Gifted science education in Turkey: Gifted teachers' selection, perspectives and needs

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Abstract

The purpose of this study was to explore the fundamental problems that Turkish gifted science teachers encounter in the process of teaching gifted students. Three Science Art Centers (SACs) were visited and, semi structured interviews were conducted with all science teachers, (total fourteen). SACs are specifically for the education of gifted students in Turkey. It was found that on the whole, gifted science teachers perceive what their duties are. However there is a need for help with measurement and assessment techniques, updates on modern learning theories, the planning and implementation of research projects, questioning techniques and the use of laboratory approaches. It is

suggested that in-service courses, which include the above topics, should be organized for the gifted science teachers, and the use of action research projects should be encouraged.

Introduction

The individuals' education in a community is important, and the community should not avoid financing ways to develop solutions about educational issues whether it concerns a small or large part of society. When this philosophy is followed, it means, for example that a large amount of money may be needed to support the education of students with intellectual disability and in general, this is acceptable to society. Similarly, special education and opportunities should be provided for gifted students to maximize their full potential and be more included into the community (Renzulli, 1985). From the literature, it is clear that all communities contain a proportion of approximately 2-3% gifted students (Witty, 1958; Marland, 1971). If these individuals cannot be correctly identified and educated accordingly, they may experience psychological problems and may even become dysfunctional within the community (Marland, 1971; Feldhussen, 1986).

Giftedness has been described as a complex of intelligence, aptitudes, talents, expertise, motivation and creativity that lead an individual to productive performance in intellectual, scientific, leadership, creative, artistic, dramatic, musical, mechanical and physical areas (Feldhussen, 1986). One point of view is that given these extraordinary skills, gifted students need to be educated through different programs and with different strategies. The main reason for giving a different kind of education to these students is to make their own psychological development healthier and to use their own potential for the benefit of the society in which they live (Feldhussen, 1986; Renzulli, 1999; Çepni & Gökdere, 2002). 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. From a historical standpoint, there have been many gifted education studies about gifted students in different countries and quite a few models have been developed and implemented from the related literature, for example, the autonomous learning model (Betts, 1986), the "Three Phases of Enrichment Model" (Feldhussen & Kolloff, 1986) and the Learning Enrichment Service (LES) model (Clifford, Runions & Smyth, 1986).

Teachers' roles in the education of gifted students may require that they see the gifted student function in different ways in the classroom. For example, as a scientist - inquiring, observing, testing, analyzing and forming conclusions (Sherwood, 1996). In addition, gifted science teachers should have other roles such as modeling behaviors, demonstrating the inquiry process, teaching values, motivating and conducting functional evaluation during different phases of the teaching process (Archambault et al, 1993; Gökdere & Çepni , 2003). The actual ideal profile of the gifted teacher of gifted students is one in which the teacher has shown proficiency in a particular subject area and general academic area, and demonstrates flexible thinking, tolerance and neutrality in the

classroom. In addition the gifted teacher has self-awareness as a former gifted student about what the characteristics and life style of gifted students are. Such teachers are able to encourage students towards higher levels of learning, work with areas of concern and promote independent studies (Jordan, 1962; Sisk, 1987).

Gifted teachers face some problems in the teacher education process in relation to gifted education and appear to need specific help in areas such as, perceiving gifted student's signals, programme differentiation, setting objectives, attitudes, measurement and assessment techniques, and individual and program planning (Feldhussen & Kolloff, 1986; Archambault et al, 1993). Two recent studies, found that gifted teachers mostly faced problems in determining gifted student's needs, alternative assessment techniques and teaching activities (Feldhusen, 1997; Schultz, 2000). As well as identifying teaching process difficulties, one study stressed the need for in-service seminars in problematic areas in order to solve problems (Schwizer, 1994). Work by Gallagher found that gifted teachers face some problems about measurement and assessment in the gifted students' teaching process and another study suggested there should be, "accountability for gifted students" (Gallagher, 1998).

The Turkish context

In comparison with other countries, Turkey began studies of gifted education relatively recently. The studies indicate progress in gifted education, but in an isolated and often fragmented manner. With the opening of special high level achievement classrooms in the 1960's, more study of gifted students' education occurred. For example, one finding was inequity in student identification and this persisted for a considerable period (Gökdere & Küçük, 2003). By the 1980's new starts had been made and some projects have been developed. These projects helped develop talent centers which were called Science Art Centres, (SACs). By 1993 SACs had been established in five cities. Now, there are ten SACs in Turkey under the control of The National Ministry of Education and there are seven new SACs, which will open soon. SACs are rich of instructional technologies compared with other schools; however, some of them do not have Internet connection by the time this study was finished. SACs in Turkey then are relatively new, and many are still in the establishment phase. Difficulties with student and/or teacher selection and program implementation have been and continue to be encountered in these centers (Çepni & Gökdere, 2002; Gökdere & Küçük, 2003). It appears that teacher selection is the biggest problem (Çepni, Gökdere & Küçük, 2002). However, teachers play an important role in all phases of the education process and may be the most influential factor in gifted learning. On the other hand, because SACs have only been established for a few years (indeed some are still at the construction stage), it is hardly surprising that problems in teacher selection have been encountered. Teacher selection is a crucial factor. Ganschow, Weber and Davis (1984) explained that gifted teachers who are most appropriate for the task of teaching gifted students, who have the ideal characteristics

similar to currently employed gifted teachers and can be developed professionally, may be the best choice.

The literature examined, revealed there are many studies about the problems faced by gifted teachers during teaching. However, these studies are not about gifted teachers' and specifically gifted science teachers' problems in Turkey. This raises an issue as to whether these gifted science teachers' problems are different from other gifted teachers. This study examines the problems in teaching faced by Turkish gifted science teachers working in SAC' s, and offers some ideas about future directions for teacher education for gifted science teachers in Turkey and also in the world. The study will be of particular interest to countries that are at an early stage in the development of gifted education.

Method

In this study, a case study approach was used as it was necessary to examine a few aspects of gifted teacher education in some depth, yet within a limited time scale (Bell, 1989; Cohen & Manion, 1989). Limitations of the study are discussed next. Just fourteen gifted science teachers working at three SAC's were studied. Data was gathered through a profile questionnaire and semi-structured interviews using nine questions in order to determine what gifted science teachers' ideas are about gifted students' education as well as their learning and teaching approaches, what teaching methods are used, what problems are faced and what the expectations are about support from teacher educators. Firstly, the profile questionnaire was applied to the sample and then interviews were done with each of the gifted science teachers by one researcher of the study. A profile in the form of a table was constructed from data gathered through a brief questionnaire. This covered details on: subjects' type of degree, graduation levels, teaching experience, type of programme, and whether or not there was a research component in each subject's degree programme. Interviews were lasted for 20-30 minutes and recorded on time. Responses to each question were analyzed for common features, which were then summed to form a proportional percentage. In the analyses of questions one and four, the frequency of explained teaching methods were calculated based not on the number of gifted science teachers but based on all the given answers to these questions. For example, a gifted science teacher could give more than one answers to these questions. This kind of qualitative data analysis method was also used in some studies by Gökdere and Küçük (2003) and Küçük (2002). Anonymity of the subjects was protected through the use of code letters.

Findings

Teachers' Profiles

Profiles of ten gifted science teachers are shown in Table 1. Whether or not gifted science teachers had received a background in research through components in their own degree

studies was of interest, as it was postulated that this might serve as a form of impetus to engage gifted students in research projects as a type of teaching method. In addition, it was speculated that the quality of their degree might have some bearing on their subsequent classroom teaching. A system of grading from one to four (four highest) was adopted so that Degree Level would be comparative. All of the teachers in the profile table were working at the initial stage (orientation) of gifted science programmes.

Table 1. Profiles of the gifted science teachers' sample

Teachers' code name	Profiles				
	Degree Type	Degree Level	Number of years of teaching	Gifted Teaching program	Degree Research Component
A	Physics teacher education	2.80	3	Orientation	Physics engineering.
B	Chemistry teacher education	3.20	3	Orientation	Chemistry education
C	Biology teacher education	2.80	2	Orientation	No
D	Chemistry teacher education	3.21	2	Orientation	Chemistry education
E	Physics teacher education	2.45	3	Orientation	No
F	Physics	2.50	10	Orientation	No
G	Biology teacher education	2.60	10	Orientation	No
H	Chemistry	2.55	8	Orientation	No
J	Biology teacher education	2.40	7	Orientation	No
K	Chemistry teacher education	2.70	3	Orientation	No

Only a total of three subjects had a background in research from their own degrees, (two of these in science education). Other aspects of interest were the number of years of teaching, which ranged from two to ten years, and the type of degree programme studied-- 80% had studied science education degrees. The degree level ranged from 2.40 to 3.21 and did not appear to be of significance.

Interview Findings

In the interviews nine questions were asked to the science gifted teachers. These questions and responses were analyzed and grouped according to similarities in responses.

Q1. How can the best learning be constructed in gifted education?

Each respondent identified more than one method related to this question. Learning style types and the proportion of learning styles considered best by subjects are given in Table 2.

Table 2: Number and % of learning style considered best by gifted science teachers

Learning Styles	Number	%
Group work	9	64
Practical experiments	8	57
Interactive learning	5	35
Computer-based learning	5	35
Direct instruction style	4	28
Individual learning	3	21
Cause and effect reasoning	3	21

The results indicate that respondents think group work and practical experiments are the best ways of learning. Other methods rated relatively highly were computer-based learning and interactive learning.

Q 2. How do you explain your role in gifted education as a science teacher?

Short answers supplied in response to this question are grouped around roles such as guide, supporter and researcher. One respondent clarified role as giving knowledge to students, guiding them and expanding gifted students' viewpoints.

Q 3. Did you have any dilemmas before teaching in the Science Art Centers?

Half of the respondents stated that they had a concern that gifted students might have a clearer view about science than the teacher. Half said they had some positive expectations about beginning teaching in SAC's.

Q 4. What are your teaching techniques, which you use in science lessons or think you would use in Science Art Centers?

Responses grouped by technique are presented in Table 3.

Table 3 Frequency and % values of the gifted science teachers' teaching methods used in science courses.

Teaching techniques	Number	%
Experiment observation	13	92
Demonstration	10	71
Questions and discussion	9	64
Explanation	8	57
Problem solving	5	35
Induction, and deduction	5	35
Drama	4	28
Brain-storming	4	28
Project work	3	21

The results indicate that respondents use or intend to use a wide variety of teaching techniques. There is high usage, (or intended high usage), of experiment and observation, demonstration and question and discussion format. There is some match to the answers on best learning styles in response to question one.

Q 5. Which of the modern learning theories do you apply in lessons?
One respondent said that learning theory was used. However, five respondents said that they did not know anything about learning theory. Others explained that they knew a little on learning theory, but did not apply it.

Q 6. How do you evaluate or plan to evaluate in your science courses?
Most of the respondents stated that they would give students different examples related to a science topic and ask them write what they understood in their own words. Respondents also used or planned to use marking of experiment reports, oral assessment, and encouragement of students to think about science phenomena by asking "Why" and "How" questions. Written or oral examinations were also advocated.

Q 7. Which do you think will be, or what are the most helpful sources for your studies in the Science Art Centers?
Respondents mainly stated that the most helpful materials were books and notes they had used prior to teaching. Other useful sources were prepared programs, laboratory books and journals of a science-technical nature.

Q 8. Up until now, what are the biggest problems you have faced while working at the Science Art Centers?
Respondents felt they didn't become familiar enough with students. They felt they lacked

knowledge about contemporary learning models and lacked good programmes for gifted students. Respondents would like more on question techniques, and clarification on measurement and evaluation. Respondents had difficulties determining the subject of projects, as well as planning and conducting projects, academic support, and difficulties with foreign language, which prevented them from accessing information from other countries.

Q 9. What do you expect from teacher educators?
Respondents stressed that they expected support by information about ways of determining project subjects, and planning and conducting projects. Another expectation was interaction with universities, and courses on science education for gifted students. Teacher educators were seen as a source of materials and expert guidance that was needed. In particular, courses on laboratory approaches, the development of laboratory skills, activities and modern teaching theories were desired.

Discussion and Conclusions

The selection process for gifted science teachers at SAC's has not been clearly stated in the instructions for selection published by the National Ministry of Education. Hence different selection ways are used (Gökdere & Küçük, 2003). Gifted science teachers working in SAC's are mostly graduates from faculty of education with teaching experience between two and ten years. This range in years of teaching experience represents a relatively early to middle stage in the teaching profession. There is some research that indicates that new teachers beginning in the teaching profession are faced with some important problems, for example, lack of experience in learning and teaching area. However, they are more successful, creative, show more initiative and are keen on research (Renzulli, 1985). This is why new teachers beginning in the teaching profession still feel themselves as students and have greater desire to learn than experienced teachers. It is noted that teaching in a SAC and following up an interest such as research on a topic with a class is difficult as teachers do not teach a specific year group of students but a whole range of students between 4 and 10^{th} class.

The teachers in the study had quite different ideas about the best learning styles, although they agreed that group work and experimentation are good methods and, they all stressed that learning could be effective through active practical activities connected to real life. Project-based learning should be included as an activity for gifted teachers and its incorporation should be one of the aims of SAC's. Most of the respondents identified their roles in gifted education as guide, demonstrator and researcher. In the process of educating gifted students, gifted teachers need to be aware of their roles as models, evaluators, and values educators (Sisk, 1987; Gökdere & Çepni, 2003). Science teachers are able to implement more than one teaching method. However, they had a preference for: experiment-observation, presentation, question-discussion and induction-deduction

methods, although this varied in accordance with their teaching experience (Azar & Çepni, 1999).

Teachers did not seem familiar with learning theories, and accordingly were unable to apply them to the classroom. A previous study in Turkey on science teachers who work at the primary schools found that they didn't have sufficient knowledge about learning theories and consequently could not apply them to classroom practices in teaching (Çepni, Şan, Gökdere & Küçük, 2001). Knowledge alone of theories does not mean that they will necessarily be applied. Knowing how to use theory and its importance and contribution to the intellectual development of gifted students is critical. For example the development of understanding of learning by theorists such as Ausebel, Gagne, Bruner, Piaget and Kelly should be taught to gifted science teachers and they should be encouraged and supported to use it in their classroom practice (Colette & Chiappetta, 1989). We think that a gifted science teacher should have a wide interest and knowledge area. Thus, they shall be ready to work with the gifted students about whatever problem he/she wants to conduct research. In addition, gifted science teachers need to accept the idea of individual learning for the gifted students. It is a fact that students are able to learn whatever and how much they need. This means for gifted education that gifted science teacher is responsible to determine a gifted student's interest area and support him/her to carry out further work on it.

Gifted teachers had individual preferences for the use of different kinds of teaching methods in their science courses. The methods they used appear to be based on their personal teaching experience, rather than any sort of objective criteria. It is particularly important that the method used in measurement and evaluation techniques is based on determined criteria, as they are an important factor in the development of effective assessment practices and the same applies to learning processes (Angelo & Cross, 1993). In aspects such as the preparation of questions for use with gifted students, gifted science teachers need to be able to use tools such as thinking keys, questions matrixes and Bloom's taxonomy (Painter, 1996).

Gifted science teachers have mostly used their university course books, course notes and TUBITAK's (Scientific Academy of Turkey) sources as resources for teaching. It is important to note that some of the respondents were keen to do educational research, in areas such as chemistry education but they could not access and read any academic works in their areas. Science teachers working in SAC's similar to teachers working in regular schools cannot use the Internet and educational technology effectively as teaching tools. This is because in Turkey new technology in regular schools and SAC's is not yet fully available or used. In addition there are too many other initiatives being introduced into all schools to make the use of Instructional Technology (IT), widespread. As part of IT learning gifted teachers need a course that covers how to access periodical publication

and Internet sites about gifted student's education in other countries. Gifted science teachers also need support with foreign language so that they are able to follow the development of their subject areas through IT and the literature.

Teachers would like academic support from teacher educators about subject areas which they are not familiar with through in-service courses. Such courses need to include laboratory approaches and increased laboratory skills, guidance and research, and ways of planning and conducting research projects. The last item is important as the lack of implementation of research projects is a widespread problem among Turkish teachers (Küçük, 2002; Gökdere & Küçük, 2003). There is some urgency in this matter, as one of the aims of the SAC's is to prepare gifted students for careers as scientists. If gifted science teachers are weak at research design, they will not be able to develop the research skills of gifted students and enable them to work towards eventual contribution to the development of scientific research in Turkey.

Some shortcomings about gifted science teachers' teaching emerged from the data. The performance of gifted science teachers in the classroom needs regular and reliable assessment so that they are able to improve themselves. In addition, cooperation between the National Ministry of Education and universities is quite important, because, for example, in the selection process of gifted teachers, the type of degree held by applicants should be considered. Teacher education does not address giftedness and gifted student's education sufficiently. Concepts of giftedness and the aims of capacity development programs should be covered in detail and gifted teachers should be aware of differences in their roles as teachers, in comparison to regular school teachers (Sisk, 1987). Employment of gifted teachers should focus on those who are in the early stages of teaching, and who have reached high attainment in their degrees, as they are more likely to be able to address gifted student's cognitive development. Teachers' numbers should be increased at SAC's and teachers should be directed towards the development of grouping of students based on age. In addition, gifted science teachers should be encouraged to continue their professional development through programmes such as those available at postgraduate level and they should be supported in such endeavors. We believe that some quality standards should be constructed for gifted teachers' selection process and performance evaluation in the profession.

In this study, there has been an examination of Turkey's gifted science teachers' problems by way of the study of a small number of teachers who are employed in SAC's and some suggestions have been made that might help alleviate the situation. More studies need to be done at other SAC's and in particular with other subject area teachers. Some criteria such as age, academic achievement level, type of graduate program, teaching experience, and appropriate training can be used in the process of gifted science teachers' selection. We want to stress that the most important one of those criteria is a gifted teacher's views

about learning and teaching. Finally an appropriate selection process should be developed for selecting gifted teaching staff and different criteria should be used according to the subject to be taught (Feldhusen, 1997).

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