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Full Length Research Paper

Exceptional students' attitude toward physics education in science and art centers

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The aim of this study was to investigate the gifted students' opinion about physics education in the Science and Art Centers. This study has been conducted for three years on 178 different students who got their education in the Aydın Do an Science and Art Centre. Gifted Students' Opinions toward Physics Education Inventory was applied to gifted students' in Science and Art Center. The results of the study indicated that gifted students thought that physical environment and activities related to physics education was inadequate.

Key words: Exceptional student, physics education, science art centers.

INTRODUCTION

A gifted student showed great performance in special academic areas or in intelligence, creativity, art and leadership capacity and to be able to perform these abilities one needs services that were not provided in the school. The priorities of general education programs were for children with ordinary abilities. As a result of this, gifted student were bored and later became unsuccessful in his classes. Parting this child from his school and peers had got also very big risks. In the end he was a child and he should spend his childhood with his peers. That is why Science and Art Centers called SAC have been opened in our country. Gifted student who got his normal education in his own school got education that improved his abilities and peculiarities in the Science and Art Centers.

Although gifted children have the same basic needs as the other children, they are still very different than the others. Gifted children need to be educated through different programs and with different strategies. Every child is gifted for his parents. Children who actually perform the requirements of their ages are creating miracles according to their parents. However, some children are really intelligent and skillful. Parents who recognize that their children are gifted get happy and are proud of their children at the beginning but within a short period of time, problems start. When such child comes to their pre-school age they are generally not accepted by the pre-school administrators because of their being very active, independent, and perfectionists, as well as their not wanting to be with their peers but with elder people.

These children should be dealt with before adults destroy them, in other words make them loose their abilities. The English called these children "gifted". The high features of these children affect their intelligent and emotional sides at all points. An active and productive student who is benefiting from books researcher-like, who is atellite -ting, who is producing projects, who is constantly asking questions, and who is sharing his thoughts may also have distinguishing abilities. At the same time a student who isolates himself from his peers, who is not interested in his courses or environment or who makes his peers laugh and wastes the lessons or who negatively is always against something can also be a gifted child. The first sample reflects a gifted student whose needs have been supplied whereas the second sample reflects the behavior of a high-potential student who has been neglected. Unfortunately, a lot of students similar to the second sample can be seen in our country. The purpose of educating these children in a different way is generally to make them use their own potential for the benefit of the society in which they live. It is believed that if a community gives an effective education to their gifted students, these students are able to give impetus to the development of the society in both art and science areas. For instance, because Russia gave an effective education to their gifted students, it threw the first atellite to the space (Colengelo and Davis, 1991). Their creative, occupational, and life accomplishments are compared with those of graduate students (299 males, 287 females) enrolled in top-ranked U.S. mathematics, engineering, and physical science programs in 1992 and tracked over 10 years. By their mid-30s, the two groups achieved comparable and exceptional success (e.g., securing top tenure-track positions) and reported high and commensurate career and life satisfaction (Lubinski et al., 2001).

Education researches and studies about the gifted students have begun very early in some countries. These kinds of studies in Turkey have rooted to the Enderun schools in Ottoman state. Later special-high level classrooms were opened in Turkey in the 1960. To develop students' skills and projects, "science art centers" were established in five cities by 1993. Now, there are fourty-three science-art centers, which have been functioning and enrolling students in Turkey with the control of the Ministry of National Education and also there are seven which have not yet enrolled students. However, because of the fact that these centers are new and many are still in the establishment phases. It was found out that a lot of problems in student and/or teacher selection and program implementation are encountered in these centers.

With the help of researches done, the features of gifted children come to be known better and especially in the field of practice, meeting their educational necessities becomes the centre point. For instance Renzulli (1975), has developed a differentiated education program in which "real life problems" are solved project based. Many highly gifted students appreciate the rich presentation of the courses and benefit from this variety of courses (Perrin, 1984). In a similar way Tomlinson (1995), also states that differentiated courses that provide suitable learning experiences for gifted students will make them use their potential to the utmost. Sometimes, as it is in Turkey, studies that try to provide the educational necessities of gifted children may push the lines of the education system of that country. For instance SAC an experimental learning model which tries to find real-life-problems and which requires learners to develop projects to solve the problems strives to find suitable environments for gifted students. Especially from 1970s, many studies have focused on how physics can be learned and taught in a better way. Persons who are interested in teaching physics have been for a long time studying on learners' understanding and learning the physical world (Arons, 1997) . Near ly half of the students who participated in the longitudinal study conducted in an urban high school were underachieving in school. Some of the high achieving students also experienced periods of underachievement in school. Talented students who achieve in school acknowledged the importance of being grouped together in honors and advanced classes for academically talented students. Underachievement for the other students began in elementary school when they were not provided with appropriate levels of challenge and never learned to work (Hébert and Reis, 1999; Rei and Diaz, 1999) . Physics courses given in a classical method certainly have beneficial sides; however studies in the field of physics education have shown that such courses have some drawbacks the examples of which can be seen at the conceptual level (Hake, 1998; McDermott, 1991; 1993; Laws, 1991; Arons, 1990; 1997). Halloun (1996) indicates the three problems in physics courses in this way: 1) Low level benefit 2) Short-term memory learning 3) The lowness of the number of students studying physics.

Observing the training programmes of gifted students', individual and student-centered education model can be seen. (Betts, 1986; Clifford, Runions Smyth, 1986). Another important factor, the last step of this type of program consists of independent project (Diffly, 2002). To maximize their performances and potentials, the factors of learning environments, programs, properties and also the quality of teachers should be higher than the traditional educational students' levels (Renzulli, 1977; Abram, 1982). Regarding the training model of gifted students in the world, based on the interactive, active and individual training which recent phase of working with small groups or individual project is seen. The contribution of educational technologies in the learning process is to capture the gifted students of the targeted performance level in the education process. However, regarding of applications in the world, educational technology is used education process of gifted students actively in many developed countries (Meeker and Meeker, 1986; Diffly, 2002). Many industrialized countries prepare training programs based on skills levels and implement these programs effectively (Renzulli, 1999). While individuals with normal ability are being trained in traditional educational institutions, individuals who have lower skill levels were being trained with special training (Betts, 1986; Gallagher and Gallagher, 1994). Large amounts of financial resources are spent for the training of individuals with low intelligence level and disabled each year in these countries. The main goal of this training process is to gain qualifications to these individuals such as other people (Gallagher, 1983). Similarly, gifted students who are different from the normal group of people, need the special education such as lower intelligence individuals (Van Tassel- Baska, 1998a; Renzulli, 1999) . The Effects of Grouping and Curricular Practices on Intermediate Students' Math Achievement indicated significant differences on math achievement for treatment group students (who were grouped for an enriched math lesson and exposed to an enhanced unit) when compared to the comparison groups. Further, results indicated significant differences favoring the group that received a modified and differentiated curriculum in a grouped class (Tieso, 2002). According to multiple intelligence theory Ford and Gardner (1991), explained seven types of intelligence and pointed out while the individuals have normal intelligence level in one field, in other field high intelligence level may be seen. Science is one of these fields that many students who are gifted in mental area are interested in. Researchs and discoveries about science become always interesting to the gifted students who generally investigate unknown topics. So they want access to the information directly. Regarding the contribution of science to find the truth, importance of science for gifted students can be understood clearly. They can create new products concerning of science. For example, they can make experiments at home by establishing a personal laboratory or follow science journals and publications (Feldhusen, 1986; Van Tassel-Baska, 1998a; Van Tassel-Baska, 1998b; Geake, 2000). The use of many different types of acceleration practices results in higher achievement for gifted and talented learners. Students who are accelerated tend to be more ambitious, and they earn graduate degrees at higher rates than other students. Interviewed years later, an overwhelming majority of accelerated students say that acceleration was an excellent experience for them. Accelerated students feel academically challenged and socially accepted, and they do not fall prey to the bore-dom, as do so many highly capable students who are forced to follow the curriculum for their age-peers (Colangelo et al., 2004). Cooperative learning opportuni-ties do not usually challenge gifted and talented students and should not be substituted for specialized programs and services for academically talented students. A lack of attention to the needs of gifted students may result when cooperative learning is used for this population, who often require more advanced content and faster pacing (Robinson, 1991). Gifted students were randomly assig-ned to the SEM-R intervention or to continue with the regular reading program as control students. Those who participated in the enriched and accelerated SEM-R program had significantly higher scores in reading fluency and attitudes toward reading than students in the control group, who did not participate. Students in the SEM-R treatment group scored statistically significantly higher than those in the control group both in oral reading fluency and comprehension, as well as attitudes toward reading (Reis et al., 2007).

The features of gifted students in the area of physics

Reads the resources in the field of physics, develops an information background by interpreting the physics reports. Scans the authority resources in the field of physics, carries out experiments to control the ideas and hypotheses. Is cognizant of technical devices; doesn’t have any problems in using them. Makes valid inferences out of the data and makes guesses.

Identifies and evaluates the hypothesis that lies under the techniques and processes used during problem solving. Has the power to express ideas both qualitatively and quantitatively. Uses and applies physics for social change, reaches new ideas and concepts through the present reality and concepts. Have the skills of collecting data, doing scientific observation and interpreting it? Has sensitivity towards problems? Is always inquiring? His mechanical thinking capacity is always at the utmost? His interest to spatial relationships is high. His communication and comprehension skills are developed? Is always open to knowledge and learning? Has the ability of quick learning and comprehension and a strong memory? Can transfer information to other fields by generalizing and abstracting? Is decisive and patient? Can bring thoughts and objects together systematically? Looks for answers to “What?”, “How?”, and “Why?” in questioning and tries to see the further side of these questions? Feels sure of him and can undertake jobs and responsibilities on his own. Can guess the next step when confronted with successive topics and sequence of events? Can establish a reasonable relationship between topics in different fields? With respect to their peers, distinguish connections in events, cause-reason relation-ships and similarities faster.

Can use learned knowledge in new and different fields? Can make reasonable criticism on various topics? Asks never asked questions. Can guess the meaning of indirectly stated meanings in written and spoken expressions? Can use complex and unusual methods in problem-solving? Can work on projects or experiments without the guidance of adults? Can organize and plan his friends’ activities. Is willing to make new experiments? Approximately 5% of a large, national sample of gifted students dropped out of high school. Gifted students left school because they were failing school, didn't like school, got a job, or were pregnant, although there are many other related reasons. Many gifted students who dropped out of school participated less in extracurricular activities. Many gifted students who dropped out of school were from low SES families and racial minority groups, and had parents with low levels of education (Renzulli, and Park, 2000). By sampling selected Science Art Centers, general situation of physics education can be examined across the country. At this point, one of the problems that need to be emphasized; Science Art Centers’ (SAC) physical conditions and educational technology equipments.

For this reason, the aim of the study was to find out what kind of physics education gifted students want and to give an education accordingly.

METHODOLOGY

Participants

This study was performed with 178 gifted students from Aydin Dogan Science and Art Center during 3 academic years.

Instruments

Gifted students’ opinions toward physics education inventory (GSOPEE): A 17-item draft scale composed of all the targets to be achieved was prepared. Draft form of the scale was applied to 178 students, and factor loads of them were calculated. As a result, 10

Table 1. Frequency, percentages and mean in GSOPEE.

Item	Absolutely Disagree		Disagree		Undecided		Agree		Absolutely Agree		N	$\overline{X}$
	f	(%)	f	(%)	f	(%)	f	(%)	f	(%)		
1	160	89,89	8	4,49	4	2,25	5	2,81	1	0,56	178	1,197
2	71	39,89	2	1,12	-	-	7	3,93	98	55,06	178	3,331
3	-	-	8	4,49	125	70,22	25	14,05	20	11,24	178	3,320
4	-	-	-	-	-	-	21	11,80	157	88,20	178	4,882
5	-	-	45	25,29	-	-	125	70,22	8	4,49	178	3,539
6	3	1,69	2	1,12	3	1,69	107	60,11	63	35,39	178	4,264
7	-	-	-	-	-	-	18	10.11	160	89,89	178	4,899
8	7	3,93	125	70,22	45	25,29	1	0,56	-	-	178	2,224
9	25	14,05	2	1,12	21	11,80	125	70,22	5	2,81	178	3,466
10	-	-	-	-	-	-	160	89,89	18	10,11	178	4,101

questions were selected (Appendix 1). The Cronbach - reliability coefficient was found to be 0.88 for GSOPEE. In ınstrument, the minimum point was 10 and the maximum was 50. As the point increase so does the positive opinion. GSOPEE is applied to carry out gifted students' opinion toward Physics Education in Science and Art Center.

Data analysis

In this study, quantitative data are analyzed. Analysis of the results of the quantitative data is done by using SPSS/PC 11.0 program. In analyzing the quantitative data, frequency, percentage and arithmetic mean were calculated.

RESULTS

The data collected from GSOPEE is given in Table 1. 90% (N = 160) of the students replied as "absolutely disagree" to the item-1 "Equipments, devices and physical environment are adequate in physics classes of SAC" which states the inadequacy of physical conditions.

55% (N = 98) of the students replied as "absolutely agree" to the item-2 "Students at SAC should be able to put the devices designed in their physics courses into practice" whereas 40% (N = 71) of them replied to the item as "absolutely disagree" thereby stating that these places are not inventor schools.

70% (N = 125) of the students were "undecided" about the item-3 "The constant change in the physics teachers at SAC affected the success of students."

88% (N = 157) of the students "absolutely agree" to the item -4 "SAC students should carry out projects aimed at real life needs in their physics courses" thus stating that because of their age they should produce something that can be used in real life.

70% (N = 125) "Agree" to the item-5 "The project studies at SAC should be shared with business centers around, universities, factories, and official institutes" where as 25% (N = 45) "disagree" indicating that everything should be done here.

60% (N = 107) of the students "Agree" to the item-6 "Physics education at SAC should support students' success at their own schools" and 35% (N = 63) of them "absolutely disagree" because they stated that these places should be completely independent and different from schools.

90% (N = 160) of the students "absolutely agree" to the item-7 "Students at SAC should carry out their physics courses only experimentally and as visual activities." According to students visual is the most effective method in learning.

70% (N = 125) of the students "disagree" whereas 25% (N = 45) of them are "undecided" about the item-8 "Students at SAC should have their physics courses first theoretically and then experimentally and as visual actives".

75% (N = 125) of the students by ticking "Agree" to the item-9 "Topics in the physics activities should be handled in detail at SAC" indicated that they were curious to learn more interesting things. 15% (N = 25) of the students replied as "absolutely disagree" to item-9.

90% (N = 160) of the students replied as "Agree" to the item-10 "Physics courses at SAC should be student-centered". Students wanted to be more active during the courses.

DISCUSSION

Students stated that SACs are inadequate in terms of place. According to them SACs should have their own buildings with gardens. Additionally, their being located in the city centre would be a motive of preference. By sampling selected Science Art Centers, general situation of physics education can be examined across the country. At this point, one of the important problems in SAC is inadequateness of physical conditions and educational technology equipments. SACs were opened under a project carried out by the Ministry of National Education.

Therefore, they have the same diversity material, although have a number of quality differences on the physical hardwares. Future's scientists are to be expected to grow up from SACs which have got current technology equipments but according to one research, teachers cannot use them (Gökdere et al., 2004).

Students don't believe that they should put their designed practices into life consequently they state that these places are not inventor schools. However, some of the students believe just the opposite. Benefits of gifted programs indicate that students maintained interests over time and were still involved in creative productive work. Students who had participated in gifted programs, maintained interests and career aspirations in college. Students' gifts and talents could be predicted by their elementary school creative/productive behaviors (Delcourt, 1993). Students' involvement in gifted programs in high school enabled them to explore potential career interests and allow students to see themselves in the role of practicing professionals and visualize a different sense of self. Students had increased post-secondary education plans (from attending 2.6 years to attending 4.0 years) (Taylor, 1992).

Students think that the constant change of physics teachers at SAC does not affect student success. To ensure an effective training to the gifted students, teachers should be given more importance (Feldhusen, 1991; Dettmer and Landrum, 1998; Croft, 2003). All branches of gifted students' teachers need to be training. This training process must not limit with arestrict period. If the processes are pre-service and in-service training, teachers' developments will be seen accurately (Dettmer and Landrum, 1998).

Students think that in physics activities at SAC projects intended for real life needs should be carried out. Gifted programs had a positive effect on subsequent interests of students which affect post-secondary plans; early advanced project work serves as important training for later productivity; non-intellectual characteristics with students remain consistent over time (Hébert, 1993).

Student's state that project studies should be carried out in cooperation with business centers, universities, factories, and official institutes around.

Students who participated in a program based on the Enrichment Triad Model in 1981 - 1984, maintained interests and were still involved in both interests and creative productive work after they finished college and graduate school (Westberg, 1999).

Most of the students state that physics education at SAC should support the courses given at school. Some of them, however, state that these places should be totally different and independent from school. In a research that is Curriculum compacting and achievement test scores; Teachers used curriculum compacting for gifted students could eliminate 40 - 50% of regular curriculum for gifted students and produced achievement scores that were either the same as a control group or higher math and science, regardless of what they did instead (independent study in a different content area) (Reis et al., 1998).

Students state that physics courses at SAC should be carried out experimentally and visually. For students the most effective method is learning by doing and by seeing.

Students state that they are already given theoretical information at school and therefore physics courses should be given experimentally and visually by small groups. Achievement is increased when gifted and talented students are grouped together for enriched or accelerated learning. Ability grouping without curricular acceleration or enrichment produces little or no differences in student achievement. Bright, average, and struggling students all benefit from being grouped with others in their ability/instructional groups when the curriculum is adjusted to the aptitude levels of the group. When gifted students are grouped together and receive advanced enrichment or acceleration, they benefit the most because they outperform control group students who are not grouped and do not receive enrichment or acceleration by five months to a full year on achievement tests (Kulik, 1992).

Students state that physics activities at SAC should be given more detailed thus they indicate that they are curious to learn more and more interesting things. Grouping gifted and talented students for instruction improves their achievement. Full-time ability/instructional grouping produce substantial academic gains in these students. Pullout enrichment grouping options produce substantial academic gains in general achievement, critical thinking, and creativity. Within-class grouping and regrouping for specific instruction options produce substantial academic gains provided the instruction is differentiated. Cross-grade grouping produces substantial academic gains. Several forms of acceleration also produced substantial academic effects. Cluster grouping produces substantial academic effects (Rogers, 1991). The use of curriculum compacting was examined to modify the curriculum and eliminate previously mastered work for high ability/gifted students. When classroom teachers eliminated between 40 - 50% of the previously mastered regular curriculum for high ability students, no differences were found between students whose work was compacted and students who did all the work in reading, math computation, social studies and spelling. Almost all classroom teachers learned to use compacting, but needed coaching and help to substitute appropriately challenging options (Reis and Purcell, 1993; Reis et al., 1998).

Students by stating that physics activities at SAC should be student-centered referred to the point that they want to be more active in classes. When given gifted pro-gramming options (self -selected independent study with a mentor), 82% of gifted underachieving students reversed their underachievement when they had the opportunities for strength-based gifted programming (Baum et al., 1999). Gifted students need gifted physics education programs that will challenge them in regular classroom settings.

Appendix 1

Gifted students' opinions toward physics education inventory (GSOPEE).

	A comparative Study with WICS-R sub test of observed abilities of gifted students from the point of Physics	Absolutely Agree	Agree	Undecided	Disagree	Absolutely Disagree
1	Equipments, devices and physical environment are adequate in physics classes of SAC.					
2	Students at SAC should be able to put the devices designed in their physics courses into practice.					
3	The constant change in the physics teachers at SAC affects the success of students.					
4	SAC students should carry out projects aimed at real life needs in their physics courses.					
5	The project studies at SAC should be shared with business centers around, universities, factories, and official institutes.					
6	Physics education at SAC should support students' success at their own schools					
7	Students at SAC should carry out their physics courses only experimentally and as visual activities.					
8	Students at SAC should have their physics courses first theoretically and then experimentally and as visual actives.					
9	Topics in the physics activities should be handled in detail at SAC.					
10	Physics courses at SAC should be student-centered.					

The lack of physics teacher training and profess-sional development in gifted physics education will result in fewer challenges, less differentiation, and lower achievement for gifted students. Student-centered training demonstrates the effectiveness of gifted physics education programs and curriculum in raising student achievement, as well as helping students to develop interests, creativity, and productivity, and career goals. Physics Teachers can learn how to differentiate and compact curriculum to provide more challenge to all students, when they have the professional development, time, and support to learn how to effectively implement these skills and strategies. Gifted students do underachieve and drop out of school, but those who do can reverse their underachievement and stay in Science Art Center (SAC) when provided with challenging enriched learning opportunities in areas of interest.

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