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HARNESSING OF THE "NEW STUDY PROGRAM IN SCIENCES" FROM GENDER PERSPECTIVE IN ISRAEL

Specialty: 531.01. General Theory of Education

Abstract
of the doctoral thesis in Pedagogical Sciences

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REFERNCES OF THE RESEARCH

Timeliness and importance of the topic. Against the background of the political and socio-economic contemporary transformations, major changes of human habitat occur, affecting values and human relationships, determining daily life and behavior of women and men. International studies show a direct connection between sustainable economic development and women's empowerment [18].

We note that, in the last few decades, several discussions have been held referring to the importance of engaging girls in science and technology and creating conditions and modalities of learning, which would result in attracting more girls to study and practice science [1; 6; 20]. Several researchers invoke the necessity to strengthen gender equality and eliminating educational institutions barriers, noting the significant under-representation for girls and women in mathematics, science and technology in schools and on the labor market, indicate as determinants: stereotyped attitudes, "gender neutral" school practices, and social conditions while, maintaining traditions, reproduce stereotypes etc. [1; 57].

Meanwhile, the problem of access and participation of women and girls to education, training in science and technology is still one of the priority themes of international organizations. The strategic documents, outlining global policy on gender equality, for example the Beijing Platform for Action, the Resolutions S-23/2 and S-23/3 of the UN General Assembly, etc., include several references to science and technology. The UN Secretary General recognized, within the 55th session of the Commission on the Status of Women (2011), that providing opportunities for women to gain knowledge and scientific and technical skills is also an economic imperative [14].

To compete successfully in the global economy, countries need to develop the potential of all citizens, governments must ensure men and women equal opportunities in order to develop appropriate skills and their exploration. Given that high technology industries in Israel are the locomotive of economic growth and these require a quality personnel, for Israel is important to strengthen the teaching of science disciplines in order to qualify citizens, men and women, thus ensuring the functioning of the whole society.

However, as part of the second international study (1980-1989), in Israel, differences in the boys and girls results, from the 8th grade, have been identified, all in favour of boys. Israel could lose its relative socio-economic advantage in time, if there are no interventions in education.

In this context, these factors, together with other factors, led to the development, by the Ministry of Education in Israel, of a new program (curriculum) to improve academic achievement in science and technology. The program was aimed to redender more efficient the performance of students of excellence class (the reserve), pursuing the purpose of achieving a 20% eminent students, girls and boys in nine years [2; 59].

In implementing the program, in parallel with the progress, the existence of several limitations were observed, determined also by gender stereotypes. Thus, many teachers were faced, from the begining, with difficulties in valuing gender issues regarding the teaching process, the attitudes and valuation of girls and boys, during the lessons. The following limitations were mentioned: insufficient involvement/ motivation of girls to science and technology, the parents reluctance in guiding the girls to the referred discipline, the lack of gender-sensitive technology of teaching-learning/organizing extracurricular activities.

Therefore, a contextualized approach to the perspective/gender dimension in the context of the new program (curriculum) in science is important both for meeting the challenges of the education system, as well as to improve the performance of boys and girls in science and technology.

The situation description in the research area and the identification of research issues. Concept of gender harnessing in education is actively discussed worldwide. However, its practical implementation is determined by socio-cultural and political context of each country, taken

separately. We join the position of the researcher Bodrug-Lungu from Moldova, stating that, its establishment as a scientific field can be conceived only in the context of gender issue development in general and in particular, in psycho-pedagogical science [12].

In Israel, as in other countries, including Moldova, gender studies have gone through several stages of formation and development. Conventionally, works dedicated to gender equality in Israel can be classified as follows:

a) General publications, with theoretical and practical approaches to the topic/policy analysis and documents addressed to ensure gender equality: P.Steinberg [62; 63], H.Tzameret-Kertcher, Y.Basin, O.Glybchenco [64] N.Teshner [69] etc.

b) Publications dedicated to education, which lists some additional genders elements: M.Barak, Y.Ofarim [9] etc.

c) Publications where gender aspects of education in science and technology are researched: V.Lavy and E.Sand [31], S.de Cheveigné [15], A.Baram-Tsabari and A.Kaadni [7], C.C.Miller [36], H.Ayalon [5], Y.Fridler, P.Tamir [21], P.Tamir [65], S.Bachar [6], O.Nissel [39-47] etc.

We note the appearance of works that explores Judaism doctrine in the light of gender. However, beyond the attention paid to the subject of gender equality, gender exploration theme in education is underdeveloped, especially in science and technology. Approach specific of the gender equality topic is strongly influenced by socio-political, cultural and religious context.

In Moldova the gender aspects of education is the focus of several researchers. Thus, the theoretical and methodological foundations of gender education in education institution are analyzed in the works of V.Bodrug-Lungu [12] L.Handrabura [23]; family gender education is approached by T.Mutu [38]; maternity education researched by N.Ovcerenco [51] etc. The experience in this field has an unique interest for comparative studies.

Internationally, prominent among specialists who have contributed significantly to the development of women's studies / gender studies, reported directly or indirectly to education, are to be mentioned: S.Bem, A.Eagly, E.Maccoby and C.Jacklin , G.Weiner, M.Arnot, C.Paechter, M.Penn etc. Stressing the growing interest of specialists in the gender and education topic, it is noted a shortage of works on the subject of gender equality in education for science and technology.

Gender studies from several countries show that educational institutions are social entities deeply marked by gender rules and stereotypes, which makes gender patterns are very important for the formation and the integration of the individual in society [12; 1]. Traditional cultural models on femininity and masculinity, reproduced by the school through training/education, often put limits on the effective socialization of the young generation.

Considering the above said, it is obvious that education, as a pedagogical phenomenon, and the education system in general, require a re-evaluation of the mentioned contradictions and an adjustment of concepts and methodology related to the introduction of the gender dimension in the school curriculum.

Appreciating the importance of the theoretical and practical research conducted, we can mention, however, that certain aspects of the problem remain still little explored. So, the problem of this research lies in the exploration of new education program in science and technology from a gender perspective in order to improve students' performance.

The aim of the research is theoretical and praxiological foundation of the Methodology of implementation of the new program in science from a gender perspective in educational institutions in Israel.

The research objectives:

1. To analyze the evolution of the science programs in Israel, in the gender context.
2. To establish the connections between the curriculum in science, gender and students' performance.

3. To determine the training components of the new science program in order to integrate the gender dimension.
4. To develop the Methodology of implementation of the new program in sciences from a gender perspective.
5. To experiment and validate the Methodology of implementation of the new program in sciences focused on gender achievement.

Research methodology includes: theoretical methods (scientific documentation, comparative analysis, generalization, systematization); empirical methods (questioning, observation, pedagogical experiment); mathematical and statistical methods of data processing.

Scientific novelty and originality of the research lies in:

1. Determine trends in the development of school program (curriculum), on a historical level: prioritization of science and technological disciplines based on objectives, diversification of teaching-learning methodology, motivation and stimulation of the interest in learning.
2. Identifying the determinants factors of implementation of the new program in science from a gender perspective: insufficient motivation of students to study science and technology, the discrepancy concerning the attitude of boys and girls to science and technology, low level of professionalism of teachers in guiding girls and boys into learning the subjects in question.
3. Establishing pedagogical opportunities of the new science program in order to achieve gender's procedural framework: individualization and diversification objectives, complementing the subjects/learning units with specific and motivating information for girls and boys, orientation towards active/interactive and cooperative learning.
4. Developing the Methodology of implementation of the new program in science from a gender perspective, focused on: a Constructivist approach to learning, Instructional Model to encourage girls students in science and technology, a Profile of excellent teacher who is gender-sensitive, a Instructiv Model for parents.

The scientific problem solved in the investigated area lies in the theoretical and praxiological Methodology of implementation on the new program in science and technology from a gender perspective, ensuring the reduction of gender stereotypes and prejudices with regard to the respective disciplines, but also, ensuring the efficiency of students' performance.

The theoretical significance is provided by:

- Developing educational curriculum theory by mainstreaming of gender dimension in the units/disciplines in science through integration, merger and complement of the structural components of the respective areas.
- Conceptualizing gender dimension in implementing the new program in science and technology, focusing on preventing and overcoming the stereotypes and prejudices of gender, related to attitudes and learning of disciplines in science and technology by girls and boys, and ensuring the students success and performance.
- Theoretical and praxiological modelling of the methodology of implementation of the new program in science and technology from a gender perspective: constructivist approach, curricular approach, technology approach in interaction with gender.
- Developing the concept of career guidance for girls and boys within the science and technology study of real disciplines by discovering and developing their personal skills for professions related to science and technology.

The main scientific results submitted for defense:

1. Gender prioritization, within the implementation on the new program in science and technology, is determined by socio-cultural, economic and educational environment in Israel, as well as trends in educational policies connected to gender equality.
2. Making the connection between the "new science program", gender and teaching strategies is a prerequisite and important factor: 1) learning motivation for girls and boys, 2) reduction

of gender stereotypes and prejudices in teaching-learning-assessment in science and technology disciplines, 3) career guidance for girls and boys, 4) obtaining higher academic results.

3. The Methodology of implementation of the new program in science and technology from a gender perspective is a paradigmatic construct consisting of components / patterns in interaction: theoretical component - constructivist approach; curricular component – gender integration; educational component - strategies to encourage girls students, students activity strategies, students advancement strategies; community component - including the family; psychological component - providing success.
4. Development of the Methodology of implementation of the new program in science and technology from a gender perspective is conditional upon: the preparation/special training of teachers, but also the creation of psychological conditions and effective communication in educational institutions.

Implementation of scientific results. Implementation of research results was done on the basis of experimental research; through notes at international conferences, scientific publications, practical activities. Experiment finding was conducted on a sample of 93 students. The formative experiment involved 54 students - 29 boys and 25 girls from reserve class in science and technology, of two junior high schools from Jerusalem (the experiment being carried out over three years). Also, activities were conducted, involving 10 teachers from science profile classes and 5 managers. The research results are implemented in some educational institutions in Israel, were included in the program of teachers training. Some conceptual and praxiological benchmarks of the subject were reflected in 9 publications (including 2 in Israel), being presented in 4 international conferences.

Approval of scientific results. Basic dissertations of ongoing research and conclusions are reflected in scientific articles and notes presented at the national and international scientific conferences in Israel and Moldova: International Scientific Conference "*Modern School: Challenges and Opportunities*", 5 to 6 November 2015, the Education Sciences Institute, Chisinau; the International Science Conference *Education efficiency - vector of modern educational policies*, 11 to 12 December 2014, the Science Education Institute; International Scientific Conference *INTEGRATION THROUGH RESEARCH AND INNOVATION*, 28-29 September 2013, Moldova State University etc. The results were presented at the teachers Congress dedicated to science teaching, which took place in the Pisga centre in Jerusalem; Annual's Congress of junior high school Teddy Kolek in Jerusalem and within a meeting of teachers trainers at a meeting of Jerusalem district.

Volume and structure of the thesis. The content of the PhD thesis includes 141 pages of basic text, including annotations (in Romanian, Russian and English), introduction, three chapters, general conclusions and recommendations, bibliography of 213 titles, 9 tables, 39 figures, 10 annexes.

Keywords: gender, difference between boys and girls, gender sensitivity, gender mainstreaming, gender-sensitive career guidance, motivate/encourage girls, rezerve class in science and technology, scientific-technological qualification and promotion degree, the new program (curriculum) in science and technology in Israel, "gender friendly" school.

THE CONTENT OF THE PhD THESIS

In the Introduction, the timeliness and the importance of the research topic is substantiated, the research issue is brought up and the solution alternative proposed, the purpose and the objectives are specified, the epistemological benchmarks of the research, the application and scientific value of the research is presented, confirming the theoretical and methodological novelty and scientific originality of the investigation.

Chapter 1, "Theoretical references of the evolution of the program in sciences", provides a theoretical synthesis regarding the historical and conceptual evolution of the program (curriculum) in science in Israel, outlining key periods and explaining the progress and the limitations within the education system.

Israel was founded in 1948, science teaching (science subjects) was enacted by the Israeli Knesset in 1953 [24; 25]. Since then and until now, science teaching programs were modified and promoted without considering the science and technology as integral units, as applicable aspect, based on scientific principles appropriate to students age and gender particularities [40; 3]. In the last decade, the education system was characterized by deficiencies in science and technology, being called " the lost decade" - 10 years in which Israeli students have studied only half the hours of science study, technological schools being closed, budgets for research reduced to 15% versus 23% in OECD countries [3; 20; 69].

Meanwhile, in the second international study (1980-1989), in Israel, differences in the boys and girls results, from the 8th grade, have been identified, all in favour of boys. In the age group of 12th grade, students specializing in science - biology and chemistry, differences between boys and girls performance were not identified [2; 5]. Out of 41 participating countries, the biggest differences in performance between boys and girls in science were recorded in Israel (TIMSS 1996). This required changing the curriculum, the teaching methods, the activities and teaching materials in the age group of 7-9th grade, which would attract more girls and increase their interest in these fields [57; 58; 66].

The rate of eminent Israeli students in science and mathematics was only 6% (calculations based on international data from 2007). The level of Israeli students achievements in science and technology has long-term implications, such as high-tech industries, which contributing to economic growth, are based primarily on the quality of staff. A significant period, the education system was not concerned about the problem of eminent students rising rates and the number of girls in science and technology, the explored hypothesis being that outstanding results are the expression of innate talent. This has resulted in the necessity to increase the rate of eminent pupils, both girls and boys, within a program called "scientific and technological excellence reserves" and developing the scientific qualification and promotion diploma [57].

To this end, a new program in science was developed in 2009, with the following objectives: improving results internationally and nationally, increasing the number of sciences and technology teaching hours, with a budget of 400 million NIS (New Isreal Shekel) for a period of two years, increasing the number of students studying physics and creating special classes of excellence. In 2010, the first science and technology classes of excellence (the reserve) were opened in Israel. In this research, participating classes are the ones who started learning in 2011 to the present.

In the 21st century, on the background of scientific-technological innovation development, nano-science and technology should be exploited, both at the university level as well as at school level. To identify the level/status of Israeli students compared with their peers in other countries, data from the international study TIMSS were analyzed, which evaluates the knowledge of science 8th grade students in each country-participant (every four years). Israel participated in this study 5 times since its launch in 1995 until 2011.

Following the changes in the curriculum in 2009, students' results in TIMSS test in 2011 have improved. Israel is the 9th from 42 countries in science and has a 5% rate of talented students and 13% rate of eminent students [42].

This chapter includes a comparative analysis of the science study programs in Israel, the UK and Finland. Research of national and international practices in this area was necessary, serving as a reference framework of our concerns to the implementation of the program (curriculum) in science and technology from a gender perspective. With reference to Moldova, stressing the importance of transferring knowledge and experiences in the relevant field, pointing out the gender equality expertise exploration in education in Moldova, following this research, we find some

benefits for the educational system in Moldova. Thus, according to the researcher N.Birnaz from the experience of implementing the program in "Sciences and Technologies" in Israel the following aspects can be useful for the educational system in the Republic of Moldova: the conceptualization of an integrated school discipline "Science and Technology"; the experience of the education system in Israel in preparing students for PISA assessment etc.

At the same time, we come up with an overview of science education evolution over the years; of three basic approaches to gender equality in science and technology education, as follows: "gender neutral" education, "women friendly" and "gender-sensitive". The table ‚Approaches referring to science education' (Table 1), provides basic indices, with the benchmark ideas of A.Sinnes [61]. This approach analysis enables not only the understanding of why women are underrepresented in science, but also to identify intervention strategies in the educational system.

Table 1. Approaches referring to science education (through gender prism)

Approaches	**Curriculum**	**Educaţional Materials**	**Teacher's Profile**
a "*gender neutral" science education*	Curriculumul a "gender neutral" not include express the interests of girls and boys; apparently it is addressed to both sexes without any difference. Gender neutrality may be a last resort a form of sexism.	- Abstract illustrations clearly predominant (no people). - There is a major gender discrepancy between successful models promoted. Textbooks abound with famous men. - Is induced gender segregation rather than collaboration etc.	- Pay apparently equal attention to girls and boys in the class without specifying gender-specific needs - View the traditional models in science (men), resulting in involuntary reproduction of prejudices and stereotypes etc..
a "*female friendly" science education*	Curriculumul: - Oriented specifically to women / with a focus on women - It includes the manner in which girls learn science - Responsive to feminist critique of science and incorporates the contributions of women and other oppressed groups etc.	- Built on specific interests and experiences of girls - Incorporating scientific knowledge developed by women - Presents models of women in science etc.	- It is responsive to the special interests of girls and sensitized about the manner in which girls learn science - Teach in small groups / separating girls and boys - Creates a non-competitive environment in science class - Connection between science education and girls' experience outside the school etc.
a "*gender sensitive" science education*	Curriculumul: - Adjusted to the wide range of interests of girls and boys - Reflects the social, political and psychological aspects of science - Incorporate other systems of knowledge etc.	- Reflects the differences in interest for science - View the relationships between science and society and the impact of social and political factor on science - Include sciences developed by minorities and viewing other cultures and differences between different types of scientific research / Promote gender collaboration etc.	- Based on the experiences of boys and girls / apply constructivist teaching methods / equal opportunities for g / b in laboratory - Specifies that scientific knowledge are constructed by humans and therefore influenced by its creators women and men - Introduce questions about gender, race, class, when relevant etc.

Gender concepts epistemology, gender sensitivity in education was set up based on gender ideas and theories, accepted today in socio-human science: the theory of social gender construction (C.West, D.Zimmerman [73]); gender scheme theory (S.Bem [11]; feminist pedagogical ideas (M.Arnot [4] Frances A.Maher [34]; theory of social gender roles (A.Eagly [19]). As conceptual

research benchmarks served also the ideas and recommendations of UNESCO, the UN, the Council of Europe and other international bodies on gender equality and in particular, the education of the young generation from a gender perspective, in the context of the contemporary world transformations. There were also explored some aspects reflected both by researchers from Israel (V.Lavy and E.Sand, S.de Cheveigné, A.Baram-Tsabari and A.Kaadni, C.C.Miller, H.Ayalon, P.Tamir), and from Moldova (V.Bodrug-Lungu, L.Handrabura, T.Mutu).

In the opinion of specialists, the gender is involved in science and technology education (STE) in different ways. A set of problems is related to the low participation rates of boys and girls in science, technology and professional education programs [1; 22].

Literature review shows a gradual journey, not at all easy, of gender exporation in science, including in STE. Since the late 70's and early 80's of last century the first works appear, which in one form or another, have addressed gender issues. Most of these studies have been devoted to gender differences or use of "sex" as a correlated variable to cognitive capacities considered critical for success in science. The 1990s brought other accents, namely, on science in school: the use of instructional strategies more "friendly to girls", exploring ways of raising the girls interest in science, eliminating the marginalization of women in science. The mentioned period was also a breakthrough in terms of "gender" official recognition as a crucial aspect in science education [8]. Along the way, the implications of gender, gradually, began to be correlated with other variables such as age, race, class, language, culture, religion. Beyond the positive trends in exploration of the subject, the importance of gender equality in science education remains extremely important, especially in the context of socio-economic transformations, scientific-technical achievements, both globally as well as nationally.

Chapter 2, "Theoretical and methodological approaches of the "new program in sciences" from a gender perspective", is focused on the analysis of the new science program. We invoke new categories such as scientific promotion diploma and the structure of the reserve class in science and technology, observing the way of teaching sciences and advanced technologies in Junior High School, with particular focus on gender - involving boys and girls. Theoretical approaches in learning are presented: Constructivist approach, Bloom's taxonomy model, gender-sensitive career guidance/ gender based approach.

We note that the program prepared by the Ministry of Education was structured on long-term objectives and goals. The Intel Company and the Ministry of Education declared their cooperation in the technology education advancement program in Israel. This one is a long term investment in the advanced technologies industry development, which is a vital ingredient in Israel's economy. The "scientific-technological advancement reserves" is an innovative program, guiding the students to advanced disciplines in science and technology, and paving their way to become leaders of future generations. Technion has recognized the importance of the program and have given higher awards to graduates (July 18, 2012) [67], with preference for schools that attract the largest number of girls in the program [58]. The goal of the program is the significant increase of eminent students in science and technology rate, the qualification of high school graduates with a diploma of excellence in advanced science and technology by including objectives achivement instruments and increased attention on girls.

The new degree program focused on creation of reserve classes in science and technology has created a trend of positive change in many aspects - the layout study, attracting girls, increasing the choice of advanced scientific disciplines in school, improving the outputs and the demand to study in such a class.

However, the implementation of the program identified a number of problems: insufficient motivation of students to study science and technology, persistent disparities between girls and boys in motivation and learning, difficulties in teachers' activity for training girls and boys, insufficient motivation of parents in guiding girls to choose technology programs. In this regard,

through various strategies, we have contributed to improving the program achivement presented above, from a gender perspective.

The research includes the examination of multiple investment usefulness in reserve classes in science and technology. It also focuses on determining ways to attract / motivate students, promotion and knowledge of students in the science study, with a particular focus on girls. The study determines the way of teaching science (science subjects), adjusted to the 21st century trends and students needs. Also, there were identified ways/approaches required to support and encourage girls to choose, without limitations, science disciplines as advanced science. Among the contributions is the increased number of girls in reserve science and technology classes (especially studying physics). Teachers receive special information to support students, but especially girls, to study science disciplines, aiming to improve students' results, underlined by the success in international tests - obtaining places of honor. Also, the research has focused on the evaluation of preferred teachers' teaching styles of attracting students to study the subject. Various tools were offered in capacity building to teachers in order to become the best and the most interesting that will correspond to the system and students wishes; learning various strategies to diversify teaching methods, motivation and keeping the students interest, but particularly their gender awareness.

The study covers boys and girls education, exploring several aspects. This is why we have presented and developed some basic concepts.

The gender dimension is established in various socio-cultural contexts determining the expectations, permissions and appreciation of women/men and girls/boys in these specific contexts. The gender dimension is institutionalized through the educational system, political and economic system, legislation, culture, religion and traditions.

According to international standards, mainstreaming gender approach is the (re) organization, improvement, development and evaluation of policy process, so that the gender equality perspective is incorporated in all policies at all levels and at all stages by the actors involved in the policy development [56]. In the context of the above, from our point of view, *the gender perspective in science education is presented as an integral dimension of the development, implementation, monitoring and evaluation of educational programs, in order for girls and boys to benefit from them equally, curriculum and learning materials and school environment should be sensitive to gender-specific needs of students, without preserving inequalities/limitations, based on sex.*

Gender roles, attitudes and behaviors are learned through socialization/resocialization; being flexible, they are subject to changes depending on many political, socio-economic and cultural factors, that play a decisive role in preventing negative psychosocial phenomena such as violence and discrimination based on gender, and inferiority complexes. Through the exploration of gender equality in education subject, the school offers girls and boys patterns of behavior to develop their potential, to identify needs and aspirations, career guidance.

Empowering women/girls with scientific and technical knowledge and skills is also an economic imperative. As science and technology develops, the world economy needs qualified workforce. Developing skills in women/girls will expand the reserve of human resources available to perform these tasks. Moreover, environmental concerns lead to the development of so-called ecological jobs, many of which will require a solid educational background in science or technology.

The above mentioned features provide unquestionable arguments in favour of the involvement of girls in science and/or technology. At the same time, the trend to promote the "Gender Frendly" School concept (UNESCO) worldwide, require significant efforts to transform gender stereotypes and prejudices and to eliminate the gender inequalities in all educational institutions and to promote equal opportunities for girls and boys.

In light of the above, we come with the development of basic concepts. Upon acceding to the position of the researcher V.Bodrug-Lungu, being that the gender dimension in education is a

formative educational approach through a series of actions that are based on considering specific influences related to the formation of boys and girls through the educational policies and training for preventing and overcoming gender stereotypes [12], we propose the supplementing, *by attracting girls and boys in science and technology through encouraging and exploiting their potential.*

From our point of view, *gender sensitive education in science represents the process of ensuring equal access of girls and boys to science, of opportunities for development of personal potential by applying methods of encouragement and eliminating gender stereotypes from the curriculum, teaching materials, and from the whole study proces.*

However, we reiterate the term "gender", which involves analyzing the impact of education system influences on the development of boys and girls, their awareness of their own gender identities, ideals and vital goals selection, status in school environment, having as reference the biological sex of individual [12; 39].

Meanwhile, based on existing studies in the field [4; 12; 14], we would like to specify *the main elements aiming gender in education:* access to education (girls/boys); learning content (gender patterns, specific motivating exercises etc. in textbooks, teaching materials); forms and ways of organizing education (involvement of girls/boys, in separate classes/groups or mixed etc.); ways of assessing knowledge (attitudes, assessment of students on grounds of sex, etc.); characteristics of the teachers in charge of the education of girls and/or boys (percentage of women/men, their gender sensitivity, personal and professional level of stereotyping etc.); gender sensitive climate (physical, informational, relational) of educational institutions etc.

The new program in science and technology includes, among its objectives, encouraging girls to study science and technology. Thus, girls selected from different schools in Jerusalem had the opportunity to participate once a week to the course of empowering "Alma" (extracurricular), after which it was concluded the need to include a gender perspective in the educational process, especially in the study of science and technologies. These findings prompted our decision to deal entirely with this topic. In order to ensure the implementation of the new science and technology program by ensuring the introduction of the gender perspective, we have focused our efforts on the design and the development of gender exploration methodology in teaching, learning and assessment, which was expressed conventionally, through a series of instructives models as follows: Constructivist approach to learning, Instructional Model to encourage girls students in science and technology, a Profile of excellent teacher who is gender-sensitive, a Instructive Model for parents.

The methodology is based on the fundamental principles, aiming the educational process, by taking into account gender specific. In this regard, we have followed the principles proposed by V. Bodrug-Lungu [12] and developed them (in italic): the principle of non-discrimination based on sex; *the principle of using non-sexist language;* principle of equal treatment of girls and boys, *with spotlight on socio-cultural and religious context;* the principle of gender positive experiences exploration and feelings of capable learners; the principle of knowledge and consistent promotion of gender equality in the context of human rights and fundamental freedoms; the principle of fundamental human values unity, national values, gender values; the principle of gender equality respect at personal and society level; the principle of optimal matching of psycho-physiological and gender aspects, socio-political, cultural and spiritual education - ensuring the complex approach of a person to the education process; *the principle of strengthening the self-esteem, relevant for girls; the school partnership principle - gender sensitive family training and career guidance for girls. The gender dimension, with reference to the exploration of the new degree program in science and technology relates in preventing and overcoming gender stereotypes and prejudices regarding the attitude and learning of science and technology subjects by girls and boys, but also ensuring the students success and performance.*

We propose an Instructive model to encourage girls students in science and technology, which includes the following strategies - components, pursuing the purpose of raising gender equality awareness in the classroom (Figure 1), as follows:

1) Setting a high standard of expectations towards girls, the same as for boys.

2) Encourage girls to participate at the same level activities as boys.

3) Provide equal assistance and feedback to girls and boys.

4) Encourage girls to use the technological means and equipment as much as boys, participating in activities and experiences in the field.

5) Girls tend to a more passive learning than boys. Thus, create a balance between work content and activities based on cooperation.

6) Use a non-sexist language within the lessons.

7) During advanced lessons in a laboratory, the recommendation is to strengthen prevention and safety measures in case of emergency, to review the studied material at the beginning of each lesson, to organize meetings with female scientists who practice in areas traditionally considered as male dominated.

8) Organizing classroom activities that are based on cooperation and spatial perception.

9) Assisting students to express and clarify feelings and thoughts in writing.

10) Encourage girls and their cooperation in science and math activities outside the study environment / strengthening self-esteem (leadership).

11) Classroom atmosphere should be calm and pleasant/friendly in terms of gender. Creating a gender-sensitive educational environment (in school, classes) whith demonstration materials, stands, posters etc. containing messages/role models of both genders, and not reproducing stereotyped and sexist messages.

12) Organizing the "Peak Day" to facilitate girls meeting with scientists from the relevant fields. The day is dedicated to girls' empowerment in order to attract them to science through the creation of a communication zone with women in science, using lectures, role plays, exploring professions, economic status from a gender perspective.

13) Appropriate pause: wait 4-5 seconds after addressing the question, before choosing a female student to answer. Girls sometimes need more time to formulate a complete response compared to boys.

14) Encouraging girls to study and engage them in science and technology, carrying out various activities and programs such as visiting Intel, science museums, meetings with scientists, working with Google, etc.

15) At the beginning of each lesson to summarize the previous lesson and establish a connection with the following teaching material in order to facilitate its assimilation more swiftly.

16) Using encounters between different classes of boys and girls. Prepare works and tests involving girls and boys. Encourage girls to speak in class, in front of other students. Organising mixed group activities of 2-3 girls and a boy, etc.

17) Establishing a connection of subjects with everyday life issues, so that the material would be less abstract and more accessible, problems can be more easily understood through concrete examples.

These strategies have been and continue to be applied in the gender sensitive trainings for teachers in science and technology reserve classes in order to consolidate the position of girls and to involve them in science since the 7th grade till 12th grade and additionally to school program [39].

Thus, the introduction of gender in children's education means to build into the child's development and education, his personality and individuality beyond the traditional vision of sex, giving him more freedom of choice and self-realization.

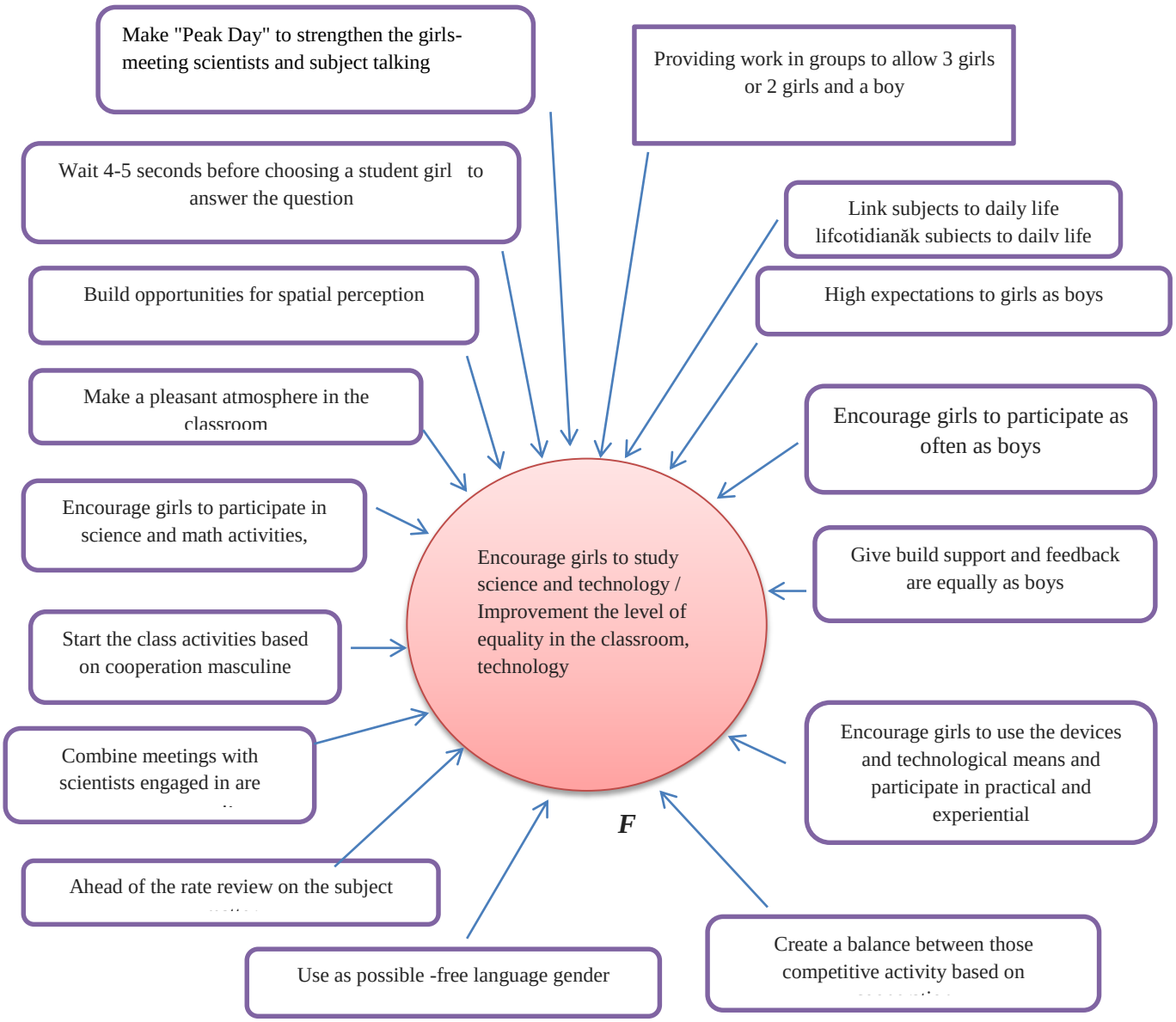

***Figure* 1. Instructional Model to encourage girls students in science and technology**

We note that several training modalities were applied: on student's level (activities, exercises with girls and boys) within lessons and breaks; on teacher's level (gender sensitive trainings); on parents' level (gender sensitive activities).

The above model manifests itself through outlined results on specific dimensions: improving the teachers' activities, greater involvement of girls in science and technology, higher efficiency of reserve classes in science, diminishing stereotypes, impact on services within the educational institutions.

Within the training activities with teachers in Junior High School, the Instructive Model has been validated to encourage girls students to study science and technology, it has been developed through exploration of several strategies, including, that were applied in Moldova. Thus, through the transfer of knowledge and experience, a successful praxiological combination of international standards and national context was ensured. As training, we applied this Model -Program among teachers involved in continuing education courses.

To reiterate the importance of the school - family - student partnership [16], we propose the instructive model for parents as "providers of success", which includes technical support in relation to the support and career guidance of students (for boys and girls). We conclude that the motivation of girls and improving their performance in science is directly proportional to the parents' involvement in the learning process, thus, becoming "providers of success."

In this regard, we note the importance of gender sensitivity of parents, especially of girls. Thus, within the parents training program, several topics were addressed: gender equality, transformation of gender stereotypes, needs/specific interests of girls and boys in the educational process, the self-esteem and the success in school, successful models of women in science/visits, meetings with women in science etc. Considering the impact of parents [68; 74] on the choice of disciplines (notably science and technology) and on the girls and boys decision with regard to career, we have decided to explore the subject of "gender-sensitive career guidance".

Thus, in our work the term of *"gender-sensitive career guidance" refers to the process of supporting girls and boys to make an appropriate choice of disciplines that will form the basis of their professionalization by harnessing individual potential, strengthening self-confidence and overcoming gender stereotypes with reference to sciences.* This process includes multiple actions starting with information to counselling and support (including psycho-emotional) to determine the possibilities and interests, mainly of girls, forming capacities in decision making with regard to livelihood strategies and future career.

In this context, we reiterate another key issue - gender sensitivity of teachers. Besides the fact that every teacher must be a professional in educational field, he should understand the specific needs of girls and boys, apply appropriate working strategies to create a non-discriminatory relationship teacher - student, but also girls - boys relationship. In our view, teacher's gender sensitivity [12; 39] represents the ability to include gender in its activity, *the ability to apply alternative strategies to patriarchal dominant stereotypes, which should encourage boys and girls to education, based on their practical and strategic needs, giving them real opportunities to develop interests and potential.*

Based on the science teacher's dimensions and working strategies study, we have built the Teacher's profile in science and technology reserve class gender-sensitive.

This research uses "constructivist approach" [28; 29; 32] and "knowledge structuring". Constructivism is a term for philosophical, psychological, pedagogical, sociological and methodological approaches. The common element for all approaches is that knowledge is rather constructed than discovered or supplied. This is a claim generally interpreted and applied in various disciplines, which is linked to the names of several philosophers and researchers from different fields (eg Kant, Piaget, Vigotzki). There is a transition from frontal traditional teaching to constructivist teaching [30; 44] and the constructivist approach unites the psychology and philosophy of learning. Student's learning skills develop simultaneously with the development of knowledge and each step is based on a previous stage of interaction with its environment in an active process.

Today, in the 21st century, technology provides the means. In the past, unrelated to pedagogy, the education system was set up with new technologies that were separated from the philosophical and psychological principles. The system "followed" the technology that began to take over teaching, demanding educational philosophy and psychology to adjust. In the new science program in 2009, a combination of the three fields was achieved. The philosophy provides the guideway, the psychology offers basic learning principles and the technology provides the means to achieve them [27]. The teaching which is based on "learning through research and projects" is more effective. The research occurs in an interesting way, with the involvement of students in accordance with their development skills and their empowerment [40]. In this process, the teacher has the role of an instructor rather than a supplier of knowledge (the knowledge is vast and discovered through technology). Since learning is based on a constructivist approach, learning

is significant and experiential for the student. Learning is based on the research achievement, which arouses curiosity and understanding the research stages. In this learning process, an interpersonal relationship is formed between teachers and students that will enhance student's interest towards science. This connection will encourage the student in future and will help to select advanced subjects in high school.

The basic idea of the research regarding the new science program created a trend of positive change in the content of the studies [41]. High motivation to study [27; 76] reduces the gap between boys and girls in class, on the basis of creation of the reserve class in science and technology, aimed at choosing science as an advanced discipline in high school, with a particular focus on physics. Given the purpose of the new study program, sets were developed for teachers - E.T.L. kits - Evaluation, Teaching, Learning [46; 71]. Kit contents, teaching sequence and details of the evaluation tasks are based on Bloom's Taxonomy [17; 47; 48; 49; 75], addressing gender. Given that the new study program aims to cultivate students' research skills, they become independent scientists [12]. As a result, students develop scientific thinking, the connection with the subject and will want to work in future in this area.

After implementing the new science program, a significant improvement in student's success was ascertained, reflected in national and international test results. It was created uniformity in study subjects, and reserve classes in science and technology opened. The difference between eminent girls and boys results became insignificant. The number of students, who enroll in science and technology studies, has increased. The number of girls who enroll in physics study has increased. The motivation of students is high and largely influenced by parents. The presence of the child in such a class is the realization of parents' dreams. Also, most teachers have excellent results and dream to teach in such a class, motivated by challenges and interests and by the fact that students are more disciplined and more interested in learning.

Thereby, we can say that the *Methodology of implementation of the new program in science from a gender perspective constitutes a series of interrelated models, focusing on encouraging girls students in science and technology, raising gender awareness of teachers and parents, constructivist approach in teaching and learning, organized on the basis of general principles of gender sensitive learning and gender sensitive socio-educational conditions, psycho-physiological and social characteristics of students, with the educational purpose of performance/advancement improvement of girls and boys in science and technology.* Thus, the Methodology of implementation of the new program in science from a gender perspective includes: Constructivist approach to learning, Instructional Model to encourage girls students in science and technology, a Profile of excellent teacher who is gender-sensitive, a Instructive Model for parents (Figure 2). However, the purpose of education is presented as a precondition for setting up a society with high level of advanced technologies development.

Chapter 3, "Experimental approach to improve the performance of boys and girls based on the new program in sciences", proposes an experimental approach to verify the hypothesis that states that the connection between "new program in sciences", gender and teaching strategies is an important factor, namely: learning motivation in science for girls and boys; diminishing gender stereotypes in learning science and technology disciplines; career guidance for girls and boys, developing methodology that will contribute to achieve the highest academic results/ girls and boys advancement in science and technology.

The finding experiment involved 93 students, and the formative one - 54 students (29 boys, 25 girls) from two high schools in Jerusalem from the 7th, 8th and 9th grades, who were studying in reserve scientific-technological classes, as well as 11 teachers and 5 managers.

Through the questionnaires, opinions of students, teachers and managers were identified with reference to several components of the educational process: teachers' characteristics from scientific-technological classes (in the light of teachers, students and managers); the teaching-learning process; the results being used for optimization of the study process.

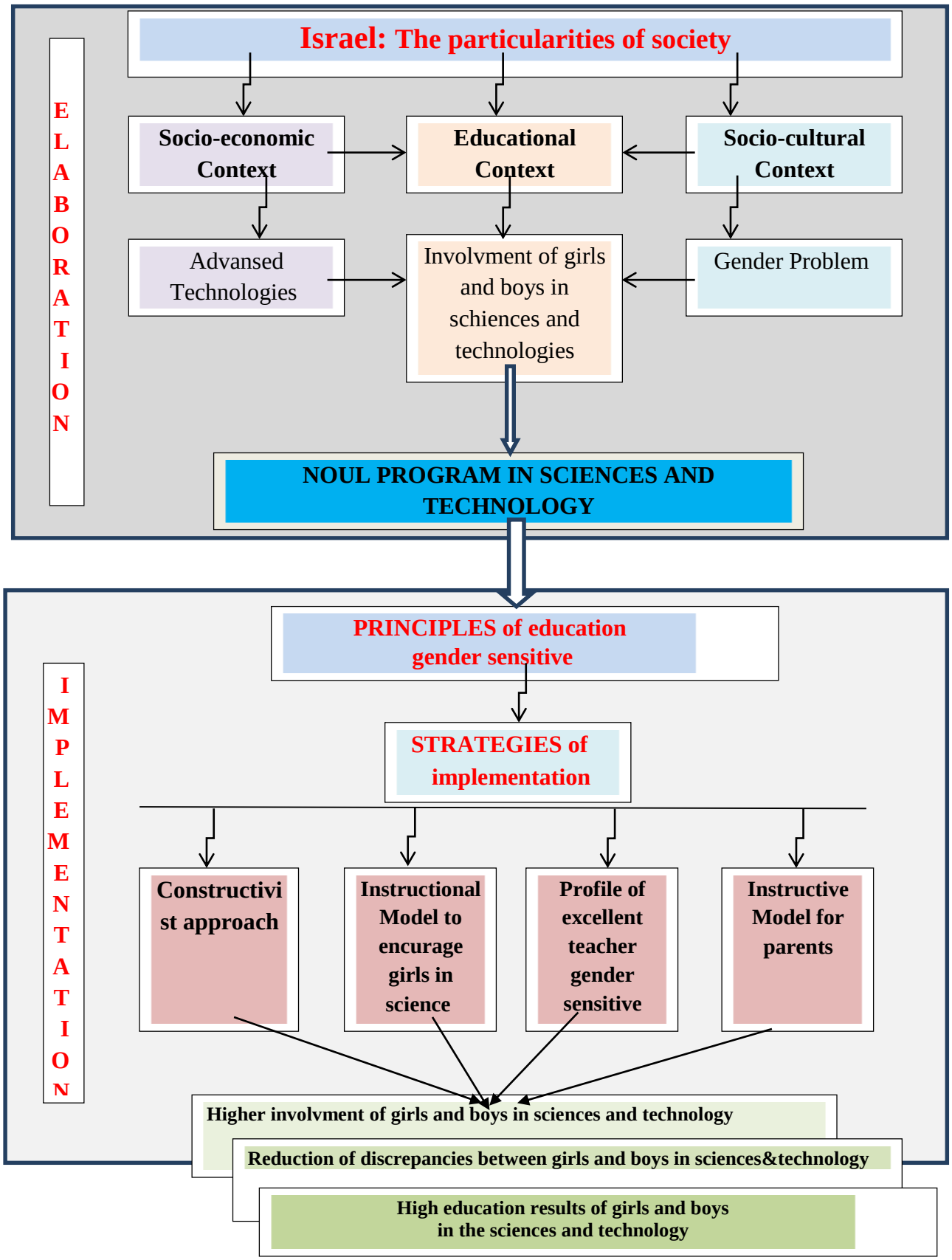

Figure 2. Metodology of implementation of the new program in sciences from a gender perspective

Based on the questionnaires, key factors were identified that affects the implementation of the new science study program from a gender perspective, namely: insufficient motivation of students, especially girls, to study science and technology; the gap between girls and boys regarding the attitude towards science and technology; low level of professionalization of teachers to guide girls and boys in learning the subjects in question.

As variable on gender exploration, we can refer to:

1) Motivation / interest in learning science of girls and boys;

2) Obtaining higher academic results/ reducing the learning gap in scores between girls and boys;

3) Students decision, especially girls, to advance in future in science/as a result of gender stereotypes decrease in learning sciences and technologies, career guidance for girls and boys.

As important tools, there are: the Constructivist approach to learning, Instructional Model to encourage girls students in science and technology, a Profile of excellent teacher who is gender-sensitive, a Instructive Model for parents, developed by us. We reiterate that those models have been developed and applied within the activities as a teacher, teaching instructor/trainer and supervisor in training courses for teachers. These models, which include concrete work strategies, are complementary instruments to ensure ultimately a more effective implementation of the new program in science and technology.

Meanwhile, during the experiment, periodical meetings were organized, according to the pre-established schedule, with teachers' continuous training, from reserve classes in science and technology, which would subsequently work with students in those classes, to discuss the challenges of teaching and learning science.

Referring to the formative background, in the context of the presentation/achievement of strategies from previously mentioned models, gender awareness of reference groups was used. Amongst *the topics addressed during the students training* were: Promoting the importance of secondary education in science and technology; the importance of involving girls and boys in science and technology; Modalities of cooperation between girls and boys in school and social activities; Gender stereotypes; developing self-efficacy; Defining professional aspirations beyond gender stereotypes; Life and career strategies. The discussion of topics was combined with study visits to various research institutions in science and technology, meetings and debates with scientists. We note that, regarding girls, special attention was paid to the topic of self-confidence, self-assessment and strategies to strengthen them.

Among *the topics discussed during the experiment with teachers* were: Gender equality and science/technology; Promoting the importance of secondary education in science and technology; The importance of involving girls and boys in science and technology; Modalities of cooperation between girls and boys in school and social activities; Gender stereotypes in teaching, assessment and teaching material; Defining professional aspirations beyond gender stereotypes; Life and career strategies.

Among *the topics discussed with parents of students of reserve classes in science and technology were*: Cooperation between parents and children; Images of scientists women and men in science/technology; Promoting the importance of secondary education in science and technology; The importance of involving girls and boys in science and technology; Modalities of cooperation between girls and boys in school and social activities; Gender stereotypes and their impact; Gender-sensitive career guidance: Defining professional aspirations beyond gender stereotypes; Life and career strategies.

We note that our research is a component that contributed to the implementation of the new science and technology program. Outcomes of program implementation (real success and increasing number of students who got a scientific promotion diploma) will be visible in the summer of 2016, the graduation of the first class of graduates.

Meanwhile, based on national statistics it is ascertained the improvement of students' results in science, following the implementation of the new science and technology program in high schools. We note that organizing multiples gender awareness activities for the girls students, teachers and parents contributed to the creation of a unique favourable environment (gender friendly), motivating, especially girls, to study science.

Thus, by applying the strategies reflected in the Instructive Model to encourage girls students in science and technology, the motivation and active involvement of girls in science (especially physics) was achieved, opening them more to science as a field of professionalization in the future.

The main scientific results:

Among significant results from the mentioned interventions, we note the increased interest in science of boys and girls. Thus, if before applying the strategies only 65.72% of boys (1st place) and 60% of girls (2nd place) from reserve class have shown interest in science, after carrying out the activities - the score grew to 100% of boys and 92% of the girls which showed interest in science (Figure 3).

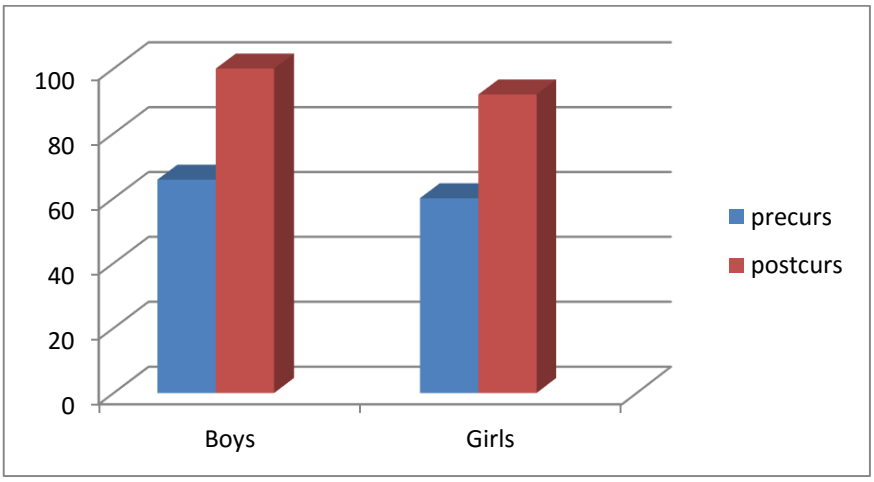

Figure 3. Interest in science of students (by sex), %

As a result of the activities, the students' attitude towards the advancement of science in future changed. Thus, if before training activities only 55% of boys (1st place) and 48% of girls (2nd place) from reserve class have confirmed ***the decision of students' advancement in science in future***, after carrying out the activities - the score increased of 93% for boys and 88% for girls that have indicated the decision of students' advancement in science in future (Figure 4).

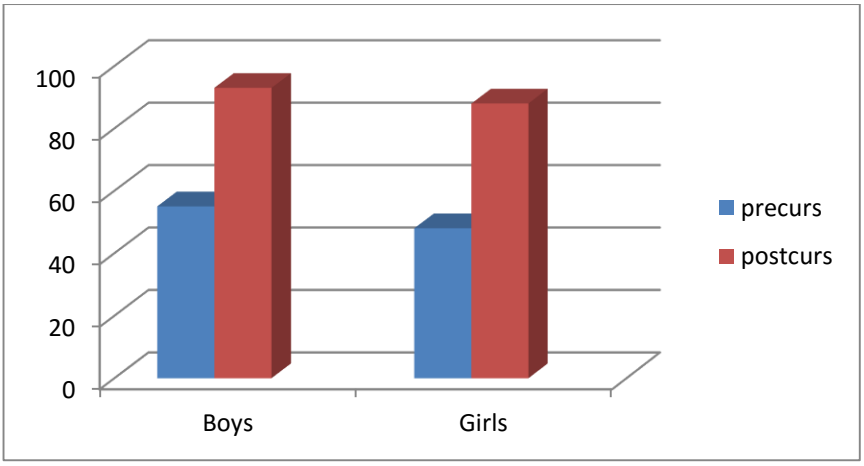

Figure 4. The decision of students' advancement in science in future

In figures 5-7 it is represented the trend of students' results improvement in science, in PISA international tests. It registered an increase of 15 points from 455 points in 2009, before the new program began, to 470 points in 2012. The Hebrew speakers obtained 483 points compared to Arabic speakers, who obtained 350 points. Therefore a major discrepancy of 133 points can be noted between Hebrew speakers and Arabic speakers. Hebrew speakers remain behind only 17 points compared to OECD countries – 500 points [45].

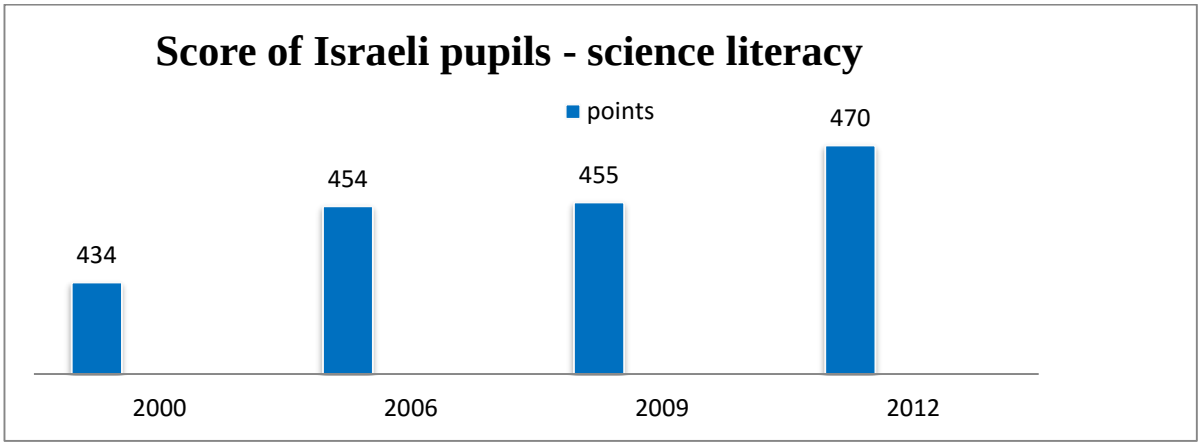

Figure 5. Score of Israeli pupils – science literacy (PISA tests)

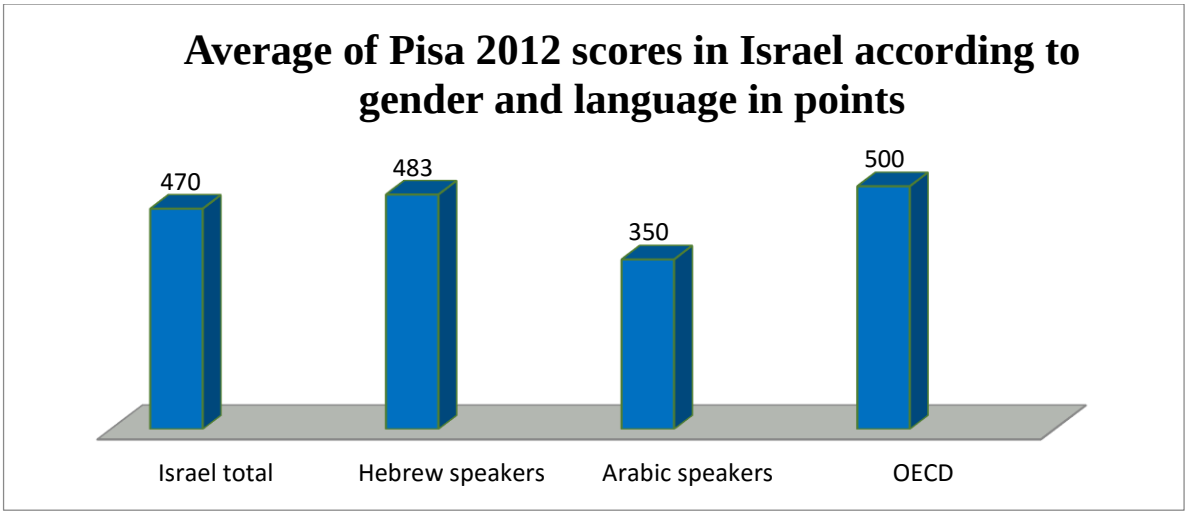

Figure 6. Average PISA 2012

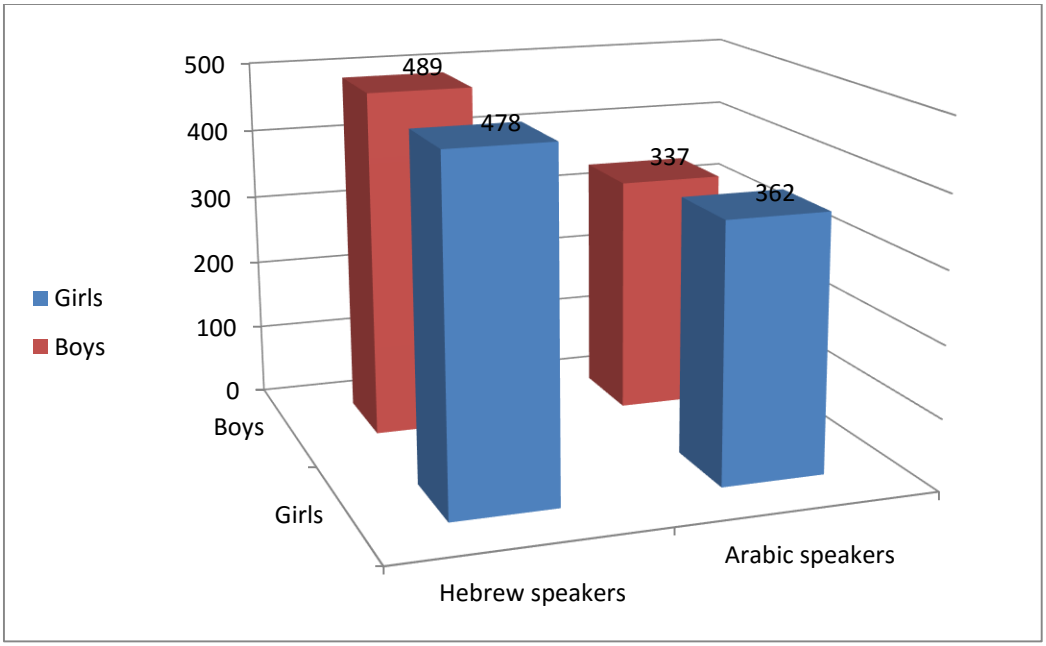

Figure 7. Average Israeli score in problem solution according to language sectors and according to gender

From Figure 7 it can be seen that the gender gap in relation to girls, decreased compared to boys. However, there is still a difference in results – of Hebrew speaking girls and Arabic speaking girls. From the gender perspective, Hebrew speaking boys have obtained 489 points and the girls, 478 points with a 11 point gap in favor of boys. The Arabic speaking girls have achieved 362 points and the boys - 337 points, which represents a gender gap of 25 points in favor of girls [54; 55].

It can be observed that since the program began in 2009, the students' achievements in the discipline of science in Israel increased. The larger is the number of Israeli students in whom the investments are made, the higher is the rate of eminent students. In 2012, the rate of eminent and excellent students in Israel, 5.6 according to PISA tests, has reached the level of OECD countries of 8%, the gender gap between boys and girls being insignificantly reduced. In 2012, Israel ranked 34th among OECD countries, but with a gender gap lower compared to countries that were in the top of the list. Thus, boys recorded a score of 457 points and the girls - 451, the gender gap being 6 points (Table 1) [54; 70].

Table 2. Gradation of countries in PISA 2012 tests, a gap between boys and girls

Grading	Country name	Average score	Gaps distribution (P5-P95)	Girls average	Boys average	Gap (girls-boys)
1	**Singapore**	**562**	**312**	**558**	**567**	**-9**
2	**Korea**	**561**	**292**	**554**	**567**	**-13**
3	**Japan**	**552**	**280**	**542**	**561**	**-19**
7	Canada	526	327	523	528	-5
9	Finland	523	307	526	520	6
10	Great Britain	517	315	514	520	-6
12	France	511	313	509	513	-5
16	Germany	509	324	505	512	-7
17	United states	508	306	506	509	-3
20	Norway	503	337	505	502	3
22	Denmark	497	302	492	502	-10
24	Sweden	491	316	493	489	4
31	Croatia	466	302	459	474	-15
34	**Israel**	**465**	**405**	**451**	**457**	**-6**
	OECD average	500	314	497	503	-7

As important factor that promotes student success is the psychological and socio-emotional support from the family. The study confirmed that children, especially girls, whose families offer support, including emotional support, demonstrate increased interest and achieve greater success in school. The families help and get involved in solving the problems faced by students during their studies in the special class. Students reported that supportive discussions with family take place; families offer assistance to students through private lessons in order to improve knowledge and results or extra-curricular advanced studies. Many parents help students, especially girls, in the afternoon or evening hours to do homework in physics, robotics and mathematics subjects. Students are aware of the investments made by parents in their children's success, and that increases their motivation in learning and strengthens the parent-child relationship.

In this research we found direct correlation between motivation for learning and social activism. Students (girls and boys) who have shown interest and have been involved in volunteering acknowledged that the emotional aspect, namely satisfaction and appreciation for the activity increases their motivation for learning (based on increased self-confidence).

At the same time, after the experiment tackled the stereotype that with advancing to higher grades, decreases the motivation of young people to learn in favor of social and sport activities. Following the choice of studying in science and technology reserve class, increases the students' motivation as they advance in the age group. This phenomenon is largely influenced by high motivation from parents (Figure 8).

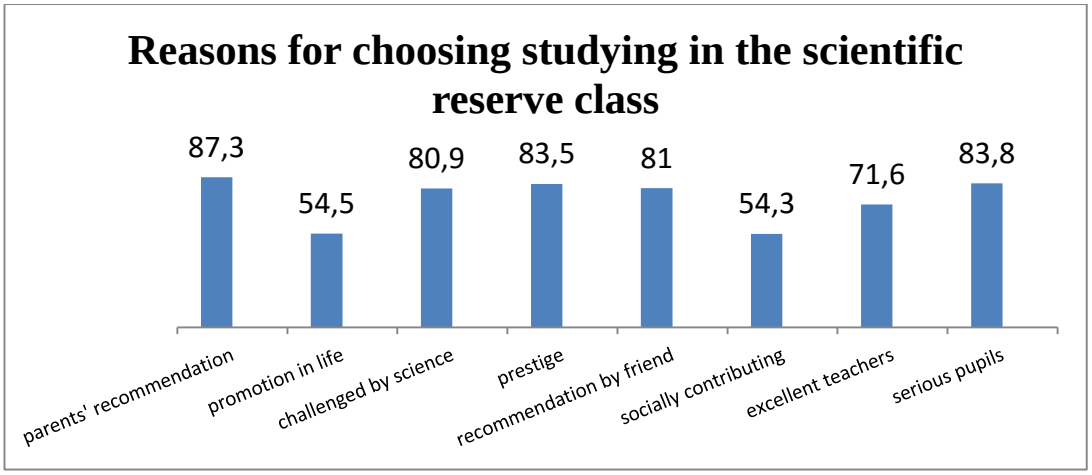

Figure 8. Reasons for choosing studying in the scientific reserve class

In terms of acceptance of physics by girls in technology reserve class, an improving trend was recorded after the gender awareness training activities. Before the experiment, the situation was as follows: girls perceive physics as a difficult discipline that belongs to the world of men, and the no. of girls studying it, is small. They have difficulties in understanding the content; do not see a future in this discipline, some who are beginning to see a future in this discipline, lack of parental encouragement on this subject. Girls do not see the connection of the subject with life, therefore the number of girls studying this discipline is low and increased only slightly. Physics is perceived as a difficult subject by a large number of girls. Only 12% believe that this discipline is not difficult and want to study physics. 56% believe that it has no connection with life. 55% believe that physics offers no prospects for the future (trend of improvement is small), 44% do not see it as a perspective for the future, while 56% mention lack of support and encouragement from family.

At the same time, following the activities undertaken by teachers and parental involvement (trained in program) the situation has changed significantly (Figure 9). Thus, the perception that physics is little required by girls dropped from 88 to 38, that it is a difficult subject - decreased from 88 to 28, that it is not connected to life - decreased from 78 to 56, that it belongs to the world of men - decreased from 80 to 35, that it is a difficult discipline - decreased from 60 to 16. We note that the positive perception of physics increased, and with the increase of parents' involvement from 56 to 90, increased the connection with life from 55 to 88.

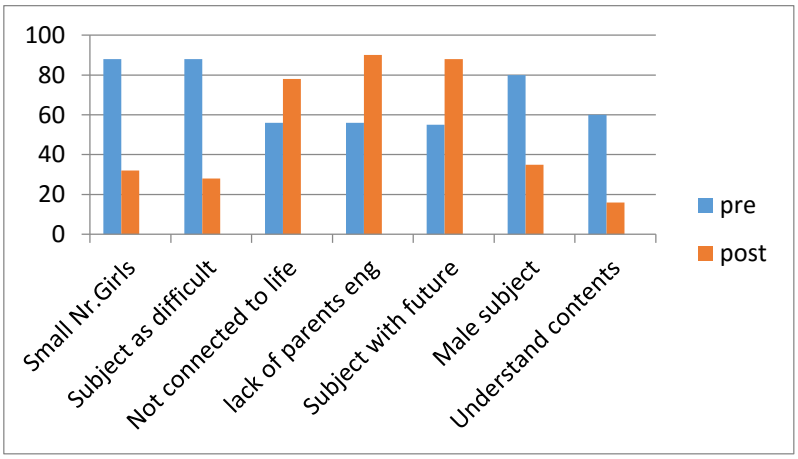

Figure 9. Perception girls of the physics subject in the technological reserve class

In figure 10, are shown obvious differences between boys and girls wish to choose the science professor. However, there are features raised both by boys as well as by girls, as follows: listen to problems, likes teacher's profession, provide relevant research tools, is an expert in the content matter. For girls, it is specific the emotional preference with regard to the teacher and intelligent learning. It is important for the teacher to create a pleasant and stress free learning environment, which stimulates learning, links the discipline with everyday life, loves his students. Boys like teachers without emotions, which know how to work with the class and are professionals.

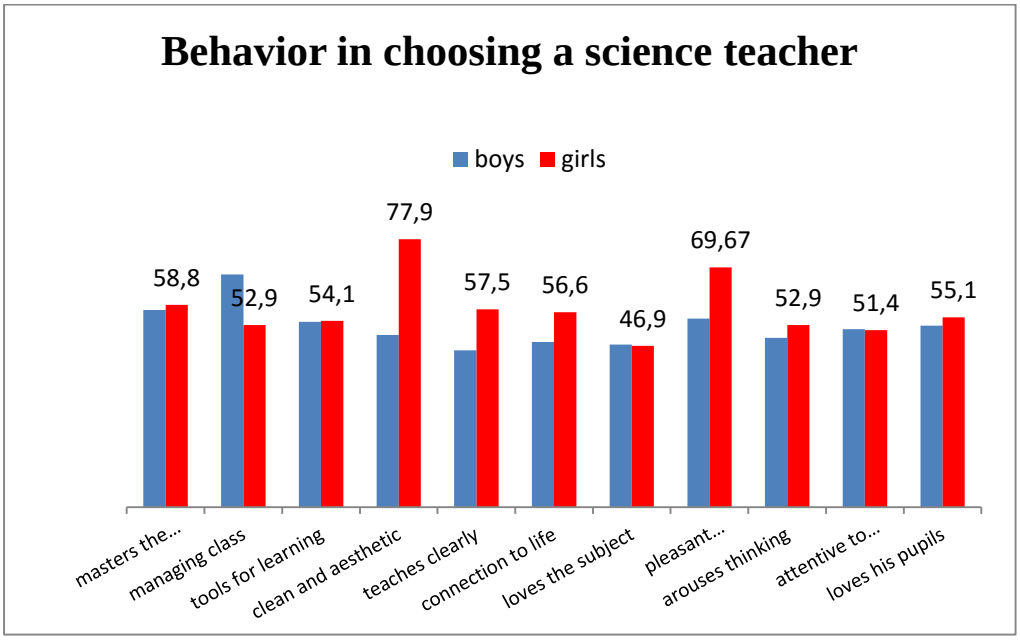

Figure 10. Criteria for choosing science teacher

Teaching in science and technology reserve class, is performed by excellent teachers who are recommended by the school administration and requested by students. This includes 2 characteristics:

1) Ability to arouse intellectual enthusiasm among students,

2) Ability to establish interpersonal contact with students, to demonstrate care, emotions and support.

The results of this research led to a noticeable gender difference in preferences of boys and girls. The girls noted the importance of communication skills and interpersonal relations - aesthetics, clarity in teaching, life skills, pleasant atmosphere, connection between the studied content and everyday life. Such features as love for the profession had a low incidence. Among the favorite features of guys are: teaching dedication and motivation promotion - which is also a method of classroom management. It is also significant the low incidence of features such as low abilities to connect with life and love for the profession. With regard to other features there was an equal correlation between boys and girls.

The results show that girls prefer a teacher with interpersonal relations skills, who is interested, accessible, and thoughtful and can make the connection between studied content and life. These results are not fixed, but neither are fixed the emotional characteristics mentioned by boys and characteristics regarding the content and the control mentioned by girls. As a result, an excellent teacher has his own profile, which is unique. It is very important that he improves all the techniques and strategies, adjusting to the class and content.

It was determined that there are differences between boys 'and girls' wishes regarding the preference related to the behavioral patterns of the teacher in excellence classes. However, there

is a meaning regarding the high and exact incidence related to the behavioral pattern of the favorite teacher.

According to study results, the teacher who teaches in the special class should be able to integrate all behavioral characteristics and meet the girls' needs in volume of 100% and boys' needs in volume of 100% without creating discrimination. He must be creative and versatile, able to "plunge" through various behavior patterns taking into account the children's gender specific without confusion, fatigue, without losing his temper, proving tolerance and without creating situations in which students should seize this difficulty [45].

We note that the visions of girls and boys have served as a basis for the Profile of excellence teacher gender sensitive. It was initially discussed with students, then teachers and it has been adjusted along the way. We indicate that the profile served in fact, as a tool and support for teachers in teaching activity. Increased interest aroused gender specificity, namely the meaning of "gender sensitive". The major challenge aimed the ability to include gender in teacher's work. These issues were also discussed during the training activities, being determined as: the ability to apply alternative strategies to patriarchal stereotypes, to encourage girls and boys in learning, teach them to identify their practical and strategic needs, guide them in designing career related to science and technology by giving them real opportunities to develop interests and potential etc.

Research program was developed by applying projective tests, which served both as a tool to identify the level of students of stereotyping, transforming stereotypes, and as formative assessment of program effectiveness. The test was performed on a sample of 54 students from a high school in Jerusalem (where I worked as a teacher), of which 29 boys and 25 girls. The test implementation was organized twice: in 7^{th} grade, first year of high school in science reserve class, and at the end of the 9th grade- at the end of their studies in high school after three years of study in science and technology reserve class. The essence of the test is to explore the attitudes of students by working with the image of women and men in science.

Result analysis of students' drawings has revealed tendency of changing of students' vision of the image of women and men scientists. If the 9th grade students drew a woman scientist, students from the 7th grade drew only male scientist. Referring to descriptions of women and men scientists, describing a day from the life / work of a scientists, visible changing trends are noticeable through separation from stereotypical patterns, especially in representations of girls. Thus, we can conclude that studies in the reserve class in science and technology have helped changing the way of thinking for a part of the students, especially of 25 girls. Changing stereotypes is due largely to multiple visits to Weitzman Institute and meetings with young men and women scientists.

We reiterate the fact that in this research, as a starting point, served the problem of gender stereotypes and prejudices' persistence in society, leading to discrepancies between the motivation of boys and girls in choosing physics as a subject and advanced discipline (with a gap in favor of boys), affecting their performance. Through the carried out experiment, opportunities were presented for prevention/transformation of stereotypes, faced by boys and girls, especially those who want to embrace science after three years of studies in science and technology reserve class. Based on the study results we conclude that the stereotypes and prejudices related to boys and girls, men and women working in science persist despite scientific and technical progress. Stereotypes are reproduced by the media, the educational system, traditional daily practices. They can be prevented and eliminated by replicating the positive obtained practices, including the ones from the present research.

Thus, we conclude that the teaching experiment, which included the steps of finding and training, involved students (boys and girls), teachers, and parents, confirmed the relevance of the implemented strategies. The gained results are better than those from the diagnostic phase and thus, the proposed model can be considered successful and the experiment valid.

GENERAL CONCLUSIONS AND RECOMMENDATIONS

The new study program in sciences and technology from 2009 has provided new opportunities to study for eminent students interested in learning, in Israel, by creating reserve classes in science and technology. Introducing the program was conditional upon external factors as well as internal. External factors target the necessity to maintain and advance the state of Israel on the international arena, on the background of scientific-technical progress, but also the contemporary socio-economic trends/challenges. The internal factors include state needs to correct previous mistakes in the education system, when science classes have been reduced, and schools that study technology have been closed, which led to lower interest and lower scores in science and technology education.

The new study program in science, focused on the reserve class in science and technology, has created a trend of positive change in many aspects - from the study matter, to increasing advanced scientific disciplines choises in school, improving results and requesting to study in this class. However, the implementation of the program identified a number of problems: insufficient motivation of students to study science and technology, persistent discrepancies between girls and boys in motivation and in learning, difficulties in the teachers' work activities with girls and boys, insufficient motivation from parents in favour of technological program. Those conclusions served as a benchmark for the decision to include gender in the implementation activities of the new program in the context of the education system in Israel.

In the present research, key concepts/terms to the relevant field were developed: gender in science and technology education; gender-sensitive skills; gender-sensitive career guidance; gender friendly/sensitive school. The conceptualization of gender in reference to the exploration of the new program in science and technology, focusing on prevention and overcoming gender stereotypes in attitudes and learning disciplines in science and technology by girls and boys, and ensuring students' success and achievement, have provided the theoretical foundations for the researched subject.

The research results have confirmed that motivating girls and boys for sciences and technologies discipline can be achieved through gender sensitive strategies that are effective, paradigmatically addressed from a pedagogical and social perspective and based on the interdependence of educational activities focused on students and gender awareness of teachers, and also parents.

At the same time, only excellent and known teachers must be admitted to teach in special classes. Science teachers must know how to integrate the two strategies for both genders, because according to this study, girls and boys want to study together. When choosing advanced subjects in high school, often there is a significant difference between boys and girls. Usually, the boys choose such disciplines as computer, chemistry, robotics, chemistry and biology, and girls are choosing subjects related to life. Thus, through applied strategies, the teacher must combine the mentioned aspects, appropriate to the strategic and practical gender needs. In order to increase tests motivation and success, beginner teachers who teach in college should be identified during the studies and trained in advance to be nominated/selected to teach in special classes. Studies should include strategies suitable for teaching boys and girls, thus appears the problem of the exploration of their gender sensitive skills development experience.

In conclusion, achieving the methodology of implementation of the new program in science from a gender perspective is conditional upon the preparation/special training of teachers, but also upon the creation of psychological and communicable conditions in educational institutions.

Significant results were obtained in this study regarding the parental involvement and the major impact on the choice of the type of class over the transition of juniors from primary to secondary school cycle. The study has confirmed the idea that students, especially girls, whose families offer support, including emotional, demonstrate increased interest and achieve greater

success in school. We can see the development of a gender-sensitive school-family-student (especially girls) partnership.

We noted that the new science study program has improved students' results. Among them, following the indicated interventions, we see as significant: the increased interest in science of boys and girls, especially girls, and the students changing attitudes in favour of science advancement in future. From the gender perspective, there is an obvious tendency to choose science and technology disciplines as advanced subjects. There is also a growing trend toward the decision to choose physics as subject, but nevertheless there is still much to be done in the field.

As a result, there was an improvement of achievements at national and international level and ranking on top of the positions after Switzerland and Sweden. In these classes, the difference between boys' and girls' scores is insignificant.

This study has confirmed the correlation between the new science study program, gender and improving achievements in the reserve classes. We note that the connection between "new program in sciences", gender and teaching strategies is an important factor of motivating girls and boys to learn, of diminishing gender stereotypes and prejudices in learning science and technology disciplines, education and career guidance for girls and boys, obtaining higher academic results/ diminishing the differences in scores of boys and girls in learning.

The survey shows that the introduction of the gender dimension in the "new program in sciences", expressed through gender-sensitive methods and techniques, is an important condition in order to improve academic performance in high school.

We acknowledge that the gender dimension in science and technology education is a formative-educational approach targeting a series of actions, which are based on considering influences specifics on the formation of boys and girls from the educational instructive process context, oriented to prevent and overcome gender stereotypes, attracting girls and boys in science and technology by encouraging and exploring their potential.

As a result of the research, it was developed and validated the methodology of implementation of the new science study program from a gender perspective, which represents a paradigmatic structure consisting of components/patterns in interaction: theoretical component - constructivist approach; curricular component - gender; teaching component - strategies to encourage female students, students' working strategies, strategies of students' improvement; community component - including the family; psychological component - providing success. Finally, this methodology included: the Constructivist approach to learning, a Profile of excellent teacher who is gender-sensitive, Instructional Model to encourage girls students in science and technology, a Instructive Model for parents.

In the context of the above mentioned, we conclude that the **solution of scientific research problem** lies in the theoretical and praxiological methodology of implementation of the new study program in sciences from a gender perspective, ensuring the reduction of gender stereotypes and prejudices with reference to the relevant disciplines, and the students' performance efficiency.

At the same time, we are aware that beyond the positive achieved results; there are still numerous challenges that require continuous interventions with joint effort of all educational actors.

The research opens new horizons for comparative studies of educational strategies through gender prism in various studies' fields at national and international levels.

Based on the results obtained in the research, we propose the following **recommendations**:

At decision-makers level:

- Develop the educational policies through gender mainstreaming
- Extend the possibilities of gender sensitive training for teachers in the initial phase of students training in higher education institutions by introducing in the curriculum the Course "Gender equality in education".
- Introduce the instructive Model of the methodological training of teachers to

encourage girls students in science and technology.

- Conduct gender analysis of the textbooks and teaching materials in the field of science and technology studies.
- Organize/coordinate, on an educational system level, information and awareness campaigns regarding gender equality in education, focusing on science and technology education.
- Create opportunities for motivating teachers, due to the effort to increase the numbers of students studying sciences and technologies (rewarding, appreciations, credits etc).
- Develop of methodological guides, theoretical and applicative supports referring to activities concerning gender sensitive training in the educational institutions.
- Collect and disseminate positive practices on gender education, on gender mainstreaming in the educational system.

At the educational institutions level:

- Implement the gender-sensitive strategies at the educational institutions level. Pay particular attention to girls, especially from the reserve classes in sciences, choosing physics, by diversifying the working methods focusing on content and praxiologic aspects connected to daily life.
- Create the gender sensitive/friendly environment in educational institutions (physical, informational, relational conditions).
- Develop partnerships between schools and research institutions in order to explore the patterns of women and men scientists in science and technology (meetings of students with scientists, study visits, joint projects), ensuring gender balanced approach.
- Develop partnerships between school and students, focusing on gender awareness, for the purposes to guide efficiently children in the process of career design and training (beyond stereotypes and prejudices).
- Provide opportunities, for parents, of gender-sensitive training / assistance in overcoming stereotypes related to study and advancement in science and technology.
- Encourage, through various methods, boys and girls studying physics since pre-school during afternoon lessons, starting with awards to university scholarships.

At family level:

- Parents should maintain and develop a continuous dialogue with girls and boys, offering them support in favour of choosing and supporting education in science and technology.
- Apply strategies to encourage girls' self-esteem, strengthen their self-confidence, and their motivation to study in science and technology.
- Develop partnerships between school-family-students, focusing on gender sensitive aspect, in order to guide efficiently children in learning and career in science and technology.
- Orient girls and boys towards cooperation during lessons within community social activities.

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ADNOTARE

Nissel Orly, "Valorificarea noului program în ştiinţe din perspectiva de gen în Israel", Teză de doctor în pedagogie, Chişinău, 2016

Structura tezei: introducere, trei capitole, concluzii generale şi recomandări, bibliografie din 213 de surse, 10 anexe, 141 pagini de text de bază, 39 figuri, 9 tabele. Rezultatele au fost reflectate în 9 publicaţii ştiinţifice.

Cuvinte cheie: dimensiunea de gen, diferenţa între fete şi băieţi, sensibilitatea de gen, abordarea integratoare de gen; ghidarea în carieră sensibilă la gen; motivarea/încurajarea fetelor, clasa de excelenţă (de rezervă) ştiinţifică şi tehnologică, diplomă de promovare şi calificare ştiinţifico-tehnologică, noul program în ştiinţe şi tehnologii în Israel, şcoală „prietenoasă la gen".

Domeniul de studiu: Teoria generală a educaţiei

Scopul cercetării constă în fundamentarea teoretică şi praxiologică a Metodologiei de valorificare a noului program în ştiinţe din perspectiva de gen în instituţiile de învăţământ din Israel.

Obiectivele cercetării: analiza evoluţiei programelor de studii în ştiinţe din Israel în contextul dimensiunii de gen; stabilirea conexiunilor dintre programul de studii în ştiinţe, dimensiunea de gen şi performanţele elevilor; determinarea valenţelor formative a noului program de studii în ştiinţe în vederea valorificării dimensiunii de gen; elaborarea metodologiei de valorificare a noului program de studii în ştiinţe axate pe dimensiunea de gen; validarea experimentală a metodologiei de valorificare a noului program de studii în ştiinţe în vederea realizării dimensiunii de gen.

Noutatea şi originalitatea ştiinţifică a cercetării este asigurată prin: determinarea tendinţelor în dezvoltarea curriculumului şcolar în plan istoric şi de gen; identificarea factorilor şi condiţiilor de valorificare a noului program de studii în ştiinţe din perspectiva de gen; stabilirea potenţialului şi a valenţelor formative a noului program de studii în ştiinţe, în vederea realizării dimensiunii de gen în cadrul procesual; elaborarea Metodologiei de valorificare a noului program de studii în ştiinţe din perspectiva de gen axate pe Abordarea constructivistă de învăţare, Modelul instructiv de încurajare a elevelor în ştiinţe şi tehnologii, Profilul învăţătorului de excelenţă sensibil la gen, Modelul instructiv pentru părinţi.

Problema ştiinţifică soluţionată în cercetare rezidă în fundamentarea teoretică şi praxiologică a metodologiei valorificării noului program de studii în ştiinţe şi tehnologii din perspectiva de gen asigurînd diminuarea stereotipurilor şi prejudecăţilor de gen cu referire a disciplinele respective, dar şi eficientizarea performanţelor elevilor.

Valoarea teoretică a cercetării: dezvoltarea teoriei curriculumului educaţional prin introducerea dimensiunii de gen în unităţile/disciplinele în ştiinţe prin integrare, fuzionare şi completare a componentelor structurale ale domeniilor respective; conceptualizarea dimensiunii de gen cu referire la valorificarea noului program de studii în ştiinţe şi tehnologii; modelarea teoretică şi praxiologică a metodologiei de valorificare a noului program de studii în ştiinţe şi tehnologii din perspectiva de gen; dezvoltarea conceptului de ghidare în carieră a fetelor şi băieţilor în cadrul studierii disciplinelor reale /în ştiinţe şi tehnologii prin descoperirea abilităţilor proprii pentru profesiile legate de ştiinţe şi tehnologii.

Valoarea practică a cercetării: Metodologia de valorificare a noului program de studii în ştiinţe din perspectiva de gen reprezintă un demers validat prin experiment, fiind util pentru eficientizarea activităţilor instructiv-educative din instituţiile de învăţământ, a relaţiei profesor-elev-familie. Rezultatele cercetării sînt adresate şi pot fi de real folos cadrelor didactice, supraveghetorilor, formatorilor, părinţilor şi altor persoane interesate de domeniu.

Implementarea rezultatelor ştiinţifice s-a efectuat în două şcoli în clase de excelenţă (de rezervă), din Ierusalem, în care cercetătoarea activează în calitate de cadru didactic şi ca formator, şi au fost prezentate instructorilor şi managerilor în ştiinţă, prin comunicări la conferinţe ştiinţifice naţionale şi internaţionale, publicaţii ştiinţifice etc.

АННОТАЦИЯ

Ниссель Орли, "Реализация новой программы точных наук в гендерной перспективе".
Диссертация на соискание ученой степени доктора педагогических наук, Кишинэу, 2016

Структура диссертации: введение, три главы, выводы и рекомендации, библиография из 213 источников, 10 приложений, 141 страница основного текста, 39 фигур, 9 таблиц. Результаты отражены в девяти научных публикациях.

Ключевые слова: гендерный подход, различия между девочками и мальчиками, гендерная чувствительность, гендерно чувствительная профориентация, мотивация / поощрение девочек, передовые классы (резервов) в области наук и технологии, степень научно-технической квалификации и продвижения, новая программа в области наук и технологии в Израиле, школа "дружественная гендеру".

Область исследования: Общая теория воспитания.

Целью исследования является теоретическое и методологическое обоснование методологии реализации новой программы в области наук в гендерной перспективе в учебных заведениях в Израиле.

Задачи исследования: анализ эволюции учебных программ в Израиле в контексте гендерного измерения; определение взаимодействия между программой в области наук, гендерным измерением и успеваемостью учащихся; определение формирующих составляющих новой программы в области наук с целью включения гендерного измерения; разработка и экспериментальное апробирование методологии реализации новой программы в области наук в гендерной перспективе.

Научная новизна и оригинальность исследования заключается в: определении тенденций в развитии школьной программы в историческом и гендерном разрезе; выявлении факторов реализации новой программы в области наук в гендерной перспективе; определении потенциала и формирующих составляющих новой программы в области науки с целью включения гендерного измерения; разработке Методологии реализации новой программы обучения в области наук в гендерной перспективе, сфокусированной на: Конструктивистский подход к обучению, обучающую Модель поощрения студенток в области наук и технологии, Профиль гендерно чувствительного учителя передового класса, обучающую Модель для родителей.

Научная проблема, решенная в данном исследовании заключается в: теоретическом и методологическом обосновании методологии реализации новой программы обучения в области наук и технологии в гендерной перспективе, обеспечивающей снижение гендерных стереотипов в отношении соответствующих наук, а также повышении эффективности успеваемости учащихся.

Теоретическая значимость исследования: развитие теории образовательного куррикулума посредством включения гендерного измерения в точные предметы путем интеграции, слияния и заполнения структурных компонентов; концептуализация гендерного измерения реализации новой программы в области наук и техники; теоретическое и практическое моделирование методологии реализации новой программы в области наук в гендерной перспективе; разработка концепции профориентации девочек и мальчиков в рамках изучения точных предметов / науки и технологии посредством раскрытия персональных навыков для профессий, связанных с наукой и технологией.

Практическая значимость исследования: Методология реализации новой программы обучения в области наук в гендерной перспективе представляет подход подтвержденный экспериментально, необходимый для улучшения образовательной деятельности образовательных учреждений, отношений учитель-ученик-семья. Результаты исследования могут быть полезными учителям, тренерам, родителям и другим заинтересованным людям.

Внедрение результатов исследования было проведено в двух школах в передовых классах Иерусалима, где исследовательница работает в качестве преподавателя и в качестве тренера, и были представлены тренерам и менеджерам в сфере наук, посредством докладов на научных национальных и международных конференциях, научных публикациях и т.д.

ANNOTATION

Nissel Orly, "Harnessing of the new program in sciences from a gender perspective in Israel",
Doctor Thesis in Pedagogy, Chisinau, 2016.

The research includes introduction, 3 chapters, conclusions and recommendations, bibliography – 213 titles, 10 appendixes, 141 pages of main text (until Bibliography), 39 figures, 9 tables, 9 publications on doctoral thesis.

Key words: gender dimension, gap between boys and girls, gender sensitivity, gender mainstreaming; gender-sensitive career guidance; motivation / encourage girls; scientific technological reserve class, quality scientific-technological matriculation diploma, the new program in science and technology in Israel, "gender friendly" school.

The study field: General Theory of Education.

The aim of the research is setting of the theoretical and praxiological foundation of the Methodology of implementation of the new program in sciences from a gender perspective in educational institutions in Israel.

Objectives: analysis of the evolution of studies programs of Israel in the context of gender; establishing of connections between the curriculum in science, gender and students' achievements; determining of the training components of the new science program of study aimed at integration of a gender dimension; experimental validation of the methodology of implementation of the new program in science from a gender perspective.

The scientific novelty of the research relies in the identification of tendencies of the school curriculum development from a historical and gender perspective; identification of factors and conditions related to the implementation of the new program in science from a gender perspective; determining of the perspectives and training components of the new program in science for integration of gender in the process; development of a Methodology to implement the new program in science from a gender perspective focused on: a Constructivist approach to learning, a Instructional Model to encourage girls students in science and technology, a Profile of excellent teacher who is gender-sensitive, a Instructiv Model for parents.

The scientific problem solved in this research consists in setting of the a theoretical and methodological foundation of the Methodology of implementation of the new program in sciences from a gender perspective, reducing of gender stereotypes related to these subjects, and improving of students' achievements.

Theoretical value of the research: the development of theory of educational curriculum by mainstreaming of a gender dimension in units / subjects in science through the integration, unification and and completion of the structural components of these areas; conceptualization of gender perspectives in the new program in sciences and technology; theoretical and praxiological modeling of the methodology of implementation of the new program in sciences and technology from a gender perspective; developing the concept of career guidance to girls and boys in science and technology by discovering their skills for professions related to science and technology.

Practical value of the research: The Methodology of the implementation of the new program in sciences from a gender perspective is an approach validated by experiment, is useful for improving educational activities of educational institutions, the relationship teacher-student-family. The research results are addressed and can be of real use for teachers, supervisors, trainers, parents and others interested in the field.

The implementation of the scientific results: was conducted in two schools in scientific technological reserve class in Jerusalem, where the researcher works as a teacher and as a trainer and were presented to trainers and managers in science, through papers at scientific national and international conferences, scientific publications, etc.

NISSEL ORLY

HARNESSING OF THE "NEW STUDY PROGRAM IN SCIENCES" FROM GENDER PERSPECTIVE IN ISRAEL

Specialty: 531.01. General Theory of Education

Abstract
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