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THE 8TH AND 9TH GRADES STUDENTS' ATTITUDE TOWARDS TEACHING AND LEARNING PHYSICS

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Abstract: The students' interest and attitude towards Physics have been the object of international testing, the most recent of which is the PISA testing from 2006. The students' attitude towards sciences is considered to be a significant predictor of their school results in science, respectively of pursuing a career in areas related to Science. The present paper had in view to discover the existence of convergences or divergences among the attitudes of the students in 8th and 9th grade towards the study of natural sciences and towards the teacher's role in studying for the natural sciences. The obtained results have not rendered evidently the existence of major differences but have allowed for the shaping of a profile for Physics as a school subject, from the interviewees' perspective. Thus, Physics is considered to be a difficult but pleasant and interesting subject, with use for oneself but for others as well. Our investigation has pointed out the fact that the students study too little for Physics at home, but that the Physics teacher is effective in teaching and motivating the students to learn. Although this is a pilot research project, our investigation signals a state of fact that implies reflection, mainly on the Physics curriculum but also on the teaching methods.

Key words: attitudes, PISA testing, Science, school students

1. The students' interest and attitude towards the study of scientific school subjects. PISA testing

Interests are considered to be the most important motivational factors in learning and development. The students' attitude towards studying natural sciences have been the object of some studies and research begun at an individual level, by independent researchers, by project teams, or by organizations (PISA, TIMSS, ROSE). The studies and research carried out have shown the fact that students acknowledge the importance of natural sciences for life and career but have also pointed out a significant drop in their interest in the study of these subjects (Ciomos, 2010; Keevs, 1992; National Science Board, 2004, Osborne et al., 2003; Zara, 2009). Among the factors that relate to the students' attitude towards science, the researchers have identified the following: gender, age, education level (elementary school, secondary school, high-school, etc.), type of school (government or private school), the students' school results in sciences and their classmates' influence, self-image, social self-perception, their family's socio-economic status (parents' education, jobs and monthly income), teaching methods, the parents' attitude towards sciences, the students' cognitive style, their interest in a certain type of career, social view on science and scientists (Adesoji, 2008; Cokadar & Kulce, 2008, Gardner 1975, Taber, 1992 cited by Lin, 1998).

The PISA evaluation was for the purpose of obtaining data relating to students' attitude towards Natural Sciences and Math. The students' interest towards science was chosen as an area of investigation in PISA because research shows that it is a significant predictor of school results in science or of pursuing a career in Science-related areas. (OECD,2007). Students' attitudes are considered to be a key component in the students' appropriating their competences within Natural Sciences and Math and they include the students' motivation, interest and sense of self-effectiveness. Thus, the PISA 2006 data that was collected related to the students' attitudes in four areas: the value (support) given to scientific research, the convictions about the ability to study Natural Sciences and

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Math, the interest in these areas and the responsibility towards resources and different environments. The value (support) given to scientific research is an important objective of scientific education. It involves the process of the students rendering valuable scientific ways of collecting data, drawing up rational arguments, having a critical attitude, formulating conclusions about different scientific situations that the students face in their daily life, etc. These aspects were included in PISA in the shape of using the scientific proof in making daily decisions and using logic and rationality in formulating conclusions.

The students' beliefs/convictions about their own abilities to study Natural sciences and Math are important for their involvement in the study process in general and for the investigational activities in particular. Moreover, research even shows that the beliefs about one's own abilities to get involved in the process of gaining scientific knowledge are related to the students' gender and can explain to some extent the differences in gender related to the students' motivation and performance in Science.

The students who value scientific research are confident in their abilities to engage in the scientific educational process, can solve scientific tasks efficiently, are able to overcome difficulties in solving scientific problems, use different perspectives and scientific and rational arguments, etc. In other words, they exhibit strong scientific abilities. Students interested in science manifest a curiosity towards scientific problems and they manifest a desire to enrich their scientific knowledge and abilities. Thus they use a variety of resources and methods and exhibit a desire to search for information, showing interest in a potential career in the scientific area. (OECD, 2007).

2. Method

Prokop, Tuncer & Chuda (2007) show that students' attitude towards sciences differs from one subject to another and modifies with age. According to this source, the students' attitude towards Physics becomes more negative with age while their attitude towards Biology becomes more positive with age. Likewise, boys' attitude towards science modifies with age, becoming more positive towards Physics than towards Biology, while girls' preference for Biology remains constant and at a high level.

***Statement of the Problem*:** The purpose of this study was to investigate if the attitude towards Physics differs from the 8^{th} grade students to the 9^{th} grade students.

Subjects

The subjects involved in the research were formed of two samples of students, one made up of 8^{th} grade students (ages 14-15 years old) and another made up of 9^{th} grade students (ages 15-16 years old). The sample with the 14-year old students was comprised of 112 students and the one with 15-16-year old students was comprised of 101 students.

The 8^{th} grade students came from four schools (two elementary schools and two high-schools) from the counties of Cluj, Sălaj, Alba, Bistrița; over 70% of the students' number having the age corresponding to the schooling level they are at, that is, 14 years old. The 9^{th} grade students came from the Agricultural College "Traian Săvulescu" Tg. Mureş, but study different profiles in school: economics, public administration, food industry, agricultural.

The 8^{th} grade subjects were questioned during September-October 2008, and the 9^{th} grade subjects were questioned during the same period of the year in 2009.

Instrument

The applied questionnaire was drawn up and used by the researchers. The questionnaire is comprised of 10 questions and the answers are distributed on a scale with five degrees of intensity: 1-totally agree, 2-partially agree, 3-partially disagree, 4-totally disagree, 5-I don't know.

The items of the applied questionnaire were the following:

- Physics is a difficult subject for me.
- I think Physics is an interesting subject.
- I like studying for Physics.

- Everybody has to study Physics in school.
- I'm convinced that what I study in Physics will be useful for me in life.
- The Physics teacher's role is important for my success in this school subject.
- The way I'm evaluated in Physics stimulates me to study.
- I believe I can get good results in Physics.
- The Physics teacher is efficient in teaching his/her classes.
- I study…. hours/week for Physics.

Context of the research

The study of Physics in the Romanian education system is done spirally. During the 6th grade (first level in the study of Physics) students get an overview of the main physical phenomena: Mechanical phenomena, Thermal phenomena, Electric and magnetic phenomena and Optical phenomena. At this level, the approach is somewhat limited. At the next level, during the 7th grade, students revisit the study of certain phenomena: The force; The mechanical equilibrium of bodies; Mechanical work and mechanical energy; Light and sound; Thermal phenomena. To exemplify, we present in the following table the curricular specifications within the theme of Optical phenomena, at both schooling levels:

Table 1. *The study of the theme of Optical phenomena*

6th grade students	***9th grade grades students***
1. Sources of light *2. Propagation of light* *2.1. Transparent, opaque and translucent bodies* *2.2. Straight line propagation. The speed of light. Shadow. Eclipses* *2.3. Reflection of light. Plane mirror*	*1. Reflection of light. Laws of reflection* *2. Plane mirror. Image construction* *3. Refraction of light. Total reflection* *4. Lenses* *5. Graphic constructions of images in lenses* *6. Optical instruments* *6.1. The eye* *6.2. Glasses. The magnifying glass* *7. The dispersion of light.* *The rainbow

As we note from table 1, the way the theme of Optical Phenomena is approached at the level of 9th grade is more profound and vast (a knowledge enrichment) than the previous level.

During the 8th grade, the following themes are studied more thoroughly: Thermal phenomena; The mechanics of fluids; The electric current; Optical instruments; Radiation and radioprotection; Nuclear energetics.

We present in Table 2 the way the theme "Thermal phenomena" is approached on three levels.

The analysis of the data included in the tables points out the curricular view described above but also the fact that at the moment of the investigation the theoretical and applicable knowledge of the 8th grade students are inferior to those of their colleagues in the 9th grade. Moreover, we can state that the 9th grade students have a more general overview of Physics.

Table 2. *The study of the theme of Thermal phenomena*

6th grade student	***7th grade student***	***8th grade student***
1. Heating. Cooling *1.1. The heating state. Thermal contact. Thermal equilibrium* *1.2. Temperature. Measurement unit. Thermometers* *2. Dilatation* *2.1. Dilatation of solids* *2.2. Dilatation of liquids* *2.3. Gas Dilatation* *2.4. Consequences and practical applications*	*1. Diffusion* *2. Calorimetry - heat, temperature* *Caloric coefficients * Fuels *3. Thermal engines* * Thermal efficiency of engines	*1. Heat* *1.1. Thermal agitation* *1.2. Heat – conduction, convection, radiation* *2. Change in aggregation state* *2.1. Melting/Solidifying* *2.2. Vaporization/Condensation* 2.3. * Latent heat

3. The results and their discussion.

The obtained results are presented as follows:

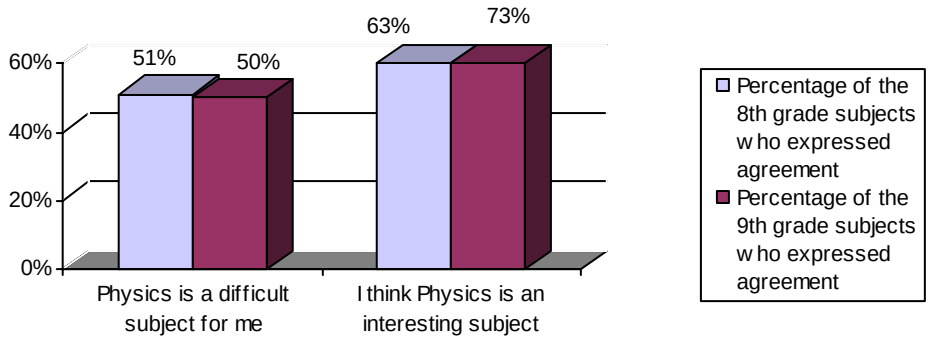

Figure 1. *The students' answers to the item " Physics is a difficult and interesting subject for me".*

The 8th and 9th grade students expressed their agreement in a percentage of 50% regarding the fact that Physics is difficult. The absence in differences regarding the agreement between the 8th grade students and the 9th grade students about the item *"Physics is a difficult subject for me"* can be explained by the fact that the 9th grade students, due to pursuing their vocational specialization, study a much more simplified content compared to the content of the students with a specialization in natural sciences or Math-Informatics.

Within the 8th grade classes, the percentage of the students who expressed agreement regarding the fact that *Physics is an interesting subject* was 63%, while among the 9th graders the same results were higher by a 10% margin. This difference can be explained by the variance in the volume of the theoretical and applicable knowledge in Physics of the two groups of students as well as through the fact that the 8th grade students are about to take the tests for admission into high-school and as a result they give much less attention to studying Physics.

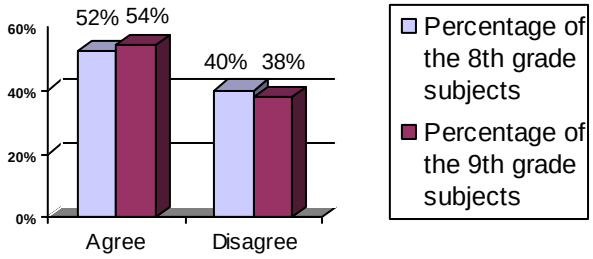

Figure 2. *The students' answers to the item "I like studying for Physics"*

Unfortunately, both levels include fairly high percentages of students who dislike studying for Physics: 50% of the 8th graders and 38% of the 9th graders. This fact is further confirmed by the students' answers about the time they allot to studying.

Table 3. *The students' answers to the item " I study…. hours/week for Physics".*

The students' percentage	**¼ hour**	**½ hour**	**1 hour**	**2 hours**	***Not at all***
8th grade students	32%	20%	13%	11%	***25%***
9th grade students	***41%***	***26%***	***20%***	***7%***	***6%***

As we notice in Table 3, most students study for Physics only a quarter of an hour. Even though the 8th grade students are on the verge of being tested for high-school admission, it is surprising that 25% of them do not study for Physics at all.

As to the agreement for the recommendation to study Physics, the percentage of the 9th grade students is slightly superior the one of the 8th grade students.

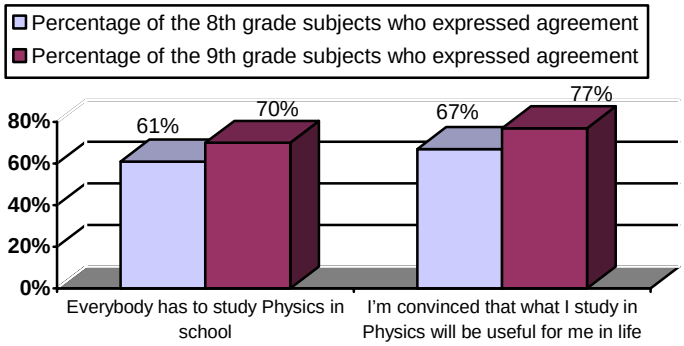

Figure 3. *The students' answers to the item regarding Physics' utility for oneself and for the others*

As we notice from Figure 3, there are minor differences between the percentages of the 8th grade students and the 9th grade students who state they agree with the necessity that everyone should study

for Physics. The situation is similar when it comes to the statement "I'm convinced that what I study in Physics will be useful for me in life." But the fact that 25% of the 8th grade students compared to 15% of the 9th grade students disagree that what they study in Physics will be useful to them in life may be the result of a mainly theoretical approach that sometimes characterizes the teaching and studying of Physics, especially in elementary school.

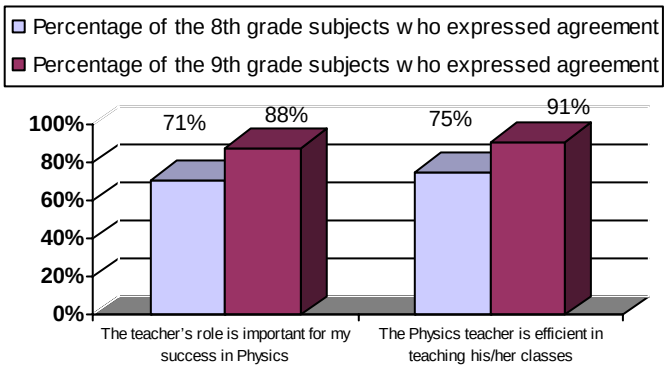

Figure 4. *The students' answers to the items referring to the Physics teacher's work activity*

We notice that very high percentages of students from both levels consider the teacher's role as an important one in teaching and studying Physics. This fact must be rendered valuable at its maximum by the teacher, who has to teach content centred around life, use efficient teaching and studying methods, motivate students towards studying sciences and monitor and evaluate the students' progress, thus meeting the students' trust.

The fact that the teacher's image is a positive one is also derived from the students' answers to the item "The Physics teacher is efficient in teaching his/her classes." The 9th graders appreciate the Physics teacher's efficient work in class in a greater measure (91%) than their younger colleagues (75%).

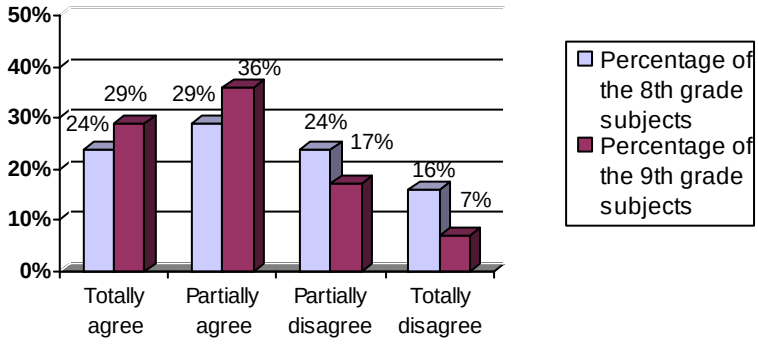

Figure 5. *The students' answers to the item "The way I'm evaluated in Physics stimulates me to study".*

According to the Figure 5, a percentage of 40% of the 8th graders and only 24% of the 9th graders believe that the evaluation methods are not stimulating them to study. This percentage is high among the 8th grade students. This could be because of the use of some traditional evaluation methods or the excessive use of methods like "paper" or "project".

Considering that for a percentage higher than 50% of the students Physics is an interesting subject that they like to study for, useful for oneself and for the others, for the studying of which they have the teacher's support etc, it is expected that students believe they can get good results in Physics.

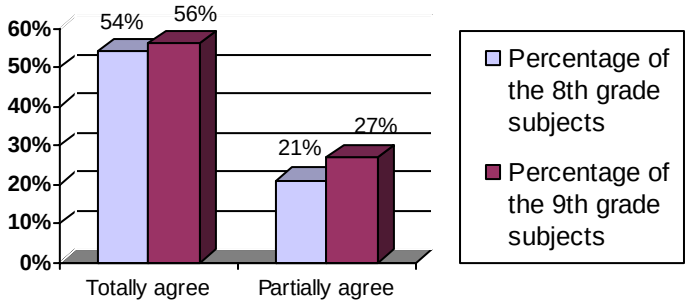

Figure 6. *The students' answers to the item "I believe I can get good results in Physics".*

Within the 8th graders, 75% of the students believe they can get good results in Physics while within the 9th graders the percentage of the students having this belief is 83%. The high percentages of students who believe they can achieve good results in Physics (75% of the 8th grade students and 83% of the 9th grade students) suggest that, despite the perception that Physics is difficult, the students are confident that they can achieve good results, which should be supported by the teacher through their systematic assistance offered to the students.

4. Conclusions. The limitations of this research

The present paper has purposed to investigate the possible differences between the students of the 8th and 9th grade regarding the study of Physics. The investigation was carried out in a written form with 213 sample students, from 8th and 9th grade, participating in it. Their answers allow for the outlining of a profile of Physics as a school subject. Thus, half of the subjects that were interviewed in the investigation consider Physics to be a *difficult subject*, but which they *enjoy studying* (52% of the 8th graders and 56% of the 9th graders). For more than half of the subjects Physics is an *interesting subject* (63% of the 8th graders and 73% of the 9th graders). Regarding Physics' usefulness in life, half of the subjects (48% and 51% respectively) express their total agreement with the statement that *Everybody should study Physics in school*. A higher percentage of subjects (55% of the 8th graders and 76% of the 9th graders) express their total agreement with the statement that they would be able to use what they study in Physics later in life. 47% of the 8th graders and 62% of the 9th graders totally agree that the teacher's role is very important to their success at that particular subject. Also, more than half of the subjects (55% of the 8th grade students and 76% of the 9th grade students) totally agree that the Physics teacher is efficient in teaching his/her classes. This efficiency is probably the basis for the students' belief that they can achieve good results in Physics (75% of the 8th graders and 83% of the 9th graders) without studying too much. Thus, 77% of the 8th graders and 73% of the 9th graders state that they don't study at all at home or that they study less than an hour.

In conclusion, Physics is a school subject students like but which they study too little. Physics teachers should pay greater attention to selecting those methods that would point out to the students Physics' relevance to life, render their life experience valuable, stimulate their curiosity, involve them in research and practical activities, and thus help convince them of the necessity for extra preparation at home. Concomitantly with pointing out the above-mentioned situation we have to mention as well the limitations of our research. These are in regard to the representative character of the students' sample, which has been selected only from urban schools, though at different levels (two elementary schools and two high-schools) as well as to the fact that the 9th grade students attend the same school. The authors' intention, though, is to extend the pilot research carried out, so that the obtained results may be used as a foundation for reflections regarding the curriculum and teaching methods.

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