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The Physics Questions in Student Selection Examination and Physics Curriculum and the Effect of Those Questions in Students' Success in Turkey

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Abstract: Success of high school students in solving physics questions of student selection examination (ÖSS) that has to be taken by high school students before entering the Turkish universities have been investigated with regard to these questions to be solved by students and suitability to high school physics curriculum and factors affecting students success. In this purpose a questionnaire has been distributed to undergraduate students of Necatibey Faculty of Education and Faculty of Science and Literature of Balıkesir University in Turkey, especially to volunteer students (a total of 194 students) from Biology, Mathematics, Computer, Science Teacher Education programs and Physics departments. In addition to this, more than 30 high school physics teachers and university professors have been interviewed one to one to ask their opinion about this subject in order to investigate the results. Students and teachers criticized new ÖSS examination system and made some recommendations.

Key words: Physics teaching, Student Selection Examination (ÖSS) and success in Turkey, high school physics curriculum.

INTRODUCTION

In Turkey, before entering any university, one has to take national examination which is called ÖSS, Turkish acronym of student selection examination, during the least year of high school study or following years. This examination consists of two main parts: numerical and verbal. The verbal part consists of two sections, Turkish literature and grammar usage, and social sciences (history, geography, sociology). Also the numeric part consists of two sections: mathematics and science. Mathematics parts also could be divided as algebra and geometry section. Of the numeric part, science section consists of 60 % and includes physics, chemistry and biology questions. According to the scores obtained from these verbal and numeric parts, students could be replaced to any Turkish university that student had chosen and matched his score to those university department scores. In this case, the national student selection examination (ÖSS) plays very important roles for students, parents, and educators or simply everyone who lives in Turkey because; this examination shapes one's future life by entering any university, getting a job according to graduation from this university and so on. Students' performance in this examination has to be very high to compete with more than 1.8 millions each year and growing.

Also, a big portion (40 %) of science section consists of physics questions. In this case physics questions are vital to obtain high scores and enter any department that one wants. It is an expected result that the high school physics curriculum and physics questions in the ÖSS examination have to be in relation with each other and physics questions must originate from this curriculum. However, most of the students are not satisfied by their teacher or school or curriculum and want to get extra help and study outside the school setting to prepare for this ÖSS examination.

In Turkey, there is a private institution, called "dershane", to prepare the students to the national ÖSS examination besides the schools. Students could go and attend this institution during the high school years or after graduation from high school. The question is if almost all of the students choose this private institution, do not we have to interrogate high school system and its functions and revise the system and curriculum?

After 1998, there was a dramatic change about the national students selection examination (ÖSS) reducing two level examinations (first exam was selection exam, and second one was replacing exam with detailed areas in all sections) to only one. After this change, there appeared some gaps between physics curriculum and physics questions in national exam that did not cover the entire high school physics curriculum. When we looked at last five years students' overall physics net, we came up with only around 2.5 (out of 19 questions) or 13 percent instead of more than 80 percent. Why is this result so low to an unacceptable rate? What kinds of consistency levels or relationship are there between physics questions in national selection examination and high school physics curriculum? Or what level should

Table 1: ÖSS physics questions (1999-2005) and related to subject matter

Physics Subjects	1999	2000	2001	2002	2003	2004	2005
Vectors and Forces	1	1		1	1	-	-
Equilibrium and Moment	-	1	1	1	1	1	1
Center of mass	1	1	1	1	1	1	1
Simple machines	1	-	2	1	1	-	1
Work-Energy	1	2	1	2	2	2	2
Pressure	2	1	1	1	1	2	1
Matter and specifications	1	2	1	1	1	1	1
Archimedes Principles	2	1	1	-	-	1	1
Heat –temperature and expansion	2	2	2	2	2	2	2
Motion, kinematics	1	1	2	2	2	2	2
Light-shadow-illumination	1	-	1	1	1	-	1
Mirror-plain/convex/concave	1	1	1	1	1	1	1
Refraction	1	1	-	1	1	1	-
Lenses	-	1	1	-	-	1	1
Electrostatics	1	1	1	1	1	1	1
Lamps-Simple circuits	1	1	1	2	1	1	1
Electrical current and ohm law	1	1	1	-	1	1	1
Magnetism and magnets	-	1	-	1	-	1	1
Transformers	1	-	1	-	1	-	-
Total questions	19	19	19	19	19	19	19

this relation be? Before entering the university, do students have enough physics knowledge? Is the new national selection exam, in the same aspect, better than the old one? In this study we are going to answer these kinds of questions. For this purpose, a questionnaire was developed and used for 194 volunteer students from Balıkesir University, Necatibey Faculty of Education and department of Science and Liberal Art and one to one interview to high school physics teachers and university professors (more than 30 physics teachers).

ÖSS PHYSICS QUESTIONS and PHYSICS CURRICULUM in TURKEY

We should first look at physics questions in the national selection examination (ÖSS) were covered by new physics curriculum. To start this investigation we have to classify last five years ÖSS physics questions according to their subjects. In Table 1, you will see last five years ÖSS physics questions related to subject matter; and Table 2 classifies these questions related to high school levels.

One can see on in this table that there is a disorder in distribution among the ÖSS physics questions relative to high school curriculum. There are many topics in the high school physics curriculum that are excluded from ÖSS physics examination. In the mean time, in the old ÖSS system, this was called ÖSYS (Students Selection and Replacement Examination); the physics questions had orderliness and appropriateness in dispersion of high school physics curriculum (Morgil, 1996).

In general, Table 2 shows the number of questions according to high school physics curriculum subjects and high school grade levels.

One can see in Table 2 that all the physics questions in ÖSS examination do not come from high school physics curriculum. Some questions related to junior high school program, and some of them are a combination of two and more physics subjects (like simple machines-Archimedes principles- energy, etc.). In average, about six and seven physics questions come

Table 2: Number of ÖSS physics questions relative to high school grades level and physics topics

Level	*Subjects*	Number of questions						
		1999	2000	2001	2002	2003	2004	2005
9th grade	Matter and Specifications &Heat, temperature &Electrostatics	6	7	6	6	6	6	6
10th grade	Mechanics & Electricity and Magnetism	5	7	6	7	7	5	7
11th grade	Optics & Waves &Modern Physics	3	3	3	3	3	3	3
	Total	14	17	15	16	16	14	16

from 9th and 10th grade level subjects while only three questions come from 11th grade level. (Note that in Turkey –from kindergarten to high school we have total 11 grade level, k11 instead of k12).

RESULTS

To determine the effect of students' ÖSS physics success, a survey (it can be seen in the appendix) was used to 194 students at Balıkesir University, Science and Liberal Art and Necatibey Faculty of Education Department. Specifically, volunteer students participated from mathematics, computer, science, biology, physics department. Results obtained from this survey related to participants are given in Table 3 through 8. In Table 3, you can see students gender, average physics nets from ÖSS and attendance in private institution of "dershane" according to their departments.

Turkey was 2.5 (ÖSYM, 2004), participants' average physics net was 13.39. Participated students' average attendance to private institution of "dershane" was 87.6 %. In the next table, Table 4, it is given Participants' attendance to private institution of "dershane" according to their entrance years.

According to Table 4, participant students attended to private institution of "dershane" were 87.6 %. Attendance rate changes among the given years; however, this rate never dropped lower than 75 percent. Higher attendance rate is found in 1999 with 97.4 %. In the following table you will see attendance of private institution of "dershane" according to their gender.

It can be seen in Table 5 that when we make distribution according to gender, attendance of private "dershane" rate for female higher than male students

Table 3: Number of students, average physics nets and attendance to private institution (in percent) according to their departments

Departments	Number of students female	male	Average physics nets from ÖSS exam	Attendance to private institution (in %)
Mathematics Education	19	20	15.46	97.4
Computer Education	17	18	14.17	80.0
Science Education	25	21	12.07	93.3
Biology Education	7	7	12.79	100.0
Physics	18	42	12.74	78.3
Total	86	108	13.39	87.6

Table 4: Participants' attendance to private institution of "dershane" according to their entrance years

		Private "DERSHANE"				Total
		Attended		Not attended		
		N	%	N	%	N
Entrance years	2002	66	93.0	5	7.0	71
	2001	41	75.9	13	24.1	54
	2000	25	83.3	5	16.7	30
	1999	38	97.4	1	2.6	39
Total		170	87.6	24	12.4	194

with 93 %. In general this attendance rate seems very high with average of 87.6 percent.

Another survey question asked to participant was given high school physics curriculum if physics ÖSS questions could be solvable or not. There was three choices with yes, no, and partial. Their answers related to this question were given in Table 6.

It can be seen in Table 6 that 20.6 % of the student said it can not be solved these ÖSS physics questions given that physics curriculum, 24.7 % of the students said these question can be solved with given curriculum; and 54.6 % of the students said those questions can be

Table 5: Participants' attendance to private institution of "dershane" according to their gender.

		Private "DERSHANE"				Total
		Attended		Not attended		
		N	%	N	%	N
Gender	Female	80	93.0	6	7.0	86
	Male	90	83.3	18	16.7	108
Total		170	87.6	24	12.4	194

When we look at Table 3, a number of students participated to the survey was 194, of the 56 % was male, and 44 % was female. Even though (for the last five years) students' overall average physics net in

solved partially. When we look at these results according to gender, 31.5 % of the male students said yes those physics questions can be solved with given high school physics curriculum; while this yes rate for female

Table 6: Students' answers related to solvable of ÖSS physics questions with given high school physics curriculum according to gender

		Solvable of ÖSS physics questions						Total
		Yes		No		Partial		
		N	%	N	%	N	%	N
Gender	Female	14	16.3	17	19.8	55	64.0	86
	Male	34	31.5	23	21.3	51	47.2	108
Total	N	48	24.7	40	20.6	106	54.6	194

students was only 16.3 %. In Table 7 is given same question's answer with according to students' departments.

Table 7: Students' answers related to solvable of ÖSS physics questions with given high school physics curriculum according to students' departments

		Solvable of ÖSS physics questions						Total
		Yes		No		Partial		
		N	%	N	%	N	%	N
Departments	Biology education	1	7.1	4	28.6	9	64.3	14
	Mathematic education	15	8.5	4	10.3	20	51.3	39
	Computer education	4	11.4	14	40.0	17	48.6	35
	Science education	9	19.6	8	17.4	29	63.0	46
	Physics	19	31.7	10	16.7	31	51.7	60
	Total	48	24.7	40	20.6	106	54.6	194

It can be seen in Table 7 that students' responses about solvable of ÖSS physics question rates change among the departments but the higher none answer was given by computer education department with 28.6 percent and the lower none answer rate was given by the mathematic education department with 10.3 percent. In general, most of the students said ÖSS physics questions partially solvable with given the high school physics curriculum. When asked to participant students a question of who is responsible for these lower physics nets, they gave the following answer as indicated in table 8.

According to Table 8 participated students made curriculum most responsible for getting the lower physics rate with 28.87 percent, and than this continued with teacher, students, ÖSYM, physics text books with given percent rates.

Table 8: Percent rate of students answer related to responsible of lower physics rate.

Responsible	Percent rate (%)
Curriculum	28.87
Teacher	20.08
Student	18.41
ÖSYM	14.64
Physics text books	12.55
Others	9.62

DISCUSSION and RECOMMENDATIONS

In this section let's give some new questions and revise the answer to first parts' questions that we asked: is there any problem with new ÖSS examination related to physics questions and high school physics curriculum? Why is average net of ÖSS physics examination too low with around 2.5 for the last five years? Why do most students choose and attend private institution of "dershane" while they are in high school? When the students entered the university, do they have enough physics knowledge? Can we make any conclusion about the new ÖSS system?

To increase ÖSS physics net, participant students' opinion can be summarized like this: first, most of them made complaints about the curriculum that must aim to ÖSS examination. In this high school physics curriculum many physics topics are not covered by ÖSS physics exam questions. They said that in this system the high school physics curriculum and ÖSS exam contradict with each other. The physics curriculum must be more research and conceptual based for preparing students to ÖSS physics exam. The private institution of "dershane" only prepares students to ÖSS exam (they have only ÖSS exam curriculum); therefore these institutions attract more students. Many parents and students have widespread opinions and they believe in that "to be successful in ÖSS exam, one has to attend this institution". Many teachers who were interviewed said that current high school physics curriculum has to be in parallel with the current ÖSS exam or the new ÖSS system has to include the entire physics curriculum. They urged some changes with new approach to curriculum or ÖSS exam to make a more reasonable combination of both.

Participant students' second criticism was about teachers. The teachers have to be well prepared and have to have enough knowledge in their area. They have to make the instruction and lecture interesting and more fun and attractive to students. They have to be self-sacrificing and love their jobs. They also have to have good management skills and a class discipline. Students do not have to be worried about grades and passing the exams while focusing on logic and the conceptual understanding of the subjects. Moreover participant

students have criticized themselves. They said that students before entering the class have to study and prepare the subject covered in classroom. They have to make more practice and conceptual understanding of the topics without only memorizing them. The textbooks have to be well written and organized to teach any subject and textbooks have to be parallel with the high school curriculum and ÖSS exams. The curriculum, textbooks and exam have to be complementary of each other.

In this issue teachers made their complaints about insufficient physics classroom time, distributions of physics topics into high school physics curriculum and discord between ÖSS exam questions and high school physics curriculum. Because the ÖSS exam does not cover the whole high school curriculum, the physics teachers could not explain this issue to students and parents. Mostly 10th and 11th grade high school physics topics are not included in the ÖSS exam, therefore; students are not interested in and pay attention to those physics topics, and classrooms. Another problem related to physics teacher is their low salary. Because of the low salary, some teachers said about their colleagues that they could not willingly do their jobs, and are not interested in their works. The possibility of insufficient lab environment and usage also affect their instruction and performance.

Participant students made also their critics about Students Selection and Replacement Center (ÖSYM) especially about Turkish Higher Education Association (YÖK) and they said and emphasized that the ÖSS selection examination and system need to be changed. The new system has to prevent getting attendance to private institution of "dershane" and without entry of university any kind of examinations. The current ÖSS examination lasts three hours. Students do not have to shape their future according to the performance in this three-hour examination with excitement, fear and many more kinds of emotions. In order to be successful in this examination one should be decisive, steady and believes in their success and studies with patience.

Also many university colleagues complained about increasing students' lack of and lower physics knowledge levels in all of the areas since the change of new ÖSS exam in 1998. They also urged a change in the current ÖSS examination and made it responsible for all of the results.

Limitations:

Obtained results have limited the following:

- Volunteer students from Balıkesir University, Necatibey Faculty of Education and Science and Liberal Art Department in Turkey.
- High school physics teachers from many high schools (these physics teachers participated from more than 20 different cities), and some university professors in Turkey.
- Survey questions.

Recommendations:

According to participated students' and one to one interviewed high school physics teachers' responses we can make the following recommendations:

1. High school physics curriculum and its distribution to grade levels have to be reviewed and necessarily changes have to be made (some teachers and students complained about 10th grades physics curriculum most). When improving and changing the new physics curriculum it must applied to teachers' opinions and ideas.
2. The ÖSS physics questions must cover and comprise whole high school physics curriculum.
3. Three hours ÖSS examination system has to be changed. It cannot shape one's future only from performance of this exam results.
4. Physics classrooms and instruction must be devoted to conceptual understanding, research and practice based and not just memorizing the facts and knowledge. Because misconceptions do affect students' success (Tatlı, 2001), physics instruction and labs should aim at overcoming to those misconceptions. As an alternative to the current physics curriculum, first physics course should be replaced and related to only conceptual not mathematical based.
5. Students should not worry or fear from participating to the class discussion (Çepni, 1999); they have to engage in any class involvement actively.
6. Before coming to the classroom, students' ideas and opinions affect their physics learning and performance (Eryılmaz, 1999). Therefore, teachers and parents have to motivate and help students.
7. New physics curriculum focus more on samples related to real life situations and examples. In that way physics should be more attractive and fun in learning. As an addition to physics course some related courses should be included in new curriculum like history of science, ecology, astronomy, etc. (Eryılmaz, 1999).
8. It is essential and a necessary that physics textbooks have to have a teacher editions with necessary explanation and solutions. Also each classroom instruction has to come with its materials like transparent, computer related materials, manuals, etc.
9. To inform new development and update their knowledge, occasionally Ministry of National Education has to arrange courses for in the service of physics teachers.
10. Current salary of the teachers seems very low. It needs financial improvement. It can be looked at and evaluated according to their performance.
11. Lab tools and devices and environment have to be improved with more contemporary

equipments to compensate necessity accepted modern levels.

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Appendix: The Survey

Please fill out the giving questions and information.
Thank you for your corporation.

1. Gender: □ Male □ Female

2. Your major: □ Physics Education
□ Chemistry Education □ Biology Education
□ Mathematics Education
□ Computer and Techno Education.
□ Science Education □ Physics
□ Chemistry □ Biology □ Mathematics
□ Another:_____ (if different)

3. University Entrance Year: □1999
□2000 □2001 □2002

4. When entering your department, how many physics nets did you have?_____

5. What was your ÖSS exam points?_____

6. Did you attend private institution (dershane) while preparing the ÖSS exam? □ Yes □ No

7. Is it possible to solve ÖSS Physics question with giving high school curriculum?
□ Yes □ No □ Partially

8. Who is responsible for getting low physics nets in ÖSS exam? (You can choose more than one choice, if applicable)
□ ÖSYM □ Curriculum
□ Teacher
□ Text Books □ Students
□ Another_____

9. To be success and/or get more physics nets on ÖSS exam, what one should do? What's your opinion?

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