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Gender Differences in Teenagers' Perceptions and Attitudes toward Sciences

Elena Ancuța SANTI¹, Gabriel GORGHIU^{2*}

Abstract

The adolescence represents a significant period in the life of an individual, characterized by rapid transformations and evolutions, where new experiences are faced and lived - practically, the most complex stage on the road to maturity. In general, the dynamics of this age is marked by deep crisis, by internal and external conflicts, emerged in the attempts to discover the self-identity. Studies on gender differences in adolescence are focused on issues concerning the formation of self-identity, self-esteem, appearance of crisis that marks this stage and ways to overcome them on educational performance and school success, but also on the existed options of choosing a career or crystalizing the future profession. Differences in the perception and attitude of male and female adolescents are important in terms of discovering the mechanisms that favor to achieve outstanding results, which may generate interest for major topics and motivational support for specific activities. But when Science area (even in the traditional format of Physics-Chemistry-Biology) is presented to adolescences, it seems that it cannot be said that Science peak their interest, being qualified as having rather a negative image for most of them. In this sense, the aim of the paper is to highlight the teen-agers' perception and their attitude towards scientific activities, taking into account the gender variable, considering the designing of appropriate learning opportunities in relation to students' interests and particularities. The analysis was performed following the feed-back expressed by 185 high-school students (11th and 12th grades), before the classroom interventions of inquire-based science teaching modules designed in the frame of the European FP7 Project entitled: "PROFILES - Professional Reflection Oriented Focus on Inquiry-based Learning and Education through Science".

Keywords: adolescents, perception, attitude, Science, students' feedback, PROFILES Project.

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1. Introduction

The studies that deal with the issue of gender differences, although frequently approached in the field of psychology, still remain an area of interest for experts, as it is quite difficult to set the elements defining a gender more detailed than the other (from the cognitive and behavioural point of view) or which are the mental and internal factors determining gender particularities. Are girls more efficient than boys in certain areas? Are there such activities that boys can perform faster and better than girls? Surely, there are such activities. But the variables influencing the development of a mental or physical attitude are numerous: inheritance, background, education, life experience, cultural and social influences, socio-economic status, and that is why it is difficult to establish precisely to what extent is gender the only element responsible for some of the students' acquisitions or performances.

In educational context, the issue of gender differences was noticed and studied starting with certain observations and empirical papers, which indicated significant differences at different levels among students, which lead to the creation and implementation of educational projects and policies, focused on fighting against gender stereotypes met in schools, by offering equal chances to each student, by creating opportunities when choosing their future careers.

2. Problem Statement

Gender represents the sum of specific elements making the difference between male and female. This is the alternative to sex as a biological category. The *World Health Organization* (2009) states that: “there are differences between those two notions - *gender* and *sex* - thus: the term *sex* refers to the biological and physiological features defining men and women, while the term *gender* refers to socially built parts, to attitudes, activities and attributes that a specific society considers appropriate for men and women.” [1].

According to those issues, *man* and *woman* are *sex categories*, while *male* and *female* are *gender categories*. Aspects related to sex do not vary significantly among the various cultures of human society, but those related to gender can vary a lot from one country to another, one culture to another, one moment to another.

In our society gender differences are established and encouraged since childhood, within the family and at school: boys play with toys more

often, girls play with dolls; boys are supposed to be independent, active and tough, while girls are asked to be kind and affective... [2]. Gender identity is built early by providing models, codes of behaviour and conduct, values related to male and female. During the adolescence, once with the multiple transformations taking place within the body and mind of the young person, this identity of gender is structured more and more, in relation to the sexual identity, the person assuming gradually his/her inherent roles, statuses, attributions, obligations and rights.

Considering the school performances, one of the studies on gender differences in education - conducted by the *Education, Audiovisual and Culture Executive Agency*, in 2010 (*EACEA P9 Eurydice*), at primary and secondary levels, in all countries of the *Eurydice Network* - shows results which are significantly better in reading among girls; the advantage registered by girls is constant in several countries and by different age groups, irrespective of the timeframe of the studies and the curricula [3]. Coming to *Mathematics*, the results obtained by girls and boys in fourth and eighth grades are similar. Nevertheless, in the last years of study, the boys' results are better than the girls' results. In *Sciences*, the results obtained indicate very small differences between boys and girls, yet, in all countries, there is a tendency of underrating the girls' performances compared to the boys' performances, namely the girls' level of the self-confidence in their abilities on obtaining good results in the field being lower than the boys' ones [4].

In their work called *The Psychology of Sex Differences* (1974), Maccoby and Jacklin assert that girls have a higher level of verbal competence development compared to boys, whereas the latter have better developed abilities in the field of Mathematics [5]. However, Hyde (2005) claims that there are no significant differences between the two sexes, both girls and boys having similar values in most psychological variables studied [6].

Another study on the cognitive differences between genders [7] indicates three major differences concerning cognitive abilities of the male and female subjects: upper verbal abilities in the case of girls (more rapid development of language, a richer vocabulary, better fluency, understanding of meanings), upper spatial abilities in the case of boys (space orientation, geographical localization) and better developed arithmetic abilities also for boys (solving arithmetic and geometric exercises). The same study shows better abilities in the case of female subjects with regards to psychomotor speed and accuracy, perception speed and fine motor abilities.

Also, in the field of Sciences, there are gender differences in terms of the students' perceptions and attitudes towards science, scientists, scientific disciplines and scientific careers [8]. The male subjects asserted that they participated to extracurricular activities implying work with batteries, electric

instruments, microscopes and pulleys and they showed special interest in issues such as the atomic bomb, atoms, machinery, computers, X rays, technology. The female subjects participated to extracurricular activities of knitting, baking, sewing, seed planting and they manifested special interest in activities such as communication with animals, healthy diets, weather, serious diseases. The subjects' perceptions were also different, i.e. the girls stated in a higher percentage that science was difficult to understand, while science may be "dangerous and destructive" for the boys.

3. Research Questions/Aims of the research

The research questions start from the general students' perception and attitudes towards Sciences. Since the elementary school, the boys are more interested in studying science than girls, and the attitudes towards science - interest, curiosity, desire to know more - are obvious, especially between 10 and 14 years of age. Boys are more interested in reading scientific articles, in science TV programs, in experiments, demonstrations and manoeuvring scientific equipment. The girls prefer biology-related activities, biology being seen as the science about nature, animals, plants and care towards them, where the boys prefer physics which is perceived by girls as "destructive" and associated with wars and destruction [8].

However, the issues of gender differences in children's cognitive abilities are controversial - while some studies have discovered such differences, others assert that gender differences are insignificant compared to other factors.

The existence of gender differences in perceptions and attitudes towards certain disciplines or fields of study represents an important element in the educational process, as it provides the teacher with a strong argument for the individualization of the educational process, but also to the application of innovative methods and strategies which may contribute to positive results for both categories of gender, to help on increasing the school performance. Therefore, this has a prospective and remedial nature and it represent an important element on choosing the future profession (career counseling and guidance).

Consequently, the aim of this paper is oriented to discover the existence of gender differences on the perception and attitudes of students towards science, going also to identify perceptive and attitudinal elements typical of boys (on the one hand) and girls (on the other hand).

4. Research Methods

The research method proposed a questionnaire with items assessed on a Likert 7-levels scale, which focused on how the educational activities in the field of Sciences (as global perception, considering the degree of attractiveness and the practical and applicative lessons character) are perceived, and also, what is the students' attitudes towards them (as scientific attitude: decoding information, understanding scientific problems and attitude towards Sciences, considering the individual and collective effort).

The research sample was made up of 185 subjects, of which 83 girls and 102 boys - teenagers, enrolled in upper secondary schools. The study was conducted in the frame of the European FP7 Project entitled: "PROFILES - *Professional Reflection Oriented Focus on Inquiry-based Learning and Education through Science*" (2010-2015), which had as objective to promote *Inquiry-based Science Education* through raising the self-efficacy of science teachers to take ownership of more effective ways of teaching students, supported by stakeholders [9].

5. Findings and Discussions

The main contribution of this research consists on identifying gender differences in student perceptions and attitudes towards the field of Sciences and establishing the *gender* as a variable that influences the achievement of school performance in certain fields of study (school subjects).

The results obtained are important because they confirm some of the theories debating the issues on the gender differences in relation to the perception and the attitudes of the students towards Sciences, since there are theories stating that they have identified gender differences and theories which state that such differences are insignificant. Therefore, in terms of the students' perception towards science attractiveness (Fig. 1), as area of study, 29% of respondents stated that science is attractive, half of the responses with such answers being boys and the other half girls. The boys considered science extremely attractive and very attractive in a higher percentage, while the girls stated that it is unattractive in a higher percentage.

(a)

(b)

Fig. 1. (a) and (b). Global perception of teenager students related to Sciences - degree of attractiveness

However, no subject considers science to be very unattractive or extremely unattractive, which means that both boys and girls have a global perception on science as being an attractive, interesting domain.

With regards to the students' perception as to the importance of Sciences in their daily life (the practical and applicative character of the classes with scientific content), figure 2 illustrates that 28% of the subjects consider that the lessons studied in relation to science are important in their daily life, the boys being however the ones who consider this in a higher percentage compared to girls. 4% of students consider that the science

classes are extremely unimportant and very unimportant, of which girls are represented in a higher percentage. By contrast, the boys consider the importance of the lessons studied in Sciences to a higher extent than girls (extremely important, very important and important).

(a)

(b)

Fig. 2. (a) and (b). Global perception of teenager students related to Sciences - practical and applicative importance of the lessons

The students' attitudes towards Sciences have a cognitive component and a non-cognitive component. Therefore, in terms of abstract information and decoding operation (specific signs and symbols), figure 3 shows that as a first step in the process of understanding of the specific knowledge, 48% of the subjects considered that the content of the classes always refer to signs

and symbols, the higher percentage being represented by boys. In contrast, a percentage of 3% - more girls - consider that science classes never imply abstract symbols.

(a)

(b)

Fig. 3. (a) and (b). Teenager students' scientific attitude related to decoding abstract symbols in Science classes

In close connection to the previous item, figure 4 presents the facts on understanding the subject approached in Science classes, as follows: 21% of subjects stated that they always understand and 23% almost always understand the subject of the lessons taught. 21% of them (half are girls

while the boys are represented in a slightly higher percentage) expressed that is an insignificant difference. 4% stated that they never understood the subject of the science lessons taught, distribution by gender being approximately equal.

(a)

(b)

Fig. 4. (a) and (b). Teenager students' scientific attitude related to understanding the content of Science classes

The subjects' attitude towards Sciences, namely the effort made by the students during Science classes (ratio between actual work and learning results) is appreciated by students as heavy in a percentage of 31% of which the number of girls is double compared to the number of boys (figure 5); the girls assessed this effort to be heavy in a significantly higher percentage than the boys which means that boys found it much easier to study Sciences, and they considered this effort to be rather moderate. On the contrary, the girls think that they make an extremely heavy, very heavy or heavy effort to learn the content of the science classes.

(a)

(b)

Fig. 5. (a) and (b). Teenager students' attitude towards Sciences considering the group effort, actual work and learning results ratio

If the effort in the Science class was perceived differently by girls and boys, the latter considering that the collective effort made was not very heavy, while the girls stated the exact opposite, the actual results are also similar in terms of individual effort (individual work and learning results ratio): 31% of the subjects assessed the effort made in science classes as moderate, the percentage being significantly higher for boys. The girls thank that the effort required was extremely heavy, very heavy or heavy during science classes (Fig. 6).

(a)

(b)

Fig. 6. (a) and (b). Teenager students' attitude towards Sciences considering the individual effort, actual work and learning results ratio

6. Conclusions

There are several categories of factors in the educational process that can influence the outcomes of students' learning, one of those being the student's gender. Individualization of teaching represents an indispensable requirement for education, reflected on a personal and social level, including educational policies and strategies. In the social plan, the knowledge of gender-specific elements and traits contributes to the identification of the optimal professional profile and to the use of psychological, emotional and motivational resources, at the highest odds, in order to achieve the success.

The overall importance of this research is that it can be a starting point for studying gender differences in a clear area of education: Sciences.

The conclusions one may draw following this research are: girls perceive classes and science-related contents as more difficult, harder to learn, sometimes unattractive and requiring a heavy effort; abstract signs and symbols are difficult to be decoded and notions are hard to be understood and imply a lot of effort. However, boys see the same things differently, they claim that science classes are attractive, interesting, have a practical and applicative character, whereas the individual or collective effort to learn is not very heavy. The explanation of the differences between the girls' perception and attitudes, compared to the boys' perception and attitudes towards science classes and contents, may be related to their different psychical structure, their different interests, specific cognitive and emotional attitudes, gender stereotypes encountered and sometimes promoted in schools and family. To go beyond the gender barrier and to remove the image according to which Sciences are more appropriate, more attractive and accessible, as area for boys than for girls, one should select the contents suitable to stimulate, from a cognitive and emotional perspective, the girls' interest and curiosity, to have a practical and applicative character and to encourage the girls to choose a scientific career. The obtained results in this research support the theory that specifies there are certain actions and educational activities in which girls get better results than boys, and other activities in which boys are doing better, in the field of Sciences [8].

Understanding how gender differences is manifested in the field of Sciences is extremely important for attaining higher educational performances and equal chances, as to working in this field.

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The authors of this paper declare, on their own responsibility, that the subjects who participated in the research have been informed related to the voluntary nature of their participation, the understanding of the received information and the fact that the withdrawal from the research process can be done at any time without any negative consequences on participants. The whole research respected the actual ethical standards and the participants expressed their consent to participate in the undertaken research.

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