# Specialized vs. Standard High School Classes and Their Results in Physics

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**Abstract.** Three years ago, one high school class for students with special abilities in physics was founded in Nis, Serbia (www.pmf.ni.ac.yu/f_odeljenje). The basic aim of this project is introducing broadened curriculum of physics, mathematics, computer science, as well as chemistry and biology. Three years after establishing of this specialized class, we present analyses of the pupils` progress in knowledge of physics. These results are compared to the progress results of the pupils in a standard Grammar School and the corresponding classes of the Mathematical Gymnasiums in Nis, Novi Sad and Belgrade. We make some conclusions and remarks, may be useful for the future work that aims to increase pupils` interest in physics.

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## INTRODUCTION

In the countries of former Yugoslavia, classes for students with special abilities have a long and successful tradition. Despite some improvement that has been made through last few years, today three fundamental problems still characterize the teaching at the schools in Serbia: obsolete equipment, obsolete education concepts and insufficient motivation of teachers (small payroll). One of the results of this situation is a very small number of students in the natural sciences and engineering sciences at the university. Moreover skills of pupils in using methods and tools developed in physics and other sciences seem to decrease at the same time with a new, revolution in science and technology in developed countries.

The main goals of the project "GRAMMAR SCHOOL CLASS FOR STUDENTS WITH SPECIAL ABILITIES IN PHYSICS" are to offer a high-quality education, to give gifted pupils a perspective for continuing with high-quality education and to convey initiative and enthusiasm. These goals are to be reached by the following measures: (i) focus on the natural science, in particular on physics, (ii) provision of basic laboratory equipment and PCs (virtual experiments and Internet access), (iii) close collaboration with the University (Host teaching by docents, assistants and project guests, mentors from the university), (iv) close collaboration with similar projects in EU and Eastern Europe, (v) more intensive foreign languages teaching (especially English), for details see [1].

The authors of the curricula and project have been faced with a lot of problems in implementation of the project in its basic form during last three years. However, one of the most important aims has been permanent evaluation of the pupils in the ``new class`` and comparison of their results with pupils educated in the standard and ``mathematical`` classes in Serbia. In this paper we present some starting results in a very brief form.

## EVALUATION

Results of two tests in physics made in October 2005 and May 2006 are given in the Table 1. There have been five groups of pupils (1. Special class for "physicists" in Nis (9 pupils), 2. Special class for "mathematicians" in Nis (7), 3. Standard grammar class in Nis (20), 4. Special class for "mathematicians" in Belgrade (17) and 5. Special class for "mathematicians" in Novi Sad (7). All pupils worked out the same test with 20 questions (in total 100 points) and 2 problems (in total 50 points). At this stage we measured abilities of pupils only in physics and mainly in the first class. The differences in syllabus in physics are so big in the second and third

year that comparison of results is sensible just after the end of the grammar school, i.e. after 4th year.

In the table bellow we present results of the third generation pupils born in 1990. The other results will be presented elsewhere. In the first column we denote the corresponding class and the numbers of pupils that took part in both testing. In the following columns one can see their records in test the questions and solving problems in percents.

**TABLE 1.** Results of the third generation

| | Questions 1 (%) | Problems 1 (%) | Total 1 (%) | Questions 2 (%) | Problems 2 (%) | Total 2 (%) |
|---|---|---|---|---|---|---|
| "Physicists"-Nis (9) | 52,67 | 22,4 | 42,58 | 71,11 | 27,78 | 56,67 |
| „Mathematicians"-Nis (7) | 35,00 | 0,00 | 23,33 | 64,86 | 4,29 | 44,67 |
| Standard class-Nis (20) | 42,60 | 0,00 | 28,40 | 61,40 | 0,00 | 40,93 |
| "Mathematicians"-BG (17) | 67,06 | 0,71 | 44,94 | 68,29 | 29,18 | 55,25 |
| "Mathematicians"-NS (7) | 69,14 | 8,29 | 48,86 | 81,86 | 31,43 | 65,05 |

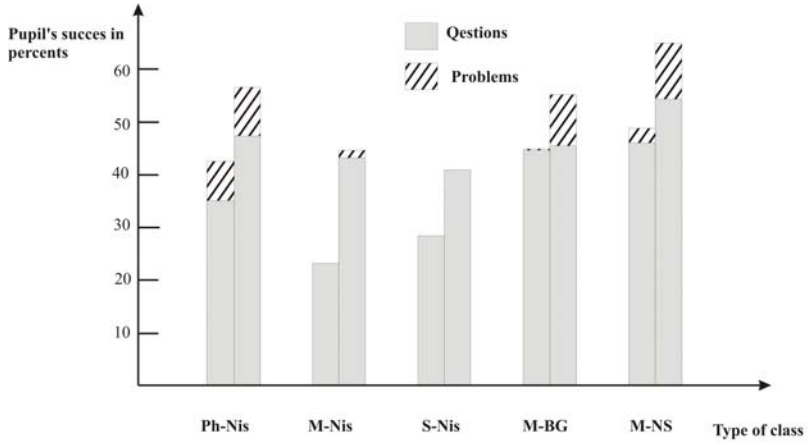


**FIGURE 1.** Pupil's success in solving test questions and problems. Ph-Nis, M-Nis, S-Nis, M-BG, M-NS.

## CONCLUSION

Let us note that this program of evaluation of the curricula and its implementation, even focused just on physics at this stage is quite nontrivial. There are 5 groups of pupils in 3 different cities and 4 schools. About 10 people are included in this evaluation practically on a complete voluntary basis. Finally syllabus on physics is similar just in the first year and after that rather different until the end of the grammar school when they have the same "corn" in physics.

Let us denote that pupils from the standard class are not able to solve problems (their records in solving problems tend to zero in all three generations). The "physicists" show slightly better improvement in physics, and continually good records in solving problems. Let us note that the second test in Novi Sad was done just by seven best pupils chose by their school. It is worth to note that the new class and program "for physicists" has attracted better pupils and that number of pupils is increasing 7, 11 and 15 in 2nd, 3rd and 4th (the newest) generation. It can be explained by attractive curricula, a lot of guest lecturers, additional laboratory work, excursions, some support in books and awards

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## REFERENCES

1. G. S. Djordjevic and Lj. Nesic, *Grammar School Class for Students with Special Abilities in Physics*, Proceedings of the BPU5, V. Banja, Serbia, 2003, pp. 161-164.
2. G. S. Djordjevic, Lj. Nesic, and M. K. Radovic, *Experimental Education in Physics for Talented Secondary School Students*, Proceedings of the Annual Meeting on Physics Education, Belgrade, 1999, pp. 651-654.