enigmatic universal tool (in regards to the students' achievements in both groups).
4. To examine the intervention of background characteristics, learning, and thinking styles as an explanation of the achievements of the students who had experienced the challenging learning environment of the Chamizer challenges method.

The research contribution is that the present research study has the potential to develop programs in the fields of education for higher thinking and to promote curiosity among the students (in both learning environments), love of knowledge and independent learning, personal and social responsibility, intellectual daring, and direction of the necessary effort. All these are values that contribute to the abilities that the educational system seeks to cultivate. These programs require learning and social conditions

that respect values and encourage the children's attempts to attain their deserved achievements.

2. Review of the Literature

2.1 The Gifted and Talented Child

Society's treatment of the gifted child and the theoretical perspectives on his development both have experienced far-reaching changes in recent years. The researches of Hollingworth (1942), Oden (1968), and Terman (1925) refuted the negative stereotypes that had been affixed to the gifted. These researchers showed that intellectual giftedness is not necessarily accompanied by emotional disorders, by deficiencies in the social skills, and by other 'strangeness'. Rather, the reverse is true – the results of their research studies showed that the gifted children are mentally and physically healthier than are children their age who have an average intelligence quotient. These researches showed an advantage to the gifted in areas such as maturity, self-image, cognitive independence, and general adjustment.

The concept of 'giftedness' has many definitions. The definitions accepted today throughout the world are qualitative in nature and also include a quantitative element – I.Q. They were first designed at the end of the 1970s and in the beginning of the 1980s by Tannenbaum and Sternberg. Today, the definitions include the following elements:

1. Quantitative – statistical element: The level of the innate abilities (which can be measured using intelligence tests).
2. Personality abilities.
3. Environmental variables.

One of the known definitions of giftedness is the ability to attain achievements of performances that are rare in their level and/or to posit exceptional ideas in different areas of contents that contribute to moral, physical, emotional, social, or aesthetic

aspects of functioning in the society in which we live (Tannenbaum, 1983). This definition focuses on two dimensions: on the one hand, the first dimension is expressed in the inculcation of knowledge or a new interpretation while on the other hand, the second dimension is expressed in ideological or concrete products.

The definition determined by the Steering Committee of the Ministry of Education states that “gifted are the top percentage of the population in each year in each one of the domains of ‘giftedness’ if they have also met the criteria of motivation and creativity. In actuality, these are people with an intelligence quotient of 135 and above. A subgroup of the gifted is the ‘super gifted’ or ‘especially gifted’ or ‘genius’.”

Concomitant Requirements for the Definition of ‘Giftedness’

As aforementioned, the definition of ‘giftedness’ includes two additional conditions, beyond the unique statistical deviation:

1. Level of motivation (perseverance, determination) that is above the year’s median.
2. Level of creativity (originality) that is above the year’s median.

Agreed-upon instruments do not yet exist to describe these two elements and to measure them.

The definition of excellent students is the top five percent of the population in every age group, in each one of the domains of ‘giftedness’, if the people have met the criteria of motivation and creativity. This refers, in actuality, to an intelligence quotient of 125 and above.

Renzulle (1981) defines the gifted child in a descriptive manner. He describes him as a curious child who takes the initiative and is possessed of original thinking in problem solving. He has exceptional ideas, expresses himself fluently without obstruction, has a developed and refined sense of humor, is emotionally sensitive, and is aware of his impulsive responses. He is sensitive to beauty and has a developed sense of criticism. He is individualistic, is not willing to accept authority, and is not afraid of being different.

Other researches in the field list traits of giftedness that overlap those of Renzulle. They can be summarized as a higher than average intellectual ability, positive self-perception, and motivation to attain high achievements. In Israel and throughout the world, many research studies have been conducted to characterize the gifted child from cognitive, social, and personality perspectives.

Zorman (1993) summarizes the findings of these researches. Cognitively, the gifted child is characterized by an excellent memory and abstract thinking ability, an ability that requires the ability to analyze, synthesize, and find analogies and logic among concepts. In terms of the functioning of these children in the school, it was found that they begin their studies at a relatively early age compared to children with an average intelligence quotient. They advance more rapidly in their studies and evince greater interest in theoretical subjects. They excel in the subjects that require verbal understanding and abstract thinking, such as mathematics and sciences, and succeed less in subjects that necessitate flexibility and motor coordination such as gymnastics and crafts. Their scores in the achievement tests are high relative to those of their classmates although not to the same extent as their scores in the intelligence tests.

In terms of their personality, they adjust to their environment at least as well as do their classmates with average intellect. They invest effort in a focused and persistent manner to achieve goals that they set for themselves. They are curious in regards to different phenomenon, and this curiosity is expressed in their asking of questions on topics that interest them and in their investigative approach to what occurs around them. They are socially and personally mature in their development in comparison to their age group and this maturity is expressed in their connection to people older than them and in their social insight and social interest, which are typical of older people.

Among gifted children, and primarily among gifted children of elementary school age, there is a gap between the cognitive side and the emotional side. In the regular classroom, the gifted child suffers from a lack of an appropriate environment in which he can share his knowledge with others. In addition, although he is

curious and is interested in many areas, he finds himself bored and unchallenged. In the gifted class, the child is found with others his age who are similar to him, but he never finds himself competing with those who are better than him. Katznelson (1983) maintains that the self-confidence of some of the students who move to a special cultivation framework for the gifted is impaired when they move from a framework where they excelled to a framework where their chances to excel are reduced.

The Unique Characteristics of Gifted Students

Shore and Kanevsky (1993) summarized different researches that focused on the differences between the thinking processes of students who have a very high intellectual ability during the problem solving process and their peers who have average intellectual ability. Differences include aspects such as:

- Effective use of memory that enables the association of new and old knowledge.
- Effective use of meta-cognition to maintain self-control over thinking, when this control directs the thinking during the work process to different tasks.
- High speed of thinking – Speed that is expressed in quicker problem solving. It should be noted that students with high intellectual ability spend more time on the search for relevant information for problem solving but are quicker in the implementation of skills of basic operations, such as the four arithmetic operations. Therefore, in general they are quicker in problem solving.
- Effective representation of problems – The ability to classify problems and re-analyze them clearly while separating between irrelevant information and information relevant to the problem and clear definition of the data that are missing to solve the problem.

- Meaningful process knowledge – Knowledge how to solve problems and use existing information allows students with high intellectual ability to search for information in a more organized manner and to examine different possibilities of research through the positing and confirmation of hypotheses and not necessarily through trial and error.
- Flexibility in the representation of problems and the use of different strategies for solving – depending on the integration between the existing knowledge basis and effective representation of problems and considerable processual knowledge.
- Preference of complex problems, since these embody a more serious challenge to solve.

As known, gifted students, by definition, have exceptional learning ability, which allows them to acquire information rapidly and efficiently. They can collect encyclopedic information from the areas that interest them and cope with the challenges of learning on a high level of abstraction. In light of this definition of giftedness, it is obvious that the ability to acquire knowledge rapidly and efficiently constitutes a necessary but not sufficient basis for the attainment of exceptional achievements in the different content domains.

In light of the definitions of giftedness, it is possible to ask the following question: What characterizes the figure of the ideal graduates of curricula for the gifted?

According to the Ministry of Education General Circular (Abuab, 2000; Salomon and Almog, 1994), the figure of the desired graduate includes:

- A person who is characterized by curiosity and intellectual interest, which originate in the desire to understand different and diverse topics, and who can identify by himself the information and the tools for the satisfaction of his curiosity and interest.
- A person who engages in his true fields of interest, according to his choice.

- A person with management skills, creative thinking, general and flexible intellectual skills, extensive and active general knowledge, a tendency to innovation.
- A person who has a value oriented outlook, which is nurtured by universal human social values.
- A person with value judgment abilities in conditions of lack of clear value-oriented standards.
- A person who is involved in the life of Israeli society and who is willing to assume roles and fill them with responsibility and dedication.
- A person who knows his roots and his identity, is aware of them, and knows and respects his identity (Ministry of Education and Culture, 1996, in Abuab, 2000).

In addition, the gifted graduate should develop the following aspects:

- Self-inquiry: The graduates can research in-depth, independently, problems and topics that interest them.
- Aspiration to breakthrough: The graduates search for creative solutions from different viewpoints for problems that interest them and for breakthroughs in different content realms.
- Aspiration to solve problems of society and environment: The graduates are aware of the problems of society and the environment that are on the agenda and invest their time and resources in attempt to cope with these problems, with their complexity, and to find alternative and non-routine solutions.

Learning Styles of Gifted Students

The learning style is defined as a constellation of conditions under which the person begins to concentrate new and difficult information and new and difficult skills, works out their details, and attempts to internalize and assimilate in his memory what is learned. The learning style is comprised of the combination of elements that enable absorption and storage of information and skills that the person has become aware of and is interested in or

has access to and the storage of the information and the skills so as to use them (Krathwohl, Bloom, and Masia, 1964).

According to the cognitive style theory, people process information in one of the two ways: analytical processing or general processing. The 'analytic' people learn more easily when the information is submitted to them step by step in the correct continuum in a process that leads gradually to the understanding of what was learned. The 'inclusive' people do well to learn something new or difficult if it is presented to them using anecdotes, illustrations, symbols, or graphs that explain the idea or basic concept at its basis.

Both 'analytic' students and 'inclusive' students use thinking and logic but they do this in different approaches. Both can acquire knowledge and skills in the same information if they are taught in methods or means that are adjusted to their learning styles. The elementary school students for the most part belong to the 'inclusive' groups but over the years as they accumulate knowledge and experience most become more 'analytic'.

Learning styles are characterized through the ways of absorption and perception of the material and through environmental factors, physiological factors, and emotional factors. Many researches examined the relationship between cognitive distinctions and environmental, emotional, sociological, and physiological characteristics of the students. They found that there is a relationship between the learning perseverance, light, quiet, and clarity, formal sitting order, and little eating and drinking and belonging to the group of the analytic information processors.

Researchers found that for the most part the inclusive students prefer to learn with others, 'in group', over learning individually or with direct contact with an adult. These students for the most part prefer to perform the assignments their way as opposed to acting according to the directives of others.

The engagement in the learning styles of gifted students inspires a series of questions. Are the learning styles of the gifted different from the learning styles of non-gifted students or is their

ranking in the learning style different? Are the learning styles of gifted students unique to them or do all students have these styles and they, the gifted, tend to prefer them over those of the non-gifted?

There are hypotheses in regards to the answers to these questions but the answers are not unequivocal. Tannenbaum (1995) maintains that the gifted are different from others not only in the product of their activity but also in the stages of the absorption of the information conveyed to them. They perceive the world differently and from this perspective they process the information that they absorb.

Tannenbaum (1995) notes that it is necessary to address the question of homogeneity and heterogeneity in the context of the learning style. Gifted students may prefer working alone in problem solving since they are special in their classes and do not have anybody to work with there. In the gifted classes, in a more homogenous group, an approach of working together in problem solving and in different activities may be adopted. The issue of the learning styles of gifted children is complicated in light of the considerable heterogeneity among these children. Children are gifted in ways that are so different that it is not possible to focus on one style that is suited to all. It is necessary to design the educational process according to the needs of each and every student. The basis of this approach needs to be a general perception of the phenomenon of giftedness, which emphasizes the learning style and what is derived from it – namely, the adjustment of ways of teaching to every student.

Gifted students can derive benefit from opportunities to cope with appropriate tasks, since the gifted students think differently from the other students (Strip and Hirsch, 2000). For instance, unlike most of their peers, gifted students can work with abstract or complex concepts – to enrich them they need activities that go beyond the level of understanding. Gifted students tend to advance in new material rapidly, at their pace, and they do not need extensive review or practice. Gifted students may approach tasks in special ways, sometimes since they see a new way for the completion of the assignment or a relationship to another process that gives them insight. For their enrichment, they need

opportunities for creativity and independence. In short, gifted students do not need additional work of the type of work proposed in many textbooks. Instead, they need another type of activity (Galbraith, 1998).

Gifted students need the teacher's direction and opportunities for independence. These students are sometimes perceived as not needing help since they can perform the regular curriculum without considerable help. In contrast, when we challenge them to implement concepts in new ways or to cope with problems that take them to new directions, we cannot expect them to learn completely by themselves. Gifted students also need opportunities to develop personality traits such as creativity, curiosity, insight, perseverance, and imagination (Piiro, 1998).

These traits may develop in the best possible way, when an important area in which the gifted students need help is motivation. Although many gifted students are able to extend their attention and focus on the assignment when it interests them, they do not always have internal motivation, when they are challenged to engage in work that is more difficult than what they are accustomed to. Guiding teachers may help students keep on the assignment and dedicate themselves to the problems. In addition, many gifted students battle perfectionism, when they are required to work on problems for which it is not possible to see an immediate and unequivocal solution (Smutny, 2001; Strip and Hirsch, 2000; Winebrenner, 2001). A guiding teacher can support gifted students by helping them learn self-discipline, take chances, and develop tolerance of ambiguity.

This review has showed us that when we go to construct a curriculum for the gifted child, we must be aware of his cognitive, personal, and social characteristics and know what makes him different from the members of his age group with average intelligence. Only by knowing these characteristics can we construct a unique cultivation plan for the gifted child, a plan that will help him realize his innate potential and provide an adequate response to his unique needs.

Another area that should be examined is the student's style of thinking. The examination and conceptualization of the concept of style of thinking is presented in the next chapter.

2.2 Thinking Styles

2.2.1 Types of Thinking Styles

Thinking is a process (influenced by heredity and the environment) that occurs in the mind. It is not visible and includes the absorption and processing of stimuli. Thinking allows us to supervise our words and deeds and it has different roles in the different stages of teaching and learning. Accordingly, there are different forms of thinking, such as scientific, analytic, creative, etc. (Weinberg and Zohar, 2005).

Students differ from one another in their style of thinking. In other words, they differ in the way in which they acquire knowledge, crystallize ideas, feel, and behave. There are several theories that describe a person's different thinking styles. Knowing the person's thinking style (or the profile of thinking styles) may explain why a certain activity suits him and why another one is not appropriate.

The thinking style is the form of thinking that the person prefers in a given situation. The thinking style is the way in which the person chooses to express his thinking (Sternberg and Wagner, 1991). Hence, the thinking styles are not found in the realm of abilities or realm of personality but in the areas of tangency between them (Sternberg, 1994a).

The thinking styles are not fixed and they may change over the person's course of life. For instance, the styles (for learning and teaching) on the level of the elementary school are not necessarily the styles that will continue to work on the level of the high school or the level of the university. To a certain extent, a person is gifted in a given domain and is not gifted only because of abilities relevant to the assignment but from appropriate implementation of relevant styles in a given area.

According to Sternberg and Grigorenko (1995), the research of thinking styles is divided into three overlapping approaches. The first approach focuses on cognitive domain, the second approach focuses on the personality and is expressed in two approaches – externalized and internalized, and the third approach, which focuses on activity, tends to focus on the learning styles.

Sternberg (1994) composed on the basis of the three approaches a theory on the question of how people conduct their everyday cognitive activities inside and outside the school. He classifies the styles of thinking into thirteen styles under five categories. (See appendix number 1.)

- Function – the learner’s mode of operation.
- Forms – the learner’s form of activity.
- Levels – the learner’s level of coping with the situation or task.
- Scope – the learner’s tendency to cope with the task alone or in the group.
- Leaning – the learner’s tendency to think independently or perform instructions.

Category 1: Functions

There are three styles of thinking in this category.

1. **Legislative style:** The learner in this style tends to decide by himself how and when to do things. He tends to invent his own rules and prefers problems and situation that are not understood ahead of time or are not fabricated. He likes writing creative articles, designing and planning new projects, inventing mathematical problems with solutions. A legislative learner tends to be critical of the teacher. His grades are generally low and in the study class where the teacher provides guided work he appears to be a weak student. He does not like to learn dates by rote, to perform guided experiments, to solve mathematical problems using textbooks, etc. (Sternberg, 1997). The legislative style seeks to justify the answer and does not create a processual project in which there is a learning process with obvious answers (hence this style will not be used in the present research).
2. **Executive style:** The learner with this style acts according to directives and instructions and prefers pre-determined problems and situations. In group work he prefers to be the executor and therefore he tends to attach to a legislative style learner who creates the performance themes of the work or project and the two learners complement one

another. Teachers appreciate executive learners because of their loyalty to the instructions and directions (Smith, 2002). This style is relevant to the solution of a riddle since it is structured, can be implemented in work in groups through comprehensible guidance required for the present activity. (Sternberg, 1995, in Shany and Nachmias, 2001)

3. **Judicial style:** The learner with this style assesses and critiques laws and procedures. He tends to engage in critical writing, giving opinions, judging people and their work, and evaluating plans. He judges the structure of activity in the classroom and not only the content of the activity. In teamwork he cooperates well with the legislative learner. The activities that suit the learner in this category in the school are analysis of reading passages, evaluation of an experiment or scientific theory, finding the flaws in a mathematical proof, etc. Activities that do not suit him are writing an essay, creating and formulating a scientific experiment, and learning dates, formulae, and mathematical proofs by rote. This style is not commensurate with the solution of riddles since it primarily focuses on criticism/judgment and these characteristics are not relevant to coping with the solution of a riddle.

To conclude, this research will use the executive style relevant to the solution of a riddle in a challenging learning environment.

Category 2: Forms

There are four styles of thinking in this category.

1. **Monarchy style:** This learner is determined to solve every problem, every task, without delay, and does not allow anything to stand in his way. He does not tend to see things according to the viewpoint of other people. In the classroom generally his attention is not focused on the teacher and he is interested in performing things differently from what was asked. To cause him to be interested in what is happening in the class, his fields of interest should be linked to the class activity, for instance, a learner who is interested in sports

and does not like to read can be interested in a reading passage on sports.

2. **Hierarchic style:** This style of learner tends to perform a number of tasks in parallel, after he has organized and ranked them hierarchically. He knows that he will not always complete the assignments and in some of them he will invest more than in others. He is consistent and organized in his decision making and problem solving and these traits grant him an advantage in the school. In the classroom he is prominent because of his ability to write essays in a hierarchical and well organized manner and because of his ability to read and discern between what is important and what is trivial.
3. **Oligarchic style:** This style of learner also tends to perform a number of tasks in parallel but he does not know how to arrange and rank the tasks according to their importance. He has excellent work ability but since his priorities are not commensurate with what is required of him in the classroom this ability is not always expressed. This type of learner should be helped in the determination of the order of the assignments.
4. **Anarchic style:** This style of learner also tends to perform a number of tasks in parallel but does not know how to order and rank the assignments according to their importance. He has difficulties sorting the goals and ranking them according to their importance. He suffers from social problems and sometimes drops out of the school. He challenges the teacher with questions and goals that are difficult to implement. He performs assignments randomly. In unfocused class discussions he proposes theories based on fragments of information from different areas and sometimes is considered creative.

To conclude, in the categories of forms it is possible to see that this category addresses the learner's forms of action and not form of thinking. Hence, this category was found to be not relevant to this type of challenging activity.

Category 3: Levels

The learner's level of coping with the situation or assignment. There are two styles of thinking in this category.

1. **Global style:** This style of learner tends to cope with tasks on the global level, to see the picture in its entirety, and does not tend to go into details. This characteristic can be included in the challenging learning environment in which the student is required to construct thinking while going into detail, just like the riddle is understood in its context.
2. **Local style:** This style of learner tends to like to cope with tasks on the local level, to see the picture in full detail, in concrete examples. He does not tend to see the global picture. For example, when they look at the forest, they do not see the forest but rather the trees and each tree separately. The challenge they face is to attempt to see the global picture, the general picture. (Sternberg, 1995, in Shany and Nachmias, 2001)

To conclude, this research will use the local style alone as relevant to thinking in a challenging environment.

Category 4: Scope

The learner's tendency to cope with the assignment alone or in a group. In this category there are two styles of thinking.

1. **Internal style:** This style of learner is introverted, focused on the task, and sometimes not aware of what happens around him. He tends to perform a task or project alone. He learns better when he acts alone and loses his patience in work in the group.
2. **External style:** This style of learner is extroverted, sociable, interested in others, connects with people easily. He learns better in the group setting.

To conclude, this research uses the two styles in the category of scope as styles relevant to the challenging learning environment.

Category 5: Leaning

The learner's tendency to think independently or perform instructions. There are two styles of thinking in this category.

1. **Liberal style:** This style of learner tends to cope with assignments in a new and innovative manner, to research them, and to go beyond the written rules. He seeks for situations that are not unequivocal. In the school he attempts, for example, to decide by himself how to perform a laboratory experiment even if his way is not accepted by the teacher.
2. **Conservative style:** This style of learner adheres to the existing rules and avoids changes and assignments that are not unequivocal. In the school he does not tend to think independently how to perform a laboratory experiment but tends to perform the clear instructions of the teacher.

To conclude, this research uses the two styles in the category of learning as styles relevant to thinking in a challenging learning environment.

To conclude the review of the model, of the thirteen styles of thinking of Sternberg six styles were found suitable, according to the explanation provided above as relevant to the styles of thinking in the challenging learning environment.

The style of thinking is the learner's preference for using his abilities in a certain way and not in another way. This does not refer to ability itself. Sometimes the learner's style of thinking is not commensurate with his ability. The fit between the style of thinking and ability is the recipe for success. Every learner has a profile of learning styles and not one single style. A creative learner may be very organized or very scattered, very lonely or sociable. The styles of thinking change from task to task. Learners are different from one another in the flexibility of their style of thinking. Sometimes the style of thinking is not commensurate with the style of teaching in the school and the learner must evince a degree of flexibility to allow the learning.

The style of thinking can be learned and measured. To learn how to use a certain style of thinking, activities should be provided that require the person to use this style of thinking. The learners must be assigned diverse tasks that require different styles of thinking to accustom them to use different types of styles of thinking. The styles of thinking are evaluated at different times in a different way. For instance, the learner's style of thinking in the elementary school is evaluated differently in the high school. Styles of thinking are evaluated differently in different lessons. For example, the style of thinking suitable for a student in a mathematics lessons may not suit a student in an English lesson. There is no room to speak about a correct or incorrect style of thinking, good or bad style of thinking; rather, it is necessary to examine which style is most suited to the task at hand. Every person has a profile of styles of thinking and not one sole style. For the most part, the learners have one preferred style of thinking of every category, but the style may change from one topic of study to another topic of study. When there is fit between the learner's style of thinking and the nature of the task he has been set, the results are the best (Smith, 2002; Sternberg, 1994a).

The objective of the research is to operationalize the theory and to implement it for different educational activities and primarily the method of 'Chamizer Challenges in Education'. The present research examines patterns of thinking as one of the characteristics in the student's personal world. The pattern of thinking is the composition of styles of thinking. The students' styles of thinking in the present research are examined using a questionnaire, which had content validity based on the theory of Sternberg, who characterized thirteen styles of thinking (Sternberg, 1997). From these thirteen styles, six styles of thinking were selected – internalized, externalized, liberal, conservative, local, and performance. These styles of thinking characterized and are suited to the 'Chamizer challenges' learning environment.

2.2.2 Factors that Influence the Styles of Thinking

Several variables influence the person's style of thinking (Smith, 2002; Sternberg, 1994a).

1. Culture

Some cultures prefer a certain style of thinking, while others prefer the reverse style. For example, the culture in the United States encourages innovation and the liberal style of thinking, while the Japanese culture is more traditional and reinforces the conservative style of thinking. The reference to language as an element with an element of culture versus origin can be derived from the researches of Sternberg and Smith, when they argue that cultural origin (such as the United States and Japan) directs to the style of thinking. Hence, it is possible to hypothesize that the native language as a characteristic of cultural origin constitutes a distinction between students whose mother tongue is Hebrew – local culture or not Hebrew – culture that is not local. In some cultures children are taught not to ask questions on certain principles in their religion or government while in other cultures children are encouraged to ask questions on everything they have learned and will learn. Some countries esteem the success of the individual person while other countries esteem the success of the cooperative work of a group of people (Smith, 2002).

2. Gender

Some cultures discriminate – negatively and positively – against a certain gender. This discrimination is expressed in the learner's style of thinking. For example, Sternberg (1994) describes in his book a research conducted in thirty countries by Williams and Best in 1980. The research examined the difference in the style of thinking between boys and girls. Boys were described as adventurous, possessed of initiative, individualistic, with inventive ability, and progressive. Girls were described as cautious, dependent, supported, nosy, shy, and obedient. These stereotypes represent predictions more than reality; they have no solid basis but the boy and girl are educated and develop a style of thinking according to what is expected of them. Among the boys the legislative, internalized, and liberal styles of thinking are reinforced while among the girls the performance, judicial, external, and conservative styles of thinking are strengthened. These reinforcements are expressed from their birth. On the basis of the findings that Sternberg presents in his book, it can be assumed that in a challenging learning environment, characterized as adventurous, with initiative, and progressive, the boys will be

characterized as having higher achievements more than girls, who Sternberg characterizes as cautious, dependent, supported, shy and they will not attain achievements relative to the boys. This assumption is different from the research of Shany and Nachmias (1999), which examined the relationship between the students' functioning and their success in a virtual course and did not find differences between boys and girls in regards to the styles of thinking of Sternberg.

3. Age

When children are of kindergarten age, the legislative style of thinking is strengthened, but when they grow older and begin to go to school, this reinforcement weakens. In most schools, the learner is expected to be sociable and to act according to the norms of the school and according to the teacher's directive. The period in which the learner decide by himself what he will do and how and when he will do it has ended. Learners who do not follow the instructions and do not accept the school's rules are considered unfit. In the school and in life, the method of reinforcement changes without preliminary notice.

4. Parenting Style

The parents have considerable influence on their child's style of thinking. A style of thinking that the parents reinforce will be expressed in their child in a prominent and immediate manner. The child imitates his parents and aspires to be like them. A parent who directs his child to focus on general and important topics in essence encourages in his child the global style of thinking. One of the important variables in the child's intellectual development is how the parent copes with the questions that the child asks him. The parent's response to the child's questions may influence and change the child's style of thinking. Children tend more to be legislative if their parents encourage them to formulate and ask questions. Children tend to develop a judicial style of thinking if their parents encourage them to assess, compare, and analyze different situations. Children develop a global style of thinking if their parents deal with economic problems and children develop a local style of thinking if they see their parents cope with topics on the level of considerable detail.

5. The School and Its Role

The different and diverse teaching methods in the school influence the learner's style of thinking. Some schools encourage independent thinking, asking questions, and developing algorithms for problem solving. Other schools only teach frontally, dictate to the students what to do and how to do it; in other words, they strengthen the style of thinking of the executive factor (Smith, 2002).

The gifted and talented student is distinct, according to Shor and Kanevsky (1993), in the efficient use of memory, efficient use of meta-cognition, high speed of thinking in regards to the regular child, efficient representation of problems, significant processual knowledge, and flexibility in the representation and use of different strategies for problem solving and preference of complex problems. These characteristics, upon which the diverse teaching method, which aims at the development of the gifted and talented child, is based, influence, according to Smith (2002) the learner's style of thinking.

6. Styles and Abilities

To differentiate this factor from the previous factors, this factor refers to the learner's personal ability to develop a certain style of thinking. Some learners develop a legislative style of thinking, but they do not have momentum and are not creative. When there is a fit between the learner's abilities and preferred style of thinking, he derives the utmost. When there is no such fit, the learner may fail in his studies. We know very little about the change of thinking and we know less about the change of the style of thinking (Smith, 2002).

2.2.3 Styles of Thinking in the School, in Research and in Theory

Sternberg (1997) emphasizes in his book that to create effective learning processes we must provide the learner with a variety of activities and teaching methods so that at least a part of the activities of teaching methods will suit his style of thinking. He

does not maintain that there needs to be a perfect fit. The learner must also cope with activities that require him to think about different styles of thinking. This flexibility is important both to the learner and to the teacher. The teachers must attempt to achieve the fit between the two so as to correctly evaluate the learners (Smith, 2002). Some methods of teaching are appropriate to a certain style of thinking more than to another one. The following table presents a list of teaching methods and the commensurate styles of thinking (Sternberg, 1997).

Table Number 1: Styles of Thinking and Methods of Teaching

Teaching Method	Commensurate Style of Thinking
Lecture	Executive, hierarchical
Questions based on thinking	Judicial, legislative
Work in groups	External
Solution of given problems	Executive
Project	Legislative
Work in small groups: answers to factual questions	External, performance
Work in small groups: group discussion on ideas	External, judicial
Reading	Internal, hierarchical

Most high schools and middle schools teach according to the frontal teaching method. In the elementary schools, the teachers are more flexible and teach in diverse methods. The frontal teaching method is most suited to the executive style, since the student is not required to intervene but to accept the information that the teachers presents to him as it is, and to the hierarchical style, since the hierarchical learner generally does not accept the teacher's statements as they are and therefore he organizes the information according to his order of priorities. Sometimes the lectures in frontal teaching are very detailed and are suited to the learner with the local style of thinking.

Work in groups is better suited, obviously, to people with an external style of thinking and less to people with internal style of thinking. Work on projects encourages the learner to think independently and creatively. Generally projects are gratefully received by the legislative learners, since there is room to make rules as the learner sees fit. Learners with a hierarchical style of thinking may enjoy projects as well, since they can see them as an opportunity to organize themselves the work rider and tasks order in a hierarchical manner. Work in small groups, which is

characterized by giving answers to the factual questions posed by the teachers, suits executive learners, since they are willing to undertake all that is required, and to external thinking style learners, who are not shy to present their arguments versus the others in the group. During work in small groups, the student with the internal style of thinking, who is embarrassed to present his opinions to the other members of the group, may give the teacher the impression that he does not understand the material. Work in small groups and group discussion of ideas are commensurate with learners with the external thinking style since they are willing to converse on their opinions and with learners with the judicial thinking style, who judge the task and analyze it. Free reading suits students with an internal thinking style and learners with a hierarchical thinking style, since they have the possibility of choosing and ranking the topics according to the level of importance. The following question is therefore asked. How do we evaluate students with different thinking styles (Vygotsky, 2003)?

According to Sternberg and Wagner (1991), a certain style will be expressed in a person in a certain situation, while in another situation it is possible that a different style will be prominent. Sternberg sees the person's thinking style to be a social construct and not necessarily as a hereditary construct. The person through interaction with other people and with the environment distinguishes the form of behavior that leads to reward. Although people tend to adopt the form preferred by society, they have tendencies that limit them in the attempt to adopt the accepted form. Sternberg presents a partial list of variables that can influence the person's thinking style: the society/culture in which the person is raised, gender, age, the style according to which his parents raise him – what his parents cultivate and what they ignore, religious education, educational framework, and work framework (Sternberg and Wagner, 1991).

According to Sternberg (1985, 1992) the student chooses the thinking style for the situation in which he is found. When he is found in a situation of evaluation, he attempts to adjust himself, if possible, to perform the task of evaluation to the best of his ability, so as to obtain the reward. In contrast, the approach of resources

management maintains that the person adjusts the environment to himself.

According to this approach, in the choice of the type of evaluation, the student, from his own free will, adjusts the environment to himself instead of adjusting himself to the task, when the task was chosen by the teacher. Sternberg addresses the teacher's impact on his students' thinking style. He maintains that teachers teach and evaluate students in a way that encourages and compensates students with a certain style of thinking and learning and discriminates against students with different styles. Thus, there is confusion between the lack of fit in the student's thinking style and the student's lack of ability to perform the task. Sternberg proposes that the teacher use different modes of evaluation according to the student's style of thinking (Sternberg, 1994a). It is important that the evaluation activity allow the use of different actions that reflect the student's personal ability and his achievements and even the student's different styles (Sternberg, 1994b). He maintains that the use of one type of assessment causes a bias in favor of students with a certain thinking style.

According to Sternberg (1994a, 1994b), a teacher teaches and evaluates learners according to his personal thinking style. As the learner is distinct from the teacher culturally, socially, and socio-economically, so he appears to the teacher to be less talented and the reverse is also true – a learner receives high scores and is considered by the teacher to be more successful as his thinking style is similar to the teacher's thinking style.

To conclude, the research community recognizes thinking styles and their importance to the teaching-learning process. Frequently the learner attains poor achievements and is considered lacking ability since his thinking style is not commensurate with the evaluating teacher's thinking style. It is important that the teaching style in the classroom fit the learner's thinking style.

Aside from the characteristics of the student population and their thinking styles, another factor that influences the students' achievements is the learning environment and the perception of the learning environment. These topics are addressed in the following chapter.

2.3 The Student's Perception of the Learning Environment

2.3.1 The Learning Environment

Educational research in the past was based primarily on the measurements of the students' achievements and on other findings related to the evaluation of the learning results in the school.

Fraser¹ (1986) notes that the findings of these researches, which are based on isolated variables, are not enough to delineate the entire picture of the class. He is based on Kurt Lewin, who recognized that potential factors that influence human behavior are related to the environment and the reciprocal activity that exists among its elements, including the personal characteristics of the individuals therein. The formulations of Lewin contributed to the advancement of new research methods, in which behavior is addressed as an outcome of the reciprocal activity of the person with his environment (Fraser, 1986). So too in regards to the approach to the research of learning environments according to the perceptions of the students and the teachers, which commenced 25 years ago. This approach is based on the main assumption that determines that the social-ecological constellation, in which the students act, can influence their attitudes, moods, behavior, scholastic performances, self-perception, and good general sense (Muss, 1979) and can be influenced by them (Bronfenbrenner, 1977).

Researches of this type focus on the perceptions of students of the important psycho-social aspects of the learning environments that are created in the classes in the schools. The argument is that the students' perceptions constitute factors that cannot be ignored, when we seek to improve the effectiveness of schools (Fraser, 1986). In their opinion, the advantage lies in that this approach allows data to be absorbed and characterized, data that can be concealed from an observer. The basis of the research is the

¹ The books of Fraser (1986) and of Fraser and Wohlberg (1991) review the findings of many hundreds of researches conducted in different countries using a wide variety of instruments. Their records were used in the present research as a basis of the review of the broad realm that engages in the research of class learning environments according to the students' perceptions.

information collected in regards to the subjective, complex, and important judgments of the students, of the teachers, and of others, which influence the learning.

Another advantage, according to this approach, focuses on the argument that the students' behavior is influenced more by their perceptions of the learning environment than by the situation (Fraser and Wohlber, 1981). The approach that researches class learning environments according to the students' perceptions uses questionnaires that include items related to different personal, social, and scholastic aspects of the class life. The questionnaires are built generally according to a scale of predetermined dimensions. Moos (1979), Fraser (1986), and Fraser and Wohlberg, 1991) defined three types of basic dimensions for the characterization of human environments.

1. Relationship dimensions: The role is to identify the nature and strength of the interpersonal relations in the learning environment. They allow the degree to which people are involved in their environment and support one another to be evaluated. In the questionnaires developed for the purposes of different researches, these dimensions are expressed on scales of degree of cohesion, degree of involvement, degree of friction, degree of preference, etc.
2. Personal development dimensions: These dimensions allow the basic directions in which there is a tendency for personal growth and promotion to be evaluated. In the questionnaires developed for the purposes of different researches these dimensions are expressed in scales of task orientation, independence, inquiry, competition, etc.
3. System maintenance and system change dimensions: These dimensions address the degree to which the environment is orderly, has clear expectations, is in control of the situation, and is sensitive to the change of questionnaires that were developed for the purposes of the different researches. These dimensions are expressed in scales of order and organization, clarity of the rules, degree of democracy, etc. According to Sternberg (1997), an environment

characterized by clarity promotes success in problem solving (riddles).

This research allows the examination of the learning environment that acts according to innovative pedagogical perceptions. (In the present research study, the innovative environments are courses for gifted children where the method of Chamizer challenges is used in education.) This research engages in the research of the student's perception of the learning environment using the method of Chamizer challenges in education and how it influences his achievements.

In the 21st century, the educational systems face the challenge of adjusting themselves to the demands of the new technological era, so that they can meet society's needs and fill their purpose in the training of the coming generations (Salomon, 2000). The characteristics of a new society and the diverse developments expected therein serve as a starting point for the re-definition and updating of the education goals. Brown and Campione (1989, in Fraser, 1991) note that the primary goal is to develop thinking in the student. The graduates of the schools need to be *independent, with critical thinking, and self-motivation*, who can assume upon themselves *responsibility for learning* that lasts throughout the entire life.

Perkins (2000) emphasizes the need for what he calls 'thoughtful learning'. The need is for schools where the students will learn to think using things they learn about. The emphasis is on the processes of understanding that inculcate meaning for the learned knowledge.

Schools in the modern era are required more and more to promote a high level of literacy, which is based on the use of modern writing instruments – 'open instruments' programs (Givon, 1996). These tools – the 'writing utensils of the modern man' – constitute an impetus to change of writing and reading in the future school (Givon and Ben-Zakan, 1995). In the method of Chamizer challenges we integrate the best of the relevant modern technological means (Givon and Ben-Zakan, 1995).

The starting point is that learning environments are dynamic and changing systems that are comprised of a constellation of factors, among which there are reciprocal relations. In addition, the learning environment itself is a factor that influences the learning (Salomon, 2000). The scholastic environment includes the physical conditions and the resources, work procedures, teachers' behavior, students' behavior, contents, and learning tasks, the scholastic climate, and the social climate (Fraser and Wohlberg, 1991).

The class learning environment is a system of factors. As such, it can be defined, first and foremost, in terms of the place, space, and time, in which the processes of teaching and learning occur (Salomon, 2000). This system is comprised of a large number of elements that connect together to enable the performance of the functions of teaching and learning and the achievement of educational goals. This definition addresses the elements that constitute an inseparable part of the class learning environment. This refers to the elements that must be included, such as teacher, student, learning contents, learning activities, learning materials, physical and technological apparatuses, rules of organization and behavior, class climate, etc. In essence, these are the same elements without which no environment can be called a class learning environment.

When speaking of learning environments, it is impossible to ignore the educational reality that is steadily changing in front of us. Innovative pedagogical perceptions that combine intensive use of information technologies and communication direct the changes in the learning environments. The following section focuses on differences between the innovative pedagogical perceptions and the traditional pedagogical perceptions we know. This topic today constitutes a true challenge for every educational system. The comparison between the content of the elements and the structure of the relations among them in the traditional learning environment and those in the innovative and technology rich learning environment is essential to the better understanding of the changes that are occurring and of the nature of the innovative pedagogical perceptions.

2.3.2 Online Learning Environment

The present research examined the teaching and learning in a learning environment that is an online environment (the learning process does not depend on being online). It is necessary to remember that an online learning environment is, first of all, a learning environment, for which there is considerable and diverse theoretical reference in the professional literature.

In the online learning environment, the students are the researchers, teachers, and directors of advancement; with the guidance of their teachers they engage in the directed discovery according to a research model. The curricula are based on thinking as basic literacy, are built in-depth and tied to meaningful topic, which encourage understanding and expression ability. The computers are tools for directed thinking, learning, and cooperation. The evaluation methods are aimed at the discovery and use of information, the level of performance, projects, and summation works (Brown, 1992).

Most theoreticians and researchers who engage in innovative pedagogical approaches assert that to realize the goals derived from the challenges that the education systems face, we must think on the re-design of schools and study classes. The direction is the definition of innovative learning environments as opposed to the traditional environments we have known till now. However, Brown (1992) notes, for instance, the changes that occur in the philosophy of the classroom while she compares between the traditional class and what she calls an online learning environment.

In the traditional learning environment, the students fill the role of passive instruments for the absorption of information. The teachers engage in didactic teaching and fill a role of class managers. The curricula are built horizontally, are generally segmented, and are aimed at the memorization of facts. Computers, if they exist, are used for practice and training or for programming. The evaluation is performed on the memorization of facts using traditional tests.

In the online learning environment, the students are the researchers, teachers, and directors of progress. With the guidance of their teachers they engage in the guided discovery according to the model of active research. The curricula are based on thinking as basic literacy, are built in-depth, are related to meaningful topics, and encourage understanding and expressive ability. Computers are tools of thinking, learning, and cooperation.

Braun (1993) also describes a new paradigm of schools that addresses the needs of the information and technology society and compares between it and the existing traditional paradigm. He primarily emphasizes the behaviors of teachers and students in the same environments.

The traditional learning environment is a *rigid system* in which the students adjust themselves to standard behavioral expectations. The *teacher is the font of all knowledge*, which he conveys frontally to passive students who sit in the classroom in orderly lines. The students are addressed as *empty vessels* that should be filled with knowledge and work separately from one another and collect knowledge and techniques without any real connection to their applications.

The innovative learning environment is a flexible system with designed learning environments, which are adjusted to the students' needs and abilities. The teacher is a *helper and guide* who works with his students in small groups to jointly design the work. The students are addressed as *individuals* with unique learning styles and *work cooperatively*, collect facts, and develop skills in decision making, problem solving, and information processing (Hertz Lazarowitz and Fox, 1992).

Technology, as a learning resource according to Brawn (1993), must be included in every program for the re-design of the schools, since it offers students and teachers an *approach to information and tools that enable information to be addressed, processed, and internalized* and thus it facilitates the promotion of the students' achievements. Hawkins (1993) maintains that it is necessary to emphasize the use of technology, to improve the school organization. The roles of the schools in the technological era are, in his opinion, the promotion of inquiry, interpretation,

discussion, debate, judgment, and re-examination of ideas and products – aspects that are intended to increase the students' achievements (Hertz Lazarowitz, 1997).

In the present research we engage in constructivist learning environment (Salomon, 1997), since technology has developed rapidly and today offers tools for intellectual collaboration for information processing, design, accessibility, and communication that can be used in learning environments established from the constructivist perception. In the tool of Chamizer challenges, we examine what the students learn in the constructivist learning environments.

The constructivist approach proposes many sources of information from which we can draw an entire world of information and an invitation to be a full and active partner in the broad, virtual, and diverse information society. In addition, according to Salomon (1997), knowledge is constructed actively and is closely related to the individual's cognitive repertoire and to the context in which the activity is held. Thus, it is positioned. The learner is more active than observing. According to Von Glaserfeld (1990), knowledge serves the organization of the individual's experiential world.

Knowledge is in essence found in the constructivist process and is not the content collected in the memory but the activity of the construction. In other words, "children do not receive ideas, they create them" (Neil, 1977).

Constructivism is in essence a creature with two heads. At first, it was greatly influenced by the cognitive developmental approach of Piaget, which emphasized the individual and the way in which he constructs the knowledge. Today alongside this approach a competing social-cultural approach is steadily developing, influenced by the Soviet thinking school of Vygotsky, Leontiev, and Bektin (Cole, 1991; Rogoff, 1991). The latter approach primarily engages in the social processes of interaction and participation and the acquisition of meaning on a social basis, or in other words, the way in which the positioned social system – and not the sole individual therein – acts interactively to build shared knowledge (Greeno, 1997; Vygotsky, 1962).

The positioned approach, which emphasizes the ‘here and now’ of the acting system, is significantly epistemologically different from the individual oriented cognitivist approach. The cognitivist approach emphasizes how good learning occurs, namely, how appropriate teaching and learning environments should be planned. Conversely, the social-cultural approach is more philosophical. The transition from the cognitivist approach to the positioned approach changes the meaning of ‘knowledge’ and ‘learning’ from its affiliation with personal achievements to dispersed actions of context dependent participation. This is a transition from the planning of activities that lead to certain results to the formation of activities primarily related to interpersonal social processes. Thus, this is the transition from the evaluation of the impacts ‘of’ the learning environment to the impacts ‘with’ this environment. This emphasizes the systemic nature of reciprocal actions in the learning environment and the ways of building socially shared knowledge. (Brooks, 2000)

Impacts ‘with’ are changes that occur when students cooperate, solve problems, surf the Internet. Greater involvement, more focused attention, more aware social activity, better formulation of a question directed to others, etc. – all these are processual positioned impacts of constructivism that occur during the activity and do not derive from it (Maslow, 1971).

The transformation of the didactic class to the constructivist class, which includes work teams, interdisciplinary problems that should be resolved together, technologies, etc., requires thinking about the standards and new goals that are more commensurate with the new pedagogy. Salomon (1997) maintains that one of the most important and interesting results of constructivist learning environments may be the improved ability of the students to work in team to solve problems from life that are totally new, complex and built differently, and their ability to together achieve information and make it knowledge. Therefore, the knowledge will not be collected for itself but will be constructed when there will be need for it to solve a problem or to design something useful. This emphasizes the aspect of use and positioning of the knowledge. However, it also recognizes the ability of a personal cognitive mark that can be generalized, such as the ability to work

in team, to access the required information, to phrase an intelligent question, or to re-define the focus of a fruitless search, and to crystallize work procedures for the resolution of problems (riddles) (Rosso, 2000).

In the Chamizer challenges in education method, the use of technology influences by itself the learning and the thinking, as well as the learning resources that the student creates in the learning environment. The technology, which comes to realize the constructivist learning environment, may influence the intelligence in at least four ways. The first is through the suggestion of intellectual and cooperative activities, such as simulations or design. The second is through systems of symbols through which it represents the world to us, such as multimedia. The third is related to the way in which information on the world is organized. The fourth way is through the combination of the three previous ways: the opportunity that technology enables for the active construction of knowledge and especially symbolic forms (word, figure, picture), and the knowledge built in unique organizational forms (databases, multimedia), which are available for examination and operation. The exposure alone to the systems of symbols of technologies and communication means but the active involvement in building, individually or cooperatively, is what makes the fourth way into the most powerful of all. Hence, it can be said that the purpose of the school – especially with the constructivist shades – is to enable students to think, to acquire skills of intelligent working with information and making it knowledge, and not to drown them in information. (Brooks, 2000)

Another **pedagogical paradigm** can be addressed:

1. The behaviorist approach.

The behaviorist approach to learning speaks of the acquisition of automatic mastery of skills and supports the environment that is primarily characterized by practice and didactic explanations. This approach characterizes a rigid and dogmatic system of education and it is giving way to methods based on different behavior characteristics, in which there is greater attention to the individual as a learner and not to a public of learners, which is considered beforehand to be homogenous.

2. The cognitivist approach

The cognitivist approach engages in the acquisition of understanding of conceptual contents and it appeals to the learner as a unique individual in the community of learners. These are the teaching theories of Ausubel (1963), Bruner (1996), and Perry (2002). Harpaz (2000), who presents to the learner before every lesson the general context, and thus helps him assimilate elements of the lesson in the broader scheme. The cognitivist approach engages in the learning stage in which the information, which was brought to the learner, becomes knowledge, insight, and connects the existing schools of knowledge. These methods attempt to illuminate the 'black box' that are the inner, cognitive and emotional processes that occur between the stage of the presentation of information to the person and the product that he produces. They focus on the processes that cannot be directly observed, the processes that the behaviorists avoid addressing (Dewey, 1990).

Zilberstein et al. (2001) combine between the behaviorist approach and the cognitivist approach and maintain that the learning environment needs to allow the learner three primary things as a way to success / achievements.

- A. Implementation of cognitive traits that pertain to thinking and understanding, with the goal that the learner will be critical, creative, able to choose from the different possibilities and to think about thinking.
- B. Implementation of traits of the emotional aspect that pertain to the learner's motivation to learn and to the fact that the learner will be open to changes, to a supra-view, and to the determination of an order of priorities.
- C. Implementation of traits related to skills and learning habits that pertain to the knowledge sources, the information and data processing, and the clear presentation of the learning product.

The paradigm of Zilberstein et al. (2001) suits the Chamizer challenges method as promoting the students' achievements. On

this basis, Zilberstein, Eyal, and Berkovitz (1994) establish a model of eleven characteristics of the learning environment, the primary characteristics of which are flexibility and adjustment, encouragement of choice, help, development of self-esteem, democratic conduct, encouragement of inner motivation, learning of development, use of information outside of the classroom, cooperativeness, encouragement of thinking, encouragement of assertiveness, presentation, and explanation. In addition, many others propose an ideal environment for learning aimed at understanding, which characterize the computerized environments, which, as aforementioned, are a part of the online environment.

For instance, Winn and Snyder (1996) propose the following characteristics.

- Active learning: Computerized learning environments allow the learner to learn the topic actively, through the exploitation of the ability to perform manipulations and different actions with the information in the computer. Therefore, learning environments that aspire to understanding often include simulations in which the learner is asked to implement some system.
- Cultivation of understanding and meanings: The ability to establish the learning in the computer on the combination of text, picture, sound, and voice (multimedia) allows the topic of learning to be presented in a multidimensional manner and to see it in different manners and therefore it may encourage understanding.
- Identification of thinking mistakes: ‘Smart’ computerized learning environments can analyze the learner’s performances and provide feedback that will help him understand errors of thinking or lack of understanding.
- Transfer of learning: Many computerized learning environments allow the ‘transfer of learning’ to be improved (in other words, the ability to implement a principle, concept, or strategy learned in a certain context to a different and new context) due to their being interactive.

- Focus of attention on the learning: The computer places at the designer's disposal a variety of traits that allow the attention to be focused on the learner (color, sound, animation, etc.). Design, development, implementation, and evaluations actions of systems of learning through the Internet require analysis and examination of the ways to recruit the potential innate in the Internet in favor of the scholastic goals, through the combination of principles of educational design and issues related to a variety of dimensions of the online learning environments.

Many others maintain that the online learning environment opens before the learners new ways of learning that contribute to them in the cognitive dimension and in the interpersonal dimension and bring about the increase of the inner motivation and the increase of the satisfaction with the learning processes (Mazor, Nachmias, and Mintz, 2005). Education through an online learning environment constitutes an ideal ground for the creation of an active scholastic approach, since computerized communication has important traits such as speed and interactivity, accessibility from everywhere, and creation of worldwide communication in which individuals and groups can participate actively in interpersonal learning and collaborative learning (Rosso, 2000).

The characterization of computerized learning (Winn and Snyder, 1996) and the analysis of the characteristics of the learning environment (Zilberstein et al., 2001), as described previously, are expressed in the online learning environment (Rotem and Peled, 2006). The six prominent aspects, which are the advantage of the online environment in promoting success and achievements on the basis of the characterization of the learning environment, which are greatly empowered through it, in comparison to another learning environment, are:

1. Making possibilities of choice accessible, both on the personal level of each and every learner and as a heterogeneous solution to the learning group.
2. Ongoing and intimate dialogue between the learner and the teacher.
3. Making open learning situations accessible.

4. Maximal accessibility to information sources and to up-to-date information.
5. Collaborative learning of high level of intensity and quality.
6. Encouragement of independent work, divergent thinking, and personal research.

These six aspects are the foundation stones in the characterization and implementation of the online learning environment, which, of course, are successfully implemented even without an online environment. However, the way in which these characteristics are expressed in the learning process, in the online environment, may empower them and they are the certain aspect of the advantage of use in an online environment, in contrast to learning in an environment that is not such.

2.3.3 Resources Management

Garcia and Pintrich (1996) engaged in the realm of learning strategies and motivation and addressed the index of the learning environment as a parameter in resources management.

Resources management includes four elements that are predominant in the sources that are not directly tied to thinking (Sternberg, 1985). The resources can be external, internal, and interpersonal. According to Garcia and Pintrich (1996), the resources are management of time and learning space, control of efforts, learning with peers, and search for assistance. The researcher found that students who are aware of their personal needs and who search for the resources actively, namely, they have the ability to manage the resources, are students with a high level of self-control (Zemmerman and Pons, 1988).

Sternberg (1992) maintains that it is imperative to teach students to exploit their strengths and to compensate for their shortcomings.

Hence, it can be concluded that the findings of Garcia and Pintrich (1996) and Sternberg (1992) support the fact that learning of resources management will cause the students to exploit their strong abilities and skills and to strengthen and compensate for

their weaknesses in regards to resources management in the learning environment.

The researches of Pintrich and De Groot (1990) show that as the student believes in and masters the resources of the learning-technological environment, social environment, work methods, and the understanding of the requirements, the level of performances in all the types of tasks included in the research rises. This discovery indicates that the use of resources management strategy is essential to the performance of tasks of different types, especially in regards to continuous changes in information that is updated all the time (Birenbaum, 1996). Hence, it is possible to see the reference to resources management as a process.

2.3.4 Support of the Teacher

The learning environment and the learning opportunities enable and even obligate another type of teacher / student relationship. The dialogue between the teacher and the student is a dialogue between equals, in their curiosity and willingness to engage deeply in complex issues. Thus, the learning process is the examination of an intellectual/challenging journey with results and processes that are not necessarily known beforehand. The teachers and the students contribute and are contributed, each from his place, and aspire to learn and to develop constantly. The students can take off and create and thus be aided by knowledge, understanding, guidance ability, and experience of the teachers, while the teachers can learn and create, too – both in pedagogies and in disciplinary areas, in interpretations, in the establishment of new relationships, in non-routine programs, etc.

The great difference among the gifted students and the reference to the different ages creates the need to diversify and build different programs, methods, tracks, and frameworks.

It is possible to indicate many elements that influence the teacher's support of the student: age, experience, cultural background, educational outlook, way in which he addresses his students, the way in which he perceives his role as a teacher and educator, the way in which he manages events in his classroom,

etc. The teacher's instructional behavior is not only an outcome of a great number of elements but also a function of the reciprocal relationship that these elements hold among themselves.

Dewey (1990) maintains that the teacher's behavior is methodically related to the type of activities implemented in the class. It is influenced by the educational perception prevalent in this environment. Dewey (1990) bases on research findings that emphasize that as the student is given possibilities of choice and of mobility, the complexity of the situation increases, as does the need for additional management and overt activities for control of the situation on the part of the teachers.

The teachers and the students together conduct negotiations in regards to the conditions of the structuring of knowledge. Dewey (1990) also determines that the key to the teacher's success in the class management is related to the understanding of the structure of the events that occur in his classroom, in his skill to supervise them, and in his direction and the activities according to this understanding.

According to Salomon (1997), it is necessary to address the learning environment as a system of intertwined social and instrumental factors that influence the individual. A system, in his opinion, is defined by more than one factor, when each factor has specific content. The system as a whole is characterized by the structural relations among the elements and by the reciprocal influence of these elements on one another. The class learning environment is itself an element that influences the learning and it simultaneously is a function of many other elements.

A main and important aspect in the online environment is collaborative learning. The rationale of collaborative learning is not tied to the online environment, and it is necessary to draw the distinction. Pedagogical success in collaborative learning depends, first of all, on the teacher, the characteristics of the learning / the task, and the way in which the interaction among the learners is performed in actuality.

The rationale of collaborative learning derives from the definition of the concept of learning. In general, learning is comprised of three elements (Rotem and Peled, 2006):

1. Download – ‘Reading’, conveying information details to the learner. Through reading the written text and in more generalized manner – digital text – in all its visual and auditory modes.
2. Upload – Receiving information from the learner for the common domain through text, speech, writing, visual, movement, etc.
3. Combination of items of information into existing knowledge clusters and new knowledge clusters – awakening new insights in the ‘black box’ in the learner’s head.

While processes (1) and (2) are empowered using technology, process (3) is personal and does not depend on technology at all. Hence, the understanding will not be achieved with technology but indirectly, through the enrichment of the information and its modes of expression that come from the learner and are expressed by him, also through technology.

Learning without stage (2) – expression, response to what is happening in the learner’s head – is not learning. Hence, in every learning task it is necessary to characterize some product (even an oral answer) that will give the learner reflection on himself and through feedback he thus improves his understanding and insights.

Collaborative learning offers very rich opportunities for learning, which are based on every learner’s expression. Thus, it reinforces and enriches the personal learning that occurs in his mind and thus is enriched by the peers, each of whom contributes from his insights and thus they greatly enrich the situations in which the learner reveals himself and is revealed, and thus the learning becomes far more meaningful. (Hertz-Lazarowitz, 1997). In collaborative learning, the motivation generally far exceeds that of personal passive learning. Here, the learner must express himself, participate, through social activity that is generally encouraging and is even competitive. In this way, the products of learning are greatly enriched; the student experiences in actuality an enriching and diverse learning experience when this is

expressed personally and authentically, in that he has an audience of listeners and respondents, from the sharpness of creation and learning.

All these make the collaborative learning in the learning environment a main factor of its success. An online environment is ideal for the diverse and quality realization of such a mode of learning, through different interactive elements, which improve over time (Rogers, 1973; Sheran and Sheran, 1975).

It is necessary to make certain that **online collaborative learning** will always be after previous experience of **personal learning** and the assimilation of skills in an online environment. A real added value of collaborative learning is obtained if most of the learning group is comprised of individuals who have attempted independent personal learning beforehand. Hence, every activity of collaborative learning in an online learning environment should be performed with learners who had previously experienced successfully personal learning in an online environment. According to Hertz-Lazarovitz (1997), it is possible to identify two elements in activity of online collaborative learning as promoting success in the students' achievements:

1. Interpersonal interaction. In certain context, it is private and even intimate. The interaction is between the teacher and the learner and/or among the learners themselves. In both cases, the success of the learning is very important.
2. Personal expression to the public of listeners. Every participant personally expresses himself and even receives a response, since reference in many cases is to the 'personality itself'. The user is granted attention to what he has to say and to the way in which he says it. This element is less effective among those who know one another but there is still focused attention to a greater number of types of other interactions. The participant in the process has a possibility of personally choosing the peers with whom he has created an interaction as a basis of the promotion and achievement of the goal.

One of the goals of the method of Chamizer riddles is to develop thinking in the child. Teaching in the approach of the development of thinking presents the teachers with new challenges. These challenges are complex and constitute more than once an obstruction that is difficult to pass, a blockage that may prevent the successful implementation of programs for the development of thinking.

The 'traditional' teacher has considerable authority in the classroom. The teacher's role and status in the approach that emphasizes the transfer of information is clear and defined, since the teacher is, first of all, a source of knowledge. The teacher who 'conveys material' (frequently but not necessarily through frontal lectures) knows ahead of time the body of knowledge that the students must acquire. Thus, the teacher knows beforehand the response to most of the questions that may arise during the lesson.

In lessons that emphasize thinking, the teacher's role changes: his primary role is no longer to provide knowledge but to initiate thinking events and to navigate the occurrences in the classroom. The teacher still enjoys precedence in knowledge over the students but when truly open questions are asked, the teacher does not always know the answer. Sometimes the teacher does not know the answer since he did not think ahead of time on the question that arose in the class. In other cases, he does not know the answer since the question that arose was very difficult or since there are questions that do not have one correct answer but rather a number of possible answers, each of which may, under certain conditions, be correct.

Teachers who are prepared to cope with the new challenge will be aware of these difficulties and will adopt an active approach to surmount it, such as the use of appropriate technological means, experts, books, etc (Zohar, 1996).

2.3.5 Learning Climate Causes Learning Involvement

The class is the physical and social environment where the child spends his time and where he attempts different experiences. The learning climate addresses the learning atmosphere in the classroom, the norms on the topic of the studies, the students'

expectations of success in the studies and their achievement behavior (Bar-El, 1996).

In the classroom framework, social processes and reciprocal activities are created, influenced by many variables, such as characteristics of the physical environment, characteristics of the populations of students and teachers, and organizational characteristics. These variables influence the unique characteristics of the class, such as norms, attitudes towards the learning, democracy, performance of assignments, help, cooperation, interpersonal expectations, cohesion, and patterns of interpersonal communication.

In every class patterns of behavior that characterize it are formed. These patterns of behavior influence the nature of the reciprocal activity. The occurrence of this circular process is influenced by the personal mindset of each one of the participants in the process of the reciprocal activity. In the process of the reciprocal activity in the classroom, perceptions and attitudes towards what is happening are created. These perceptions constitute a new source of knowledge, which becomes a part of the participants' personal mindset and as such, it influences the individual's reciprocal activity with the learning environment. This process implies that, on the one hand, it is possible to address the climate as a product of reciprocal activity that occurs in the learning environment and on the other hand, it is possible to address the climate as a part of the participants' characteristics and perception of what is happening in the classroom – a perception that influences their behavior and the reciprocal activity between them and the environment (Kaplan and Assor, 2001).

The class climate is also important to the student's development as a citizen in society. Students in a class with a positive social climate may develop a personality that is suitable to life in a democratic society, a personality that takes the initiative, assumes responsibility, is socially involved, is able to stand up for rights, can make decisions, and has internal locus of control (Zedkiyahu, 1998).

The class climate addresses the way in which the class learning environment is perceived by the teachers, the students, or

even by any observer from the side. This element has an essential role in regards to activity that occurs in the class learning environment. It derives from the need to see human behavior a product of relations between the person and the environment. The class climate is a product of the typical needs of the participants in the class learning environment and the characteristic pressures that the environment exerts on the participants. It is possible to discern between scholastic climate and social climate.

The learning climate is related primarily to the way in which the learning occurs in the environment. This includes, for example, the compositions in which the learning is performed, the students' degree of autonomy, the students' desire to be active and to assume upon themselves responsibility for their studies, the relations formed between teachers and students in all that pertains to the learning in the class, etc.

The social climate is the result of the nature of the interpersonal and social relations that exist between one student and another, among the students themselves, and nature of the interpersonal interaction between the teachers and the students (Gal-Or, 1982).

An environment that promotes competition may cultivate learning from an orientation of ego and the desire to do better than others. In contrast, a class environment that promotes learning for the purpose of mastery and interest and curiosity in the material cultivates among the students learning from the inner motivation to improve and develop in the learning realm (Assor, 2001).

The procedures of teaching that the teacher uses will influence the atmosphere. The teacher needs to act in ways that encourage cognitive involvement.

In-depth thinking can be achieved through the opening of discussions on responses that were given and inviting the students to respond and evaluate different opinions. When the teacher requires explanations of answers, this proves that he is not satisfied with the correct answer but requires the student's involvement in knowledge. The teacher can also encourage association among different ideas.

Even the students' perception of the teacher influences the motivation. The students' attitudes and achievements change if they perceive the teacher as enthusiastic, cultivating, respecting, and trustworthy. The teacher himself exemplifies motivation if he evinces enthusiasm and interest.

The review of the literature shows that the class climate is today measured by the students' subjective perception, since the students' feeling and perception of what is around them influence their involvement in the relations in the classroom and in learning in the learning community (Anderson, 1982; Huesmann and Guerra, 1997).

According to the researches, a positive climate promotes the students' self-esteem and promotes their scholastic performances. Classes with a climate of competitiveness, hostility, and alienation cause anxiety and lack of comfort and do not allow the scholastic development of many of the students. Classes in which there is reciprocal support among the students and between the students and the teacher allow the development of self-esteem, inculcate security, induce calm, cultivate personal responsibility, and willingness for involvement and sense of belonging (Lewis, Schaps, and Watson, 1996).

2.3.6 Interest-Inducing Teaching and Motivation to Learn

In addition to the characterization of an environment that allows the use of resources, it is possible to characterize the student according to his motivation to perform the riddle or the task, or in other words, how the teaching inspires interest and desire to learn. Motivation is a process of decision making in which the person functions on three levels: on the cognitive level to perform the assignment, on the supra-level where he supervises his progress (Michenbaum, Burland, Gruson, and Cameron, 1998), and on the emotional level. Motivation can be defined as the "perceived value" that the student gives to the learned material and that influences the student in the choice of the strategies when learning the material (Pokay and Blumenfeld, 1990).

Motivation is an energizing and directing process that preserves the behavior of people to achieve the intended goal. It reflects the entirety of the reasons that cause the person to behave in a certain manner in a certain situation. Motivation is a factor that addresses the strength of behavior on the one hand and direction of the behavior on the other hand. Motivation cannot be disconnected from the student's beliefs on the importance of topics and therefore motivation determines whether the student will choose a way that leads to goal A or to goal B.

Keller (1983) notes three types of motivation: extrinsic, intrinsic cognitive, and intrinsic emotional.

- Extrinsic: The student acts so that he will be liked (desirability), to avoid punishment (external reward), or to compensate for lacks.
- Intrinsic cognitive: The student learns because he acknowledges the importance of learning (and not because he enjoys it).
- Intrinsic emotional: The student learns out of enjoyment and interest in the study material (he likes the subject and therefore he learns) or because of a sense of challenge (problem solving).

According to Ames (1990), the student who is motivated by extrinsic motivation will be satisfied with simpler tasks and will be willing to invest less effort in the learning process than will a student with intrinsic motivation, who will assume upon himself more tasks that constitute a challenge and will have a higher level of motivation.

The theoretical-ideal situation according to Neo-Marxism – the Frankfurt School (for instance, Erich Fromm) on the one hand and according to Marxists such as Anton Semionovitz Makarnko (author of the pedagogical Poem and other books) is to attain the situation in which the student acts out of emotional intrinsic motivation, after he has identified in himself what interests him, has chosen directions of action, and adheres to them on the way to the achievement of the goal. Thus, the student has:

- A positive emotional experience and feelings of interest and enjoyment, of freedom, choice, self-integrity and wholeness,

tranquility, and self-fulfillment (and perhaps even an answer to existential questions such as 'who am I', which contribute to the construction of the self-identity), which derive from the lack of pressures, the disappearance of anxiety, and the willingness to try new things.

- Profound understanding of the learned material, since when people learn from intrinsic motivation, they learn in-depth and in-breadth, and they also learn things that are not dictated by the teacher. This student will converse on the study topic with his significant others, will read texts related to the topic, will build for himself a map of thinking, and will organize the concepts in their correct contexts. All this will lead to the learner's possession of extensive knowledge on the study topic.
- Reinforcement of social relations. The student who enjoys learning will attempt to find students who are similar to him, so as to develop with them learning relations that can develop into social relations. It is necessary to be aware and to prevent the reverse phenomenon – a student who is immersed in his hobby may reduce his social relations.

In the present research, the term motivation addresses a constellation that includes the element of the value of the task for the student, the element of expectation, and the emotional element (Pintrich, 1999; Pintrich and De Groot, 1990). These are expressed in that the student sets for himself goals that interest him. He believes in his ability to accomplish the riddle and he has feelings towards the riddle that include pride and success. The student's expectations and the beliefs influence his efforts in the studies. Giving the student the right to choose the riddle that inspires motivation in him influences both his performance of the riddle and his process of learning (Ames and Archer, 1999).

Assor (2001) maintains that the two main measures of motivation are strength and autonomy:

- Strength – the degree of the desire to invest in the relevant activity.
- Sense of autonomy – is the desire to invest perceived and felt by the individual due to his choice and due to the

activity that he can understand and identify with or is it based on unjustified external coercion (Perkins, 1998).

Sternberg (1992) asserts that from an early age the child differentiates in his reciprocal relations between people and situations. The interactions are a part of the child's thinking style. Following these interactions, the child receives inner or external reward and this reward is what motivates his decision.

2.3.7 Characteristics of an Innovative Learning

Environment

Review of the extensive literature that engages in the publications of theoreticians in the educational system emphasizes a number of basic principles that characterize to some extent most of the innovative approaches in education (Brawn, 1992; Rotem and Peled, 2006; Salomon, 1997; Salomon and Almog, 1994).

The innovation is not in the ideas themselves. It focuses on the following points:

- The approaches are integrative approaches built on the combination of a number of theoretical ideas.
- The reference to the information and communication technologies is reference to main factors in the cultural reality forming in front of us. This reality is characterizing the school and class learning environments to a steadily increasing degree.
- The emphasis is on the formulation of new definitions for effective ways for the promotion of learning, for the roles of teachers and of students (Brown and Campiagna, 1989, in Fraser, 1991; Salomon, 1997), and for ways to integrate information technologies in the teaching processes (Givon et al., 1996; Givon and Ben-Zakan, 1995).

According to Salomon (1997), the change addresses the entire learning environment and each one of the individuals therein. He lists five characteristics of the changes that occur following different projects that are implemented in technology rich environments.

- Intensive use is made of *computerization technologies*.

- The learning is *interactive* to a large extent, autonomous, and based on *teamwork*.
- The *scholastic tasks* enable the students to engage in a structured and active manner in *interdisciplinary and authentic tasks*.
- The projects are directed by *inquiry learning and self-direction*.
- *Computerized communication* enables near and far information sources to be combined.

Salomon (2000a) and Perkins (1998) formulated eight principles that address the nature of learning.

1. *Constructivism*: This refers to learning from context that necessitates the learner's commitment to address the information, thinking, and learning activity. The identification of a process in which the learner interprets the learned contents while he associated among them and derives meanings.
2. *Understanding as thinking*: Understanding is a goal in the learning process. Understanding is achieved through involvement in the activities that inspire such thought. It is expressed in the following abilities: the ability to explain a topic, the ability to implement information in different contexts, the ability to derive representations of knowledge, the ability to draw analogies, the ability to correct mistakes, and the ability to predict impacts of change in structure or in process.
3. *Principle of understanding as a network*: The understanding of any content is a process of structuring in a framework of a broad and rich network of relationships in which the goal of this context with supporting relationships is found.
4. *Social interaction*: The intent is the main role that should be attributed to learning that occurs in the social context, through cooperation and support of processes of knowledge structuring and understanding. Salomon (2000a) and Perkins (1998) base on Resnick et al. (1991), who emphasize the following characteristics of learning that

occurs in the social context: exchange of opinions, transfer of information among peers, asking questions, etc.

5. *Principle of social distribution*: The learned contents and thinking processes are distributed both physically and socially. The learning process is influenced not only by the individual who participate therein but also by the traits of the group and other environmental factors.
6. *Principle of situated learning*: The meaningful and effective relationship of knowledge to the unique context in which it is acquired. Therefore, effective learning needs to occur in social constellations with meaning for the learner.
7. *Principle of generalized learning*: Generalized information originates in unique contexts and can be implemented therein as well.
8. *Self-regulated learning*: Information, beliefs, and attitudes towards the learning itself can strengthen the learners, organize their learning more efficiently.

The Chamizer challenges method in education is one of the innovative pedagogies that the computer technology can promote their implementation. Computerized tools can help students collect and organize information to research data, to build models, etc. If we use the computer to empower learning and research and to ease the implementation in the school, it can meaningfully contribute to the improvement of ways of teaching and students' achievements.

However, it is not possible to ignore that technological innovations may also engender new educational goals and re-evaluation of the skills the students require. According to Salomon (2000b), technology must be given an opportunity not only to serve pedagogy but also to shape it. Technology, or more precisely, information technology, is steadily changing society, and the school has the role of intelligently training graduates to fit into the information era, one of the significant signs of which is the Internet (Owston, 1997; Salomon, 2000b). From this perspective, the ability to use the Internet as a research environment can not only contribute to the learning of research but also become an educational goal in its own right.

To conclude, from the innovative pedagogical perceptions and researches reviewed in the chapter, several important assumptions arise, pertaining to online and technology rich learning environments.

- The learning is a process of *knowledge structuring*, in which the learner discovers relationships between different items of knowledge, derives personal meanings, and composes patterns from the knowledge he acquires.
- The learning occurs during the engagement in *real problems* that allow students to cultivate their *understanding* and to develop their *thinking*.
- The learning occurs in a *social context* – the work in *small groups* is a framework essential to the process of the structuring of knowledge and it enables interpersonal communication.
- Innovative information technologies put at the disposal of the teachers and the students *new and sophisticated instruments*. The integration of these tools in the learning environment creates new opportunities. The correct use of computerized systems allows accessibility to rich corpuses of knowledge that support the desired learning processes (Kaniel, 2001).
- *Changes in the roles* of the teachers and the students in regards to the *responsibility* of each one for what occurs in the teacher's learning environment. The teacher becomes a guide, an instructor, and an assistant in the learning process. He also learns to hold reciprocal relations with peers and with the students (Sternberg, 1992).

The unique research environment studied in this dissertation is that of the Chamizer challenges method. This method is presented in the following chapter.

2.4 The Chamizer Method in Education

What is new knowledge and how is it created? Socrates, in his conversations with the slave, exemplified that by asking questions it is possible to learn almost everything. Asking questions is the foundation stone in the educational process. Far more than frontal description, asking questions involves the learners' processing mind and not only their absorbing mind.

The Goal

To acquire and assimilate knowledge, values, and natures related to a topic, situations, and interests in non-accepted ways that were intended to awaken interest, creativity, curiosity, and competitive enthusiasm.

Riddle – “Who Are the Six of You Who Begin to Surf?”

Before you begin to answer, examine yourself a bit. Is this question difficult or easy? What is difficult in it? How is it possible to solve it? Were there questions in the past, which you solved or did not solve, who can help you solve this question? Where is the hint from? Who can help you? Are there relevant sources for solution?

Dan Chamizer, through his method, creates a unique learning situation. Chamizer combines riddles of association imagination and logic in diverse realms of knowledge to create 'challenges' – a unique learning experience. The questions are both difficult and easy. It is possible to work on them for a short period of time or for a long period of time, individually or in groups, for pleasure or for a prize. The Chamizer method creates a personal learning process that involves the learners' processing mind. The process has dual value: on the one hand, true goal-oriented engagement in the content realm and on the other hand, general engagement, multidisciplinary, with problem processing, improvisation, individual's work with a team, coping in competitive situations, etc. (See appendix number 2 for further explanation on the Chamizer riddle.)

What started as a media hit that excited radio listeners, television watchers, and newspaper readers in Israel was copied in the 1990s into the realm of education in Israel and became an innovative, daring, and effective learning method that has been implemented till today in more than one-half of the schools in Israel. The daily riddle on the radio that every day motivated hundreds of thousands of listeners to move in the direction of databases, libraries, research groups, the construction of original tools, and observations with the goal of finding solutions created a diverse range of answers and creative solutions and led to the idea to copy the dynamic to the fields of the educational system and learning for children.

Main Ideas of the Chamizer Method

The Chamizer method creates a unique learning/educational process that combines elements such as teamwork, focus, challenge, competitiveness, steadily increasing interest, enjoyment, and self-motivation, with ‘adventurous enthusiasm’ and curiosity. This is an open method, in which creative imagination and associative impetus have a main part in the direction of the process.

Method of the Weekly Task

The method is based on the use of a series of weekly tasks, each of which is a ‘weekly surprise’ that transforms the class into an adventurous and enthused task group that creates adventure-oriented dynamics. The products of the groups are collected, examined, and evaluated at an online performance center.

How Does It Work?

The weekly task is conveyed to the competing groups (classes) using the Internet Performance Center. The topics of the activity focus on the learning materials, values, needs of society (problems and illnesses), the acquisition of multidisciplinary knowledge, etc. – scholastic and educational interests.

Points that Anchor the Approach and Method

- The riddle approach and its development to a perception and learning method.
- The question and the riddle at the center of the learning, not the response or the solution.
- Absolute legitimization of the imagination and creation resources.
- Use of media instruments from outside of the system of the student, today and tomorrow.
- The fear of knowing versus the curiosity of touching.
- Use of the fact that every child is ‘naturally gifted’ with associative imagination.
- The riddle, the challenge, and the reward as a proven motivation technique.
- The advantage of unmediated processes.
- The development of research and learning methods as an outcome in the process of coping with the decoding of puzzles.
- The modern teacher – the center for the inculcation of instruments for security and ethical values and not necessarily the authority of knowledge.
- The riddle of associative imagination has an infinite number of solutions – as does everything in life.
- Legitimate use of all that is ‘cool’ and ‘in’ in the media and fashion.
- The method raises new elites in the classic group (the class) since the ‘flashes’ and anchors that are essential to the debate and are required in the decoding process of imagination riddles can come from minds that till now had not been considered important or had not been taken into consideration.

A group that raises many possibilities of solution, all of which are legitimate, creates learning around a far broader scope of information and knowledge than in the classic realm of the lesson. In other word, when each one comes to the group with his own solution, the group learns even if the original riddle has not been

solved (“... so what if we made a mistake and engaged in Bialik while the solution engaged in Alterman?”)

Principles of the Method

1. The Founding Idea.

Augustine, the noted Christian philosopher and man of religion, writes in his book *Confessions*, “What is time? If I am not asked, I know; if I want to explain, I do not know”. Indeed, until a person has not explained a topic to another person, he does not know truly that he has understood and assimilated it. In learning in general and in mathematics in particular, the way to success requires *understanding and practice*. The method of the *beyt midrash / cheder*² supplies these. When the students teach one another, they need profound understanding. When they learn from one another, they will understand better, since the topic is explained to them in their words, by their friend, who also has difficulties in the same topics. And when they explain to them – they will again assimilate and understand. When a person explains material, he becomes *involved* in the learning and teaching process and thus *responsible* for its success.

Moreover, the *experience of success*, the recognition that “wow, I am smart, I know, I can!” spurs the student on to solve more exercises, to attain the utmost achievements, since he can. Accordingly, the achievement required in the class, by the students, is not to ‘pass’ but to excel, since the main gift that the method gives to students is *confidence in their ability* and this ability they want to express. This confidence is an impetus to the continuation of learning and even sometimes changes the student’s entire conduct.

There are many examples of this phenomenon. A student with an average of 40 received a 100 in mathematics and then in computers and in English. A hated student who suffers from past traumas and was accustomed to be absent and to always fail received a 100 as well. A student whose parents left the country chose to remain with friends and received a 100. A shy and marginal student became the center of the class (and received a 100).

² The *Beyt Midrash* or *Cheder* method is the traditional method of Jewish religious schooling. This method is characterized by in-depth learning in small groups.

2. Achievements.

The fundamental principle of the method is that *every student can achieve high achievements.*

3. The Way

The *beyt midrash* learning method puts the students in small heterogeneous groups (two to six students in a group) according to their desire and social relations – groups – so that they will learn together the material, among themselves. The learning is performed from *special workbooks* that are suited for independent study that I prepared for this purpose. The group decodes the material and the exercises together and advances in the workbook together. When a student has difficulties with the material, his peer helps him. If the entire group gets stuck, then it is helped by another group, which has already advanced in the material. If there is no such other group or the topic is problematic, then the teacher provides guidance. This technique implements these principles in the best possible way. The teacher's role here is to guide, to direct, and to channel the student, as detailed in the coming section. Thus, while in the regular lesson the student observes the teacher / his classmate solve on the board two or three exercises, in this *beyt midrash* method the student, in a double lesson, succeeds in solving an average of 22 exercises or 8 matriculation examination questions.

4. The Teacher's Role

The teacher's role is to lead the learning. He has to define the topics and pace, to channel the reciprocal learning, to teach by himself the different groups the difficult points, and to personally provide support for each and every student as necessary. In such a constellation, the teacher can know in detail the situation of each and every student, to dedicate his time to help the weaker students, or to advance with the stronger groups to fascinating issues that are not in the study material. Thus, for example, I sat in the last lesson at the end of the study day with a group that had already sat for three hours without a break and from the 'integral' topic we discussed multidimensional worlds. In a previous lesson we talked about the absolute versus the subjective in mathematics through

the learning about neurological lacks that change the perceptions. In addition, in such an atmosphere there is no need to waste time and strength on discipline in or control of the classroom, since the dynamics direct the student's energy instead of repressing it.

5. The Experience

At the basis of the method is the experience of the learner's success and learning. Using the *beyt midrash* method, the student becomes the person responsible for his success and even for the success of his peers in the group and the class. Moreover, when the student becomes the one who teaches – as described in principle 3 – the learning and teaching experience sweeps him away and makes him a partner. The teacher does not supervise the students but only helps them and directs them in the general learning experience of the entire class.

On the scholastic dimension, the difference between the students and learning in small groups leads to mutual productivity. Every member of the group has a meaningful role that gives him a sense of efficacy, the responsibility for learning is assigned to the learners and an autonomous learner is cultivated. Learners are allowed to express themselves using their multiple intelligences. On the social dimension, the students cope with the need to accept differences and esteem one another and to develop strategies for cooperation and learning harmoniously, and a shared language of values and ways of behavior in the group is constructed.

2.5 The Research Hypotheses

The present research study seeks to examine the following hypotheses.

Research Hypothesis Number 1

The background characteristics of the students influence their achievements. A difference will be found among the students in their achievements. These differences will be expressed in the comparison among the students according to age, gender, native language, and study framework.

Secondary hypotheses:

- Older children will solve more Chamizer riddles than will younger children.
- A difference will be found between the percentage of riddles that the **boys** solved and that the **girls** solved.
- A difference will be found between the percentage of riddles that the students solved according to **native language**.
- A difference will be found between the percentage of riddles solved by the students in the **gifted class** and that solved by the students in the **regular study framework**.

Research Hypothesis Number 2

The student's style of thinking influences his achievements. A relationship will be found between the degree to which the student uses each one of the thinking styles and the level of his achievements.

Research Hypothesis Number 3

The student's perception of the learning environment influences his achievements. A relationship will be found between his evaluation of the learning environment (according to all its different elements) and his level of achievements.

Secondary hypotheses:

- A positive relationship will be found between the student's evaluation of the **resources** and the percentage of riddles he solved.
- A positive relationship will be found between the student's evaluation of the **teacher's support** and the percentage of riddles he solved.
- A positive relationship will be found between the student's evaluation of the **motivation to learn** and the percentage of riddles he solved.
- A positive relationship will be found between the student's evaluation of the **learning climate** and the percentage of riddles he solved.
- A positive relationship will be found between the student's evaluation of the **social climate** and the percentage of riddles he solved.

Research Hypothesis Number 4

A relationship will be found between the student's evaluation of the dimensions of the learning environment and the level of expression of the different thinking styles.

Research Hypothesis Number 5

The background characteristics of students do not influence their evaluation of the learning environment. Hence, differences will **not** be found among the students in the evaluation of the learning according to age, gender, native language, and learning framework.

Research Hypothesis Number 6

The relationship between the student's background variables and the styles of thinking that he expresses and his level of achievements will be mediated by his degree of evaluation of the learning environment.

3. The Research Methodology

The research objective is to learn about the contribution of the implementation of a learning program based on riddles has on the learning experience and achievements of the students. In the present research study the learning program is the Chamizer challenges method in education.

3.1 The Research Design

The research is a **quantitative** research study, based on a methodology of **comparative correlative** research. In this type of design, the research subjects answer questionnaires that enable the researcher to measure the research variables. The responses to the research questions are given through the description of the distribution of the variables in the different populations of the research and the examination of the hypotheses is based on the examination of the statistical correlations among the variables. The comparison between the populations is performed both in regards to the distribution of the variables and in regards to the strength of the relationships among the variables (Birenbaum, 1993).

3.2 The Research Population

The research population consists of students from two scholastic frameworks: regular schools and the Gordon Center.

The Regular School Students

These students learn in the schools that use the program of the *Chamizer* challenges method in education. 40% represent schools in the Central area, 30% represent schools in the North, and 30% represent schools in the South. Among the clusters, there is no difference in regards to the characteristics related to the family, the socioeconomic status, the native language, and the participant's gender. There is also no difference in regards to characteristics related to the school: the size of the school where the child learns, the class size, the teacher's education (all the teachers possess an undergraduate degree). There is a distinction in regards to the student's age and thus the class in the elementary school or middle

school. Hence. One cluster is taken from the school in the Central Area and one cluster from a school in the North. The two clusters constitute a basis for the sampling framework.

The Gordon Center Students

This is a center for gifted and talented children. The sampling framework includes all the students in the Gordon Center, a total of 300 students. The Gordon Center students were assessed by the Szold Institute as gifted (stage B) and talented (stage A) at ages 9-12.

The Gordon Center is an enrichment center for these children. The scholastic session is held weekly. In this framework the students participate in unique courses (such as mathematical thinking, magic and science, zoology, aviation and space, etc.) and come to the center on a voluntary basis. The characteristic of this student population is a similar cognitive level; in other words, it is possible to speak about homogeneity in the cognitive aspect (see section 2.1 for further detail).

79 students participated in the sample and represent 50% of the elementary school (fifth grade) and the rest the middle school classes (grades seven to eight). 161 students represent the Gordon Center, chosen on the basis of the courses in which they participate – mathematical thinking, creative thinking, magic in science, archaeology, zoology, environment and Internet, aviation and space). The rationale was for there to be representation of courses in the development of thinking (Zohar, 2007).

3.3 The Research Sample

The research sample consisted of two groups of students:

1. Gifted and talented students who learn according to the Chamizer challenges method of education during 2005 in the Gordon Center (an enrichment center for gifted and talented children in the framework of the Gordon Academic College for Teacher Training) through riddles presented on the Internet site and responses presented on a CD (79 students).

2. Students who learn according to the Chamizer challenges method of education in the regular framework, in the school in regular classes, through riddles presented on the Internet site and responses presented on a CD (161 students).

3.4 The Research Process

The approval to conduct the research study was asked of the school principals. On the basis of the approval granted (see appendix number 3), the researcher turned to the teachers, when the principal provided a list of teachers. (In every school, there is one representative – the teacher responsible for the Chamizer challenges method). The first teachers who responded were the teachers who in the end participated in the research. The teachers were explained the research goal, during a personal meeting held with each and every teacher. The participation in the research constituted an impetus for teachers to examine the potential of the continuation of the process in the school framework where they work. All the teachers possess an undergraduate degree in education. The teachers do not know one another (thus neutralizing the fear of competition regarding the students' achievements).

The researcher visited the schools (four schools) in the morning hours. Every session was held with one school. To examine the phenomenon in the most general manner, two schools were chosen from the North area and two schools from the Central area. The schools were selected on the basis of the voluntary agreement of the teachers who have worked according to the Chamizer challenges method for seven months. The schools that were chosen were not distinct among themselves in regards to the socioeconomic situation of their students, the school size, and the number of students in the classes.

The riddles were given to students in the elementary and middle schools aged nine to fourteen in the class/ course framework. In the schools in the regular classes the activity was conducted under the teacher's guidance, when the teacher presented to the class the riddle in cooperative activity. In the classes there were work groups, which sometimes brainstormed together during the process for the construction of the solution. In a dissimilar fashion, in the

Gordon Center the riddles were given to the students in two ways. First, the riddle was sent to the site of the Gordon Center (every participant in the center is entitled to access the Gordon Center site by password). Second, the riddle was copied and sent to every student in the course separately. The process of solution of the riddle is characterized in the Gordon Center through individualized and/or dyadic work.

The activity of Chamizer challenges was evaluated using closed questionnaires. The evaluation was performed only when in schools and in the Gordon Center all the conveyed riddles were finished – a total of thirteen riddles were given via CD (all the schools worked under the same directives and schedule determined by Dan Chamizer – seven months of continuous activity).

In the encounter in the schools the researcher presented to the students herself and the research, with its general goals. The students who are participating in the research were asked to complete the questionnaire, in all its parts, when the researcher was present so as to provide support and instruction in the filling of the questionnaires as needed. The research subjects were assured complete confidentiality and anonymity.

The questionnaire was completed by 100% of the participations; there was complete cooperation. No questions were raised regarding the understanding of the contents presented in the questions. After the questionnaires were completed, the researcher collected all of them.

The teachers in general were interested in the topic and process of the research and asked to be informed of the findings.

The data were processed using the SPSS program and the findings are presented in the research.

3.5 The Research Variables

Background Variables

Age, Gender, native language (Hebrew / other), study framework (the Gordon Center / regular schools)

Table Number 2: Operational Definition of the Demographic Research Variables

Variable Type	Variable	Definition
Background variables	Age	Years, by student's report
	Gender	Male/female, by student's report
Personal	Native language	Hebrew/Arabic/Russian/Amharic, by student's report
Scholastic	Study framework	Gordon Center / regular school Elementary school / middle school
	Study class	

The Student's Perception of the Learning Environment

Nominal Definition

The student's perception of the ecological social constellation in which he acts along with the rest of his study peers includes psychosocial aspects, the teacher's support of the learning, the learning-inspiring learning climate, and the social climate (Fraser, 1986; Fraser and Wohlberg, 1991).

Operational Definition

The student's perception of the learning environment is comprised of five dimensions that were identified in the research of Ben Zakan (2000):

1. Resources management: this dimension includes items that pertain to the aids that exist in the learning environment and are at the student's disposal, accessibility to the use of technology, etc.

2. The teacher's support: this dimension is defined as the teacher's perception as conveying (mediating) learning contents and learning tasks.
3. Motivation to learn: this dimension describes the contribution of the activity / riddle as inspiring interest to learn and think.
4. Learning climate: this dimension includes the learning atmosphere as inspiring learning involvement.
5. Social climate: this dimension describes the degree of cohesion and crystallization that characterize the class and the social atmosphere as the students feel it.

Table Number 3: Operational Definitions of the Research Variables

Student's Perception of the Learning Environment	Resources management	Environment that enables use of resources
	Teacher's support	Degree to which the teacher invests in the students
	Motivation to learn	Teaching that inspires interest and desire to learn
	Learning climate	Learning climate causes involvement in learning
	Social climate	Crystallized and cohesive social climate

The Style of Thinking

The cognitive strategies that people use to solve problems / riddles, perform tasks, and make decisions are called style of thinking: local style of thinking, executive style of thinking, internal style of thinking, external style of thinking, liberal style of thinking, and conservative style of thinking. (Sternberg, 1997).

Achievements: The percentage of riddles that the students solve

3.6 The Research Instruments

The research questionnaire consists of four parts (see appendix number 4):

1. Background information

2. The student's perception of the learning environment
3. The style of thinking
4. Record of achievements

3.6.1 The Student's Perception of the Learning Environment Questionnaire

For the purposes of the research, the data were collected in the present research through a closed questionnaire that examined the student's perception of the learning environment. The questionnaire, which is based on the theory of Lewis Guttman, so as to discover structural rules of the learning environment according to the student's perception (Guttman, 1982) was designed and validated by Ben-Zakan (2000). From the overall questionnaire of Ben-Zakan use was made of five elements of the learning environment: resources management, the teacher's support, motivation to learn, learning climate, and social climate. These elements were found to be relevant to the present research. Ben-Zakan composed a multiple choice questionnaire that includes a large number of statements that repeat themselves to examine the tools' reliability. Accordingly, the researcher in the present research study chose five statements that characterize each element (filtering the repetitive questions). The statement content was adjusted to the unique learning environment of the Chamizer challenges (appendix number 5). The reliability of the instrument was examined using the internal consistency coefficient of Cronbach's alpha and was found to be 0.94 for the general variable.

3.6.2 The Style of Thinking Questionnaire

For the purposes of the research, the style of thinking and learning of the students who are participating in the research was evaluated using a questionnaire based on the styles of thinking according to Sternberg (1997). Using this instrument, it is possible to determine the expressions of style of thinking among the participants. On the basis of the fit between the characteristics of the challenging learning environment and the styles of thinking it was found that of the thirteen styles of thinking that Sternberg

proposed only six are relevant to the present research (see chapter 2.2 for further detail).

The content of the statement was adjusted to the challenging learning environment of Chamizer challenges (appendix number 6). The respondent had to answer the extent to which every statement describes his style of thinking on a continuum of five ranks (when 1 represents not at all and 5 represents to a very great extent).

3.6.3 Validity of the Research Instrument

To perform content validity as relevant to the challenging learning environment through Chamizer riddles, the researcher met with the originator of the idea and examined with him as an expert in the realm the relevance of all the statements that represents the different styles of thinking.

This action ensures the ability of the instrument to examine the styles / characteristics as the researcher sought to do in the present research. The process of elimination of the different styles proposed by Sternberg also was conducted with the support and guidance of Chamizer as an expert in the realm of the challenging learning environment (Birenbaum, 1993).

4. The Research Findings

This chapter presents the research findings, in the following chapters:

- 4.1 This section presents the descriptive statistics for the quantitative research variables in the entire sample: means, standard deviations, and internal reliability.
- 4.2 This section presents the examination of the research hypotheses and statistical conclusions regarding the research hypotheses and the regression analyses for the prediction of the dependent variable.
- 4.3 This section includes models of regression for the examination of the mediation of the perception of the learning environment of the relationship between the style of thinking and the background variables and the level of achievements and paths analysis, which describes the structural relations among the research variables.

4.1 Descriptive Statistics

Table number 4 presents the descriptive indices of the background variables of the entire sample and in the two learning environments separately.

Table Number 4: Background Variables of the Research Sample and the Two Learning Environments

Variable	Categories	Entire Sample N=240		Gordon Center N=161	
		Number	Percent	Number	Percent
Age	9-10	98	40.8	90	55.9
	11-14	142	59.2	71	44.1
Gender	Boys	123	51.3	88	54.7
	Girls	117	48.8	73	45.3
Native language	Not Hebrew	50	20.8	23	14.3
	Hebrew	190	79.2	138	85.7

The table shows that the percent of the children aged nine to eleven is higher among the students of the Gordon Center than in the traditional schools, while among children aged eleven to fourteen the percentage of children in the traditional schools is higher than in the Gordon Center. In the Gordon Center there is a higher percentage of boys than in the traditional schools while in the traditional schools the number of Hebrew speakers is lower than that in the Gordon Center.

Table number 5 presents the means, standard deviations, and internal reliability of the variable of the styles of thinking in the entire sample.

Table Number 5: Descriptive Statistics of the Dimensions of Styles of Thinking in the Entire Sample

Variable	Dimension	Items	Mean	Standard Deviation	Minimum
Style of Thinking	Local	1,2,18	4.05	0.83	1.00
	Executive	2,11,19,20,24	3.90	0.72	1.50
	Internal	1,6,8,14,18	3.48	0.80	1.00
	External	9,10,15,22,23	4.09	0.78	1.00
	Liberal	5,7,3,16,25	4.14	0.78	1.00
	Conservative	19,20,22,23	3.67	0.82	1.50

Table number 5 shows that there is above average agreement on the part of the subjects with the dimensions of style of thinking. It can be seen that the styles of thinking that most characterize the students in the entire sample are: local, external, and liberal. However, variance is apparent in the subjects' responses. This variance is expressed in the range of responses, as expressed in the difference between the minimum values and the maximum values. After the examination of Cronbach's alpha, a good level of reliability was obtained in all the dimensions.

Table number 6 presents the means and standard deviations of the styles of thinking in each one of the two learning environments researched here. To examine whether there are

significant differences t test for independent samples was conducted and its results are presented in the table.

Table Number 6: Perception of the Styles of Thinking by the Students in the Two Learning Environments

Style of Thinking	Gordon Center N=161		Traditional Schools N=79		t(230)
	Mean	Standard Deviation	Mean	Standard Deviation	
Local	4.02	0.86	4.13	0.77	0.97
Executive	3.82	0.76	4.05	0.61	*2.28
Internal	3.45	0.82	3.53	0.77	0.72
External	4.12	0.76	4.02	0.83	-0.9
Liberal	4.11	0.84	4.21	0.64	0.89
Conservative	3.66	0.83	3.69	0.80	0.24

Table number 6 shows that the patterns of thinking styles in both learning environments are similar to one another and also to the general sample. The executive and the liberal thinking styles are high in both environments and the only meaningful difference is in the executive style, which more characterizes the students of the schools than the students of the Gordon Center.

Table number 7 presents the means, standard deviations, and internal reliability of the dimensions of the perception of the learning environment by the student in the entire sample that is comprised of two learning environments.

Table Number 7: Descriptive Statistics of the Perception of the Learning Environment by the Student in the Entire Sample

Variable	Dimension	Items	Mean	Standard Deviation	Minimum
Perception of Learning Environm	Social climate	12,13,17,21	3.93	0.75	1.67
	Learning climate	2,11,19,20,24	3.95	0.84	1.00

ent	Motivation to learn	1,6,8,14,18	3.94	0.82	1.00
	Resources management	9,10,15,22,23	3.73	0.75	1.00
	Teacher's support	5,7,3,16,25	3.66	1.03	1.00

Table number 7 shows that there is an above average positive perception of the subjects with the dimensions of the learning environment, when the dimension with the highest average of agreement is that of 'learning climate'. Study of table number 7 shows that the dimensions of 'resources' and 'teacher's support' were less identified by the students in comparison to the other dimensions of the learning environment. However, variance in the subjects' responses is apparent. This variance is expressed in the range of the responses as expressed in the difference between the minimum values and the maximum values and in the values of the standard deviation. It should be noted that an identical dispersion was found in regards to the dimensions of 'social climate' and 'resources'. Examination of Cronbach's alpha yielded a good reliability in all the dimensions of the learning environment and in the general variable in the overall sample.

Table number 8 presents the means and standard deviations of the perception of the learning environment in each one of the two researched learning environments. To examine whether there are significant differences t test for independent samples was performed and the results are presented in the table.

Table Number 8: Perception of the Learning Environment by the Students in the Two Learning Environments

Perception of Learning Environment	Gordon Center N=161	Traditional Schools N=79	t (
---	--------------------------------	-------------------------------------	----------------

	M e a n	S t a n d a r d D e v i a t i o n	M e a n	S t a n d a r d D e v i a t i o n	2 3 7)
Social climate	3.91	0.77	3.94	0.71	0.25
Learning climate	3.98	0.92	4.04	0.67	1.18
Motivation to learn	3.98	0.84	3.85	0.76	-1.1
Resources management	3.72	0.80	3.73	0.64	0.12
Teacher's support	3.54	1.11	3.88	0.82	*2.44
Perception of learning environment	3.82	0.71	3.89	0.59	0.91

The table shows that the patterns of the perception of the learning environment in both frameworks is similar and is similar to the general sample in that the most meaningful dimensions for the student were the learning climate and the social climate. A significant difference was found in the perception of the teachers support. Students in traditional schools perceived the teacher's support as higher than did the students in the Gordon Center.

Table number 9 presents the means of the students' achievements according to the number of riddles they solved. The students coped with 24 riddles. The coping was in the Gordon Center in small teams (three to five children) and in schools in large teams (class coping).

The students' achievements were calculated according to the number of riddles they solved in percentage (see table number 9). Some teams did not solve riddles at all or only solved a very few, one to three riddles. 101 students solved more than three riddles and their achievements were written down.

Table Number 9: Achievements of the Students in the Entire Sample and in the Different Learning Environments

Parameter	Entire Sample	Gordon Group	Traditional Schools
Lowest achievement	45.83% (11 riddles)	45.83% (11 riddles)	75% (18 riddles)
Highest achievement	95.83% (23 riddles)	95.83% (23 riddles)	91.67% (22 riddles)
Mean achievement (standard deviation)	72.89% (12.74%)	69.51% (14.8%)	77.81% (6.35%)

It can be seen that the achievements of the students in the Gordon Center are lower than those of the students in the traditional schools. To examine the difference in percentage of the achievements t test for independent samples was performed and found a significant difference in the percentage of the achievements between students in the traditional schools and students in the Gordon Center [$t(99)=3.39$, $p<0.001$]. Thus, the achievements of the students of the traditional schools were higher than that of the students in the Gordon Center.

4.2 Examination of the Research Hypotheses

In this stage, the relationships between the independent variables and the mediating variable were examined and then the models for the prediction of the dependent variables were constructed, as appearing in the model, and the weights of each one of the independent variables and the mediating variable for the prediction of the dependent variables were also constructed (Birenbaum, 1993).

According to **research hypothesis number 1**, differences would be found among the students in their achievements according to age, gender, native language, and learning environment. The secondary hypotheses that link between the students' background characteristics and their achievements were examined using t tests for independent samples (see table number 10).

Table Number 10: Differences in the Achievements according to Age, Gender, and Native Language

Background variable	Categories	N	Mean of achievements	Standard Deviation	t
Age	9-10	36	69.0	16.6	*-2.27
	11-14	65	75.0	9.4	
Gender	Boys	39	71.0	12.2	-1.15
	Girls	62	74.0	13.0	
Native language	Hebrew	78	71.7	13.3	- 2.00 *
	Not hebrew	23	76.8	9.7	
Learning environment	Regular schools	41	77.8	6.3	**3.39
	Gordon Course	60	69.5	14.8	

Thus, the table shows that the research hypothesis that links between the student's background characteristics and his achievements was **partially confirmed**.

- It was found that the **age** influences the achievements. The mean of achievements among the older children (aged eleven-fourteen) is significantly higher than the mean of the achievements of the younger children (aged nine-ten).
- It was found that the **native language** influences the achievements. The mean of achievements among the children who do not speak Hebrew as a native language, most of whom are immigrants from the Former Soviet Union, is significantly higher than the mean of the achievements of the children who speak Hebrew as a native language.
- It was found that the **learning environment** influences the achievements. The mean of the achievements of the children who learn in the regular schools (regular heterogeneous class) is significantly higher than that of the achievements of the children in the Gordon Center (gifted and talented children).
- Significant differences were **not** found in the achievements between boys and girls.

According to **research hypothesis number 2**, a relationship would be found between the degree to which the student uses each one of the thinking styles and the level of his achievements.

Table number 11 presents the relationships between the dimensions of styles of thinking and the level of achievements, relationships that were examined using Pearson correlations in the entire sample and in the two learning environments separately.

Table Number 11: The Relationship between the Dimensions of Styles of Thinking and the Achievements in the Entire Sample and in the Two Learning Environments Separately

	Achievements (Entire Sample)	Achievements (Traditional Schools)	Achievements (Gordon Center)
<u>Local thinking pattern</u>	*0.22	**0.35	0.19

Executive thinking pattern	0.14	**0.50	0.06
Internal thinking pattern	**0.28	0.21	0.23
External thinking pattern	-0.08	0.005	0.03
Liberal thinking pattern	**0.24	*0.35	0.2
Conservative thinking pattern	-0.07	-0.03	-0.09

*p<0.05, **p<0.001

Examination of the findings in table number 11 shows that there is a significant positive correlation between the executive, internal, and liberal pattern of thinking and the student's level of achievements in the entire sample. Among the students of the Gordon Center a relationship was not found between the thinking style and the level of achievements while among the students of the traditional schools it was found that as the student perceives his style of thinking as more local, executive, and liberal his level of achievements rises.

Prediction of the Student's Achievements by the Dimensions of the Styles of Thinking

To predict the student's achievements by the dimensions of the independent variable (perception of the style of thinking) in the entire sample multiple regression of the Enter type was calculated and the model was not found to be significant ($F_{(6,90)}=2.04$, n.s.).

Examination of the regression model in each one of the learning environments separately found that among the students in the Gordon Center a significant model was not found ($F_{(6,50)}=1.76$, n.s.) while the model for the prediction of achievements among the students of the traditional schools was found significant ($F_{(6,33)}=3.93$, $p<0.004$), when six of the dimensions explain 42% of the variance in achievements. Table number 12 presents the coefficients of the regression model among the students of the traditional schools.

Table Number 12: Coefficients of the Regression for the Prediction of the Achievements among the Students of the Traditional Schools

	b	β	t
Local	2.25	0.28	1.41
Executive	6.13	0.64	**3.16
Internal	1.34	0.15	0.79
External	-2.28	-0.34	-1.79
Liberal	0.81	0.07	0.33
Conservative	-2.51	-0.31	*-1.89

* $p<0.05$, ** $p<0.001$

Table number 12 shows that among the students of the traditional schools as the student perceives himself as having a more performance and less conservative thinking the level of his achievements rises.

According to **research hypothesis number 3**, the student’s perception of the learning environment influences his achievements. A relationship will be found between his evaluation of the learning environment in its different elements and the level of his achievements.

Table number 13 presents the relationships between the dimensions of the perception of the learning environment and the level of achievements, relationships that were examined using Pearson correlations in the entire sample and in the two learning environments separately.

Table Number 13: Relationship between the Dimensions and Variable of the Student’s Perception of His Learning Environment and His Achievements in the Entire Sample and in the Two Learning Environments Separately

Learning Environment	Achievements (Entire Sample)	Achievements (Traditional Schools)	Achievements (Gordon Center)
Social climate	0.17	0.11	*0.3
Learning climate	0.13	0.17	-0.09
Motivation to learn	0.08	0.03	0.17
Resources management	0.14	0.007	0.24
Teacher’s support	**0.31	0.02	*0.3
Perception of learning environment	*0.21	0.15	*0.28

*p<0.05, **p<0.001

Examination of the findings in table number 13 shows that there is a significant positive correlation between the perception of the teacher’s support and the achievements of the students in the entire sample. As the students perceive the teacher’s support as higher, their level of achievements is higher. The significant relationships were found only in the Gordon Center, so that as the students there perceive the social climate and the teacher’s degree of support as

higher, their level of achievements is also higher. It is possible to see among the students of the Gordon Center that as their general perception of the learning environment is more positive, their achievements rise.

Prediction of the Student’s Achievements by the Dimensions of the Learning Environment

To predict the student’s achievements by the dimensions of the independent variable (perception of the learning environment), a model of multiple regression of the Enter type was calculated and the model was found significant ($F_{(5,95)}=2.27$, $p<0.05$). The predictors explain 11% of the variance in achievements.

Table Number 14: Coefficients of the Regression for the Prediction of Achievements in the General Sample

	b	β	t
Social climate	1.48	0.08	0.65
Learning climate	1.44	0.11	0.61
Motivation to learn	1.04	0.07	0.49
Resources management	0.83	0.05	0.35
Teacher’s support	4.09	0.34	**2.75

** $p<0.001$

The table shows that the single predictor of the achievements that was found to be significant was the degree of the teacher’s support. As the student feels that the teacher supports him, his degree of achievements is higher. Examination of the regression model in each one of the learning environments separately found that among students of the traditional schools a significant model was not found ($F_{(5,35)}=0.4$, n.s.). The model for the prediction of the achievements among the Gordon students was found to be significant ($F_{(5,54)}=2.72$, $p<0.029$), when the five dimensions explain 20% of the variance in the achievements. Table number 15 presents the coefficients of the regression model among the students in the Gordon Center.

Table Number 15: Coefficients of the Regression for the Prediction of Achievements among the Students of the Gordon Center

	b	β	t
Social climate	6.08	0.29	*1.94
Learning climate	-6.55	-0.45	*-2.09
Motivation to learn	2.08	0.12	0.67
Resources management	4.69	0.22	1.39
Teacher's support	3.53	0.27	1.82 marginal significance

*p<0.05, **p<0.001

Among the students of the Gordon Center, it was found that as the social climate is better evaluated, the learning climate is less emphasized and the teacher's support is higher, the students' achievements rise. The other predictors were not found to contribute significantly to the model.

According to **research hypothesis number 4**, a difference would be found between the level of expression of the different thinking styles and the student's evaluation of his learning environment. To examine the relationships between the independent variable – style of thinking – and the mediated variable – evaluation of the learning environment – Pearson correlations were calculated between all the dimensions of the two variables in the entire sample and in each learning environment separately. Table number 16 describes these correlations in the entire sample and tables number 17 and 18 describe this correlations matrix in the learning environment of the regular schools and in the Gordon Center, respectively.

Table Number 16:
Correlations between the Expression of the Style of Thinking and the Perception of the Learning Environment in the Entire Sample

Learning Environment	Local thinking style	Executive thinking style	Internal thinking style	External thinking style	Liberal thinking style	
Social climate	0.35**	0.27**	0.19*	0.35**	0.37**	0.
Learning climate	0.48**	0.42**	0.25**	0.39**	0.45**	0
Motivation to learn	0.59**	0.45**	0.36**	0.44**	0.55**	0
Resources management	0.35**	0.36**	0.23**	0.36**	0.36**	0
Teacher's support	0.27**	0.31**	0.24**	0.26**	0.31**	0

It was found that the expression of the different thinking styles is related to the degree of enjoyment and evaluation from the learning environment. A strong statistical relationship was found between the local thinking pattern (engaging in the creation of 'something' from 'nothing') and the liberal thinking pattern (doing things in new ways) and the motivation to learn (teaching inspires interest and desire to learn).

Table Number 17:
Correlations between Perception of the Learning Environment and Expression of Style of Thinking among Students in the Regular Schools

Learning Environment	Local thinking style	Executive thinking style	Internal thinking style	External thinking style	Liberal thinking style	
Social climate	0.41**	0.39**	0.19	0.49**	0.38**	0
Learning climate	0.45**	0.43**	0.20	0.44**	0.45**	0
Motivation to learn	0.42**	0.47**	0.23*	0.44**	0.51**	0
Resources management	0.32**	0.46**	0.21	0.37**	0.32**	0

nt						
Teacher's support	0.24*	0.38**	0.21	0.35**	0.23*	0

Among the students of the regular schools significant relations were found between the different thinking styles and the evaluation of the different dimensions of the learning environment. However, it is possible to see that the relations are weaker with the conservative and internalized thinking styles.

Table Number 18:
Correlations between Perception of the Learning Environment and
Expression of Style of Thinking among Students in the Gordon
Center

Learning Environment	Local thinking style	Executive thinking style	Internal thinking style	External thinking style	Liberal thinking style	
Social climate	0.33**	0.22**	0.19**	0.29**	0.37**	0
Learning climate	0.49**	0.41**	0.27**	0.39**	0.44**	0
Motivation to learn	0.67**	0.47**	0.43**	0.44**	0.57**	0
Resources management	0.37**	0.33**	0.24**	0.37**	0.38**	0
Teacher's support	0.28**	0.27**	0.25**	0.26**	0.32**	0

The pattern of relationships among the students of the Gordon Center is similar to that of the students in the other schools but due to the size of the sample the weaker relations were also found significant. As the patterns of thinking are more creative and liberal, the perception of the learning environment is significantly better.

According to **research hypothesis number 5**, the background characteristics of the students do not influence his perception of the learning environment. A difference would not be found between the students in the perception of the learning

environment. The absence of the differences will be seen in the comparison among the students according to age, gender, native language, and learning environment.

Examination of the differences between the categories of the background variables in the dimensions of the perception of the learning environment was performed using MANOVA multivariate variance analysis, in which the independent variables were (each separately) age, gender, and native language, every time in interaction with the learning environment under the influence of the five dimensions of the evaluation of the learning environment.

First, the impact of the child's age and learning environment on the five dimensions of the evaluation of the environment is examined. Table number 19 presents the means and standard deviations of each one of the dimensions of environment evaluation in the two age groups and learning environment. A significant impact was not found for the child's age on all the dimensions of the perception of the learning environment together [Hotelling's $T=0.02$, $F_{(5,231)}=1.01$, n.s.]. In addition, a significant impact was not found of the learning environment on the indices together [Hotelling's $T=0.021$, $F_{(5,231)}=1.01$, n.s.] and of the interaction between the child's age and the learning environment with their impact on the indices [Hotelling's $T=0.03$, $F_{(5,231)}=1.39$, n.s.].

Table Number 19: Means and Standard Deviations of the Dimensions of the Perception of the Learning Environment on the Different Levels of the Child's Age and Learning Environment

Dimension	Younger		Older	
	Gordon	Traditional	Gordon	Traditional
Social climate	3.99 (0.77)	4.12 (0.74)	3.92 (0.44)	3.82 (0.45)
Learning climate	4.04 (0.67)	3.95 (0.54)	3.68 (0.49)	3.73 (0.66)
Motivation to learn	4.05 (0.66)	3.75 (0.56)	3.88 (0.54)	3.87 (0.46)
Resources manageme	3.71	3.65	3.75	3.74

nt	(0.50)	(0.39)	(0.50)	(0.48)
Teacher's support	3.67 (0.50)	3.43 (0.39)	3.37 (0.50)	3.94 (0.48)

Then, the impact of the child's gender and learning environment on the five dimensions of the evaluation of the environment was examined. A significant impact was not found for the interaction between the child's gender and the learning environment on all the dimensions of the perception of the learning environment together [Hotelling's $T=0.005$, $F_{(5,231)}=0.25$, n.s.]. However, a significant impact was found for the child's gender beyond the learning environment on the five dimensions together [Hotelling's $T=0.07$, $F_{(5,231)}=3.39$, $p<0.01$]. Table number 20 describes the means and standard deviations of each one of the dimensions of the evaluation of the learning environment among the girls and boys separately, beyond the learning environment.

Table Number 20: Means and Standard Deviations of the Dimensions of the Perception of Learning Environment on the Different Levels of the Child's Gender

Dimension	Boys	Girls	F_(2,97)
Social climate	3.80 (0.81)	4.05 (0.65)	**6.66
Learning climate	3.83 (0.93)	4.07 (0.73)	3.24
Motivation to learn	3.82 (0.98)	4.06 (0.68)	**5.17
Resources management	3.62 (0.22)	3.83 (0.64)	*4.04
Teacher's support	3.62 (1.08)	3.69 (0.64)	0.05

It can be seen from the table that girls perceive the learning environment in a number of dimensions in a higher manner than do boys. They evaluate the social climate, the motivation to learn,

and resources management that they obtain as higher than do the boys. These results are beyond the specific learning environment.

Last, the impact of the child's native language and learning environment on the five dimensions of the evaluation of the environment was examined. A significant impact of the interaction between the child's native language and the learning environment, with the influence on all the dimensions of the perception of the learning environment together, was found [Hotelling's $T=0.04$, $F_{(5,231)}=2.25$, $p<0.05$] and a significant impact was not found on the child's native language beyond the learning environment on the five indices together [Hotelling's $T=0.01$, $F_{(5,231)}=0.69$, n.s.]. Table number 21 describes the means and standard deviations of each one of the dimensions of the evaluation of the learning environment in the two groups of native language in each one of the learning environments.

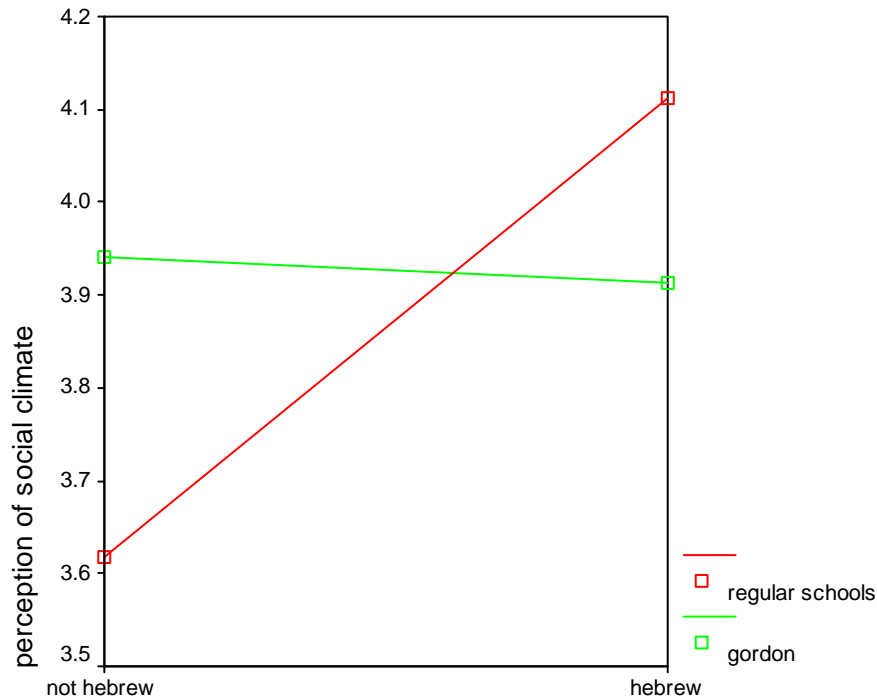
Table Number 21: Means and Standard Deviations of the Dimensions of the Perception of the Learning Environment on the Different Levels of the Child's Native Language and Learning Environment

Dimension	Hebrew		Not Hebrew		F(1,235)
	Gordon	Traditional	Gordon	Traditional	
Social climate	3.91 (0.77)	4.11 (0.56)	3.94 (0.76)	3.62 (0.84)	*4.63
Learning climate	3.88 (0.54)	4.14 (0.68)	4.01 (0.49)	3.85 (0.66)	2.2
Motivation to learn	3.88 (0.66)	3.87 (0.65)	4.00 (0.81)	3.81 (0.91)	0.07
Resources management	3.73 (0.79)	3.81 (0.54)	3.67 (0.87)	3.59 (0.79)	0.39
Teacher's support	3.48 (1.14)	3.96 (0.68)	3.92 (0.82)	3.74 (1.03)	3.31

ANOVA variance analyses for the examination of the source of the significance found that the interaction between the native language and the learning environment is significant only with the

influence on the perception of the social climate. Therefore, simple effects analysis was performed to examine the impact of the child's native language on his perception of the social climate in each one of the learning environments. Figure number 1 describes the impact of the native language on the perception of the social climate in each one of the learning environments. It can be seen from the figure that in the Gordon Center there are no differences in the perception of the social climate, whether the children speak Hebrew as a native language or whether they do not, while in the traditional schools the native Hebrew speakers experience a better social climate than do those who are not native Hebrew speakers. These findings were confirmed in the simple effects analysis: when in the Gordon Center a significant impact of the native language on the social climate was not found ($F_{(1,58)}=0.01$, n.s.) while among the students of the other schools a significant impact of the native language was found on the perception of the social climate ($F_{(1,77)}=9.56$, $p<0.001$). Thus, the children who speak Hebrew as a native language perceive the social climate as better than do those whose native language is not Hebrew.

Figure Number 1: Impact of the Native Language on the Perception of the Social Climate on the Different Levels of the Learning Environment



4.3 Prediction of the Student’s Achievements by the Thinking Style and Background Variables with the Mediation of the Perception of the Learning Environment

According to **research hypothesis number 6**, the relationship between the thinking style and the student’s background variables and the achievements will be mediated by the student’s perception of the learning environment. The hypothesis was that the relationship between the student’s background variables and thinking style and his achievements would be mediated by his perception of the learning environment.

To examine the degree of medication of the perception of the learning environment (the general variable) as mediating the relationship between the background variables and the student’s thinking style, two models of stepwise multiple regression were

performed. (The category variables are presented as dummy variables - in gender: 0 – boys and 1 – girls, age: 0 – younger and 1 – older, native language: 0 – not Hebrew and 1 – Hebrew, study framework: 0 – traditional schools and 1 – Gordon group.)

Table Number 22: Stepwise Regression to Examine the Impact of the Background Variables on the Student’s Achievements in the Mediation of the Perception of the Learning Environment

<u>Step 1</u>	b	β	T	sig
Gender	3.52	0.14	1.42	0.16
Native language	-2.07	-0.07	-0.69	0.49
Age	2.1	0.08	0.72	0.47
Learning environment	-6.9	-0.27	*-2.39	0.019
<u>Step 2</u>				
Gender	2.54	0.09	1.02	0.31
Native language	-3.02	-0.1	-0.99	0.32
Age	2.44	0.09	0.85	0.39
Learning environment	-6.19	-0.24	*-2.16	0.03
Perception of learning environment	3.71	0.19	*2.05	0.04

Step 1 – R2=0.13, p<0.008

Step 2 – R2=0.17

The model includes: F(5,95)=3.84, p<0.003

It can be seen that the variable of the ‘perception of the learning environment’ does not serve as a mediating variable in the relationship between the student’s background variables and his level of achievements. It is significant in the prediction of the achievements but its entrance does not change the finding that the learning environment is what predicts achievements, so that in the regular schools the achievements are higher than in the Gordon Center.

It can be seen from the previous analyses that one of the significant variables in the differences between the relationships between the variables is the learning environment in which the students learn – the Gordon Center or traditional schools. The previous findings show that the relationship between the thinking

styles and the achievements is significant only in traditional schools and not in the Gordon Center. Therefore, the models for the examination of the mediation of the perception of the learning environment of the relationship between the thinking styles and the level of achievements are presented in each learning environments separately.

Table Number 23: Stepwise Regression to Examine the Impact of the Dimensions of the Thinking Style on the Student’s Level of Achievements with the Mediation of the Learning Environment among Students of Traditional Schools

Step 1	b	β	T	sig
Local	2.25	0.28	1.41	0.16
Executive	6.13	0.64	**3.16	0.003
Internal	1.3	0.15	0.79	0.43
External	- 2.2	-0.33	-1.79	0.082
Liberal	0.81	0.08	0.33	0.74
Conservative	-2.51	-0.31	-1.89	0.067
Step 2				
Local	1.69	0.21	1.11	0.27
Executive	1.45	0.15	1.07	0.32
Internal	-0.51	-0.06	-0.307	0.76
External	1.34	0.21	1.07	0.29
Liberal	1.38	0.14	0.59	0.55
Conservative	-1.76	0.16	-1.11	0.43
Perception of learning environment	3.62	0.37	*2.2	0.035

Step 1 – R2=0.42, p<0.04

Step 2 – R2=0.49

The model includes: F(7,32)=4.46, p<0.001

It can be seen that among the students of the traditional schools the variable of the perception of the learning environment completely mediates the relationship between the thinking styles and achievements. The direct relationships (which were confirmed in hypothesis number 2) found between the executive and conservative thinking styles and the level of achievements are not

significant in the mediation of the learning environment that constitutes a meaningful variable in the prediction of the achievements in the traditional schools.

Table Number 24: Stepwise Regression to Examine the Impact of the Dimensions of the Thinking Style on the Student’s Level of Achievements with the Mediation of the Learning Environment among Students of the Gordon Center

<u>Step 1</u>	b	β	T	sig
Local	1.48	0.08	0.38	0.71
Executive	-7.35	-0.39	-2.31	0.025
Internal	3.28	0.21	*1.32	0.19
External	-0.81	-0.04	-0.30	0.77
Liberal	6.87	0.42	1.88	0.15
Conservative	1.95	0.11	0.79	0.44
<u>Step 2</u>				
Local	2.38	0.13	0.58	0.56
Executive	-7.17	-0.38	-2.25	0.029
Internal	2.41	0.15	0.89	0.37
External	-1.14	-0.06	-0.42	0.68
Liberal	6.24	0.42	1.68	0.09
Conservative	1.84	0.10	0.74	0.46
Perception of learning environment	3.55	0.35	*3.21	0.018

Step 1 – R²=0.13, p<0.008

Step 2 – R²=0.17

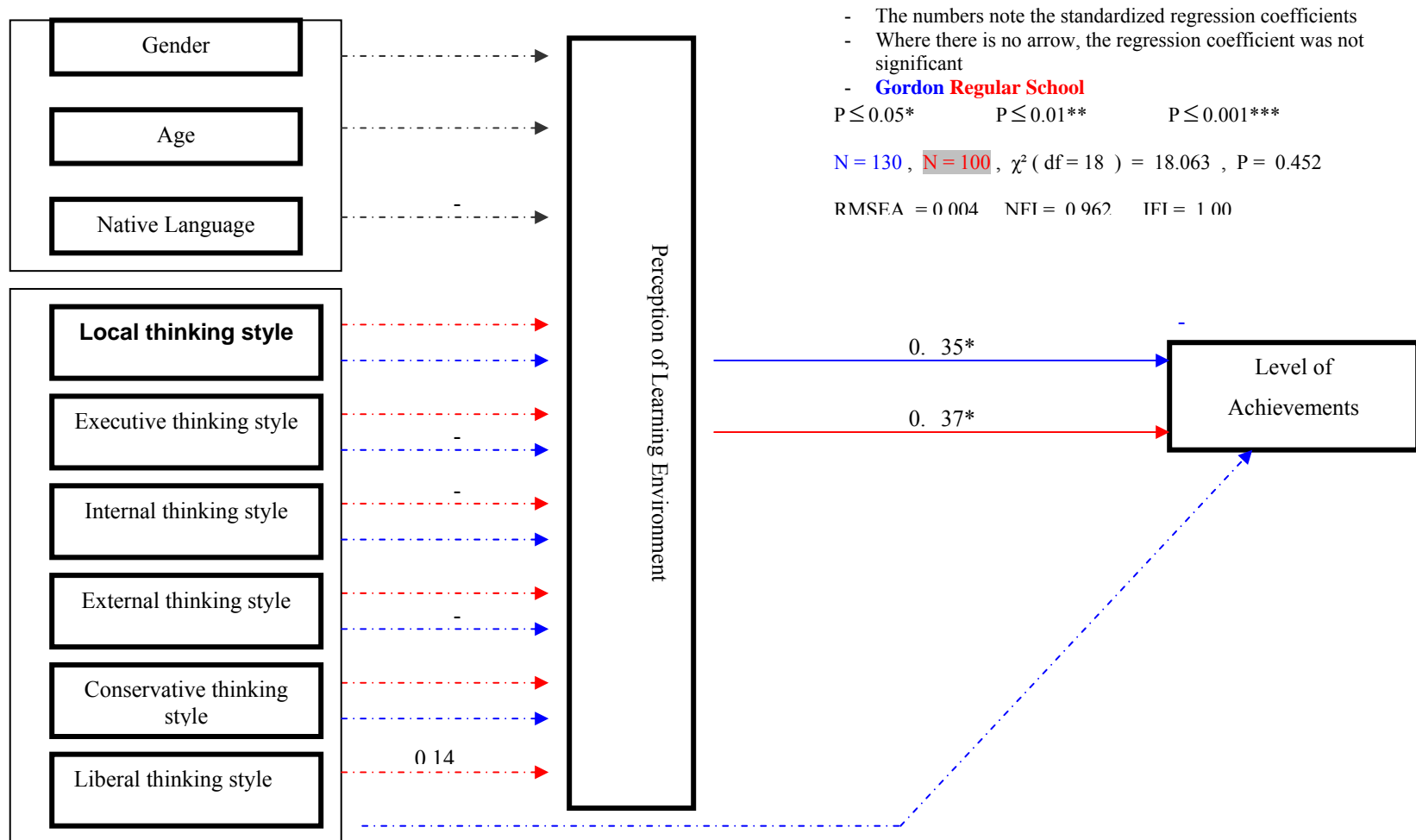
The model includes: F(7,49)=4.12, p<0.02

It can be seen from table number 24 that the variable of the perception of the learning environment does not serve as a mediating variable in the relationship between the thinking styles and learning achievements among students in the Gordon school. The executive thinking style is related to achievements even when the perception of the learning environment is found in the model. The presence of the variable of the perception of the learning environment in the model barely changes the intensity of the relationships that exist without it.

Paths Analysis Describing the Structural Relations among the Research Variables

The main research hypothesis examined the relationship between the student's background variables and thinking styles and his level of achievements with the mediation of his perception of the learning environment. To examine these hypotheses paths analysis was performed using the AMOS program, which examined the relations between all the research variables. Due to the fact that throughout the entire research findings it was found that the variable that moderates the relations is the type of learning environment in which the student solves the riddles (Gordon Center or traditional schools) two models were examined.

Figure Number 2: Paths Analysis Describing the Structural Relations between the Research Variables – Reference to Each Learning Environment Separately



Model Number 1 – Paths Analysis for the Two Learning Environments (Figure Number 2)

In this model, it was found that the learning environment mediates the relationship between the thinking styles and the achievements only in the traditional schools. The executive, external, and conservative thinking styles lose their impact on the achievements when the learning environment is examined as a mediating variable. In the Gordon Center, in contrast, there is no direct impact of the thinking styles on the achievements aside from the liberal thinking style. As the liberal thinking style is higher so too are the achievements higher. The factor of the learning environment does not mediate this relationship and constitutes in essence the meaningful factor that directly influences the achievements. All the thinking styles, aside from the liberal style, were not found to influence the achievements directly, a finding that strengthens the significant impact of the perception of the learning environment on the achievements in the special learning environment of the Gordon school.

5. Discussion and Analysis

The objective of the present research study is to learn about the contribution of the implementation of the learning program through riddles on the student's learning experience and achievements. In the present research, the investigated curriculum is the Chamizer challenges method in education. The goals of the research are as follows:

1. To evaluate the Chamizer challenges method in education as an impetus for cognitive development that crosses the bounds of curriculum as a strategy of thinking-focused teaching in any learning framework. In a more focused manner, the goal is to examine:
 - A. The contribution of the learning environment to the promotion of achievements and motivation among students in the traditional class as well as among gifted and talented students
 - B. The presence of differences in the achievements of the groups of students
 - C. The fact that the learning environment mediates between the thinking styles and demographic and personal data and the students' achievements.
2. To evaluate the applicative ability of the model of Sternberg in the learning environments of gifted and talented students and of students who are not gifted.
3. To develop and validate an instrument for the evaluation of the Chamizer challenges method as an enigmatic universal tool (in regards to the students' achievements in the two groups).
4. To examine the intervention of background characteristics, learning, and thinking styles as an explanation of the achievements of the students who have experience in the challenging learning environment of the Chamizer challenges method.

The research was conducted in two main learning environments, one among students in a traditional (regular) school and one among the Gordon Center for Gifted and Talented students. The data were collected using a number of instruments: self-reporting questionnaires to collect data on the perception of the learning environment and thinking styles and activity of the students to measure achievements in solving problems / challenging riddles – the Chamizer challenges, which were produced in collaboration with the Intel Corporation (the Internet site of the Intel community relations).

The findings that are discussed in the present chapter were obtained according to the research goals.

The challenging learning environment, as addressed by Chamizer (<http://www.Chamizer.com/press.htm>) intends to create a unique learning experience of different levels of difficulty for the purpose of enjoyment or a prize. The perception behind the idea is that the learning process is not aimed at examining scholastic achievements or contents accepted in the educational system. Hence, it has dual value: on the one hand, true goal-oriented engagement in the content realm and on the other hand, coping in situations of competition, etc. In other words, the participants in this program participate on a voluntary basis and hence it is possible to expect intrinsic and extrinsic motivation to guide their participation (both the challenge and the prize). Hence, the motivation of the present research is to examine the contribution of the implementation of the Chamizer challenges on the students' learning experience and achievements. Since the environment is a challenging environment, the research sought to examine the achievements of gifted and talented children in comparison to those of children in the traditional (regular) learning environment. In addition, the research sought to examine the different styles of thinking as proposed by Sternberg as predicting the achievements in the challenging environment. The discussion in the challenging environment and the distinction between gifted and talented children and regular children necessitated the distinction between the different learning environments and primarily how the students in both cases perceive the learning environment. The research

encompassed students of different ages, different native languages, and representation of the two genders.

5.1 Perception of the Learning Environment

The literature discussed teaching that inspires a challenging learning environment as an impetus to enjoyment and learning and addressed the level of interest that is inspired by the content and the desire of desire to learn it and experience it. In this process, the student copes with the performance in actuality of the task – the cognitive level (the ‘what’), the supervision of his progress – the meta-cognitive level (the ‘how’), and the challenge/interest in the topic for the student – the emotional level (Michenbaum, Burland, Gruson, and Cameron, 1998). Arousal that pertains to the affective level has the potential to create cognitive arousal, namely, the desire to solve the problem, to search for sources and alternative ways, to challenge the old ways, etc. (Sternberg, 1995, 1997).

From the process that was conducted in the present research it was found that in general the **learning environment** that included aspects of the *social and learning climate, the teacher’s support, the learning process, and resources management* were perceived by the students highly (a mean around 4). Of the indices of the perception of the learning environment, the *social climate, the learning climate, and the motivation to learn* obtained the highest mean (3.93, 3.94, and 3.95, respectively) with similar standard deviations.

The purpose of the present research was to examine whether the different learning environment attains different achievements, especially, whether there is a difference in the students’ achievements between those who learn in a traditional heterogeneous environment (gender, native language, difference in levels of achievements, etc.) and those who are found in a homogenous talented learning environment (gifted students – Gordon framework).

The introductory chapter described the research objective, to examine the assimilation of a challenging program that till now was incorporated in the Gordon School for Gifted and Talented Children, in regular classes (traditional education) as well. This decision had the goal of examining the challenging learning environment as suited also for children of the regular schools. The program developers (the Intel Corporation and Dan Chamizer)

sought to examine the success of the widespread implementation of the program without the condition of talent (gifted students), as a **natural and effective way for assimilation of educational values and information (learning aspects)**.

The research, in the comparison of the two learning environments (Gordon and traditional), found that the mean of the **learning motivation** in Gordon was higher (3.98 with standard deviation of 0.84) than that of traditional schools (3.85 with standard deviation of 0.76). This finding was not significant but it is possible that it indicates the level of stimulation that the challenge (the Chamizer challenge) creates among the gifted students. It is possible that the finding would have been significant with a larger sample. The motivation to learn in Gordon was perhaps related to the solution that the program (Chamizer riddles) provides as an intellectual stimulus for gifted children who receive in this school enrichment and stimulation of curiosity as a means of the development of cognitive independence and critical thinking (Salomon, 2000). These students, whose everyday framework is traditional, meet, as aforementioned, in once a week sessions for an innovative experience that focuses on challenging them and enabling the development of their personal and intellectual skills – the extension of the horizons and the development of a window for broad and diverse topics. This challenge was also attempted in the traditional schools. These schools do not provide resources and advanced learning aids as are offered in the Gordon program.

The findings of the present research study cast light on the ability of the challenging project (the basis of which aims at talented/gifted students) to create stimulation and promote success in the traditional learning environment. Researches confirm the argument that the class climate has considerable value (Levin, Doniza-Shmidt, and Zellermeier, 2005). The research of the learning environment focuses on the class climate, on the way that this climate is perceived by individuals who belong to and participate in the educational environment. According to this approach, there is a relationship between the reciprocal activity that occurs in the classroom and the many environmental variables (physical environment, teaching ways, study subjects, etc.). These

variables influence the way in which the participants address the different events that occur in the classroom. According to this approach, the students are the primary element of the class group and what determines the class behavior is the participants' perception of the reality therein and the subjective interpretation that they give to this reality (Walberg, 1974). Bar-El (1996), too, sees the learning climate as a measure of the learning atmosphere in the classes, the norms on the topic of the learning, the expectations of the student in the task, and their behavior on the route to achieve the goal.

The findings of the present research show that the mean of the responses to the learning climate was higher in the traditional schools (4.04 with standard deviation of 0.67) than in the Gordon Center (3.98 with standard deviation of 0.92). The variance in the standard deviation indicates the higher level of homogeneity in the responses obtained in the traditional schools regarding the learning climate. This finding can be explained by the difference of the learning atmosphere of the students in the homerooms, where there is reciprocal activity and continuity – the urgency of daily sessions and crystallization of a stronger climate in comparison to the Gordon group, where the sessions are once a week (meaningfully lower level of intensity), apart from the homeroom.

Salomon (2000a) notes that the learning is not only an intra-personal process but also no less an interpersonal process. In other words, it is not enough to refer to the engagement of what happens in the mind of some student or another (his thinking style). But when referring to a supportive learning climate, the observation should be what happens when the minds of others meet around a shared team task and beyond this what happens when other teams act around one main problem (for example, Chamizer riddles). Under these conditions, every individual feels that he can influence what happens in the class/the team and it is important to him to meet the expectations of his peers. This aspect is weak in the Gordon group. All these can develop only in a place where there is a learning and social climate that encourages learning and peer involvement (Salomon, 2000a; Vygotsky, 2003). Thus the ability to balance the peers, respond to their statements beneficially, develops, as does the culture of freedom of

expression, active participation, and the ability to involve others in thoughts and concepts related to reflective skills (Vygotsky, 2003).

This is the first growth of the development of reflective skills, as Dewey (1969) coined, and it is a rise in the level of the development of critical thinking (Harpaz, 1996). Challenging thinking has a higher development potential among adults, since the cognitive maturation in the reflective ability develops in these stages (Harpaz, 1996).

A challenging learning environment, as proposed by the Chamizer project, allows the student to attempt, for the first time in his life, a process suited for his age and success. This challenge proved successful among students in the traditional learning environment beyond gifted and talented students. This activity hints that it is possible through certain programs processed in a challenging manner to include a broader spectrum of students with different abilities. Hence, the importance of the present research rises, when it indicates the need to dare, challenge, and believe in the ability to develop skills considered futuristic in the present at an early age under conditions that allow this type of experiences. These conditions include the referral of resources – time, place, teacher, technology, etc. – namely the openness to accept innovative experience in a traditional and rigid environment (in a hierarchical organization without flexibility).

The measurement of the learning environment included an aspect of the teacher's support. Among the students of the Gordon Center the mean of the **teacher's support** was lower (3.54 with a standard deviation of 1.11) in regards to the regular schools, where the mean was higher (3.88 with a standard deviation of 0.82). This finding was found significant in comparison between the two learning environments (Gordon and traditional). Different research studies identify in the gifted characteristics such as low self-image, competitiveness, perfectionism, envy, and exaggerated expectations towards them as individuals on the part of the learning and social environment (Kaniel, 2001). In this environment (the Gordon Center), the teacher barely intervenes in the learning. The vision of the Gordon group is to cultivate gifted and talented children, though the focus on the gifted student's

work style that is characterized by the literature as preferred for the performance of the tasks in an individualized manner, according to his way and not according to the teacher's directives (Tannenbaum, 1995). Hence, it is possible that the teacher's support has only marginal meaning for the gifted student and lower evaluation in comparison to the traditional learning classes.

In the traditional schools, the teacher's role is perceived as more meaningful and hence is more evaluated since he is the mediator on the path to success. The teacher's place is accorded secondary importance when the student's activity focuses on riddles and competition and there are prizes at stake. Here the teacher assumes a more meaningful place in comparison to his place in the traditional subjects of learning. Here the teacher is no longer the authority that assigns duties to the students but serves as a mediator between the students and the riddles. The teacher constitutes a model of imitation for the students, connects to them meaningfully, and allows every student to feel ownership of the achievement. This change in the teacher's role is reflected in the students' evaluation of the personal relations and not necessarily instructional and functional, with the teacher (Dewey, 1990). Researches have found that the students are more satisfied in classes characterized by the high involvement of students, by personal relations between the teacher and the students, by innovative teaching methods, and by clear laws in regards to the behavior in the classroom. Students feel interest and confidence in the classes that emphasize the dimension of interpersonal relations and the teacher's support. The teacher's support is an important index (Levin, Doniza-Shmidt, and Zellermeier, 2005).

Another important contribution of the teacher in the traditional class is the development of reciprocal assistance among the staff members who solve the riddles. This finding sheds light on the centrality of teamwork, which must be addressed in the cultivation of gifted students, in light of the rising need of the job market and the coping with the decisions in life in general through teamwork and mutual assistance. The gifted student's progress at a personal pace (individualized level) apparently is encouraged more in comparison to that of a student in a regular class. In contrast, in the traditional class, the demand is to achieve on a

class level. This method in the Gordon group is not commensurate with active learning of learning groups / work teams (Herz Lazarowitz, 1997; Salomon, 2000).

The topic's importance rises in regards to the learning climate as a catalyst of the development of personality that is suited to life in a democratic society, is socially involved, and contributes to society (Zedkiyahu, 1998).

As aforementioned, the creation of interpersonal and social relations constitutes a key point in the pedagogical goals (Gal-Or, 1982). The class climate is measured as a subjective perception of the students since the students' perception and feeling of what is around them are what influences the involvement of the relations in the class, the learning in the learning community, and the achievement of the goals (Anderson, 1982; Huesmann and Guerra, 1997).

The positive climate has implications on the student's self-esteem and promotion of their learning performances. The research findings show that the **social climate is perceived similarly in both learning environments** – in the Gordon Center the mean is 3.91 (standard deviation 0.77) and in the traditional schools the mean is 3.94 (standard deviation 0.79). This finding, since it relies on the student's subjective responses, is not necessarily indicative of similar teamwork in both learning environments. It is possible that in relation to the needs of the gifted students the level of cooperation that they experience is indeed high but high in relation to their expectations of themselves and not necessarily indicative of high in comparison to the traditional school.

From the assumption that the perceived social climate is a subjective view as a function of the needs that arise in the students, the identity or closeness in the mean score necessitates further examination (see the recommendations for future research in the continuation of this chapter).

The elements of the learning environment address another aspect – **resources management** – that includes the individual's ability and his belief in regards to his ability to exploit the skills

and resources in the learning environment – technologies, recruitment of the social environment, work methods, understanding of the requirements in all types of the tasks (Birenbaum, 1996; Garcia and Pintrich, 1996). These skills in the present research were found similar both in the Gordon Center (mean 3.72, standard deviation 0.8) and in the traditional learning environment (mean 3.7, standard deviation 0.64), in regards to the perception of the resources management. In regards to the other indices of the learning environment, this index was perceived as lower in the score, as the students indicated in the two learning environments (Gordon Center and traditional). This finding necessitates methodical reference to the value that should be developed among the students in both learning environments (Gordon Center and regular). It is possible that students lack the relevant skills needed for work and for life in general, especially when discussing the challenging learning environment that is measured on the basis of the effective ability of resources management. When this environment uses aids such as Internet online technology and learning kits (CDs), the importance of the ability to manage resources, both technology resources and knowledge resources, rises.

To summarize, the examination of the different elements of the learning environment sought to examine the students' subjective reference in both learning environments (Gordon Center and traditional) and found minor differences in the perception of the learning environment in the comparison between the two learning environments. The exception was the index of the teacher's support, which was found to be significantly different between the two learning environments and was perceived as higher in the traditional schools. Additional aspects of the learning environment show the need that also rose from the literature to cultivate a team learning environment of work teams, with emphasis placed on the management of resources, which was found to be of lower values in regards to the other indices.

5.2 Perception of the Thinking Style

The learning environment and thinking styles were chosen, as aforementioned, in the present research study in two groups with

different learning environment characteristics; one a traditional learning environment and the other a challenging learning environment – for gifted and talented students. The Chamizer challenges project was implemented in both learning environments.

The literature characterizes the gifted and talented students in a number of characteristics that differentiate them from the traditional environment. Some of these characteristics spur on the thinking processes and some limit the thinking processes; for instance, Tannenbaum (1995) addresses three limits:

- Most of the gifted students prefer to perform tasks according to learning individually (or with direct contact with an adult).
- These students prefer the tasks according to their method as opposed to acting according to the directives of others; in other words, they prefer working alone in solving problems.
- These students perceive the world differently and at their starting point they process the information that they absorb (this was not interpreted or re-examined in the studied researches).

The strengths of the gifted students are:

- A reverse of the third limitation, which can constitute a strong point, since these students, according to Strip and Hirsch (2000), can derive benefit from opportunities to cope with appropriate tasks, since they think differently from the other students.
- Gifted and talented students tend to advance in new material rapidly and do not need considerable repetition and practice (Shore and Kanevsky, 1993). However, according to Galbraith (1998), to develop thinking and enrich the gifted and talented children, it is necessary to give them opportunities for creation and independence. In the present research, this point was the starting point of the researcher – to give an opportunity and independence in the completion of the challenging task of Chamizer in the Gordon framework. There was direction of a teacher who is expert in the knowledge realm relevant to the topics raised in the Chamizer riddles.

This opportunity is also given to students in the traditional learning environment. The goal was to concurrently allow two learning environments (gifted and traditional) to develop traits such as creativity, curiosity, insight, perseverance, and imagination (Piiro, 1988).

The thinking style is the manner of thinking preferred by a person in a given situation; namely, styles of thinking are not found in the realm of abilities and personality but in the areas of tangency between them (Sternberg, 1994a). Thinking styles are not fixed and they may change during the lifetime and they reflect the conduct of everyday cognitive abilities inside or outside of the learning environment. The challenge, according to Sternberg (1994a), is to enable learning through the development of flexibility in the implementation of the style according to the tasks, preferences (individualized or group work).

The research of Sternberg (1994a) shows that the *thinking style can be learned and measured*. To teach how to use a certain thinking style, it is necessary to give the learners activities that require them to use a relevant thinking style. The present research study used six of the thirteen thinking styles of Sternberg as relevant to the challenging learning environment that the Chamizer challenges program seeks to develop among the students.

It could be expected that when there is a fit between the learner's thinking style and the nature of the task that the expected results would be better (Smith, 2002; Sternberg, 1994b). The measurement tool developed by Sternberg served as a measurement tool in the present research, from which six thinking styles relevant to the Chamizer challenges environment were chosen (Sternberg, 1997). According to Sternberg (1997), measurement of the learning styles is performed by the student's perception of the relevant styles. The goal of the research was to examine the challenging learning environment, the Chamizer challenges project, as contributing to the development of thinking styles.

The research findings support the development ability of the learning styles relevant to the Chamizer challenges environment. It

was found that the **perception of the thinking styles in each one of the two learning environments (gifted and traditional) is similar** (mean that ranges from 3.45 to 4.21 for all the thinking styles in the two learning environments). The exception is the executive style. This style was found significantly different between the two learning styles. This finding shows the challenging learning ability to be similarly expressed among students in the traditional schools and among gifted and talented students in the Gordon Center.

The interesting point is that in the Gordon Center the executive style is slightly lower (mean of 3.82) in regards to the traditional environment (mean of 4.05). This finding is explained by Sternberg (1995) in his reference to the characteristic of the executive style. He maintains that the executive style likes situations where the role is clear, the performance is according to directions that must be followed. A person with this style likes to be told what to do, to implement rules for solution, and to repeat the ideas of others. According to Levin, Doniza-Shmidt, and Zellermeier (2005), these characteristics are more relevant to the students in the traditional class. It can be assumed that talented students are less directed to executive thinking and the Chamizer challenges environment does not encourage the development of this type of thinking especially among this population. In other words, to develop the executive style according to Sternberg, it is necessary to implement other stimuli among the gifted and talented.

The challenge in the present research was to examine how the project of Chamizer challenges creates a process of coaching of gifted and talented students in the **performance realm**, in which, as aforementioned, the gifted child lessens his evaluation in regards to the styles of others. This type of thinking style requires elements of following directions and obeying rules that the gifted student prefers skipping and feeling free, since he prefers a framework that is not institutionalized and dictated. Hence, it is possible to explain the gap between the gifted students' perception of themselves as having the executive thinking style in comparison to the traditional learning style, where the teaching characteristics entail directions, instructions, preferences, and demands for

performance. In this environment, the teachers evaluate their learners according to the performance of the instruction and direction (Smith, 2002). It is perhaps possible to differentiate a traditional class as developing an executive thinking style and thus the distinction between the two learning environments.

Another interesting finding that derived from the present research and was not statistically significant is the **liberal thinking style** – leading a challenging environment use of new ways, challenging the conventions – the **traditional environment evaluated itself as higher than did the gifted**. The following question is therefore asked. Does the difference derive from the fact that the challenging activity created among the students in the traditional environment stimulus and challenge beyond the norm to which they were accustomed and hence the tendency of the learners in this environment to evaluate the characteristics of the style as higher in regards to students from the Gordon Center? They are found in a framework of the challenging environment (gifted and talented). It is possible that they do not see the activity in a new way and the challenge they face is an unusual characteristic for them and hence the lower evaluation they gave themselves. This explanation was not seen in the professional literature and thus it would be interesting to examine it in a future research.

To summarize, it can be said that the Chamizer challenges as an impetus to a challenging learning environment is expressed both among students in the traditional class and among gifted and talented students. The **liberal thinking style** was found to be higher in the traditional learning environment. Thus, the Chamizer challenges encourage thinking that leads to the use of new ways, challenging conventions, namely, the development of critical thinking (Harpaz, 1996). The executive thinking style was found to be stronger in the traditional class and needs to be encouraged and developed – giving tools and correct mediation in the class of the challenging environment (gifted and talented students).

5.3 The Relationship between Thinking Style and Learning Perception and Achievements

This chapter presents the discussion on the research hypotheses.

The **first research hypothesis** linked the students' background characteristics and the achievements – solution of a number of riddles in a given time. The goal of this hypothesis was to examine the role of demographic, personal, and environmental variables in the successes in the task / achievements, as a control variable. The examined variables are age, gender, native language, and learning environment. Four of the variables were defined dichotomously when age had two categories (nine-ten and eleven-fourteen), gender (boys and girls), native language (Hebrew and not Hebrew), and learning environment (traditional schools and Gordon Center). The present research study found that the mean of the achievements at age eleven-fourteen was significantly higher than at age nine-ten. This finding possibly derives from the natural cognitive development according to Piaget (Fried, 1984; Piaget and Inhelder, 1972). This finding is different from the rationale that guides the Chamizer challenges. According to the perception of the program developer, it is possible to attain achievements (success in the solution of riddles) in a way that cuts across age, gender, etc.

In the present research, most of the participants are gifted and talented children, who belong to the lower age group (nine-eleven). They attained lower results than did the students in the traditional group. This finding is contradictory to the literature that discusses higher findings in classes that have norms of learning and achievements and that implement influences to realize them through a learning climate that it develops and behavior models of imitation that it provides. Therefore, classes with a high learning level (Gordon Center) may have norms of effort and scholastic achievement that act as environmental pressure on the students to improve their achievements (Dagan, 1989). This finding is explained in-depth in the chapter that discusses the impacts of the learning environment and thinking styles on the students' achievements.

According to the perception of the Chamizer challenges, significant differences were not found in the mean of achievements between **boys and girls**. This finding is supported by the researches of Shany and Nachmias (1999), who examined successes of students in a virtual course (innovative environment) and did not find differences between girls and boys. In contrast, the **native language** was found in terms of the level of achievements between Hebrew speakers and non-Hebrew speakers when the students whose native language is not Hebrew had a higher mean of achievement more significantly than those who speak Hebrew. According to the data collected, most of the students whose native language is not Hebrew are immigrants from the Former Soviet Union and most belong to the traditional learning environment. Researches found that the achievements of the immigrants from the Former Soviet Union catch up to those of the native speakers only after many years. The population of the Former Soviet Union comes from culture that cultivates studies, achievements, and excellence (Levin, Shohami, and Spulsky, 2002). It is possible that the difference found in the present research constitutes evidence of these findings (Smith, 2002).

As aforementioned, significant differences were found in the achievements between the traditional schools and the Gordon Center when traditional schools attained higher achievements significantly in regards to the Gordon Center. This finding can be explained in regards to the ages of the participants in the Gordon center (represent the lower age group) and through the difference between the thinking styles and two learning environments (traditional and Gordon), as in the first part of the chapter. However, in regards to the goal of the present research, the learning environment can explain the finding. The learning environment where the students meet in the everyday framework and create language and shared cultural codes such as cooperation, teamwork, reciprocal assistance, consideration of another, creation of synergy, creates the change in regards to Gordon, where the sessions are held weekly, for three intensive hours, with very clear goals. At the end of the session, the students go to their homes, which are geographically distant, unlike the real potential of connections among the children who are found in the traditional, neighborhood based school.

Researches (Hertz Lazarovitz, 1997; Rotem and Peled, 2006; Salomon, 2000) maintain that learning in groups increases achievements. The argument is that productivity in the social aspect creates conditions of thinking on thinking (meta-cognition), raising and examining ideas, and creating synergy that contributes to the process of effective decision making. These arguments can possibly explain the lower achievements of the Gordon Center and the need to develop skills of teamwork in the decision making processes among gifted and talented students as an impetus for life and the workplace.

The **second research hypothesis** examined the presence of statistical relations between the student's perception of the thinking style and his level of achievements. The rationale of the hypothesis was to examine how the thinking styles and use of them can explain the level of achievements in general and in the two different learning environments (traditional and Gordon Center).

It was found that of the six thinking styles of Sternberg (1995) that were used in the present research study and in the comparison between the traditional schools and the Gordon Center, the local pattern of thinking was found in general to have a low correlation with the achievements in general ($r=0.22^*$). However, examination of the learning environments found a higher relationship (0.35^{**}) between the local thinking pattern and the level of achievements in the traditional school alone. In other words, the local pattern of thinking was not found to predict the level of achievements in the Gordon Center. The local thinking pattern, as aforementioned, requires direction and intentional examples of the teacher to depict a global picture. Researches have found that this pattern characterizes the teaching strategies in the traditional schools. According to Smith (2002), the teaching pattern depends on the teacher's teaching style and the adjustment between the teacher's teaching style and the student's thinking style (Sternberg, 1994a).

In the Gordon Center, in the comparison to the traditional schools and classes, the potential of the connection between the teacher and the student is lower. As aforementioned, the low number of sessions, and perhaps also the lesser need on the part of the gifted

student, contribute to the atmosphere that is created between the teacher and the student. (As aforementioned, the session in the Gordon Center is held once a week for three hours.) Thus, the potential is lower for the development of this pattern of thinking among the students of the Gordon Center.

The unsurprising finding is the relationship between the **executive thinking pattern and achievements in the traditional schools** ($r=0.5^{**}$). As aforementioned, the executive thinking pattern is frequent in the learning classes in traditional schools (Smith, 2002). The researchers assert that the performance pattern is more esteemed in relation to other patterns by the teachers, since this pattern is more frequent among them, as well (Sternberg, 1997). In the comparison between the learning environment, it was found that among the students of the Gordon Center the executive thinking pattern is significantly lower than among the students in the traditional learning environment.

The **internal thinking pattern was found related in general to the achievements** ($r=0.28^{**}$) but is not significantly related to the achievements in the two learning environments. This pattern of thinking is characterized by individual learning that cannot predict achievements and success. This pattern is not strengthened in the traditional environment (Smith, 2002; Sternberg, 1994a). However, it has higher potential to develop in the environment of the Gordon Center, a challenging environment.

In regards to the internal thinking style, it does not predict success in the Gordon Center as well. According to Sternberg (1995, 1997) and in regards to the approach of Chamizer, the solution of the riddle should be formed through work in small groups. Since this style is characterized as suited for individualized work (the person loses patience in work in groups), an internal style becomes less relevant and apparently has less potential to attain high achievements. This style also obtained the lowest means that the students gave, both in the Gordon Center and in the traditional schools. Surprisingly, the external style, which is characterized by better learning in groups, was not found to predict success/achievements, in contrast to researches that argued that work in groups influences success and performances (Hertz Lazarowitz, 1997; Rotem and Peled, 2006; Salomon, 2000).

However, the **external** style is what was found to be the most evaluated in the Gordon Center (mean of 4.12) and in the traditional schools it is even higher than in the Gordon Center (mean of 4.21). The external style, according to Sternberg, is a friendly style and works better in the group. The **conservative** style, according to Sternberg, was not found to predict success; this style is characterized by fixation and adherence to the existing rules and lacks the integrative ability to see since it tends to perform clear instructions without implementing the imagination and creative abilities (<http://www.chamizer.com/press.htm>).

To conclude, there is a significant positive correlation between the local, internal, and liberal thinking patterns and the level of achievements of the students in the entire sample. Among the Gordon Center students, a relationship was not found between the thinking styles and the level of achievements; in other words, the thinking styles do not predict success/achievements among the gifted and talented students. In contrast, in the traditional schools it was found that as the style is perceived as more local, executive, and liberal, the level of achievements rises. Hence, it can be understood that the thinking styles in regards to the present research study can predict (in part) success when the conditions of the development of the thinking style are conditions as described in the school in the traditional environment. On the basis of the findings of Sternberg (1997) and in regards to the findings of the present research, it can be assumed that through the assessment of the thinking styles it will be possible to adjust the type of task to the thinking style and thus to increase the chances of success.

In the present research study, it is possible to present the existence of differences in patterns of thinking in regards to the different learning environments (traditional, Gordon Center). However, it is not possible to present clusters of thinking patterns due to the low number of research subjects.

The **third research hypothesis** examined the student's perception of the learning environment as influencing his achievements. This hypothesis relies on the findings of the research of Zedkiyahu (1998). The rationale of the hypothesis is to examine the perception of the class climate (the learning environment) under

conditions of a challenging project (Chamizer riddles) as related to success / scholastic achievements.

In the 21st century, the educational systems are facing a challenge, the goal of which is to adjust themselves to the requirements of the new technological era, so that they can respond to the renewing needs of society and fill their mission in the training of the coming generations (Salomon, 2000).

Zedkiyahu (1998) in his research study found a relationship between different dimensions of the class climate and the learning achievements. This relationship was found in his research to be dependent on the subject of study as well. This information contributed to the establishment of the present research hypothesis and it was found that of the dimensions examined in the learning environment the **teacher's support and the perception of the learning environment** are positively correlated with the achievements of the students in the entire sample. However, in regards to the difference between the two learning environments, only among the students of the Gordon Center were the indices of social climate, teacher's support, and perception of the learning environment found to predict success / achievements. In other words, **as the perception of the Gordon Center students rises in regards to these dimensions, so too do their achievements**. The finding is very important in the understanding of the needs of the gifted children and thus can increase their potential of success. It is possible that the explanation of these findings lies in essence in the fact that gifted students are in an environment that is beyond a learning environment and is characterized by academic characteristics (the geographic place of the Gordon Center is located in the Gordon College, an Academic College for the Education and Training of Teachers). The students come for three years, once a week, to the college and participate in two courses during the year, when the solution of the riddle plays an integral part in the course curriculum. From their evaluation of the learning environment, it is apparent that there is a significant difference in the score they gave in regards to the students in the traditional environment.

The very fact of the lower evaluation of the learning environment gives rise to the following question: Does this evaluation originate

in their critical ability that derives from the comparison to their expectations? The findings of the present research study reinforce the need for the cultivation of the environment in all its aspects that were examined, so that the potential for achievements / success of the gifted and talented students will rise. It can be seen that the achievements of the students in the traditional learning environment surpassed those of the students in the Gordon Center. When speaking of the talented, it is necessary to bring all the conditions under which it is possible to develop these students, including the learning environment.

The situation is not the same in the traditional learning class. In this learning environment, significant statistical relations were not found. In other words, the perception of the learning environment does not predict the success / achievements among these students. The explanation can be the very fact that the Gordon Center children are gifted and talented children who are preferred because they have been selected to be in the Gordon Center and in an environment rich in resources and advanced technology. This is beyond their session in the everyday learning environment. The evaluation of this environment and in it the social climate, which is beyond the climate that they encounter everyday, the support of a figure in addition to the teacher in the class (who constitutes for them an authority figure), and the environment, the apparatus, and the class aids – they can predict their achievements. In the comparison to the students in the traditional schools, the conditions in the learning environment are given/static conditions with the chances of change/upgrade (because of the limitations of budget in the educational system). The Chamizer challenges program goes beyond the structured learning program and hence this is likely to be the possible explanation of the difference between the two learning environments and the findings obtained in the third hypothesis.

To conclude, the third research hypothesis was partially confirmed. It was found that the perception of the learning environment predicts success / achievements only among the students of the Gordon Center.

The **fourth research hypothesis** discussed the relationships between the perception of the thinking styles and the evaluation of

the learning environment. The rationale of this hypothesis is to examine predictors of the learning environment as the student perceives it. If the learning environment is influenced by the thinking styles, then it is necessary to examine the fact that it is mediated (hypothesis number 6) between the learning style and the success/achievements in the solution of the riddles.

The present research study found that the **expression of the different thinking styles is related to the degree of motivation and evaluation of the learning environment**. In learning conditions when the task/assignment for the students is challenging (Chamizer riddles), relationships were found between the thinking styles and the perception of the learning environment. A strong statistical relationship was found between the **local thinking style (concrete thinking) and the liberal thinking pattern (thinking in new ways) and the motivation to learn** (teaching inspires interest and desire for learning). The concept of motivation to learn includes the cognitive level – how to perform the task and the affective level – the desire to perform it (Michenbaum, Burland, Gruson, and Cameron, 1998). This concept can be defined as perceived value that the student ascribes to the learned topic. This value can be as a result of the stimuli that are received in the student that connect to his existing schema and encourage the creation of different schema (Piaget, in Zorman, 1993) and influences the student in the choice of the strategies when he learns and copes with the tasks (Pokay and Blumenfeld, 1990). The local pattern likes, as aforementioned, to engage in details and concrete examples. The challenge they face is to attempt to attain insights in regards to the entirety, the picture that creates meaning of the system of reciprocal relations among the different parts. The pattern that characterizes the liberal thinking is the need to innovate, to investigate, and to challenge the existing situation. The two styles can complement one another and indicate the learner's tendency to think independently or to perform instructions (Sternberg et al., 1995).

This finding enhances the importance of the teaching method that inspires interest and motivation to learn (as in the Chamizer riddles). It can be assumed that the motivation and arousal from the teaching process are not disconnected from the student's

beliefs and the importance that he attributes to the learned topic (the content and the method). This parameter is strong in its ability to influence the student's degree of willingness to act in the direction of the goal achievement. These aspects of motivation to learn according to Ames (1990) are characterized primarily among those with inner motivation. This motivation causes the individual's development towards challenges. Hence, its relevance to the challenging learning program, as developed by Chamizer. The program has the ability to develop internal motivation and arousal to cope with the challenge that the individual perceives as beneficial beyond the cognitive experience he has experienced so far. The emotional experience – the feeling of motivation, the freedom of choice, self-actualization – also has the potential to motivate the learner towards the willingness to attempt new issues for experience. All these promote the importance of the dimension of motivation to learn as a catalyst for success in the achievement of the goal (Ames and Archer, 1999; Pintrich, 1999; Pintrich and De Groot, 1990). The findings of the present research show that the patterns of the relations in the student of the Gordon Center are similar to those of the students of the traditional schools but due to the size of the sample even the weaker relations were found significant.

To conclude, the fourth research hypothesis asserts that as the patterns of thinking are more local and liberal, the perception of the learning environment is better significantly.

Research hypothesis number 5 sought to examine in the challenging learning environment that the program developers claim can bridge across gender, age, and native language whether these variables can present an alternative explanation of the model proposed in the present research. In addition, according to the perception of the program developers (the Intel Corporation and Chamizer) this program is supposed to bridge across the learning framework, in the present research, a traditional learning class and a learning environment for the gifted and the talented in the Gordon Center.

First, the hypothesis was examined using multivariate two-factor variance analyses of the MANOVA type, in which the independent variables were age, gender, and native language, each

time in interaction with the learning environment. The present research study examined students aged nine to fourteen, boys and girls, whose native language was Hebrew and not Hebrew. Age was not found to have an impact on all the dimensions of the perception of the learning environment. A significant impact was found for the child's gender, beyond the learning environment, on the five dimensions of the learning environment: girls perceive the learning environment in a number of dimensions higher than do boys. In other words, girls evaluate the social climate, the motivation to learn, and resources management as higher than do the boys. However, these results do not go beyond the specific learning environment (see table number 20 in the chapter of the research findings). Thus, the present research study provides reinforcement for the program developers for their ability to act and be effective in every learning environment (traditional / Gordon Center).

It was further found that the perception of the social climate was higher among the girls (4.05) than the boys (3.80). The gap is not essential. However, the significant difference seeks to find an explanation of the finding. Since the professional literature did not explicitly address the difference between boys and girls in the perception of the social climate, the explanation of the finding may be related to the trait that was found in the researches to be different between men and women – the ability to work in teams (Kreindler, Klein, and Weiss, 2007). It was found that women are more attentive, evince greater openness to staff conduct, tend to involve their peers more in their thoughts and consultation, problem solving, and decision making. In contrast, men have a tendency to make decisions and solve problems more individually (egocentrism), less involve others, are less able to be attentive to another (patience), and make decisions in a more individual manner. This finding is aimed at the population of older workers in the work environment, but the following question is asked: Can indications of these behaviors be found among young children (environment or genetics)? This finding should be examined in a future research study.

The present research study examined the native language as an additional explanatory factor. It was found that in the Gordon

Center the native language did not have a significant impact on the social climate while among the students in the traditional schools the native language did significantly influence the perception of the social climate. Namely, the students who speak Hebrew as a native language perceive the social climate as better than those whose native language is not Hebrew. This finding is addressed in the research of Lipshitz et al. (1997), who maintain that it is very difficult for children whose language is not Hebrew (namely, they come from another culture) to combine values in their thinking processes, which originate in another culture. The explanation lies perhaps also in the skills that the child whose mother language is different from Hebrew has to acquire in language, both oral and written. The time spent in Israel is also a meaningful variable. Rong and Garet (1990, in Lipshitz et al., 1997) maintain that in most cases the integration of the immigrant students improves as their time in the country grows longer. This dimension was not examined in the present research study but it is possible that it could explain the difference in the scores that the students gave regarding their evaluation of the learning environment. Hebrew as a native language characterizes the generation that is born in Israel and does not have to surmount the same obstacles, processes, and coping that are experienced by those whose native language is not Hebrew (such as the Ethiopian population, the population from the Former Soviet Union, the non-Jewish sector in Israel, etc.).

The present research study did not specifically address a certain native language since the representation of every sector was very small. Therefore, in the process of the analysis of the findings it was decided to create a dichotomous variable of speakers of Hebrew as a native language and speakers of a different language as a native language. It is possible that with a larger representation of native languages that are not Hebrew it would be possible to examine the differences according to cultures as representing native languages and to derive additional insights.

However, a main point that differentiates between the Gordon Center and the traditional environment should be noted. In the Gordon Center, the students' activity is performed in a more individualized manner in the once a week session that necessarily makes the creation of a 'we' and 'them' as culturally distinct more

difficult. Hence, the antagonism against the absorbing society and the creation of groups with an identical native language is small relative to the traditional learning environment, where the chance of such an encounter is greater. Hence, it is possible perhaps to explain the perception of the learning environment in a different manner between Hebrew speakers and speakers of a non-Hebrew native language. This finding should be examined in future research studies in larger samples through the reference to sectors according to native language.

To conclude, the present research study found that the girls evaluate the learning environment more highly than do boys, beyond the specific learning environment. In addition, the child's native language was found to influence the perception of the social climate so that a child whose native language is not Hebrew perceives the social climate as lower than does the child whose native language is Hebrew. The literature that addresses the learning environment and how it is perceived by the students as a variable that explains achievements in the studies did not examine demographic variables as having the ability to explain the evaluation of the learning environment. In addition, the native language was not explicitly addressed in the literature.

Research hypothesis number 6 examined the perception of the learning environment as mediating the relationship between the background variables and student's thinking style. The findings of the present research study (research hypothesis number 1) show that the relationship between the thinking style and the achievements is meaningful only in the traditional schools (not in the Gordon Center). This finding caused the examination of the mediation of the perception of the learning environment of the relationship between the thinking styles and the level of achievements in every learning environment separately (traditional / Gordon Center).

The findings of the present research study show that among the students of the traditional schools, the learning environment is a variable that completely mediates the relationship between the thinking styles and the students' achievements. However, the perception of the learning environment does not constitute a variable that mediates the relationship between the thinking styles

and achievements in the Gordon Center. In the Gordon Center only the liberal thinking style had an impact on the students' achievements. As the liberal style is higher, the achievements are higher. In other words, as the Gordon Center students received challenges with tasks in an innovative, original, and challenging manner, which provide a platform for investigation of new situations that are not unequivocal, challenging the existing situations in a daring and creative way through the inculcation of skills of personal leadership and creation of a toolbox for the coping with challenges of thinking on a high level, their achievements are higher (Krathwohl, Bloom, and Masia, 1964).

The factor of the learning environment does not mediate the relationship and constitutes in essence the meaningful factor that will directly influence the achievements. This finding reinforces the meaningful influence of the perception of the learning environment that the student experienced on the achievements in the special learning environment of the Gordon Center.

The findings of this hypothesis are explained first for the Gordon Center and then the meaning of the mediation of the learning environment in the present research study is explained.

The constructivist theory (Vygotsky, 1981) preaches that knowledge must be structured among the learners themselves through processes of active thinking and not through the transfer of knowledge from the teachers to the students (passive process). This theory, in addition to the insight that Piaget created regarding learning as dependent on the schemas that exist in the child's mind, illuminates the present finding. Through them this finding can be explained. The Chamizer challenging activity creates cognitive stimulus and affective (motivational) stimulus among the students in that it is implemented through active, challenging learning and motivates the desire for the development of the students' knowledge and thinking. In the processes of the acquisition of the schema, the organization and storage of the acquired information are performed, through the association to existing schema, especially in the computer environment that today constitutes an accessible instrument with multiple uses among youth (Lave, 1988; Lave and Wenger, 1991). In the terms of Vygotsky, the effective mediation of the environment can

‘stretch’ the expertise of transfer to further ranges of development. A good curriculum for the development of transference will grow in the environment in which there is the need for ongoing coping with new situations that by nature necessitate the implementation of knowledge and principles of solution of the unfamiliar / challenging situation, which motivates and creates the desire for coping. If there is no such environment, it must be constructed in such a way as to create new situations for the learner at high frequency (Kaniel and Feuerstein, 1989, in Kaniel, 2001) and thus will ‘force’ upon the learner the need for transfer and the activity to achieve it.

Piaget (1972) maintained that it is necessary to create methods for the identification of stages and unique expectations for the child as a child. In other words, the identification of the learning styles can be one of the methods that the researcher coined. Support can be seen in Vygotsky (2003), who added that one must not speak of an abstract child but of a child who grew up in a certain period (every period has characteristics that can be seen as an impetus to the child’s development, for example, a computerized/online environment, Internet, etc.), in a certain society, with certain cultural instruments. Certain behavior and cognition are attributed to a specific child.

However, Vygotsky (2003) also criticized the theory of Piaget, which, in his method, focused only on the individual’s mental activity and was perceived by him as extremely individualistic. He maintained that the social context in which the learning occurs has far greater importance than can be hypothesized according to Piaget’s theory. Vygotsky (2003) researched the impact of social and cultural interactions on the mental development and cognitive functioning in general and on the learning processes in particular.

Vygotsky (2003) believed that diverse interactions in the social-cultural context are a basic need of the person. Moreover, according to his outlook, the social interaction is the first arousing factor that enables and spurs on cognitive and intellectual development among people.

Vygotsky (2003) did not ignore the existence of mental actions that occur in the individual’s mind (cognition). He called them

“internal speech” but in his opinion, the person’s initial internal speech (performed using spontaneous ambiguous concepts) becomes thinking in distinct concepts. Only the impact of the individual’s interaction with the external, environmental factor, which holds a dialogue with him – for instance, the teacher who teaches the child.

Vygotsky (2003) asserts that all the mental functions on a high level develop from social relations. Chamizer challenges were intended to develop the child in a different environment from the known environment and to transform the didactic class to a constructivist class that includes work teams and interdisciplinary problems that should be solved in team. These are enabled through the use of modern tools, computer, Internet environment, development of thinking skills – logic, criticism, and knowledge organization (Salomon, 1997, 2002). In addition, Chamizer challenges inculcate practical experience and opportunity to conflict with concepts from different content worlds and to structure the learners’ knowledge through processes of active thinking (Harpaz, 2000).

Modern constructivism supports the opinion that knowledge develops all the time and is created through social-cultural mediation (Vygotsky, 1962), in light of the social integrations that have a main role in the development of cognition. The realization of the student’s development potential depends on the existence of full social reciprocal relations in the learning group. The learning unit is not an isolated individual but a group that holds discussions that are accompanied by thinking and considerations, giving and receiving feedback on the decision making process and the learning process. Every student in the group is perceived as a resource with supreme importance in the process of the social, learning, and cognitive development of himself and of his peers in the group (Hertz Lazarovitz and Fox, 1992; Sheran and Sheran, 1975). This style of teaching on the one hand and learning on the other hand develops from dialogue and encounter of different disciplines (aimed at a project of riddles / Chamizer challenges) and educational theories (Dewey, 1990; Vygotsky, 1962).

The starting point in the learning groups is the existence of negotiations with others in the group using interpersonal

communication. The students are exposed to concepts and information items that belong to different realms of knowledge and engage in solving problems of different types through the improvement of independent learning skills (Rosso, 2000). In this process, the teacher presents to the group stimuli (riddle for solution). Students cope with the topic by raising questions on the basis of existing knowledge and information that they have to achieve by means such as the Internet, literature, etc. The students identify the problem they face, analyze the different aspects required for the solution of the problem, and attempt to evaluate the results with the rest of the group members (Hertz Lazarowitz, 1997).

At the center of the Chamizer challenges is the constructivist approach, which puts the student at the center and the environment as enabling him a pace of learning and development suited to him so as to present him with learning, social, and personal goals that are commensurate with his ability, tendencies, and ways of learning (Maslow, 1971; Neil, 1997). This is through the creation of opportunities adjusted to their level of readiness. Hence, in this constellation the role of the teacher / instructor is to develop a learning environment that allows the development of cognitive skills including critical thinking, logical thinking, creative/imaginary thinking, asking questions, effective use of information through the analysis of data, and drawing conclusions (Krathwohl, Bloom, and Masia, 1964). In addition, the student develops skills of evaluation of the learning process, the product, and the ability of self-reflection. This encounter invites the development of additional skills in the social realm, such as management of conversation and discussion, persuasion and decision making processes, teamwork, and distribution of roles as preparation for the world of the studies and work (Kreindler, Klein, and Weiss, 2007).

However, the personal realm also develops – perseverance ability, inner motivation, initiative, personal curiosity, taking responsibility, and the student's independence. To achieve these qualities among the students, a learning environment with basic conditions that allow maturation and development of these skills is mandatory (Harpaz, 2000). This learning is achievement and

success oriented and encompasses the student's involvement in the process and the understanding of the product. The conditions for the development of success oriented learning are:

- Motivation to learn: Students learn well when they engage in the topic from interest (intrinsic motivation) and not because they want a prize (extrinsic motivation). While Chamizer challenge riddles do have prizes, the emphasis is placed on the class prizes, the goal of which is to improve the learning processes, the programs, and the technology in the school (Kaplan and sAsor, 2001).
- Authenticity: Students learn well when they engage in problems that are tied to their life plans. The Chamizer riddle challenges encompass areas of knowledge that are related to real life situations, such as road safety, environment and ecology, and scientific treasures (Rotem and Peled, 2006).
- The teacher's support: Students learn well when the learned topic is found in an 'area' that they can reach with the help of another person and when the learned topic is commensurate with their developmental stage (Vygotsky, 2003). Chamizer challenges / riddles are held in such a way that the student can identify the information he needs with the direction of the teacher, who is at the learner's disposal.
- Optimal challenge: Students learn well when the challenge they face necessitates effort that they are capable of, is achievable, and is cognitively challenging (Brant, 2000; Harpaz, 2002). Chamizer riddles / challenges cut across age, gender, demographics, and learning environments.
- Thinking styles: Students, according to Sternberg (1997), learn well when the method is commensurate with their thinking style and the Chamizer challenges create the same stimuli to motivate different thinking styles. The intent is not a specific thinking style and not higher or lower cognitive abilities.

- Learning climate: Students learn well when they are found in an environment in which dialogue develops, in which there are rules of conversation, attention, and explanation (Rotem and Peled, 2006). Chamizer riddles and challenges develop a dialogue environment. The students cooperate in solving riddles, help one another, propose solutions, and develop skills of attention and a conversation culture.
- Supportive environment: The development of learning processes is found in an environment in which the emotional climate is positive (Brant, 2000; Rogers, 1973). This climate develops with the mediation of a teacher who cultivates, encourages, cares, and is empathic to the needs of the individual and the group. Chamizer riddles and challenges are assimilated in the study classes and are held through the setting of class goals so that the class is the winner and not the individual student. Winning the prize is the result of class leadership through the teacher's support (Perkins, 1998).
- Success oriented learning: This emerges and develops as a result of the investment in the learning environment. Demographic, personal, and organizational variables and thinking styles (as proposed by Sternberg) pass through the learning environment and all these contribute to the promotion of success (achievement of the goals, solution of the riddles, prizes, peer work, etc.) This insight, which is based on the research findings, constitutes a potential for the development of an important knowledge basis in the structuring of the curricula.

Thus, the design of a challenging learning environment was found to improve achievements and develop thinking skills and personal and interpersonal (social) skills among the learners of different ages, different native languages, and both sexes. The design of the learning environment depends on the thinking style. Hence, the additional contribution of the present research lies in the identification of the relationship between the thinking style and the perception of the learning style and the perception of the learning environment and the students' achievements. The implication is

that the identification of the thinking style is an instrument that promotes and assesses and should be used to design challenging learning environments that are suited to the demands of the future society (Pessig, 1996). All this is especially correct for the primary learning environment in the schools in the educational institutions in Israel and in the world. This finding did not have a significant statistical impact in the talented learning environment. In other words, the perception of the learning environment was not found to mediate between the thinking style and the demographic and personal variables and the level of achievements. Moreover, the findings of the present research study found that the **achievements of the students in a traditional environment surpassed those of the students in the Gordon Center.**

This finding perhaps indicates the contribution of the project full of challenges developed by Chamizer and the Intel Corporation. Using Chamizer riddles / challenges the student in the traditional environment feels productive, creative, and curious; he is enthusiastic, involved, competitive, and responsible for the processes experienced by the work group.

This intervention program constituted a springboard to the world where he can better express his abilities and skills and the formation of social relations. This is a constructivist incubator for the personal and environmental conditions of growth as an impetus of success.

The explanation of the lack of mediation of the perception of the learning environment between the personal demographic variables and the thinking style and the achievements among the Gordon Center students perhaps lies in the **nature and characteristics of the learning environment.** As aforementioned, the students in the Gordon Center meet once a week and cope with the process of the structuring of the solution for the riddle in individualized and/or dyadic work. Tannenbaum (1995) notes that gifted students may prefer to work alone when solving problems as part of a heterogeneous class in which they do not have somebody with whom to work. Thus, they acquire individual traits, which create a basis for individual work. This dimension of team / group work becomes a main dimension that characterizes the learning

environment in the traditional class and it apparently creates the distinction between the Gordon Center and the traditional class.

These conditions of the learning environment, as the student perceives them in the Gordon Center, constitutes a **challenge for the promotion of the gifted and talented youth through the development of social skills, teamwork, cooperation, etc., which constitute apparently a critical link in the chain towards success.** (Recommendations for the cultivation of the learning environment among gifted and talented students are presented in the chapter of the recommendations for future research and applicative recommendations.)

To summarize, research hypothesis number 6 was partially confirmed in the present research study. The learning environment was found to be a mediating factor between demographic and personal characteristics and thinking style and achievements/success **only** among the students in a traditional learning environment.

This finding reflects a phenomenon that should be examined. The reference to it comes from the introduction of a pedagogical instrument – the Chamizer challenges, developed by a hi-tech company, the Intel Corporation, for the knowledge industries, when its interest is to develop creative and critical autonomy and broad education – the ‘thinking class’.

The present research study proposes to see the learning environment, as perceived by the student, under conditions of challenging learning (Chamizer challenges / riddles) as a variable that explains success and achievements and mediates between the thinking styles (Sternberg, 1995) and the students’ achievements in the traditional learning environment. The importance of the learning environment is reinforced since it has the ability to predict the success of gifted and talented students (without the ability of mediation).

The meaning of this thesis, as proposed in the present research study, is that a challenging project has the ability to be generalized in different learning environments (traditional / Gordon Center for gifted and talented children), under

conditions in which the students perceive the learning environment as such that cultivates a social and learning climate, motivation to learn, opportunities for resources management abilities – all with the teacher’s support and cultivation of reciprocity and teamwork in the solution of the riddles.

5.4 Summary and Conclusions

According to the modern educational approaches, the purpose of teaching is to focus less on what the teachers do and more on the creation of opportunities for active learning. These opportunities need to include diverse tasks suited to the different thinking and learning styles. Today, the contents are presented to the student in the class as the teacher sees fit. This way does not necessarily correspond to the styles of thinking and learning of all the students and therefore they are required to put forth additional effort to process and organize the information and to transform it into meaningful knowledge. It is important to create and provide for the learners a flexible environment that can be adjusted to the different thinking and learning styles, not only in the school but also in different frameworks (the Gordon Center). Such an environment is supposed to allow the learner freedom to choose his learning processes and be completely involved in the responsibility for the learning and to expose him to activities intended to gradually increase his awareness of his mode of learning. One way of doing this is to use the Chamizer challenges method.

Learners are different from one another in styles of thinking and in their perception of the learning environment. Different researchers emphasize the need to develop teaching materials suited to the learner’s thinking style (Salamon, 2000; Zohar, 2007). Sternberg (1997) emphasizes the need to encourage learners to use different and diverse thinking styles.

The present research study engages in an innovative approach of the implementation of curriculum through riddles (Chamizer challenges) on the learning experience in the learning environment in two frameworks: a homogeneous framework, the Gordon Center, where gifted and talented students learn, and a

heterogeneous framework where students learn in a traditional class. The research examined achievements in the solving of riddles (Chamizer challenges) in a challenging learning environment that allows resources management, teacher's support, social climate, learning climate, and motivation to learn. This environment is based on changing situations and can require the learners to choose and crystallize an appropriate model of action and to adopt it in changing situations. The process performed in the present research found that in general the **learning environment** that included aspects of a *social and learning climate, teacher's support, learning process, and resources management* was perceived highly by the students.

Analysis of the research findings shows that the learning climate was perceived higher in traditional schools than in the Gordon Center. The motivation to learn was perceived as higher in the regular schools than in the Gordon Center. In both learning environments, the Gordon Center and the traditional school, the development of thinking and reflective skills was found.

In the learning environment where gifted and talented children learn it is possible to adopt challenging projects such as Chamizer challenges and it is also possible to include them among students in a traditional environment. It should be noted that the traditional schools and the Gordon Center allowed the Chamizer challenges project to be introduced into their frameworks and made time for the learning and for the learning process. They created stimulation and promotion of success in both learning environments. The research findings, in the comparison of the two learning environments (the Gordon Center and the traditional framework), showed that the mean of the motivation to learn in the Gordon Center was higher (3.98, standard deviation 0.84) as opposed to the traditional schools (3.85, standard deviation 0.76). This finding is not significant but it may still possibly indicate the level of stimulation that the challenge (Chamizer challenges) creates among the gifted students. Hence, the importance of the present research study, when it indicates the need to dare, to challenge, and to believe in the ability to develop skills considered futuristic in the present at an early age under enabling conditions.

The teacher has an important role in the Chamizer challenges: his role is to mediate and help identify the thinking styles that the students prefer to work according to and to adjust the activity accordingly. It was found that in the traditional school the teacher's support is more meaningful than in the Gordon Center. Hence, it is also evaluated more highly since it mediates the way to success.

The positive climate has implications on the students' self assessment and promotion of their scholastic performances. The research findings show that the **social climate is perceived similarly in the two learning environments**. This finding, since it relies on the students' subjective responses, does not necessarily indicate similar teamwork in the two learning environments. It is possible that in regards to the needs of the gifted students the level of cooperation that they experience is indeed high but high in relation to their expectations of themselves and not necessarily in relation to the traditional school.

In addition, it is possible to note that the resources management improved the individual's ability and that belief in regards to his ability to exploit the skills and resources in the learning environment was perceived similarly in both learning environments.

To conclude, the examination of the different elements of the learning environment addressed the subjective reference of the students in the two learning environments (the Gordon Center and the traditional school) and found minor differences in the perception of the learning environment in the comparison according to the two learning environments. The exception was the index of the teacher's support, which was found to be significantly different between the two learning environments and was perceived higher in the traditional schools. Additional aspects of the learning environment show the need that also arose from the literature on the cultivation of a team learning environment of work teams, with emphasis placed on skills of resources management, which was found at lower values in regards to the rest of the indices.

The research presents the manner of coping with riddles in a learning environment mediating between thinking styles and demographic and personal data and the students' achievements. The individual's preferred thinking style that he uses to organize and shape information influences the way in which the individual copes with information, solves problems, makes decisions, and responds accordingly. The thinking style is a way of thinking, the preferred way in which the individual uses his abilities of thinking and problem solving.

The research examined the applicative abilities of the thinking style according to Sternberg (1977) in the learning environments of gifted and talented students and students who are not gifted. Analysis of the research findings shows that the perception of the thinking styles in each one of the two learning environments (gifted and traditional) is similar, with the exception of the executive style, which was found to be slightly lower in regards to the traditional environment. The executive style characterizes children who like clear roles, as a result of which it is necessary to enable gifted and talented students to develop a executive style through other stimuli.

The liberal thinking style, characterized by challenge of conventions and coping with tasks in an innovative and original manner, was found to be higher in the traditional learning environment. This style develops critical thinking (Harpaz, 1996), since this is one of the important instruments for learning in a challenging environment.

The first hypothesis that examined the relationship between the thinking style and the learning perception and the achievements found that the mean of the achievements in the solution of riddles at age eleven to fourteen is higher significantly than at age nine to ten. In the Gordon Center learning environment, the age group is lower and they attained lower achievements than in the traditional learning environment. In contrast, the native language was found in terms of the level of achievements between Hebrew speakers and non-Hebrew speakers when students whose native language is not Hebrew had a significantly higher mean of achievements than the Hebrew native speakers. This point necessitates the development of skills of

teamwork in the decision making processes among gifted and talented students.

The second research hypothesis, which examined how the styles of thinking and their uses can explain the level of achievements in the two different learning environments (traditional and Gordon Center), found that the local thinking pattern requires direction and guiding examples of the teacher to show the global picture. According to the researches, this pattern characterizes the teaching strategies in the traditional school. This finding on the relationship between the executive thinking style and achievements in the traditional school is not surprising. It was found that it is low and significant; in other words, in the Chamizer challenges environment, it is recommended, according to the findings, to develop and encourage the local, internalized, and liberal thinking pattern, since there is a significant and positive correlation between the students' level of achievements in the entire sample.

The third research hypothesis examined how the student perceives the learning environment as influencing his achievements. It was found that in the two dimensions (the Gordon Center and the traditional framework) the teacher's support and perception of the learning environment predict achievements and success in the entire sample. In other words, as the perception of the students of the Gordon Center rises in regards to these findings, their achievements rise too. In contrast, among the students who learn in the traditional environment significant relationships in the perception of the learning environment were not found; namely, the perception of the learning environment does not have the ability to predict success / achievements among these students. In other words, the perception of the learning environment predicts success / achievements only among the students of the Gordon Center.

In other words, gifted and talented children are preferred because they are selected for the Gordon Center and for the resource and advanced technology rich environment, beyond their time in the everyday learning environment. The evaluation of this environment that includes the social climate, which is in addition to the climate that they encounter everyday; the support of an adult

who constitutes for them an authority, in addition to the support of the teacher; and the environment with its aids and devices – these factors can predict their achievements and in the comparison to the traditional school students the conditions in the learning environment are given / statistical conditions, without the chances of upgrading (because of the limitations of budget in the educational system). The Chamizer action is added to the structured curriculum and hence the possible explanation of the difference between the two learning environments and the findings of the third research hypothesis.

The fourth research hypothesis examined the relationship between the student's evaluation of the learning environment and the perception of the thinking styles and found that the expressions of different thinking styles is related to the degree of motivation and evaluation of the learning environment that enables challenging tasks. In other words, a strong statistical relationship was found between the local thinking pattern (concrete thinking) and liberal thinking pattern (thinking in new ways) and the motivation to learn.

The Chamizer challenges program develops inner motivation and arousal to cope with challenges in an experiencing manner. Hence, it can be said that the dimension of motivation is important as a catalyst of success in the achievement of the goal (Ames and Archer, 1999; Pintrich, 1999; Pintrich and De Groot, 1990). It can be maintained that as the patterns of thinking are more local and liberal, the perception of the learning environment is better meaningfully.

The research examined the challenging learning environment in which it is possible to bridge across age, gender, and native language and found that **girls** perceive the learning environment in a number of dimensions as higher than do boys. In other words, girls evaluate the social climate, the motivation to learn, and the management of the resources they receive as higher than do boys. Since the girls work more in teams and in a learning environment – Chamizer challenges, the mode of action is in teams. In the present research study, the native language is examined as another factor that explains the impact of the learning environment. It was found that **among students in the traditional**

schools a significant impact was found for the native language on the perception of the social climate. Students who speak Hebrew as the native language perceive the social climate as better than do those whose native language is not Hebrew.

To conclude, the present research found that the girls evaluate the learning environment in a higher manner than do the boys, beyond the specific learning environments. In addition, the child's native language was found to influence the perception of the social climate so that the child whose native language is not Hebrew perceives the social climate as lower than does the child whose native language is Hebrew. The last hypothesis examined the learning environment as mediating the relationship between the background variables and the student's style of thinking. It was found that for the students in the traditional schools, the learning environment is a variable that completely mediates the relationship between the thinking styles and the students' achievements. However, the perception of the learning environment does not constitute a variable that mediates the relationship between the thinking styles and the achievements in the Gordon Center.

However, the perception of the learning environment was found as a factor that mediates between the demographic and personal characteristics and thinking style and the achievements / success only among students in the traditional learning environment. This finding reflects a phenomenon that should be examined and that should be addressed through the introduction of a pedagogical instrument – the Chamizer challenges – which was developed by a hi-tech company, the Intel Corporation, for the knowledge industries when its interest is to develop creative and critical autonomy and a broad education – the 'thinking class'.

The meaning of the thesis proposed in the present research is a unique project with the ability to generalize to different learning environments (traditional / Gordon Center for gifted and talented children) under conditions in which the students perceive the learning environment as such that cultivates a social and learning climate, motivation to learn, opportunities for abilities of resources management, and all

this with the teacher's support and cultivation of the reciprocity and teamwork in th solving of riddles.

5.5 The Research Limitations

The present research study has limitations that must be taken into consideration.

- The research design that was chosen for the present research study is a correlative constellation that seeks to examine relationships between variables in regards to the phenomenon that the researcher sought to examine in a situation as it is in reality without the manipulation of the variables. The research population that was examined included classes of students for which it was not possible to perform a qualitative research design. The limitation of the design is the inability to conclude from the findings on relations of cause and effect (Birenbaum, 1993).
- The research population was represented in cluster sampling of schools in the North and Center of Israel. Hence, another research limitation lies in the representation of the data for the State of Israel alone.
- The present research sought to examine the native language as a source that creates differences between students in regards to thinking styles, perception of the learning environment, and achievement of the goals (achievements in the solution of riddles). The difficulty with examining this issue derived from the low number of research subjects that represent populations from different origins (native language different from Hebrew). It is recommended to examine the impact of the native language in a large sample so that it will be possible to clarify the impact on the research variables, if indeed there is an impact.
- The present research instrument does not allow the representation of the thinking patterns. The strength of the instrument lies in the representation of a variety of thinking styles from the perception that people encompass simultaneously a number of styles and there is no preferred

and agreed-upon style. According to Sternberg, thinking styles change according to tasks and situations. Hence, to assess a thinking style in order to adjust it to the teaching style, it is necessary to adopt a different research instrument.

- The present research study did not use objective research instruments to measure the variables of the social climate (Ben Zakan, 2000) and thinking styles (Sternberg, 1995). The research instrument that was used in the present research was based on the attitudes / perceptions of the respondents to the statements in the questionnaire. The literature maintains that attitudes change and do not necessarily represent a situation that is stable over time (Beyt-Marom, 1986). To overcome this limitation it is possible to use additional research instruments, such as in-depth interviews and observations, which will allow validity to be granted to the findings (Birenbaum, 1993).
- Intervening variables – the present research study addresses demographic variables (age, gender, native language, and country of origin) as intervening variables. It is possible that control of additional intervening variables would produce different findings and explanations from those obtained in the present research study.
- Thinking styles and learning environment constituted a framework for the present research study that sought to examine achievements in a challenging learning environment. It is possible that there are additional variables that can influence the students' achievements, for instance, adjustment time from the children's date of immigration, which may possibly explain the difference between the scores given to the students in regards to their evaluation of the learning environment (Levin, Shohami, and Spulsky, 2002).

5.6 Recommendations

The research study examined the Chamizer challenges method as an impetus for cognitive development as a strategy of teaching that develops thinking and examined it as a learning environment that mediates between thinking styles and demographic and personal variables.

5.6.1 Recommendations for Further Research

- To examine and isolate the meaning of the learning environment among gifted and talented students when in the present constellation it was not found to mediate between thinking styles and achievement, it is recommended to perform a continuation study based on an experimental design that will consist of an experimental group and a control group. The experimental group will cope with the Chamizer challenges with the teacher's mediation, a technology rich environment, versus the control group, in which the students will receive the riddles in a random manner from an Internet site without mediation. The solutions will be sent to a joint center.
- It is recommended to perform a continuation research study to present a larger and more diverse sample (additional variables) through which it will be possible to differentiate between different population sectors that represent the phenomenon in the student population (native language, parental education, date of immigration, etc.).

5.6.2 Applicative Recommendations

- The present research study found differences in the evaluation of the work environment between students in the traditional schools and students in the Gordon Center. The research findings show lower scores of the Gordon Center students for their perception of the learning environment. This finding requires the re-examination of the expectations in regards to the satisfaction of the Gordon Center children so as to allow levels of development and higher achievements. The design of a learning environment for

gifted students needs to enable an opportunity to develop personal traits such as creativity, curiosity, insight, perseverance, and imagination, tolerance, and ambiguity. All this in the development of skills of cultivation of social awareness in discussions, researches, and surveys through teamwork. The program for the cultivation of the gifted student needs to be based on the assessment of the student's cognitive, personal, and social characteristics and on the recognition of what differentiates between him and his same age peer of average intelligence. Only through the recognition of the characteristics versus the mapping of the gifted child's needs will it be possible to provide a suitable solution to the unique needs (Smutn, 2001; Strip and Hirsch, 2000; Winebrenner, 2001).

- The present research study raises the following question: What is the appropriate / challenging environment that motivates success? The awareness of the ability observed in the present research study of students in traditional classes to cope successfully in a challenging environment, as the Intel program headed by Dan Chamizer proposes, necessitates continuing to assimilate in the traditional curricula challenging programs of the type examined in the present research. This recommendation requires a training program of the role-holders in education who have the ability to lead projects of this type. In addition, it is recommended to introduce into the study schedule of the students in programs for training teaching practitioners the method of accompaniment, instruction, and leadership of unique programs in a challenging environment. Thus, a challenge is created for them as emissaries, educators, and instillers of educational and scholastic values in the educational system at all levels without difference of the students' level of intelligence. These characteristics of the successful student on the one hand and the teacher who enables growth of the graduate on the other hand constitute today the vision of the educational system in the 21st century (Abuab, 2007).

- The need for change of the learning environments is obligated by reality and is linked to the cultural and technological changes and globalization that we all are experiencing today. The desired change should be based on their perception of the learning environments as a constellation of factors that should ensure the appropriate preparation of the future generation and educational and integrative perceptions. These should have challenging ability beyond the stimuli that the students find through the technology to which they are exposed more than ever.
- External factors with proven ability to intervene as a tool for educational development should be encouraged to join. This encouragement causes the decision making of the educational institutions in regards to the appropriate training of the participants, to awaken a process that allows the involvement of the factors that act inside and outside of the educational system. This process needs to lead to the adoption of the principles upon which the initiative is based and to assimilate them so that they become guidelines for everyday work in the institution.
- It is necessary to create an assimilation program beyond one-time events so that a program like that of Chamizer and Intel will be integrated into the school curriculum. Today the existing constellation is not flexible enough and it can even be argued that there is considerable difficulty in the introduction of changes in such a bureaucratic system (Fox, 1998). Therefore, the conclusion can be drawn that autonomy is required in the decision of the education institution in regards to the preference of contents and learning methods, beyond those dictated by the nationwide system.
- The access to learning resources (computers, technology) is a main point. It is necessary to address the place of the resources in regards to the desired changes and primarily to the place of modern technology. In addition, the physical place in the system – the access to it and the integration in the teaching and learning processes is very important.

- It is necessary to acknowledge the importance of the element of social climate. The social aspect, which primarily focuses on the ability to cooperate between the different individuals in the system (students, teachers, principals, parents, and other interested parties), is a main aspect in all that pertains to the promotion of change processes in the approaches of education and development of the future generation. A process of change does not develop by itself (see Fox, 1998; Levy, 2000). To create change and primarily so that the system will develop the flexibility to perform changes in the everyday life, it is necessary to distribute authorities and to allow the autonomy of the school as an organization that manufactures the product of the highest importance – the students. The realization of these goals can be through the cooperation of all the interested parties, including the students themselves. In this way we create the shared inner motivation that Herzberg refers to (in Bar-Hayim, 1996) regarding the creation of a challenging class learning environment and we prepare graduates towards higher and more creative achievements with values of greater discovery, concern, and commitment to one another.

6. Personal Reflection

The present research study investigated a challenging learning program, *Chamizer* challenges, in two learning environments. The research contributed to my personal and professional development and through it, I identified main points that lead me in my everyday conduct, both as a learning person and as a teaching person. I experienced an instructive learning process that I will present on two levels, on the personal level and on the professional level.

On the **personal level**, the process of the crystallization and writing of the dissertation provided me with an opportunity to look critically at my conduct. I identified in myself the organizational ability, determination – I do not give up – and although at times I experienced difficulties, I did not quit. In this period full of tasks and experiences, I discovered my ability in my conduct with my home – my children and my spouse, my professional work, and the research work. The patience that my family members evinced surprised me and in parallel looking at my conduct with my family members, I was with them (although for allotted times...). I have no doubt that this is the fruit of the tree I planted and today I am reaping it.

On a **professional level**, during the research I found that I have learning and thinking skills that I have acquired during my studies and work in the academia – the identification of relevant items, mastery of computer skills, curiosity, ability to organize and manage. A main axis was my guideline – the strategy of setting goals and the aspiration to realize them.

As I read the many articles, I accessed considerable knowledge and I coped with the ability to perform a synthesis and find the conclusions and insights from this process. This had a meaningful contribution in the analysis of the findings and in the writing of the dissertation.

In addition, I discovered that in this period, when I had to deal with so many valuable tasks that demanded effort simultaneously, I had a tendency to ‘get pressured’. I do not exactly know to manage the pressure around me. It is possible that this derives

from the fact that I am a perfectionist – one who wants to perform all the roles excellently.

My awareness of the shortcomings that I identified and my desire to improve them will be expressed immediately after I complete the doctorate. I intended to improve the skills of pressure management by participating in workshops on the topic.

When I entered the research process, I was a lecturer of mathematical education, a pedagogical instructor of teaching, and a manager of a center for gifted and talented children. The process of writing the dissertation promoted in me the ability to think critically – to counter and to synthesize among different parts, which in the end create the whole.

In regards to my pedagogical occupation, I learned to look at the student differently, to address his needs more meaningfully – the need for the teacher's support, his role as a mediator, the importance of work in groups, reciprocal productivity and brainstorming. In parallel, I learned to look at teachers as colleagues and at the teachers who are subordinate to me in the educational system as emissaries of the educational institution in the preparation of the qualities of the graduate. These are the **creation of a vision for a different graduate, who is evaluated not necessarily by excellence, since very few excel, but we need to encourage the endeavor, to develop motivation, so as to allow the learner to invest efforts and his qualities.**

As a result of the present research study, I intend to develop a model for the development of critical thinking among the students, through which they will learn to use different thinking strategies. In addition, I intended to change my work approaches, both among the students and among the teachers I instruct: the teacher as mediator will create the process of knowledge structuring and will allow the development of tools of 'how to learn and how to teach'. We shall see our students as searching for opportunities to learn and we as teachers will enable these opportunities to be realized.

The very fact that at the beginning I gave an opportunity to the gifted and talented students to work according to the Chamizer

challenges method indicates my thought that intelligence goes hand in hand with challenge. Today, my insights following the research study are to give opportunities to all the students, to enable the acquisition and assimilation of knowledge, values, and natures that are related to different topics, to situations, and interests in unaccepted ways that were intended to inspire interest, creativity, curiosity, and competitive enthusiasm. In other words, every individual is deserving of different opportunities.

The gifted and talented children need their opportunities but we must not forget the critical mass of the many students who are found in learning environments that they do not choose. These environments are in the hands of the educators or in my hands. In other words, I accept upon myself the responsibility not only to speak about **change** but also to **perform** it.

The change needs to include providing equal opportunity, exposure to challenging learning environments, persuading the decision making staff of the schools to assimilate the Chamizer challenges program comprehensively in all the schools in Israel as a non-threatening program, filled with stimuli and challenges. The next stage is to assimilate the Chamizer challenges program in schools throughout the world (including Hungary).

Bibliography

- Abuab, S. (2000). In *General Education Circular, Regular Directions 2000 7 (B)*, February. (Hebrew).
- Ames, C. A. (1990). "Motivation: What Teachers Need to Know", *Teachers College Record*, Spring (vol. 91 no. 3), pp. 409-421.
- Ames, C. and Archer, J. (1999). "Achievements Goals in the Classroom: Students' Learning and Motivations Processes", *Journal of Educational Psychology*, 80 (8), pp. 260-267.
- Anderson, C. S. (1982). "The Research for School Climate: A Review of the Research", *Review of Education Research*, 52 (3), pp. 368 – 420.
- Arbel, B. (1990). "Riddles (Mathematical) and Mathematics", *Strong Numbers*, Journal for Teaching Mathematics in the Elementary School, Haifa University, Beyt Berl College, The Ministry of Education. (Hebrew)
- Assor, A. (2001). "Cultivation of Internal Motivation to Learn in the School", in A. Assor and A. Kaplan (Eds.) *Education of Thinking, Motivation to Learn: New Perceptions of Motivation, Number 20*, The Branco Weiss Institute for the Cultivation of Thinking, Jerusalem. (Hebrew)
- Ausubel, D. (1963). *The Psychology of Meaningful Verbal Learning*. New York: Grune and Stratton.
- Ausubel, D. (2003). *Subsumption Theory*, <http://tip.psychology.org/ausubel.html>.
- Bar-El, Z. (1996). *Educational Psychology*, Reches Publishing House, Educational Projects Ltd. (Hebrew)
- Bar-Hayim, A. (1996). *Organizational Behavior*, The Open University Publishing House, Tel Aviv. (Hebrew)
- Ben Zakan, A. (2000). *Class Learning Environments as Perceived by the Students*, Ph.D. Dissertation, June. (Hebrew)
- Beyt-Marom, R. (1986). *Research Methods in the Social Sciences*, The Open University, Tel Aviv. (Hebrew)
- Birenbaum, M. (1993). *Who Is Afraid of a Research Study? Planning and Writing a Research Proposal and Research Report in the Behavioral Sciences*, University Press Publishing House. (Hebrew)

- Birenbaum, M. (1996). "Assessment 2000: Towards a Pluralistic Approach to Assessment", In: M. Birenbaum and F.J.R.C. Dochy (Eds.), *Alternatives in Assessment of Achievements, Learning Processes and Prior Knowledge*. (pp. 3-29). London: Kluwer Academic Publishers.
- Brant, R. (2000). "Powerful Learning", in Y. Harpaz (Ed.) *Learning: New Approaches, Education of Thinking*, Booklet 19, The Branco Weiss Institute. (Hebrew)
- Braun, L. (1993). "Help for All the Students", *Communications of the ACM*, Vol. 36, No. 5.
- Bronfenbrenner, U. (1997). "Toward an Experimental Ecology of Human Development", *American Psychologist*, 32, pp. 513-531.
- Brooks, J. G. (2000). *Towards the Constructivist Class: Searching for Understanding*, Jerusalem, The Branco Weiss Institute for the Cultivation of Thought. (Hebrew)
- Brown, A. L. (1992). "Design Experiments: Theoretical and Methodological Challenges in Creating Complex Interventions in Classroom Settings", *The Journal of the Learning Sciences*, 2(2), pp. 141-178.
- Brown, J. (1985). "An Introduction to the Uses of Facet Theory", In Canter, D. (Ed.), *Facet Theory – Approaches to Social Research*, New York: Springer-Verlag Inc., pp. 17-57.
- Bruner J. (2003). *Constructivist Theory*, <http://tip.psychology.org/bruner.html>.
- Bruner, J. (1966). *Toward a Theory of Instruction*, Cambridge, MA: Harvard University Press.
- Chamizer, D. *Chamizer Method of Education*. <http://www.Chamizer.com/press.htm> (In Hebrew)
- Cole, M. (1991). "Conclusion", In L. B. Resnick, J. M. Levine, and S. D. Teasley (Eds.) *Perspectives on Socially Shared Cognition*, Washington, DC: American Psychological Association, pp. 398-417.
- Dagan, T. (1989). *Contribution of the Characteristics of Background, Structure Factors, and Personal Traits to the Scholastic Achievements in the Elementary School*, Tel Aviv. (Hebrew)
- De Boer, A. and Steyn, T. 1999. "Thinking Style Preferences of Underprepared First Year Students in the Natural Sciences", *South African Journal of Ethnology* 22(3), pp. 97-102.

- De Boer, A. Steyn, T., and Du Toit, P.H. (2001). "Whole Brain Teaching for Whole Brain Learners", *South African Journal for Higher Education* 15 (3), pp. 188-193.
- De Bono, E. (1988). *Guide to Creative Thinking*, Kinneret Publishing House. (Hebrew)
- De Bono, E. (1993). *Teach Your Child to Think*, The Branco Weiss Institute for the Cultivation of Thinking Press. (Hebrew)
- De Bono, E. (1996). *Six Quadrants of Thinking*, Kinneret Publishing House. (Hebrew)
- Dewey, J. (1969). *Democracy and Education*, Bialik Institute. (Hebrew)
- Dewey, J. (1990). *The Child and the Curriculum*, Chicago, IL: The University of Chicago Press.
- Dole, V. (1999). *Postmodern Outlook on Education: A New Look on the Curriculum*, Sifriat Poalim, Hakibbutz HaArzi, HaShomer Hazair Press, Tel Aviv. (Hebrew)
- Fox, S. (1998). *Psychology of Resistance to Change*, Bar-Ilan Press, Ramat Gan. (Hebrew)
- Foya, G. (1961). *How to Solve*, Otsar Hamore Press. (Hebrew)
- Fraser, B. J. (1986). *Classroom Environment*. London: Croom Helm.
- Fraser, B. J. (1990). *Individualized Classroom Environment Questionnaire* (Handbook and Test Master Set) The Australian Council for Educational Research Ltd., Radford House, Australia.
- Fraser, B. J. (1991). "Two Decades of Classroom Environment Research", In B.J. Fraser and H.J. Walberg, (Eds.) *Educational Environments – Evaluation, Antecedents, and Consequences*, Oxford: Pergamon Press Plc., pp. 3-27.
- Fraser, B. J. and Walberg, H. J. (Eds.). (1991). *Educational Environments – Evaluation, Antecedents, and Consequences*, Oxford: Pergamon Press Plc.
- Fried, Y. (1984). *Jean Piaget – Psychology and Method*, Broadcast University Series, Ministry of Defense. (Hebrew)
- Galbraith, J. (1998). *The Gifted Kid's Survival Guide for Ages 10 and Under*, Minneapolis, MN: Free Spirit Publishing.
- Gal-Or, Y. (1982). "Classroom Climate", in S. Zidkiyahu (Ed.) *Class Climate: Nature and Action*, The Ministry of Education and Culture, Jerusalem. (Hebrew)

- Garcia, T. and Pintrich, P. R. (1996). "Assessing Students' Motivation and Learning strategies in the classroom context: The Motivated Strategies for Learning Questionnaire", In M. Birenbaum and F.J.R.C. Dochy (Eds.), *Alternatives in Assessment of Achievements, Learning Processes and Prior Knowledge*, Dordrecht: Kluwer Academic Publishers, pp. 319-339.
- Gardner, H. (1995). *Brain, Thinking, and Creativity*, Sifriat Poalim Publishers. (Hebrew)
- Geisle-Bernstem, E., and Schmeck, R. R. (1996). "The Revised Inventory of Learning Processes: A Multifaceted Perspective on Individual Differences in Learning", In M. Birenbaum and F.J.R.C. Dochy (Eds.), *Assessment of Achievements, Learning Processes and Prior Knowledge*, Dordrecht: Kluwer Academic Publishers, pp. 283-317.
- Givon, Y. (1996). "Characterization of the Open Instruments", in Z. Mevarech and N. Hativa (Eds.) *The Computer in the School*, Jerusalem and Tel Aviv, Shoken Press, pp. 39-59. (Hebrew)
- Givon, Y. and Ben-Zakan, A. (1995). "Vision of the Promotion of the Computerization Culture in Education Institutions", in A. Ben-Zakan (Ed.) *The Culture of Computerization – Issues and Studies*, Beit Berl College, The Center of Informatics, pp. 93-102. (Hebrew)
- Greeno, J. G. (1997). "Response: One Claims that Answer the Wrong Question", *Educational Researcher*, 20 (1), pp. 5-17.
- Guttman, L. (1982). "What Is Not What in Theory Construction", In: R.M. Hauser, D. Mechanic, and A. Haller (Eds.), *Social Structure and Behavior*, New York: Academic Press, pp. 331-348.
- Harpaz, Y. (1996). (Ed.) *Education for Critical Thinking*, Magnes Press and the Branco Weiss Institute Press. (Hebrew)
- Harpaz, Y. (1997). "Towards the Thinking School", in E. Paldi (Ed.) *Education and the Test of Time*, Ramot Press. (Hebrew)
- Harpaz, Y. (2000) (Ed.) *Teaching and Learning in the Thinking Community: On the Road to the Thinking School, Education and Thinking*, Number 18, The Branco Weiss Institute. (Hebrew)
- Hawkins, J. (1993). "Technology and the Organization of Schooling", *Communications of the ACM*, Vol. 36, No. 5, pp. 30-35.
- Hertz-Lazarowitz, R. (1997). *Innovative Pedagogy – A Collection of Articles*, Haifa University, The Faculty of Education. (Hebrew)

- Hertz-Lazarowitz, R. and Fox, A. (1992). *Design of a Policy of Change in the School: Foci in the Process of the Principal's Work*, Jerusalem, The Ministry of Education and Culture and Haifa University. (Hebrew)
- Hollingworth, L. S. (1942). *Children above 180 IQ, Stanford-Binet; Origin and Development*, Yonkers, NY: The World Dood Company.
- Horak, E., Steyn, T, and De Boer, A. (2001). "A Four Quadrant Whole Brain Approach in Innovating and Engineering Problem Solving to Facilitate Teaching and Learning of Engineering Students", *South African Journal for Higher Education* 15 (3), pp. 202-208.
- Huesmann, R. L. and Guerra, N. G. (1997). "Children's Normative Beliefs about Aggression and Aggressive Behavior", *Journal of Psychology*, 72, pp. 408-419.
- Kaniel, S. (2001). "Transference in Learning: New Hopes", *Trends*, 41 (3), in <http://portal.macam.ac.il/ArticlePage.aspx?id=44&referer=useJsHistoryBack>, (Hebrew)
- Kaplan, A. and Assor, A. (2001). "Motivation to Learn in the School – Theory and Practice", in Y. Harpaz (Ed.) *Motivation to Learn: New Perceptions of Motivation, Education of Thinking*, Number 20, The Branco Weiss Institute. (Hebrew)
- Katznelson, B. (1989). "Emotional Aspects in the Education of the Gifted Child", *Study Days on the Topic of Gifted Students*, 1, The Ministry of Education and Culture, pp. 23-28. (Hebrew)
- Keller, J. M. (1983). "Motivational Design of Instruction", in C. M. Reiguluth (Ed.), *Instructional Design Theories and Modes: An Overview of Their Current Status*, Hillsdale, NJ: Lawrence Earlbaum Associates, pp. 386 – 434.
- Krathwohl, D. R., Bloom, B. S., and Masia, B. B. (1964). *Taxonomy of Educational Objectives: The Classification of Educational Goals, Handbook II: Affective Domain*, New York, NY: David Mckay Company Incorporated.
- Kreindler, Klein, and Weiss (2007). An Empirical Test of the Interaction of "Critical Thinking" And "Courage to Act" among Male and Female Participants in a Business Administration Academy School.
- Lave, J. (1988). *Cognition in Practice*, NY: Cambridge University Press, Lawrence Erlbaum.
- Lave, J. and Wenger, E. (1991). *Situated Learning*, Cambridge University Press.

- Levin, Doniza-Shmidt, and Zellermeier (2005). "Students Perception of the Class Climate in a Communicative Environment for Teaching Writing", *Theory and Practice*, Number 10, The Ministry of Education, The Department for the Design and Development of Curricula. (Hebrew)
- Levin, T., Shohami, A., and Spulsky, D. (2003). *Scholastic Achievements of Immigrant Students: Summary of Findings and Recommendations*, <http://www.biu.ac.il/hu/lprc/Reports/TalimidimOlim.htm>. (Hebrew)
- Levy, E. (2000). *Management of Organizational Change – Approaches, Methods, and Processes*, Tel Aviv, Cherikover Press. (Hebrew)
- Lewis, C., Schaps, E. M., and Watson, M. (1996). "The Caring Classroom's Academic Edge", *Educational Leadership*, 54(1), pp. 15-21.
- Lipshitz, H., Noam, G., and Bozagalo, M. (1997). *Integration of Students of Ethiopian Extraction in the Education System: Summary Report for the Evaluation Research of the 'Integration' Project*, Jerusalem, Joint – Brookdale Institute for Gerontology and Development of Man and Society. (Hebrew)
- Maslow, A. (1971). *Toward a Psychology of Being*, Van Nostrand.
- Mazor, Nachmias, and Mintz (2005). *The Rationale of Learning and Teaching in an Online Learning Environment*, http://www.edugov.org.il/mekuvan/rational_elearning.htm (Hebrew)
- Michenbaum, D., Burland, S., Gruson, L., and Cameron, R. (1998). "Meta-cognitive Assessment", In S. R. Yussen (Ed.) *The Growth of Reflection in Children*, Orlando: Academic Press, Inc., pp. 3-30.
- Moos, R. H. (1979). *Evaluating Educational Environments: Procedures, Measures, Findings and Policy Implications*, San Francisco: Jossey Bass Inc. Publishers.
- Neil, E. S. (1977). *Summerhill*, Jerusalem. (Hebrew)
- Oden, M. H. (1968). "The Fulfillment of Promise: 40-Year Follow-Up of the Terman Gifted Group", *Genetic Psychology Monographs*, 77, pp. 3-93.
- Owston, R. D. (1997). "The World Wide Web: A Technology to Enhance Reaching and Learning?", *Educational Researcher*, 26 (2), pp. 27-33.
- Perkins, D. (1998). *Towards the Smart School: From Training the Memory to Education of Thinking*, The Branco Weiss Institute. (Hebrew)
- Perkins, D. (2000). "Vistas of Thought", in Y. Harpaz (Ed.) *Articles on Education for Good Thinking*, The Branco Weiss Institute for the Cultivation of Thinking. (Hebrew)

- Perry, D. (2002). *Gagne's Instructional Design Theory*,
<http://education.indiana.edu/~p540/webcourse/gagne.html>
- Pessig, D. (1996). *Taxonomy of Skills and Future Cognitive Abilities*, Bar-Ilan University, The School of Education. (Hebrew)
- Peter, A. F., Noreen, C. F., and Carol, A. G. (1997). *The Motivation to Think in Working and Learning*.
- Piaget, J. and Inhelder, B. (1972). *The Psychology of the Child*, Tel Aviv, Sifriat Poalim Press. (Hebrew)
- Piirto, J. (1998). *Understanding Those Who Create*, 2nd ed. Scottsdale, AZ: Great Potential Press.
- Pintrich, P. R., and De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, 82 (1), 33-40.
- Pintrich, P. R. (1999). "A Process-Oriented View of Student Motivation and Cognition", In J. Stark and Mets (Eds.) *Improving Teaching and Learning through Research: New Directions for Institutional Research*, San Francisco: Jossey-Bass, Vol. 57, pp.65-70.
- Pintrich, P. R. (1999). "Student Learning and College Teaching", In R. E. Young and K. E. Eble (Eds.) *College Teaching and Learning, Preparing for New Commitments: New Directions for Teaching and Learning*, San Francisco: Jossey-Bass, Vol. 33, pp.71-86.
- Pintrich, P. R. (1999). "The Dynamic Interplay of Student Motivation and Cognition in the College Classroom", In C. Ames and M. L. Maehr (Eds.) *Advances in Motivation and Achievement: Motivation-enhancing Environments*, Vol. 6, Greenwich, CT: JAI Press, pp.117-160.
- Pokay, P. and Blumenfeld, P. C. (1990). "Predicting Achievement Early and Late in the Semester: The Role of Motivation and Use of Learning Strategies", *Journal of Educational Psychology*, 82 (1), pp. 41-50.
- Renzolig, S. and Herbert, T. "Change of Patterns of Underachievement: Creative Activity as Methodical Intervention", in *Giftedness and Special Talents – A Reader*, The Open University. (Hebrew)
- Renzulle, J. S. (1981). *Psychology and Education of Gifted*, New York: Irvington
- Rogers, C. R. (1973). *On Encounter Group*, N.Y., Harper and Row.

- Rogoff, B. (1991). "Social Interaction as Apprenticeship in Thinking: Guided Participation in Spatial Planning", In L. B. Resnick, J. M. Levine, and S. D. Teasley (Eds.) *Perspectives on Socially Shared Cognition*, Washington, DC: American Psychological Association, pp. 349-364.
- Rosso, A. (2000). *New Trends in Teaching – Learning, Contents, Teachers, and Learners*. (Hebrew)
- Rotem, A. (2005). *Online learning Environment*, <http://avrumrotem.com>. (Hebrew)
- Rotem, A. and Peled, Y. (2006). *Towards the Online School*, Mofet Institute Press. (Hebrew)
- Salomon, G. (1997). "Novel Constructivist Learning Environments: Some Issues to Be Concerned With", Presented at the EARLI meeting, August.
- Salomon, G. (2000a). *Pedagogy and Technology: What Directs What?* Lecture in the Shared Discussion of Academia and the Ministry of Education on the topic of the Integration between Technology and Pedagogy, retrieved February 8, 2003, <http://construct.haifa.ac.il/~gsalomon/pedagogy.htm>. (Hebrew)
- Salomon, G. (2000b). *Technology and Education in the Era of Information*, Tel Aviv, Haifa University, Zmora Beitan. (Hebrew)
- Salomon, G. and Almog, T. (1994). "The Desired Figure of the Graduate of the Educational System", in *Planning Education Policy*, The Ministry of Education, The Pedagogical Secretary, Jerusalem. (Hebrew)
- Saunders, M., Lewis, P., and Thornhill, A. (1997). *Research Methods for Business Students*, London, Pitman.(001.4 SAV).
- Shany, N. and Nachmias, R. (1999). *The Relationship between Performance in a Virtual Course and Thinking Styles, Gender, and ICT Experience*, ORT – Moshinsky Research and Development Center, Tel Aviv, Israel. <http://muse.tau.ac.il/publications/64.pdf> [viewed 4.07]
- Shany, N. and Nachmias, R. (2001). "Virtual Course – For Whom?", in *Studies in Technology and Science*, Number 34 (21), pp. 26-29, <http://www.amalnet.k12.il/sites/hadshanut/articles/had00144.asp?title>. (Hebrew)
- Shemack, R. and Shemack, P. (1978). *Group Processes in the Classroom*, Haifa, Ach Press. (Hebrew)
- Sheran, S. and Sheran, Y. (1975). *Teaching in Small Groups*, Shoken Press, Tel Aviv. (Hebrew)

- Shore, B. M. and Kanevsky, L. S. (1993). "Thinking Processes: Being and Becoming Gifted", In K. A. Heller, F. J. Munks, and A. H. Passow (Eds.) *International Handbook of Research and Development of Giftedness and Talent*, Oxford: Pergamon Press, pp. 133-147.
- Shwartz, R. J. (1997). "Teaching Science Literacy and Critical Thinking Skills Through Problem-Based Learning", *Supporting the Spirit of Learning*, pp. 117-140.
- Smith, J. (2002). "Learning Style: Fashion Fad or Lever for Change? The Applications of Learning Style Theory to Inclusive Curriculum Delivery", *Innovation in Education and Teaching International*, 39, 1, pp. 63-70.
- Smutny, J. F. (2001). *Stand up for your Gifted Child: How to Make the Most of your Kids' Strengths at School and at Home*. Minneapolis, MN: Free Spirit Publishing.
- Sternberg, R. (1985). *Beyond IQ: A Triarchic Theory of Human Intelligence*, New York: Cambridge University Press.
- Sternberg, R. (1992). "CAT: A Program of Comprehensive Abilities Testing", In B. R. Gifford and M. C. O'Connor (Eds.) *Changing assessments: Alternative Views of Aptitude, Achievement and Instruction*, Boston: Kluwer Academic Publisher, pp. 213-274.
- Sternberg, R. (1994a). "Allowing for Thinking Styles", *Educational Leadership*, 52, 3, pp. 581-588
- Sternberg, R. (1994b). "Thinking Styles: Theory and Assessment at the Interface between Intelligence and Personality", In R.J. Sternberg and P. Ruggis (Eds.) *Intelligence and Personality*, NY: Cambridge University Press, pp. 169-187.
- Sternberg, R. (1997). *Thinking Styles*, Cambridge University Press.
- Sternberg, R. (1998). *Intelligence Succeeding beyond the IQ*, The Ministry of Education and the Branco Weiss Institute for the Cultivation of Thinking. (Hebrew)
- Sternberg, R. J. and Grigorenko, E. L. (1995). "Styles of Thinking in the School", *European Journal For High Ability*, 6, pp. 201-219.
- Sternberg, R. J. and Wagner, R. (1991). *Thinking Styles Inventory*, Tallahassee, FL: Star Mountain Projects, Inc.
- Stone Whisky, M. (2004). *Instruction for Understanding*, The Ministry of Education, The Branco Weiss Institute for the Cultivation of Thinking. (Hebrew)

- Strip, C. A. and Hirsch, G. (2000). *Helping Gifted Children Soar: A Practical Guide for Parents and Teachers*, Scottsdale, AZ: Gifted Psychology Press.
- Tannenbaum, A. (1995). "Learning Styles of Gifted Students", *Study Days on the Topic of Gifted Students*, 9, The Ministry of Education and Culture, pp. 24-36. (Hebrew)
- Tannenbaum, A. J. (1983). *Gifted Children*. New York: Macmillan.
- Terman, L. M. (1925). *Mental and Physical Traits of a Thousand Gifted Children*, Stanford, CA: Stanford University Press.
- Tishman, S., Perkins, D., and Jay, A. (1996). *The Thinking Classroom: Learning and Thinking in the Culture of Thinking*, The Branco Weiss Institute for Cultivation of Thinking, Jerusalem. (Hebrew)
- Von Glasersfeld, E. (1990). "An Exposition of Constructivism: Why Some Like It Radical", in R.B. Davis, C.A. Maher, and N. Noddings (Eds.) *Constructivist Views on the Teaching and Learning of Mathematics, Journal for Research in Mathematics Education*, (Monograph 4), pp. 19-29.
- Vygotsky, L. (1962). *Thought and Language*, The I.M.T. Press, Cambridge, Massachusetts.
- Vygotsky, L. (1981). "The Instrumental Method in Psychology", In J. V. Wertsch (Ed.) *The Concept of Activity in Soviet Psychology*, Armonk, NY: M.E. Sharpe.
- Vygotsky, L. (2003). *Heart, Thought, and Culture*, The Branco Weiss Institute. (Hebrew)
- Walberg, H. J. (1974). *Evaluating Educational Performance*, Berkeley, CA: McCutchan.
- Weinberg, Y. and Zohar, E. (2005). *The Development of Thinking – Challenge in Teacher Training*, Mofet Institute. (Hebrew)
- Winebrenner, S. (2001). *Teaching Gifted Kids in the Regular Classroom: Strategies and Techniques Every Teacher Can Use to Meet the Academic Needs of the Gifted and Talented*. Minneapolis, MN: Free Spirit Publishing.
- Winn, W. and Snyder, D. (1996). "Cognitive Perspectives in Psychology", In D. H. Jonassen (Ed.) *Handbook of Research for Educational Communication and Technology*, New York: Simon and Schuster Macmillan, pp. 115 – 122.
- Zedkiyahu, S. (1998). *Classroom Climate, Nature and Practice*, Ministry of Education and Culture, Jerusalem. (Hebrew)

- Zemmerman, B. and Pons, M. (1988). "Construct Validation of a Strategy Model of Student Self-Regulation Learning", *Journal of Educational Psychology*, 80 (3), pp. 284-290.
- Zilberstein, M. (2000). *Elements of a Learning Environment that Cultivates Self-Direction in Learning*, <http://www.levinsky.macam98.ac.il/arielam/hetrogeni/sviva.htm>
- Zilberstein, M., Berkovitz, A., Ginat, K., Emanuel, D., Karati, Y., and Shulman, A. (2001). *Cultivation of the Self-Directing Learner: Pedagogy of Case Literature*, Mofet Institute, pp. 7-31. (Hebrew)
- Zilberstein, M., Eyal, T., and Berkovitz, A. (1994). *Suggestions for Use of the Report of the Thinking Team on the Topic of the Cultivation of the Self-Directing Learner*, in the framework of the institutional inservice training courses in elementary schools, Tel Aviv University, The School of Education, the Unit of Scholastic Design in collaboration with the Ministry of Education and Culture, The Department of Elementary Education, July. (Hebrew)
- Zohar, E. (1996). *To Learn, To Think, and To Learn to Think*, The Ministry of Education and the Branco Weiss Institute for the Cultivation of Thinking. (Hebrew)
- Zohar, E. (2007). *Learning through Inquiry: An Ongoing Challenge*, Magnes Press, The Hebrew University, Jerusalem. (Hebrew)
- Zorman, R. (1993). *Giftedness*, The Division of the Gifted and Science Loving Youth, The Ministry of Education and Culture. (Hebrew)

Appendices

Appendix Number 1: The Model of Sternberg (1997)

The following table presents the model of Sternberg and its characteristics:

Category	Style	Characteristics
Function	Legislative	Likes to create, invent, design, do things in his own way, with little structure.
	Executive	Likes to follow directions, do what he is told, accept frameworks.
	Judicial	Likes to judge and evaluate from things and people.
Forms	Monarchic	Likes doing every thing in its own time and dedicates to it the utmost energy and resources.
	Hierarchical	Likes doing many things simultaneously according to priorities: what to do, when and how long, and what to allot to every thing.
	Oligarchic	Likes doing many things simultaneously but has problems determining priorities.
	Anarchic	Likes approaching problems randomly, hates any systems, guidelines, and constraints.
Levels	Global	Likes engaging in the whole picture, in generalizations and in abstractions.
	Local	Likes engaging in details, in concrete examples.
Scope	Internal	Likes working alone, focused on his inner self, self-sufficiently.
	External	Likes working with others, focused on outside tasks, dependent on others.
Leaning	Liberal	Likes doing things in new ways, challenges conventions.
	Conservative	Likes doing things in accepted and sure ways.

Appendix Number 2: Further Information on the Chamizer Method

General Background

Dan Chamizer has been the Israeli ‘Riddle Master’ for the past two decades. Chamizer’s preeminence in his native State of Israel is illustrated by the fact that his **surname** has become synonymous with quizzes, puzzles, original formats, and nationally organized treasure hunts. In the State of Israel, a “**Chamizer Riddle**” has become a *common term* for any game requiring wit and creativity to solve.

The admiration most Israelis across the nation have for Chamizer is attributed to his having driven the Israeli public crazy with dozens of riddles, games and innovative educational projects over his entertainment career to date including sending the Israeli public on massive treasure hunts all over the country.

Chamizer has created riddles and games for most Israeli daily newspapers and TV stations. Chamizer’s radio riddles have become a national institution in the State of Israel. The daily broadcast verbal conundrums seem at first to be impossible to solve and have often driven nuts Israeli puzzle enthusiasts trying to decode Chamizer's thought processes in order to become eligible to win ever-increasing cash prizes.

The questions are tricky. A recent example is: “Zvi is above her, and Nachum is below her.” The answer, which was worth US\$7,500, is: Golda Meir, prior to becoming the future Prime Minister of Israel, whose signature on the 1948 Declaration of Independence of the State of Israel appears between that of Zvi Luria and Nachum Nir.

17,000 school classes over the country have been exposed during the past five years to innovative teaching methods based around "Chamizer Riddle" problem-solving.

What Is a Riddle?

A **riddle** is a problem that is presented for the purpose of fun and as a thinking challenge. Sometimes the riddle is in a regular form, such as a crossword puzzle, but frequently it is not a matter of routine – and

this is its uniqueness, which transforms it from a problem into a riddle. A non-routine riddle requires a non-routine solution, although the boundary between the riddle and the problem is not always clear and sharp. A riddle sometimes appears to be non-routine only because of its special phrasing or because it is based on knowledge that the person is lacking. Sometimes a riddle is characterized by a solution that contradicts the person's intuition.

Riddles are of many diverse types. These types include the following:

- Maze: Riddles in which there is a rather complicated figure and it is necessary to find the path from one point to another point.
- Trivia: Riddles that test the person's knowledge. This type of riddle has been very popular in recent years in the framework of television game shows, such as, for example, "Who Wants to Be a Millionaire?".
- Mathematical riddles: Riddles that require mathematical ability for the solution and the use of mathematical instruments. For example, Yossi's father is older than him by 21 years. In another 6 years he will be 5 times as old as he is. Where is Yossi's mother?
- Logical riddles: Riddles that challenge the person's thinking ability and speed of thought. For instance, in a running competition you pass the person in second place, what position did you achieve? If you answered the first place, then the riddle succeeded in tricking you, since after you have passed the runner in second place, then you are in second place.
- Language riddles: Riddles that test the person's language ability. For instance, sentences may not have meaning of their own but represent certain language forms, as in the sentence 'Madam I am Adam', which is a *palindrome*; namely a sentence that can be read in either direction and remains identical.

What Is a Chamizer Riddle?

Chamizer riddles, unlike familiar riddles, most of which are fashioned around factual knowledge and/or logic, are based on the resources of associative imagination. Thus, by their very definition, everything is right. There are infinite possibilities of solution for every riddle and only one of them was chosen by the riddle master (as he sees fit). Therefore, an associative imagination riddle is analogous to the reality of life, in which every situation can be addressed in countless ways.

When the riddle asks “Who are the six of you who begin to surf”, every solution that is linked to six surfers at sea or on the Internet can be accepted. ‘I saw this morning six surfers is a legitimate answer’ but it is not the solution the author intended. His solution is WWW – which are six Us (yous) – that begin the surfing on the Internet.

Therefore, with the Chamizer Riddle every person can set sail to his domains of knowledge, imagination, and association and create a process of search and choice of a new type that ensures products of assimilation and acquisition of knowledge in an unmediated manner.

Appendix Number 3: Permission Letter to Principals

Dear School Principal,

In the framework of my position as the principal of the Gordon Center, a center for gifted and talented children, I am conducting a research study on the topic of *The Riddle as a Learning Educational Tool*. The students in your school use the Chamizer Challenges Method. Therefore, I would appreciate it if you would permit the questionnaire to be distributed among the students who participate in the Chamizer Challenges so that I can document the process of thinking and involvement of the students and the teacher. The findings of the research study will constitute an initial basis for further research studies on the development of thinking skills.

Thank you for your cooperation.

Hait Shaham

Appendix Number 4: The Research Questionnaire

Dear Student,

I am performing a research study on the use of the Chamizer Method. I would appreciate it if you can help me with my research by filling out this questionnaire.

Please answer honestly. Please indicate the response that best suits you (there are no 'correct' and 'incorrect' answers).

I am here to answer your questions – do not hesitate to ask me for explanations on the questions in the questionnaire.

Thank you for your cooperation.

Part 1: Background Information

What is your age? _____

What is your gender? Male / Female

What grade are you in? _____

Where do you use the Chamizer method? Gordon Center / School

What is your native language? Hebrew / Arabic / Russian / Amharic

Where were you born?

My code in the Chamizer Method: _____

The group name in the Chamizer Method: _____

Part 2

The following statements describe emotions and opinions on the class. For each statement please circle the possibility that appears to you to best suit your class.

Question	Not at all	Slightly	Sometimes	Greatly	Very greatly
1. The learning environment with us encourages the creation of original solutions.	0	1	2	3	4
2. The students evince great initiative in the search for the solution to the riddle.	0	1	2	3	4
3. During the lessons the teacher encourages me to solve riddles.	0	1	2	3	4
4. The students are happy to help one another solve riddles.	0	1	2	3	4
5. The teacher cultivates reciprocal help among the team members who solve the riddles.	0	1	2	3	4
6. The students enjoy offering new ways of thinking to their peers.	0	1	2	3	4
7. The teacher encourages every student to advance in his work at his own pace in the solving of riddles.	0	1	2	3	4
8. I like studying riddles even if I do not immediately find the solution.	0	1	2	3	4
9. I use the computer at my disposal to solve riddles.	0	1	2	3	4
10. I choose for myself the friends with whom I will work on the solving of riddles.	0	1	2	3	4
11. The students cooperate in the solution of riddles.	0	1	2	3	4
12. The students feel free to propose solutions.	0	1	2	3	4
13. I evince consideration of the abilities of other students who solve riddles.	0	1	2	3	4
14. The topics of the riddles inspire in me the desire to solve the riddles.	0	1	2	3	4
15. The riddle is written in a clear and understood manner.	0	1	2	3	4
16. The teacher encourages the investment of cognitive effort in the solution of the riddles.	0	1	2	3	4
17. In our class, during the solution of the riddles, there is close cooperation among the students.	0	1	2	3	4
18. I enjoy solving riddles.	0	1	2	3	4
19. I am satisfied with the computer station where I solve riddles.	0	1	2	3	4
20. It is nice to solve riddles in our class.	0	1	2	3	4

Question	Not at all	Slightly	Some-times	Greatly	Very greatly
21. In our class there is a pleasant social atmosphere.	0	1	2	3	4
22. It is important to use the Internet in the solution of the riddles.	0	1	2	3	4
23. Every group of students crystallizes for itself work procedures for solving riddles.	0	1	2	3	4
24. We work very seriously on the riddles.	0	1	2	3	4
25. The teacher is interested that every student in the class be involved in the solution of the riddles.	0	1	2	3	4

Who helps you solve the riddles? (You can circle more than one answer)

1. Me
2. Friends
3. Siblings
4. Parents
5. Other: _____

Were you surprised by the ability of other children to solve the riddles?

1. I was not surprised, they solve well, like I thought.
2. I was not surprised, they do not know how to solve, like I thought.
3. I was surprised, they solve better than I thought.
4. I was surprised, they solve less well than I thought.

Part 3

Question	Not at all	Slightly	Some-times	Greatly	Very greatly
1. I like coping with all types of riddles, even easy ones.	0	1	2	3	4
2. When I encounter a problem in the solution of a riddle, I prefer to try new methods.	0	1	2	3	4
3. I find that the solution of one riddle leads to the solution of other problems.	0	1	2	3	4
4. I like working without the counsel of others.	0	1	2	3	4
5. I like participating in brainstorming.	0	1	2	3	4
6. When I encounter a problem I use my ideas to solve it.	0	1	2	3	4
7. When searching for a solution to a riddle, I like to listen to the opinions of others.	0	1	2	3	4
8. I like situations in which everyone works together to solve the riddle.	0	1	2	3	4
9. I enjoy solving a riddle in which there are new things that were not in previous solutions.	0	1	2	3	4
10. When I encounter a problem in the solution of a riddle it is clear to me what is the order of the actions I must undertake.	0	1	2	3	4
11. When putting ideas into writing I use all that comes to my mind.	0	1	2	3	4
12. I like clear riddles.	0	1	2	3	4
13. I like focusing on one task at a given time.	0	1	2	3	4
14. I like riddles in which I can attempt solutions of my own.	0	1	2	3	4
15. When I attempt to reach a solution, I rely only on myself.	0	1	2	3	4
16. I do not like solving a riddle in the same way in which we solved a previous riddle.	0	1	2	3	4
17. I like changing the direction of thinking while searching for a solution to the riddle.	0	1	2	3	4
18. I like riddles that have a variety of solutions.	0	1	2	3	4
19. I like solutions that can be reached through regular rules.	0	1	2	3	4
20. I like to solve different riddles in the same way.	0	1	2	3	4
21. I like doing new things that I have not tried in the past.	0	1	2	3	4
22. I rely on ideas that succeeded in the past to succeed once again.	0	1	2	3	4
23. I like adhering to one main idea when I solve a riddle.	0	1	2	3	4
24. I like solving riddles in a team.	0	1	2	3	4

Appendix Number 5: Division of the Questionnaire Items into Elements of the Learning Environment

Element of Learning Environment	Question
Social Climate	21. In our class there is a pleasant social atmosphere.
	4. The students are happy to help one another solve riddles.
	12. The students feel free to propose solutions.
	13. I evince consideration of the abilities of other students who solve riddles.
	17. In our class, during the solution of the riddles, there is close cooperation among the students.
Learning Climate	2. The students evince great initiative in the search for the solution to the riddle.
	11. The students cooperate in the solution of riddles.
	19. I am satisfied with the computer station where I solve riddles.
	20. It is nice to solve riddles in our class.
	24. We work very seriously on the riddles.
Motivation to Learn	1. The learning environment with us encourages the creation of original solutions.
	6. The students enjoy offering new ways of thinking to their peers.
	8. I like studying riddles even if I do not immediately find the solution.
	14. The topics of the riddles inspire in me the desire to solve the riddles.
	18. I enjoy solving riddles.
Resources Management	15. The riddle is written in a clear and understood manner.
	10. I choose for myself the friends with whom I will work on the solving of riddles.
	9. I use the computer at my disposal to solve riddles.
	22. It is important to use the Internet in the solution of the riddles.
	23. Every group of students crystallizes for itself work procedures for solving riddles.
Teacher's Support	5. The teacher cultivates reciprocal help among the team members who solve the riddles.
	7. The teacher encourages every student to advance in his work at his own pace in the solving of riddles.
	3. During the lessons the teacher encourages me to solve riddles.
	16. The teacher encourages the investment of cognitive effort in the solution of the riddles.
	25. The teacher is interested that every student in the class be involved in the solution of the riddles.

Appendix Number 6: Division of the Questionnaire Items into the Thinking Styles

Thinking Styles	Question
Local Thinking Pattern	1. I like coping with all types of riddles, even easy ones.
	11. When putting ideas into writing I use all that comes to my mind.
	18. I like riddles that have a variety of solutions.
	2. When I encounter a problem in the solution of a riddle, I prefer to try new methods.
Performance Thinking Pattern	10. When I encounter a problem in the solution of a riddle it is clear to me what is the order of the actions I must undertake.
	12. I like clear riddles.
	3. I find that the solution of one riddle leads to the solution of other problems.
	13. I like focusing on one task at a given time.
Internalized Thinking Pattern	6. When I encounter a problem I use my ideas to solve it.
	4. I like working without the counsel of others.
	14. I like riddles in which I can attempt solutions of my own.
	15. When I attempt to reach a solution, I rely only on myself.
Externalized Thinking Pattern	5. I like participating in brainstorming.
	24. I like solving riddles in a team.
	7. When searching for a solution to a riddle, I like to listen to the opinions of others.
	8. I like situations in which everyone works together to solve the riddle.
Liberal Thinking Pattern	16. I do not like solving a riddle in the same way in which we solved a previous riddle.
	9. I enjoy solving a riddle in which there are new things that were not in previous solutions.
	21. I like doing new things that I have not tried in the past.
	17. I like changing the direction of thinking while searching for a solution to the riddle.
Conservative Thinking Pattern	23. I like adhering to one main idea when I solve a riddle.
	22. I rely on ideas that succeeded in the past to succeed once again.
	19. I like solutions that can be reached through regular rules.
	20. I like to solve different riddles in the same way.