
GRAMMAR SCHOOL CLASS FOR STUDENTS WITH SPECIAL ABILITIES IN PHYSICS

G. S. DJORDJEVIC and LJ. NESIC

*Department of Physics, Faculty of Sciences, P.O. Box 224, 18001 Nis, Serbia
nesiclj@junis.ni.ac.yu*

ABSTRACT

Grammar school "9. Maj" in Nis, Serbia, has been given the permission by the Minister of Education and Sports of Republic of Serbia to found one class for students with special abilities in physics for the school year 2003/2004. This is one of the first projects that will hopefully meet the expectations of the school system reforms in our country, which allow the development of the separate school curriculum, up to 30% different from the national compulsory curriculum. The basic aim of this project is introducing broadened curriculum of physics, mathematics, computing, as well as chemistry and biology. A special emphasis would be on closer correlation between different subjects' curriculum, while teaching process approach should be thematic and problem solving.

Keywords: physics education, gifted pupils

1. Introduction

In the countries of former Yugoslavia, classes for students with special abilities have a long and successful tradition. Today three fundamental problems characterize the teaching at the schools in Serbia: obsolete equipment (lack of demonstration and exercise laboratories), obsolete education concepts (ex-cathedra teaching, lack of problem-solving competence), 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. The goal of this project is to offer a high-quality education to give gifted pupils a perspective for continuing with high-quality education and to convey initiative and enthusiasm. This goal is to be reached by the following measures:

- Focus on the natural science, in particular on physics,
- Provision of fundamental laboratory equipment and PCs (virtual experiments and Internet access),
- Close collaboration with the University (Host teaching by docents, assistants and project guests, mentors from the university),
- Close collaboration with similar projects in EU and Eastern Europe,
- More intensive foreign languages teaching (especially English).

The improvement of the education system countrywide, especially in material intensive subjects such as natural sciences, is unforeseeable today. Many attempts have been taken during last year to provide financial support for the realization of this project.

2. Starting points and motivation

The existent grammar school curriculum, often burdened with too much information, has usually been making earlier specialization in acquiring modern knowledge and skills more difficult. Insufficiently interesting and updated natural sciences programs, including physics, especially the manner of their being presented, as well as badly equipped laboratories, makes their studying less and less popular. Such a trend, although it is not only with local characteristics, could in the long run have very bad consequences to scientific, technological and economical development. Independently of the student's future vocation choice, the neglecting the natural sciences through which a specific active and closer approach to natural phenomena, professional challenges and everyday life is developed, has impoverished the creativity of the young generations and their future potentials. What can be done?

3. Aims and tasks

The basic aim of the experimental project is introducing broadened curriculum of physics, mathematics, computing, as well as chemistry and biology. A special emphasis would be on closer correlation between different curriculum subjects, while teaching process approach should be thematic and problem solving.

These types of curricula, made for students with special abilities in natural sciences, basically tend to contribute to raising the natural sciences knowledge, abilities and skills level, necessary for general i.e. grammar school education. This provides students more possibilities for future vocation final choice. Besides, modern trends in economy will demand more and more multi-faceted education and team working, where the development of the understanding the wholeness of a certain problem at its all aspects, as well as a high level of training in the given scientific field are of great importance. The project authors and a number of experts, who entirely support it, are strongly convinced that students who finish this kind of grammar school would be prepared better than most of their coevals for the chosen studies.

The given aim includes the following tasks fulfilment:

1. To explore how much the proposed curriculum will contribute to acquiring theoretical and practical knowledge of natural sciences;
2. To find out the contribution of this curriculum to the students' creativity in the process of studying and teaching, their independence in work, their using various sources of information, as well as their logical thinking competence;
3. To do the continuous and complete expert check-up on the results of students' participation at competitions, as well as the results of their acquiring all other curriculum based tasks;
4. Constant comparison of the results of this class's students with both the results of the rest students of the school and the students of the schools with the similar orientation.

The proposed curriculum offers an extremely good preparation for all sorts of colleges and faculties and a lot of possibilities of students' choice because the concepts give a high standard of general education. That is, students can apply for the many faculties. The team of university professors has done the physics, mathematics, computing and biology curriculum with the cooperation of the Nis grammar schools' teachers. The curricula are updated and they follow the expected interests of students. Some classes, including the practice and students' project work will be done at the Nis faculties and other institutions. The course of schooling includes a number of specialized excursions inside Serbia (The Physics Institute in Zemun, Belgrade, The Vinca Nuclear Institute, The Health Protection Institute, etc.). The Physics Department of Nis is planning to organize several excursions abroad, thanks to the offer of the CERN Physics Institute from Geneva and collaboration with ICTP from Trieste.

Table 1. General Curriculum

Compulsory subjects	1 grade		2 grade		3 grade		4 grade	
	Weekly	Yearly	Weekly	Yearly	Weekly	Yearly	Weekly	Yearly
Serbian Language	4		3		3		4	
English Language	2		3		3		2	
Philosophy							2	
Sociology with Constitutional and Civil Rights					3			
Psychology					3			
History	2	2						
Geography	2	2						
Physics courses	5	+60	5	+60	6	+30	5	+30
Latin Language							2	
Astronomy							2	
Chemistry	3		3		2		2	
Biology	2		2		3		2	
Sports	2		2		2		2	
Mathematics	5		5		5		5	
Computer Science	3		3		2	+30	2	+30
Practice		+60		+60		+60		+60
Total	30		30		30		30	

? The + sign before the numbers marks the number of practical classes.

Table2. The Physics Courses Curriculum

Compulsory subjects	1 grade			2 grade			3 grade			4 grade		
	W	P	Y	W	P	Y	W	P	Y	W	P	Y
Mechanics and Thermodynamics	3		111									
Exercises I	2		74									
Laboratory I		60	60									
Electromagnetism and Optics				3		111						
Exercises II				2		74						
Laboratory II					60	60						
Mechanics with the Theory of Relativity							2		74			
Atomic and Molecular Physics							2		74			
Physical Electronics							2	30	104			
Modeling in Physics										2	30	94
The Physics of the Micro World										3		96
Total	5	60	245	5	60	245	6	30	252	5	30	190

W=weekly, P=practice, Y=yearly

4. Selection and Number of Students

The list and the candidate's ranks will be done according to the existing way of enrollment. The selection order will be done according to the following criteria:

- General student's evaluation list from VI to VIII grade, including the natural sciences competition results (especially in physics, mathematics and computer science),
- The total points on the entrance examination test in Serbian and Mathematics,
- The Physics test results.

The entrance examination consists of two parts. The first part is a test in Physics, which will be done in the Grammar school "9. Maj", after previous preparation lessons. The second part is the written tests in Serbian and Mathematics, which will be taken in their primary schools. A candidate who will have passed the exam for the special class enrolment has 25% per test (both Serbian and Mathematics) as well as 50% of the total point in the test in Physics. The number of students is 22. If necessary, the students can be divided into smaller groups. This makes teacher to students relation easier and will result in better and interesting teaching process with much more creative students. Each student will have a teacher-mentor from the Faculty of Natural Sciences in Nis, who will be of great help, following student's efforts.

5. Teachers

The selected teachers of "9. Maj", the professors and associates of the University of Nis, especially of the Physics Department will make the team of teachers.

The Physics Department formed a commission of experts from the Department and the teachers from "9. Maj", who will follow the work of the class, giving support and in-service advice, there will be another commission, formed by the Ministry of Education of Serbia, consisting of a team of experts in various fields.

6. Financial support

Besides the support of the authorities of Nis and the Republic, this project could be supported by some international organizations, i.e. UNESCO, and some expert associations and other organizations from Bavaria. It is also known that scholarships will be given to best students of the class. There is also possibility of providing flats for those who are not from Nis. Additional financial support will be provided by:

- The Nis Assembly,
- Regional Ministry Departments,
- Foreign countries funds,
- The School Donors' Club.

7. References

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