UNIVERSITY OF SOUTHAMPTON

Faculty of Social and Human Sciences

School of Education

DEVELOPING A CLASSROOM SCIENCE ENRICHMENT PROGRAMME FOR GIFTED PRIMARY SCHOOL BOYS IN SAUDI ARABIA

By

ABDULHAMID ABDULLAH ALARFAJ

Thesis for the degree of Doctor of Philosophy

June_2011

ABSTRACT

FACULTY OF SOCIAL AND HUMAN SCIENCES

SCHOOL OF EDUCATION

DEVELOPING A CLASSROOM SCIENCE ENRICHMENT PROGRAMME FOR GIFTED PRIMARY SCHOOL BOYS IN SAUDI ARABIA

Doctor of Philosophy

By

ABDULHAMID ABDULLAH ALARFAJ

Enrichment is one of the important educational facilities that are provided for gifted students. However, the research on gifted enrichment programmes still requires further exploration in order to meet the diversity of gifted students. The purpose of this study was to determine the important components of an enrichment programme in science for gifted boys in the 6th grade of primary schools in Saudi Arabia.

The current study has critiqued the components that are recommended in the literature pertaining to gifted programmes that include the Renzulli Model, VanTass-Baska Model, and Oasis Enrichment Model. Gifted programmes discussed are then discussed in relation to those that are provided to gifted students in schools and Universities in Saudi Arabia.

Mixed methods were used in this descriptive study. Three methods have been used, documentary analysis, questionnaire, and interview. The documentary analyses of selected science textbook in 6th grade used mixed (qualitative and quantitative) approaches.

The participants included 220 gifted students in primary schools in 6th grade from Dammam, Riyadh, and Jeddah city in Saudi Arabia, and 10 teachers and 10 supervisors of gifted education in science. Gifted students responded to questionnaires in order to ascertain their opinions about the current science textbook in 6th grade and what they would like to find in the Proposed Enrichment Programme (PEP). Interviews were conducted with teachers and supervisors of gifted education to examine in depth their

perception about the current 6th grade science textbook and the Proposed Enrichment Programme in order to meet the needs of Saudi gifted students in 6th grade.

The data from questionnaires were analysed in two phases. Firstly, the data were analysed and presented item by item for both the current science textbook (ST questionnaire) and the proposed enrichment programme (PEP questionnaire). All the items were examined by *Chi square* test to calculate whether there are any significant differences among each item in both questionnaires. Secondly, comparisons were made among the themes that emerged from the ST and PEP questionnaires.

The responses of the interviewees were assigned to one of the content themes (attitudes to science, thinking skills, and contents and activities). Analysis of the words from respondents and counting frequencies of occurrence of ideas, themes, pieces of data, words (Cohen *et al.*, 2007).

The questionnaire data showed that the most important theme in the PEP for the gifted students is the "content of knowledge". This reflects the students' views of the inadequacy of knowledge in the ST and their desire to further the development of content knowledge in the PEP.

All the data from students and teachers and supervisors indicated that the ST needs to be improved to meet the needs of gifted students in two main areas: the level of thinking skills (e.g. evaluating and creating), and that the topics should be close to students' daily life and their environment. The findings of this research study showed agreement across all data collection instruments regarding the weakness of the activities in the 6th grade science textbook. This study considers that in order to enable gifted students to fulfil their potential in science in the regular classroom, it is necessary to provide further content and activities that require high levels of thinking, as provided by the PEP. The findings in this study clearly showed that there is a need for more challenge to stimulate gifted learners to learn which should be included in the PEP.

Table of Contents

List of Figures

List of Tables

Acknowledgements

First, I would like to thank Allah, whom I have always asked to guide me along the right path. I am also very grateful to my supervisors Dr. Jenny Byrne and Dr. Marcus Grace for their support and motivation and for provided me with invaluable advice and assistance throughout my study. I would like to thank my previous supervisor Prof. Mary Ratcliff for her helpful supervision.

I would also like to express my sincere love to my university, University of Southampton, and School of Education for providing me with intellectual opportunities for professional growth and experience necessary to achieve my goal of advancing gifted education in the Saudi Arabia.

I am most grateful to Dr. Abdullah Aljughaiman for his generosity encouragement, and support as a director of the National Research Centre for Giftedness and Creativity. I am also extremely grateful to teachers, supervisors, and administrators who participated in this study.

My appreciation goes to my dear friend Ali Al-Qaraiw who is usually available when I need him.

Finally, on a personal note, I would like to express my greatest appreciation to my mother, my father, my wife Kholood Alarfaj, my daughter Roaa, and my brothers and sisters whose prayers, confidence, emotional support.

Chapter 1 Introduction

This study aims to identify the required components of an enrichment programme in science for gifted 6th grade students in primary schools in Saudi Arabia.

The researcher has spent more than 15 years supervising trainee science teachers in primary schools in Saudi Arabia, and has observed some of the problems that have arisen during lessons as a result of able students in their classrooms not being adequately catered for. Thus, he wanted to investigate whether the current science textbook meets the needs of gifted students at this level.

The study starts by highlighting the growing attention and interest in importance of gifted education, and the importance of science in gifted education, and then sets out the research questions. Chapter Two discusses the education system and the science curriculum in Saudi Arabia. Chapter Three provides a literature review of the definitions and theories of giftedness, the needs of gifted students and programmes for gifted students. Then Chapter Four considers the methodology of the study, which used a mixed methods approach to gather the data. Chapter Five reveals the results of the study and addresses the three research questions. Next, Chapter Six illustrates the main findings of the study from the three instruments that have been used. Finally, the concluding chapter includes a summary of the study and presents a series of recommendations and suggestions for future work.

1.1 Gifted Education: Overview

In 1901, the first special school for gifted children was opened in the United States of America (USA), and *by 1920, approximately two-thirds of all large cities in the USA had created some type of programmes for gifted students* (Davis and Rimm, 2004: 4). It is widely believed that providing opportunities for such children to develop and nurture their talents and creativity is important in helping them to express their own individuality and foster lifelong learning (Davis and Rimm, 2010). Many developing

countries have noticed the importance of education for gifted children, and have worked hard to follow the example of developed countries regarding services for gifted students. However, many of these countries are still having difficulty in providing the educational services that best meet the needs of their more able pupils. To survive in the 21st century, today's students must have opportunities to develop their thinking skills and their creativity (Jackson, 1997). Thus, many industrial countries have adopted policies and programmes to meet the needs of all students and in particular gifted children and young people. Summer enrichment programmes, special schools for able students and residential schools for gifted students in mathematics and science are examples of a long list of interventions that have been developed in countries such as the United States of America, Canada, China, Germany, and Russia (Gallagher, 2000; Grigorenko, 2000; Leroux, 2000; Persson *et al.*, 2000; Rudnitski, 2000).

1.2 Education System in Saudi Arabia: Overview

The goals of the education system in Saudi Arabia are to help all learners to face the difficulties and problems that they are likely to encounter in their lives. The goals of the Saudi Educational Policy, along with its objectives, guidelines, and principles, are to ensure that education becomes more efficient and technologically advanced, and to ensure that the religious, economic and social needs of the country are met.

Saudi educational aims are directed toward the country's special-needs population. Supporting and assisting the physically and/or mentally handicapped as well as the gifted students of Saudi Arabia are another highest concern of the Saudi educational system (Al-Hakeel, 2003).

There are six primary levels. Students graduate from the primary stage at twelve years old. At this stage, the pupils should be proficient in basic skills in reading, writing, science, and mathematics.

1.3 Gifted Education in Saudi Arabia: Overview

Saudi Arabia recognized the importance of meeting the needs of gifted children in the mid 20th century. In 1968, the educational policy in Saudi Arabia stated that, each student has the right to develop his/her talent, and his/her ability. However, no programmes or real educational services were adopted until 1995, when the Ministry of

Education started a programme called "Talent Search" (Ministry of Education in Saudi Arabia, 1998).

In 1998, the Ministry of Education in Saudi Arabia established a number of gifted education centres around the country. Afternoon and Thursday programmes for the gifted are the main task of the gifted centres during the school year, while summer camps are the biggest annual event for gifted students. For example, between 2003 and 2008, sixteen summer programmes were run yearly in several universities around the country (King Abdulaziz & His companions foundations for the Gifted, 2008). Other enrichment programmes have been held in computer science and engineering in King Fahd University (Atas and Twfeek, 2006). In 2006, about 760 students attended similar programmes around Saudi Arabia (King Abdulaziz & His companions foundations for the Gifted, 2008). Moreover, in August 2006, the first international conference on gifted children was held in Saudi Arabia. Scholars from 26 countries, such as the UK, the USA, Germany and China, were invited to the conference in Jeddah city**.** Programmes have been established in many cities in the country. A programme called "Gifted Education within Schools" was started by the Ministry of Education in 2002 which were pull-out programmes (see section 3.2). Currently, the King Abdulaziz Foundation for the Gifted (KAGF) is establishing different programmes for gifted secondary, high school and university students. All these programmes are in science and technology (King Abdulaziz & His companions foundations for the Gifted, 2008). Saudi Arabia is therefore developing a broad range of programmes, designed towards nurturing gifted people within and outside schools.

However, there is still a need for more programmes to help the gifted in schools, because schools are the best place to provide extra programmes and give attention to gifted students (Aljughaiman, 2005b). In addition, all gifted programmes in schools in Saudi Arabia are delivered outside regular classrooms. Thus, the aim of this study is to help the educators in gifted education in Saudi Arabia to discover the essential elements of an enrichment programme in science suitable for use in the regular classrooms of gifted students in 6^{th} grade (11-12 years). The next section examines the various definitions of the term "gifted".

1.4 Definitions of Giftedness

There are a variety of definitions of giftedness. However, most of these definitions share certain basic assumptions. First, there is not one specific area in which the gifted should have to be labelled as highly gifted (e.g. intelligence). Second, gifted individuals should show a higher level of skills compared to their peers. Third, *all definitions of giftedness imply the necessity of social context* (Plucker and Barab, 2005:201).

This study adopts Marland's definition (National Association for Gifted Children, 2008) (see section 3.1.2) for three reasons: first, this definition is used in Saudi Arabia by the Ministry of Education and the King Abdulaziz and his Companions Foundation for the Gifted (Aljughaiman, 2005b). Second, Marland's definition is widely used in the literature and in many states in the USA, and third the Saudi Arabia education system is similar to the USA system (Davis and Rimm, 2010). The nature of giftedness will be discussed further in Chapter Three.

1.5 The Purpose of the Study

The present study was designed to discover the current appropriateness of the 6th grade science textbook and to identify the important elements of an enrichment programme in the science curriculum for gifted students in the 6th grade in Saudi Arabia. In particular, the study seeks to (1) analyse and describe the current science curriculum (textbooks); (2) explore gifted students', teachers' and supervisors' perceptions of the current science curriculum; (3) explore gifted students', teachers' and supervisors' views about what should be done in designing a proposed enrichment programme to meet the needs of the gifted.

1.5.1 The Importance of this Study

Over the past 25 years, gifted education has become a major issue in the education field, as attested to by the proliferation of books and articles on the subject (VanTassel-Baska, 2004). This is in recognition that gifted students are the future wealth of any society. Taking good care of them should be one of the priorities of those who work in the field of education. The education system should enable gifted students to become well balanced, both personally and intellectually. In addition, *schools can provide the special educational services needed by gifted and talented youth in a number of*

different ways (Feldhusen, 1994:367). One of the important issues in gifted education is developing an appropriate curriculum for the gifted. As Feldhusen (1994:368) says this can be achieved by developing *special curriculum materials, designed specifically for the gifted, which provide opportunities for the teacher to enhance learning*.

At present, in Saudi Arabia, science is studied as a single subject in the primary and secondary stage. At a later stage, the four branches of science, Chemistry, Biology, Physics, and Geology are studied separately. The importance of science subjects in an era of fast technological development, and in connecting students with modern technology are essential considerations in developing an enrichment programme in science. This study will work to provide evidence for the developers of an enrichment programme in science subjects for gifted students in the 6^{th} grade to be able to address these issues effectively. It is also anticipated that this enrichment programme will help gifted students to benefit from the level and speed of learning within their regular classrooms. Therefore, the enrichment programme that has been developed as a result of this study has several important functions:

1. The programme provides advanced content, challenges and practices for gifted students in the classrooms;
2. The programme provides options to all students (gifted and normal students) in the classroom;
3. The programme helps gifted students who are not recognised as gifted by the Ministry of Education;
4. The programme helps both teachers and gifted education centres to reconsider the tools they use to identify their gifted children if they find a number of students who can deal with the programme successfully;
5. Because the school programmes have limited spaces and might not have the capacity to provide services to all gifted students, the programme will help parents, schools and gifted education centres by serving gifted individuals who are not able to attend gifted programmes in resource rooms or after school;
6. Because many cities and villages in Saudi Arabia do not have gifted education centres, the programme will provide materials that can be used in a regular classroom.

1.5.2 Research Questions

The study is guided by the following research questions:

1. What are the contents of the current science textbook in the sixth grade at public schools in Saudi Arabia in terms of learning demand?
2. To what extent does the science textbook in the sixth grade at public schools in Saudi Arabia meet the needs of gifted students?
3. What elements should be included in the enrichment programme in the science curriculum in the sixth grade to meet the needs of gifted students?

1.5.3 Overview of the Methodology

The general design of the study is a descriptive study. A mixed methods approach has been adopted. Several methods have been used to answer the research questions.

To address research question one, an in-depth documentary analysis of the science curriculum (science textbook) in the sixth grade in Saudi Arabia has been undertaken; this helped the researcher to understand the current situation of formal science education in primary schools.

To address research questions two and three, questionnaires were distributed to gifted students in the 6^{th} grade. The researcher gathered data concerning students' perceptions of the current science textbook, what should be done for gifted students, and how they could be better served to improve their interest and abilities in science via an enrichment programme. The researcher also conducted interviews with science teachers and supervisors in gifted education, which helped him to develop a deep understanding of their concerns about the current science curriculum and what should be done to meet the needs of gifted students in the 6^{th} grade in Saudi Arabia.

1.6 Summary

This study was designed to explore what was required in order to build an enrichment programme in the science curriculum in Saudi Arabia. A mixed method approach, using three methods, document analysis, questionnaires and interviews, was adopted to answer the three research questions posed in this study.

Chapter 2 Background of Education in Saudi Arabia

This chapter briefly highlights the background to education in Saudi Arabia, and includes public education, special education, and science education.

2.1 Introduction

Education is without doubt one of the most prominent challenges facing Saudi society (Ministry of Education in Saudi Arabia, 2008). The emphasis on the quality of education to become more efficient in order to meet the religious, economic and social needs of the country is apparent in the objectives of the Saudi education policy (Ministry of Education in Saudi Arabia, 2008). The Ministry of Education updates the National Curriculum on a regular basis to meet the global challenges of the 21st Century, there is an urgent need in Saudi Arabia to undertake an education reform to accommodate the emerging challenges of the 21st Century . Therefore, Saudi educators need to consider these significant and current educational developments which include the development of personal skills necessary to help students to think critically and creatively (Ministry of Education in Saudi Arabia, 2008). All students including most talented and creative members should be exposed to such high quality education according to the individuals' level of readiness and abilities (Aljughaiman *et al.*, In Press).

This section will provide a general outline of public education in Saudi Arabia. In addition, it will show the significant growth in education in Saudi Arabia. Then it will move to the goals of teaching the science curriculum in Saudi Arabia. Next, the science

curriculum in Saudi Arabia will be described. Finally, it will discuss the extent to which the needs of students who are gifted in science are met in Saudi Arabia.

2.1.1 Public Education

Public education in Saudi Arabia is divided into three stages: primary school, secondary school and high school.

Primary school is the most important level in the education system, and forms the base of the pyramid in education, and the foundations for further learning. There are six primary levels, and pupils start school at the age of six. Students graduate from the primary stage at twelve years old. At this stage, the pupils should be proficient in basic skills in reading, writing, science, and mathematics.

Secondary school is the second stage in public education in Saudi Arabia. The period of secondary study is three years. Students start secondary school at the age of about twelve years and end at fourteen. At this stage, the students (male / female) master the basic skills acquired during primary school. In addition, they deepen their awareness of cultural trends in society. In this stage, they also undertake special courses and preparations that will qualify them for follow-up study in the next phase.

The third stage in public education is high school. Students enrol at the age of fifteen years. The period of study at this stage is three years. All students study the same curriculum in the first year. Then in the second year, students are divided into three sections: Arabic and Religion, Management Science and Applied Science (technical). After completing high school, students (male / female) are qualified for admission to higher education and university.

In the academic year 2009, the number of public schools in Saudi Arabia had risen to 31,798, of which there were14,923 schools for boys, and 16,875 for girls. In addition, the total number of classes (222,610) included 111,336 classes for boys and 111,274 for girls. Moreover, the number of students in Saudi Arabia is 5,019,007(boys and girls) of which there are 2,522,658 boys and 2,496,349 girls (see Table 2.1).

Table 2.1: The number of schools, classes and students (boys and girls) in Saudi Arabia in 2009

(from Ministry of Education, Statistics Department, 2010)

	Schools	Classes	Students
Boys	14,923	111,336	2,522,658
Girls	16,875	111,274	2,496,349
Total	31,798	222,610	5,019,007

2.1.2 Special Education

Special education in Saudi Arabia attracts considerable attention from the Government. In addition, special education has high priority in primary, secondary and high school. Particular care and attention are given to children with special educational needs because educators in Saudi Arabia believe that children with disabilities need to be taught basic knowledge, Islamic culture and the necessary skills to operate successfully in their lives as equals in society.

Gifted Education

The Ministry of Education has several principles for gifted education. Perhaps the most important of these principles are the following (Aljughaiman, 2010):

All students in Saudi Arabia have the right to learn and be educated in a manner that matches their capabilities, and which allows them to maximise their potential. Therefore, programmes for gifted students are considered as a right. Gifted students have needs that differ - to some extent - from those of other students, and the curriculum in schools should have programmes that serve their needs

The needs of gifted students are diverse. In addition to academic needs, individual needs, social needs, thinking needs and the needs of self-fulfilment are also important. Effective ways to meet the needs of gifted students involve applying different methods that will lead to academic acceleration, including scientific acceleration and involve enrichment programmes and experiences (Aljughaiman, 2010). However, enrichment programmes for gifted students do not work very well unless they are carefully planned, adequately prepared, and conscientiously addressed in school. Furthermore, the programmes for gifted education need to be very flexible and capable of

development and adaptation by teachers to meet the needs of the individual students (Davis and Rimm, 2010).

There have been a few major developments in the gifted education in Saudi Arabia over the last 25 years, as follows:

1. The education policy in Saudi Arabia mentions the importance of using suitable methods that can identify and care for gifted students and their abilities. Moreover, it states that the Government should promote gifted and talented students by giving them special attention, in order to develop their gifts and to give them the chance to realise their potential (Ministry of Education in Saudi Arabia, 2008). In 1990 - 1996, the Ministry of Education established a research programme in the King Abdul-Aziz City for Science and Technology. In this programme, gifted students are identified. As a result of this programme, a national project called the "Programme of Discovery and Care for the Gifted Students" appeared in 1996. Consequently, measurements of intelligence and creativity were prepared to identify gifted students in schools. In addition, the programme included two enrichment programmes in science and mathematics as primer programmes for gifted students.
2. In 1997, a programme to nurture gifted students was established in the King Abdul Aziz City for Science and Technology and the Ministry of Education. The programme was started and applied in schools that were affiliated to the Ministry of Education. Both boys and girls were targeted by the programme.
3. In 2000, a public administration for nurturing gifted students was established (Ministry of Education in Saudi Arabia, 2008); it aims to implement and achieve the goals of education and the education policy in Saudi Arabia.
4. In 2003, an increasing number of centres were opened for nurturing gifted students. During this stage, the public administration sought to provide a large number of gifted centres for the creation of appropriate care for gifted boys and girls. The number of gifted centres had increased to 31 centres for boys and 20 centres for girls by 2006. Tables 2.2 and 2.3 show the number of schools for both boys and girls that participated in the Ministry of Education gifted programmes (Ministry of Education in Saudi Arabia, 2008).

Table 2.2: The number of schools that have implemented gifted programmes for boys.

(from Ministry of Education in Saudi Arabia, 2008)

No	The City	Number of schools		
		2004	2005	2006
1.	Riyhad	0	81	0
2.	Jeddah	5	8	0
3.	Eastern area	5	5	0
4.	Makah	5	5	0
5.	Alahssa	5	5	0
6.	Alnadinah	5	5	0
7.	Mhail aseer	5	5	0
8.	Ataiaf	0	5	0
9.	Alqriat	0	7	0
10.	Alqaseem	0	5	0
11.	Almahd	0	5	0
12.	Asier	0	5	0
13.	Anmas	0	5	0
14.	Sraat abidah	0	5	0
15.	Rejal Alma	0	5	0
16.	Beasha	0	5	0
17.	Aljof	0	0	15
18.	Alhdod ashmeliah	0	0	5
19.	Tabok	0	0	5
20.	Njran	0	0	8
21.	Yanbua	0	0	5
22.	Albah	0	0	6
23.	Almukwah	0	0	7
24.	Alqunfotha	0	0	6
25.	Bisha	0	0	2
26.	Alahssa	0	0	3
27.	Njran	0	0	2
28.	Allith	0	0	5
29.	Sabia	0	0	5
		26	+161	+74
Total for the three years		261		

Table 2.3: The number of schools that have implemented gifted programmes for girls.

(from Ministry of Education, 2008)

No	City	Number of schools		
		2004	2005	2006
1.	Riyadh	18	2	0
2.	Jeddah	4	4	0
3.	Easren area	5	0	0
4.	Asier	0	5	0
5.	Makah	0	5	0

6.	Ataif	0	5	0
7.	Aljuf	0	0	14
8.	Tabok	0	0	5
9.	Alquriat	0	0	2
10.	Hail	0	0	1
11.	Albaha	0	0	15
12.	Almokhwah	0	0	3
13.	Alqunfutha	0	0	6
14.	Hail	0	0	3
Total		27	+21	+49
Total for the three years		97		

From Table 2.3, it can be seen that the number of programmes for gifted girls has increased. In 2004, 27 schools implemented gifted programmes, but in 2005 there were 48 programmes; in 2006, the number increased to 97 programmes. Overall, it can be seen from both Tables 2.2 and 2.3 that the programmes for gifted boys in Saudi Arabia are prioritised over those for gifted girls, by more than double. The total number of boys' schools with programmes for gifted students is 261, while only 97 girls' schools have such programmes. Thus, it is still necessary to establish more programmes for gifted girls. It could be said that gifted programmes should be provided to both girls and boys at the same level.

2.2 The Goals of the Educational System in Saudi Arabia

Because of the dramatic expansion of knowledge in the modern world, Saudi Arabia has developed rapidly and adapted its education goals to meet and answer the needs of individuals and society in all fields. In addition, Saudi Arabia, like other nations, has goals in its education system so that it can achieve more and develop as a country. Moreover, the goals of education and teaching emerge from the heritage of Saudi Arabia. In the present study, the goals of education in Saudi Arabia will be classified into five categories, as follows:

1. Islamic goals;
2. Knowledge goals;
3. Skills goals;
4. Scientific thinking goals;
5. Interests, tendencies and concerns goals.

This section will focus on the goals that are relevant to the present study, such as goals related to knowledge, skills, scientific thinking and interests and concerns.

Knowledge Goals

Saudi Arabia aims to reach sources of knowledge and invest in creating Saudi citizens who are able to meet the requirements of life as individuals and to contribute to building the homeland. Knowledge goals are as follows (Alsonble *et al.*, 2004):

1. The Arabic language is the language of instruction at all levels of education, with instruction in another language as necessary;
2. To provide students with appropriate information, culture and different experiences which make them active members of society;
3. To study the universe widely for use in the service of the nation and Islam.
4. To show global achievements in the fields of science, literature and the arts, and demonstrate that the progress of science is the product of humanitarian efforts, highlighting the role of Muslim scholars in the fields of science;
5. To develop reading skills to increase knowledge;
6. To understand the different types of environment and broaden students' knowledge about the world and its economy**;**
7. To provide students with one foreign language at least for the acquisition of science, knowledge and innovation.

Skills Goals

These goals aim to provide Saudi young people with the necessary job skills (Al-Hakeel, 2003):

1. To acquire the ability to express oneself and communicate in order to speak and write the language of sound and systematic thinking;
2. To acquire kinetic skills based on the rules of sports and health in order to build a good body;
3. To identify individual differences among students to help them to grow according to their abilities and preferences;
4. To take care of slow learners and work to eliminate the reasons for failure. To develop special programmes according to their needs;

5. To provide special education for disabled students, whether physically or mentally disabled;
6. To attend to identifying and fostering the gifted students and to give them a chance to extend their abilities.

Scientific Thinking Goals

The aims of these goals are to help Saudi young people to use the scientific method of thinking, in addition to using methods for solving problems in their lives, as follows (Alsonble *et al.*, 2004):

1. To encourage development of scientific and technical skills, these being the most important means of development at any nation;
2. To encourage the development of research and scientific thinking, and strengthen the capacity for observation and reflection;
3. To develop mathematical thinking and the use of language mathematical language.

Interests, Tendencies and Concerns Goals

The aim of these goals is to help Saudi young people in the following areas to (Alsonble *et al.*, 2004):

1. Have opportunities for growth, which will equip students to contribute to the development of society;
2. Appease the characteristics of the psychological stages of growth of young people at every stage.

Broadly speaking, the goals of the education system in Saudi Arabia afford considerable attention to individuals and also to society. Thus, the individual attaches great importance to the development of spiritual and social skills, and to building good habits. Moreover, the educational system does not neglect other aspects such as physical growth and mental development.

On the other hand, the goals stress the importance of preserving the heritage of the Saudi nation, and developing and transferring this to the next generation in the light of the teachings of Islam.

2.2.1 The Goals of the Science Curriculum in Saudi Arabia

The goals of the education system in Saudi Arabia are to help all learners face the difficulties and problems that they are likely to encounter in their lives. Therefore, it is important to highlight the goals of science teaching that may help them achieve these life skill goals, especially as science is the subject in focus in this study.

Like many nations, Saudi Arabia has many goals for teaching Islam, Arabic, history, mathematics and science. The goals of teaching the science curriculum will be explained in more detail, because this project will use these goals as a guide when building the programme for gifted students. An inventory of the goals of science education in Saudi Arabia for primary and secondary schools has been collected from official documents from the Ministry of Education. The Ministry of Education (1988) put forward the goals for science teaching for all stages: primary, secondary and high schools. All goals in primary and secondary stages will be reviewed in brief because this study focused on 6th grade in primary schools and this falls between these stages. The ten science goals that the education system aims to achieve in the primary stage, as follows (Alsonble *et al.*, 2004):

1. Confirming that there is one God and that He is the creator of the universe.
2. Providing students with extensive appropriate facts and concepts that help in understanding and interpreting natural phenomena;
3. Raising students in the scientific direction of research and observation and exploration and experimentation and analysis of information and verification of authenticity;
4. Raising knowledge of the environment and understanding what it contains: phenomena and the use of science in its reformation, development and preservation;
5. Broadening students' awareness of their resources and natural wealth;
6. Applying the sciences and providing the opportunity for students to do experiments and tests;
7. Defining students' hygiene habits;
8. Highlighting the efforts and the role of Islamic scholars in the development of science and human progress;
9. Highlighting the attention to the world's achievements in the fields of science;

10. Developing a love of reading and the use of scientific references and scientific activities and hobbies.

As noted, the purpose of these goals is that the student acquires good working habits and develops skills to be able to study science effectively. However, they do not aim to enable students to work and cooperate with others, a key feature of how scientists work. However, it is worth mentioning that the progress of science is the result of humanitarian efforts in general, as set out in goal 9. Moreover, one of the most important goals of teaching science in primary schools is No. 10. From the above, one may deduce that this goal gives students more space and freedom to learn, or choose activities that coincide with their own preferences and concerns. In addition, it appears to give educators greater freedom to choose the content of the science curriculum. Moreover, it could be said that the achievement of the objectives at any stage depends on the methods used and the availability of tools and means, in addition to the provision of appropriate resources for each phase and age (Alsonble *et al.*, 2004).

The goals of teaching the science curriculum in the secondary stage are set out thus:

1. Science education should strengthen the new generations' belief in God;
2. Watching and observing the universe, including creatures and natural phenomena, and understanding that all these phenomena are the work of God the Creator;
3. Training students in the discussion of matters and the search for causes;
4. Taking care to reveal the preferred teachings of Islam, and that Islamic law is consistent with instinct;
5. Providing students with critical skills, and providing scientific facts and concepts that will help them to interpret and understand modern phenomena, and the development of science services to facilitate human life;
6. Developing students' knowledge of scientific methods, research skills, and the ability to give opinions boldly and politely;
7. Providing knowledge of the environment and understanding the importance of phenomena, and the use of science in environmental rehabilitation and development and preservation;
8. Encouraging healthy habits among the students.
   (Ministry of Education in Saudi Arabia, 1998).

It might be said that there is no major difference between the goals of the primary and secondary stages, and it could be argued that they both require refining in order to support the general goals of education in Saudi Arabia. For example, the growth characteristics of students must be taken into account for both primary and secondary stages, in addition to the nature of the times in which we live and the nature of science (Ministry of Education In Saudi Arabia, 1997). Therefore, it is assumed that the Ministry of Education takes into account the differences between the two stages and needs of age groups, and to determine more accurately the objectives for each stage according to characteristics of the students' age.

In general, the goals of teaching science in Saudi Arabia are feasible to some extent, but need to be redrafted to suit the current environment of rapid scientific and technological changes and developments. This idea is supported by Arsheed *et al*. (2003) and Ziton (1994). Moreover, most of these goals especially goals 5 and 6 should be taken into account during planning and teaching science which reflects the needs to increase the self-confidence of Saudi students.

2.3 Science Curriculum in Saudi Arabia

Education in Saudi Arabia is divided into three levels: primary, secondary and high school. All students in these stages have a science curriculum. The science curriculum is taught to all pupils in one overall curriculum. Therefore, Biology, Chemistry, and Physics are studied as one subject in both primary and secondary schools. Then, at the high school stage, the science curriculum is studied as separate subjects: Chemistry, Biology, Physics and Geology. In addition, the content of the science curriculum in Saudi Arabia is standardized (Ministry of Education in Saudi Arabia, 1998; Arsheed *et al.*, 2003).

Therefore, the science curriculum is designed for all students in all schools and in all regions. It is thus characterized as a coherent curriculum and sequence. However, the style of developing one format for learning and teaching science does not necessarily work well for all students as it does not accommodate individual differences.

The science curriculum in primary schools contains several science topics. (see Table 2.4).

Table 2.4: The science subjects delivered during the primary level in Saudi Arabia.

(from Science textbook of 6th grade in Saudi Arabia, 2009)

Unit	Year 1 (age 7)	Year 2 (age 8)	Year 3 (age 9)	Year 4 (age 10)	Year 5 (age 11)	Year 6 (age 12)
Unit 1	Our sensory system	Creatures around us	The Human body	The body and how it works	The materials around us	Human body
Unit 2	The characteristics and qualities of plants	My health and my safety (1)	Food groups	Living creatures	Our body and our health	The proliferation of creatures
Unit 3	The characteristics and qualities of animals	My health and my safety (2)	The Earth is the environment of life	Material	Classification of animals	The environment
Unit 4	The characteristics and qualities of the water	The characteristics of things	Diseases cause pain	Water around us	Physical phenomena around us	Magnetism and electricity
Unit 5	The characteristics and qualities of air		The phenomena around us	The temperature		The material around us
Unit 6	The health and safety of hazard		Safety of hazards	Materials changes		Science in service to the human race
Unit 7				The universe		

From Table 2.4, it might be said that the science curriculum for primary students is rich in its knowledge content and encompasses a wide range of different subjects. In addition, to some extent, most of the content is revisited every year in the primary stage but with progressively more detailed information (Arsheed *et al.*, 2003). The number of hours devoted to the science curriculum in primary schools is two hours per week in years 1 to year 4, and this is increased to three hours per week in year 5 and 6. The percentage of the science curriculum in relation to the total number of teaching hours varies, from 6.7% to 10%; the total of number hours for the entire curriculum is shown in Table 2.5.

Table 2. 5: The number of hours and the percentage of total teaching for science at the primary stage in Saudi Arabia.

Year	1	2	3	4	5	6
Number of hours per week	2	2	2	2	3	3
Percentage of Curriculum	7.14%	7.14%	7.14%	6.66%	10%	10%

Tables 2.4 and 2.5, indicated that the time devoted to science is inadequate. This view is supported by many teachers, supervisors and researchers, who recommended an increase in the number of hours for the science curriculum in the primary stage in Saudi Arabia (Arsheed *et al.*, 2003).

2.3.1 The Failure to Meet the Needs of all Students in Science in Saudi Arabia

The picture of public education has changed considerably throughout the last three decades. The number of students - both boys and girls - has increased from 104,738 in 1960 to 5,019,007 in 2009. Moreover, the world requires education to be developed in quantity of students and quality of learning simultaneously.

This section will highlight some of the results of Arsheed *et al.*'s (2003) work on the science curriculum in Saudi Arabia that are pertinent to the study presented here. Arsheed *et al.*'s project studied the science curriculum in all primary and secondary schools in Saudi Arabia from 1988 to 2002.

Arsheed *et al.* (2003) analysed the contents of the science curriculum in the primary stage against several standard factors. However, only some of those factors have been highlighted here because they are particularly relevant to the current study in relation to one of its aims; that is to examine the current science textbook in 6^{th} grade in its adequacy to meet the needs of gifted students. These factors are:

- Attention to individual differences;
- Meeting the pupils' needs, interests, tendencies and concerns;

- Development of the capacity to research and survey;
- Care of the environment and social problems.

Attention to Individual Differences

As the scientific content in the primary stage is common to all students, this means that there is no formal interest in individual differences, which confirms the lack of optional subjects for the education of certain gifted students. Researchers, teachers and supervisors agree that the scientific content of the science curriculum at the primary level does not take into account individual differences among students and does not clearly specify what is to be taught to the gifted and to others.

Arsheed *et al*. (2003) stated that there is a need to develop the scientific content of the science curriculum, to take into account the individual differences between the various categories of students. As a result, developing the contents of the science curriculum will allow for more differentiation of scientific activities. In addition, Arsheed *et al.* (2003) recommended that the science curriculum should have some scientific activities that are specifically designed for gifted students.

Meeting the Pupils' Needs, Interests, Tendencies and Concerns

Arsheed *et al*.'s (2003) results showed that the science curriculum at the primary stage in Saudi Arabia partly meets the needs and concerns and the tendencies of students. However the needs of gifted students do not seem to be specifically addressed. Therefore, educators and researchers in Saudi Arabia should undertake more studies about these factors for gifted students, and not just consider the needs, interests, tendencies, and concerns of average students.

Development of the Capacity to Research and Survey

Research results showed that the scientific contents of the science curriculum of the primary stage is poor and it does not develop students' capacity to research and survey (Arsheed *et al*., 2003). The majority of methods that are used in books and classes focus on memorization; this method is not appropriate for developing the ability to research and survey using scientific information. Moreover, in order to develop the ability in gifted students to research and survey, the science curriculum should be designed and built with consideration of the views of scientists, experts in education, teachers, as well as students. Arsheed *et al.* (2003) showed that there is a need to pay

more attention to developing research and survey skills, especially for gifted students so that the science curriculum is designed to cater for the needs of this group. Thus, one aim of this research is to analyse the science curriculum to examine in detail whether the content of units provides sufficient opportunity for gifted students to engage in research and survey.

Care for Environmental and Social Problems

Arsheed *et al*. (2003) showed that there is agreement from researchers, teachers and supervisors that the science curriculum in Saudi Arabia in the primary stage gives special consideration to the environment, while social problems are not given the same attention. From the above, it seems that there is a need to increase the awareness of topics on social problems.

To sum up, the science curriculum for the primary stage in Saudi Arabia does not pay sufficient attention to several important factors discussed above. It would appear that the students' needs in terms of knowledge, development of attitudes and concerns are not adequately addressed in the science curriculum for the primary stage in Saudi Arabia. In addition, the topics of social problems are not adequately addressed, and the content lacks topics that can enrich the science curriculum to meet the needs of average as well as gifted students. If these were addressed the science curriculum would be enhanced not only for the gifted, but for all students. It could be said that there is a need to design a curriculum to meet that needs of gifted students that is based on empirical research conducted by specialists in this field.

2.4 Summary

This chapter demonstrated that there is an urgent need for restructuring and building the objectives of the science curriculum to correspond to the differences between the capabilities of gifted students and average students, and their individual needs.

Chapter 3 Literature Review

This chapter deals with a number of topics related to giftedness, gifted education, and gifted programmes. It also presents studies that have investigated the need for enrichment programmes, planning enrichment programmes, and models of enrichment programmes. It is divided into several sections: (1) definitions of giftedness, (2) meeting the needs of gifted students, (3) enrichment programmes, (4) definition of enrichment programmes, (5) the nature of enrichment programmes, (6) common types programmes for gifted students, and (7) enrichment programmes in Saudi Arabia.

3.1 Definitions of Giftedness

This section explores definitions of giftedness. It contains many dominant theories of giftedness and concerns in the field. The scope of this review covers major theories that have been widely accepted by researchers, schools and governments (Ziegler and Heller, 2000; Suror, 2003; Davis and Rimm, 2004).

The term "giftedness" was coined in the early part of the 20th century by Stanford University's Lewis Terman (Simonton, 2009), but it is still evasive because there is no globally agreed definition of the term. Researchers and educators in the field have looked at the term from different points of view, and accordingly have developed various understandings. The terms "gifted", "able students", and "talented" have been used widely by researchers and educators. Authors sometimes differentiate among these three terms, but on other occasions they are used interchangeably. *There is no one definition of 'gifted' or 'talented' or 'giftedness' that is universally accepted* (Davis and Rimm, 2004:18).

In 1912, Lewis Terman developed the first test to measure intelligence that would help to identify gifted students (Stoeger, 2009). This kind of test focuses primarily on memory and analytical skills. *Terman believed that intelligence was biologically based, fixed and unchanging…did not necessarily make any mark in science, business, arts or commerce.* Hence he refined his position and held that, *high intelligence was only a necessary but not a sufficient condition for highly able behaviour* (National Association for Gifted Children, 2008:www.nagc.org)

(Plucker, 2003) states that, according to Terman, gifted children should be identified as early as possible. Gifted people should also have a special curriculum, with teachers who understand their needs. Moreover, Terman believed that gifted children are those who achieve very high scores in IQ tests; usually, they represent not more than 1% of the population (Plucker, 2003). Terman's view of giftedness was restricted to an IQ score, excluding other factors such as gifted behaviour and creativity or productive thinking.

3.1.1 Multiple Definitions

Since Terman's pioneering work, numerous researchers throughout the world have come up with many diverse ways of identifying gifted children (Stoeger, 2009). In 1958, Witty suggested that children with outstanding potential in art, writing or social leadership could be identified mainly by their performance. For this reason, Witty recommended that the definition of giftedness should be expanded to include children who show outstanding performance in any valuable line of human activity (Passow, 1981). Witty's definition was considered one of the earliest that did not restrict giftedness to an IQ test.

The report of the Schools Council enquiry into the teaching of gifted children of primary age in the UK defined the term 'giftedness' thus:

> *The term 'gifted' is used to indicate any child who is outstanding with either a general or specific ability, in a relatively broad or narrow field of endeavour. Where generally recognized tests exist as (say) in the case of 'intelligence', then ' giftedness' would be defined by test scores. Where no recognized tests exist it can be assumed that the subjective opinion of 'experts' in the various fields on the creative qualities of originality and imagination displayed would be the criteria we have in mind* (Ogilvie, 1973:6).

This definition of giftedness is wider than any earlier definition. In addition, a child who is gifted does not just have a high IQ but could be gifted in a particular area (Ogilvie, 1973).

Marland's definition (1972) of giftedness that has been, and continues to be the one most broadly adopted in the United States as well as many other countries around the world. The Report defines gifted children (Davis and Rimm, 2004:19) as:

> *Students, children, or youth who give evidence of high achievement capability in areas such as intellectual, creative, artistic, or leadership capacity, or in specific academic fields, and who need services and activities not ordinarily provided by the school in order to fully develop those capabilities.*

This definition is flexible and comprehensive. It recognizes more than high general intelligence. It contains several areas such as academic prowess, creativity, leadership and the arts. It recognizes the two essential aims of a gifted programme: to help gifted and talented students build up their high potential, and to provide society with cultured professionals who are creative and problem solvers (Davis &Rimm, 2004). Many experts in the field believe that the concept of giftedness is not limited to high intellectual ability. It also comprises other abilities in specific areas, such as social adeptness and creativity (Stoeger, 2009). Furthermore, this definition focuses on delineating a range of ability areas (Hewton, 2002).

In 1978, Renzulli proposed a definition that received broad recognition and was used substantially since the 1980s (Renzulli, 1998). Renzulli believes that:

> *Gifted behaviour reflects an interaction among three basic clusters of human traits, these clusters being above average (but not necessarily high) general and/ or specific ability, high levels of task commitment (motivation), and high levels of creativity. Gifted and talented children are those possessing or capable of developing this composite set of traits and applying them to any potentially valuable area of human performance* (Davis and Rimm, 2004:21).

It is important to notice that this definition does not assume that all gifted children should have high ability in all those characteristics. Moreover, the view from modern researchers towards the gifted has become wider, and it includes many abilities, not only high levels of intelligence.

A new theory and definition of intelligence was proposed by Gardner in 1985 and the first question to have been answered by this theory is that there is no single

intelligence (Armstrong, 2009). Gardner's theory suggests that intelligence is not only IQ because a high IQ in the absence of productivity does not equate to intelligence (Chen *et al.*, 2009). Seven types of intelligence in the original theory were described by Gardner, who subsequently added an eighth (Davis and Rimm, 2004). Gardner's theory assumes that *"a person thus may be gifted in one or several of the intelligence areas, but not in others"* (Davis and Rimm, 2004:24). The original seven plus his eighth intelligence area are:

1. Bodily/Kinesthetic: physical movement and knowledge of the use of the body;
2. Interpersonal relationships and communication: understanding others;
3. Intrapersonal: knowledge of own thinking and emotions;
4. Logical/Mathematical and scientific reasoning;
5. Musical/Rhythmic sensitivity to rhythm, beats, tonal patterns: performance and composition;
6. Natural: curiosity about the natural world, ability to classify flora and fauna;
7. Verbal/Linguistic: concerned with words and language;
8. Visual/Spatial: comprehension of the visual world and creation of mental images (Feldhusen and Jarwan, 2000:273).

As a result of this theory, teachers' feelings towards their pupils have changed positively which affect the teaching strategies and methodologies that are used in the classroom (Dai, 2009).

Later, Sternberg (1995) presented a theory of successful intelligence. The theory is substantially broader than conventional theories of intelligence (Sternberg and Davldson, 2005). Sternberg agrees that giftedness cannot be represented by IQ only, and he identified three major types of intelligence. The first one is Analytic giftedness, which is academic ability measured by classic intelligence tests, particularly analytical reasoning and reading comprehension (Davis and Rimm, 2004). Second, Synthetic giftedness refers to creativity, insightfulness, intuition, or the ability to cope with novelty (Davis and Rimm, 2010). This type includes persons who make the greatest contributions to society, but at the same time may not earn the highest IQ scores (Davis and Rimm, 2010). Third, Practical giftedness involves individuals applying their abilities to the kinds of problems that confront them in everyday life, such as at work, in the home or in the environment (Sternberg and Davldson, 2005). In addition, Sternberg (cited in Davis and Rimm, 2004) stated that the important factor of

giftedness is coordinating the three abilities and identifying when to use which one (Davis and Rimm, 2004).

Sternberg also describes another system of identifying giftedness, this is the implicit theory, which specifies five necessary and sufficient conditions. The theory states that in order to be judged as gifted, a person needs to meet those criteria: 1- excellence 2- rarity 3- productivity 4- demonstrability and 5- value (Sternberg, 1995).

1. The excellence criterion states that the person is extremely good in some dimension or a set of dimensions relative to peers.
2. The rarity criterion states that in order to be labelled as gifted, the person must possess a high level of skill in an area that is uncommon relative to his / her peers.
3. The productivity criterion states that the dimension(s) along which the person is evaluated as better than their peers must lead or potentially lead to productivity. The productivity criterion produces disagreements over who should accurately be labelled as gifted.
4. The demonstrability criterion states that the person needs to be able to demonstrate, in one way or another, that he or she actually has the abilities or success that have led to the judgment of "giftedness." Simply claiming giftedness is not one.
5. The value criterion states that for a person to be labelled as gifted, he or she must show a higher performance in a dimension that is valued by his or her society. The implicit theory provides a basis for understanding how persons allocate the label of giftedness to some individuals but not to others .

In conclusion, views of giftedness have undergone considerable development and change. Studies in the field of gifted education stress that many students throughout the world who have been labelled as being gifted or non-gifted must have the chance, and right to learn to their full potential, based on all their abilities, or areas of interest. In addition, programmes and curricula in schools should be developed to cater for the broad scope of giftedness. This study will adopt the definition proposed by Marland. There are two major reasons why this definition has been selected. First, this definition is used in Saudi Arabia by the Ministry of Education which follows the USA education system quite closely, and by the King Abdulaziz and his Companions foundation for the Gifted in Saudi Arabia (Aljughaiman, 2005b). Second, Marland's definition is widely used in studies from all states of the USA (Davis and Rimm, 2010).

3.2 Meeting the Needs of Gifted Students

Very often there is consensus among educators about the importance of meeting the needs of gifted students (Aljughaiman and Majiney, 2009). Many studies stress that effective gifted programmes should accommodate cognitive and none cognitive needs of students (VanTassel-Baska, 2005). Cigman (2006) emphasises one of the deepest needs of gifted children, is to have adequate mental stimulation. So, gifted students should learn differently. It is important to know that a gifted student needs to be challenged, and that he or she needs to learn to develop the study skills to handle those challenges (Cigman, 2006).

In this section, the needs of gifted students are highlighted. This section gives an overview of their needs including thinking skills, social and emotional needs and creativity because they are pertinent to the work presented in this study.

Thinking and Research Skills

There are many types of thinking addressed in the fields of psychology and education. Examples of these are: scientific, empirical, analytic, logical, critical, and creative thinking. The thinking skills of the gifted have been delineated by a number of researchers (Renzulli, 2000; Lipman, 2003; Cottrell, 2005). There are many thinking skills that tend to be used and practised by the gifted, not only those that can be taught. One of the most famous models, which has been used frequently to develop thinking skills in students, is Bloom's (1956) cognitive domain taxonomy (Maker and Nielson, 1995). The original framework of this cognitive taxonomy includes six categories of thinking skills: knowledge, comprehension, application, analysis, synthesis and evaluation. All categories were labelled as 'abilities and skills'. Later, Anderson *et al.* (2001) modified Bloom's cognitive domain taxonomy:

The original number of categories, six, was retained, but with important changes. Three categories were renamed, the order of two was interchanged, and those category names retained were changed to verb form to fit the way they are used in objectives (Krathwohl, 2002:214).

The categories in the Anderson *et al.* (2001) revision are remember, understand, apply, analyse, evaluate and create. Table 3.1 shows the details of the six new categories in the revision of Bloom's Taxonomy.

Table 3.1: Structure of the Revised Taxonomy.

(from Krathwohl, 2002:214)

1. Remember – Retrieving relevant knowledge from Long-term memory.	*1.1 Recognizing* *1.2 Recalling*
2. Understand – Determining the meaning of instructional messages, including oral, written, and graphic communication.	*2.1 Interpreting* *2.2 Exemplifying* *2.3 Classifying* *2.4 Summarizing* *2.5 Inferring* *2.6 Comparing* *2.7 Explaining*
3. Apply – Carrying out or using a procedure in a given situation.	*3.1 Executing* *3.2 Implementing*
4 Analyze – Breaking material into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose.	*4.1 Differentiating* *4.2 Organizing* *4.3 Attributing*
5. Evaluate – Making judgments based on criteria and standards.	*5.1 Checking* *5.2 Critiquing*
6. Create – Putting elements together to form a novel, coherent whole or make an original product.	*6.1 Generating* *6.2 Planning* *6.3 Producing*

From Table 3.1 it could be said that the first two levels (remembering and understanding) are necessary for all students, and that all students should be encouraged to develop higher skills (Davis and Rimm, 2010). However, it is expected that gifted students will develop higher-level cognitive skills, including applying, analysing, and evaluation and creating. Taber (2007) suggests that curricula or teaching and learning programmes for gifted students should include extension in depth and enrichment in breadth, which means these programmes should provide additional support and challenge in the classroom and outside school. In addition, an important issue in challenging learners is to build activities based on the higher levels of thinking (Watts and Jesus, 2007). Taber and Corrie (2007) suggest that teaching of gifted students in science should emphasise questions and activities that enable the learner to apply, analyse, evaluate and create.

Social and Emotional Needs

The issue of developing the social and emotional needs of the gifted has been studied by many scholars (Coleman and Cross, 2000). *The major needs of gifted and talented children should be identified, with recognition of their ability and understanding of their social and emotional needs* (Smith, 2006:102). Smith (2006) illustrates the four needs to meet social and emotional development as follows:

Recognising gifted students' needs and abilities should be given more attention in the educational system, *Like all students with special educational needs, gifted students need to feel that there is a place for them where they can be encouraged to reach their potential* (Smith, 2006:102).

Second, Challenge academically: in many cases, schools *are not (stretching) the regular curriculum and this can lead to boredom and frustration* (Smith, 2006:102). To challenge students at a level appropriate according to their abilities, the curriculum should be modified to stimulate and motivate the students to achieve their potential. Silverman (2008) found that many gifted students had not enough opportunities in the classroom to address their individual needs in mathematics. It was also reported that there was no differentiation within learning tasks for pupils of varying abilities (Silverman, 2008). In addition, Collins (2007) states that gifted students require more challenges in their learning.

Third, these students need to be allowed to develop their natural curiosity. For instance, most of these students from a young age may have a thirst for knowledge but their questions can remain unanswered within a regular school system (Smith, 2006:102). The reason is that teachers often ignore the questions of the gifted and they are told that there is not enough time to deal with their queries (Smith, 2006). Within this situation, many gifted students cannot thrive and will feel discouraged, and some may stop asking questions, which will lead to them feeling bored, frustrated and disenfranchised.

Finally, there should be acceptance of students' needs as individuals, because many of these students have a unique way of looking at things and different ways of absorbing new information (Freeman and Josepsson, 2002; Davis and Rimm, 2004). Their individuality should be celebrated and they should be encouraged to think for themselves; also, some *teachers are asking gifted students to conform to what they want them to be. Their individuality is being crushed as they are being made to fit into regular education* (Smith, 2006:103). Many families, parents and clubs take special

care to develop the exceptional skills if their child has a high ability in sports or music, but less so for those students who are exceptional at mathematics or other academic endeavours (Smith, 2006).

Consequently, the current study tries to help to meet the needs of such students by building a programme that will be designed in light of their individual needs, abilities and interest areas in science.

Creativity

Creativity is among the most complex of human behaviours (Runco and Sakamoto, 2007). The literature has provided many definitions of creativity (e.g., Sternberg, 1999, 2005; Jarwan, 2002; Davis and Rimm, 2004). Some definitions focus on characteristics of individuals whose work is determined to be creative (What is a creative person like?), whereas others consider the work itself (What makes this creative?).

In either case, most definitions have two major criteria for judging creativity: 'novelty and appropriateness' (Starko, 2005:17). For example, Perkins (1990:311) defined creativity as follows: *(a) A creative result is a result both original and appropriate, (b) A creative person—a person with creativity—is a person who fairly routinely produces creative results*. Perkins' view about both the creative person and the creative result are broad, and could be combined as a concept of creative people and creative activities in a neat practical package (Starko, 2005). To move further into the field of gifted education, there is a relationship between creativity and giftedness (e.g. Renzulli's three-ring definition of giftedness). In other words, Renzulli appears to believe that creativity is a necessary but not a sufficient component of giftedness (Makel and Plucker, 2008). To learn creativity in any style of learning, all students, including gifted students, should be taught to do four things:

1. Think of many ideas (fluency);
2. Think of varied ideas (flexibility);
3. Think of unusual ideas (originality);
4. Add to their ideas to make them better (elaboration) (Starko, 2005: 202).

There are various ways to develop creativity of the gifted. One of the most commonly used strategies is the Creative Problem Solving (CPS) Model (Isaksen *et al.*, 2000), and Six Thinking Hats is one of the most famous strategies for improving the creativity thinking skills of the gifted (De Bono, 1999). These methods help all students, including gifted students, to look at information and experiences in new ways

and with new understanding, and then formulate new ideas as a result of their thinking process.

From these studies and others, if the curriculum is inflexible, meeting the needs of gifted students will be challenging (Stein and Poole, 1997; Renzulli, 2000; VanTassel-Baska, 2004; Davis and Rimm, 2010). Teachers, parents, educational systems and students have a role to support the gifted to meet their needs. Curriculum designers should therefore plan and design the curriculum to give teachers and students more flexibility in the content and learning activities to encourage creativity.

Indeed, all of the above mentioned needs of gifted students should be met throughout suitable programmes or modified curricula in the following ways:

- The gifted student needs to move to a high level of thinking by increasing the challenge of materials or activities.
- The gifted need the freedom to ask questions related to what they want to know and find out, not what teachers want.
- The gifted need a wide range of encouragement, giving them the opportunities to study their interest areas.
- They also have the right to demonstrate their individual abilities and creativity in order to develop their subjects of interest.

3.3 Enrichment Programmes

This section describes the definitions of enrichment programmes. It then explains some models of enrichment programmes. In addition, it will give some examples of the application of enrichment programmes in several countries. Finally, enrichment programmes in Saudi Arabia will be explained.

A wide range of programmes and models are used internationally for the education of the gifted. Some of the most important programmes that have been delivered to gifted students or non-gifted students are enrichment programmes. Furthermore, these types of programmes can benefit all students, not only gifted children.

The report from the Council of Curriculum Examinations and Assessment in the UK (CCEA, 2006) points out that there are several issues in which the needs of gifted students can be met via enrichment programmes:

Gifted students can be challenged by setting tasks that encourage them to think at higher levels through the use of higher order thinking skills:

1. Gifted students can be taught how to explain, teach or design something to someone;
2. Gifted students might be expected to spend less time completing the core task than others;
3. Gifted students sometimes need to work with peers of similar ability and are expected to perform at a higher level;
4. Gifted students can be given different amounts of information, which support their thinking;
5. Gifted students can be encouraged to use a range of resources or alternative (CCEA, 2006).

Therefore, Stein and Poole (1997:13) identify some specific issues connected with enrichment programmes, these are: Planning and designing the curriculum to give children the freedom to learn by providing a wide range of open-ended activities: *Managing and organising the teaching and learning environment to meet individual interests and needs*.

Curebal (2004) shows that enrichment programmes may allow teachers to use a variety of strategies to meet gifted children's needs and interests. The arguments she might be raised that the responsibilities are shared amongst teachers, parents and administrators. Each one of them should fulfil his or her role. Therefore, if the needs of gifted students are not met by teachers, parents or administrators, we might face serious learning problems. Thus, it would be worth identifying the needs of gifted students, to design an appropriate programme. Moreover, the programme should provide effective strategies and techniques for teachers that will help both teachers and pupils to eradicate inappropriate behaviour in the classroom.

3.4 Definition of Enrichment Programmes

Many researchers have put forward diverse definitions of enrichment programmes, with these differences stemming from their views of intelligence or of giftedness. Renzulli (2000) reports that enrichment programmes should shift to be compatible with a more current conception of giftedness. Thus, this change from the more traditional concepts of giftedness may provide more flexibility in planning and designing courses

for, or teaching, gifted students. Many of the programmes and strategies that have been delivered to gifted students are based on the traditional definition of intelligence (Cohen, 1990). More recently, Freeman and Josepsson (2002) define enrichment in general thus:

Enrichment is rounding out and deepening the material to be learned for the gifted pupils, for instance, extra-curricular activities or broadening knowledge

The National Academy for Gifted and Talented Youth (2006) (www.nagty.co.uk) defines enrichment as : *enrichment means providing greater breadth of learning when a pupil is encouraged to go beyond the usual limits of a subject or topic*. Thus, enrichment means adding disciplines or areas of learning not normally found in the regular curriculum, using more difficult or more in-depth material to enhance the core curriculum, and expanding the teaching strategies used to present instructions (Clark and Gonzalez 2002). Enrichment programmes can also take place in or out of school.

From the above, it may be seen that most definitions agree that enrichment programmes should provide materials in depth and a broader experience of subjects; for example, extra-curricular activities such as Saturday programmes, field trips or learning centres can provide this wider experience. In addition, many researchers have mentioned the kind of students for whom these programmes are designed, whether gifted or normal students. According to Townsend (1996:362), enrichment refers to *learning activities providing depth and breadth to regular teaching according to the child's abilities and needs*. Enrichment activities are normally in addition to, and different from the regular classroom activities by way of offering challenges (www.tki.org.nz). Therefore, many educators, such as Freeman and Josepsson (2002), the National Academy for Gifted and Talented Youth (2006) (www.nagty.co.uk), Olenchak and Renzulli (1989) and Townsend (1996) believe that enrichment programmes should be delivered to all students, not only gifted students.

3.5 The Nature of Enrichment Programmes

The most common programme for gifted and talented students is probably the enrichment programme. Enrichment programmes have been studied extensively in the last twenty years.

There are numerous definitions of enrichment programmes. Here, the definition from Cohen has been chosen because it is simple; at the same time, it is a general

definition within which many activities could be included. Dannenberg (1984) in Cohen (1990) defines enrichment programmes as experiences that are designed to extend, supplement or deepen understanding within particular subjects. This definition shows that an enrichment programme has more depth than the regular curriculum, and it is focused not only on the subjects in school but also on special contents.

There are many strategies that may be delivered to gifted students as enrichment activities. Davis and Rimm (2010) highlight several activities for developing the abilities of the gifted in numerous areas.

Acceleration, special schools, special classes or other programmes; may all be called enrichment programmes. The question that might be raised is: why do we call them enrichment programmes? It could be said that the nature of enrichment is providing more in depth experiences for the learners, as well as increasing the level of challenge and thinking in learning. Furthermore, students who are accelerated to the next grade are enriched by the new curriculum or advanced contents. Moreover, special classes or special interest groups and clubs develop the skills of gifted learners through various activities, such as field trips, science clubs or academic competitions. Therefore, it could be said that enrichment programmes act as an umbrella term for the variety of gifted students' programmes.

3.6 Common Types of Programmes for Gifted Students

This section will outline the most common programmes that are usually delivered to gifted learners and examine their perceived strengths and weaknesses.

Acceleration

Heller *et al.* (1993:447) described acceleration as *a provisional procedure which allows highly gifted pupils to cover a curriculum in a shorter period than would be required by their peers at a normal classroom pace*. The education systems in any country should have the flexibility to allow this process in their education systems (Freeman and Josepsson, 2002). In addition, students can avoid boredom and save time and money by attending such programmes. However, some researchers believe that acceleration can cause problems for students and their parents (Suror, 2003; Davis and Rimm, 2004). For example, in primary schools, gifted children who are accelerated may be unable to learn essential skills such as reading or mathematics because they will

move to other skills or contents without studying the necessary skills in the previous levels (e.g. grammar rules and dividing skills). In this case, they might face difficulties in later years. On the other hand, acceleration and enrichment *have potential advantages and disadvantages, and it is now widely recognised that the two should be used in tandem, as complementary approaches to a qualitatively differentiated education*. (Riley *et al.*, 2004:16)

Special Schools

These schools have been *established to meet the learning needs of the gifted in the broad education realm* (Schroth, 2008:327). Many recent studies have reported that gifted students who have enrolled in these schools have greater levels of challenge and higher levels of achievement than gifted students in other settings. However, other studies found that there are limitations to this type of school, as the special environment changes real students' lives (Schroth, 2008). However, special schools seem an appropriate option for some gifted students, because a general education setting has proven inadequate for certain gifted students' learning needs (Schroth, 2008).

Special Classes

In these classes, gifted students are provided with a special curriculum that is more advanced and developed, or the curricula are different, or there is a mix of both. In addition, these classes can focus on acceleration, enrichment, or both (Schroth, 2008). Some classes are organized for special subjects such maths or science (Davis and Rimm, 2004). The literature on special classes shows evidence of positive academic and social benefits. For example, some students feel that there is more challenge in these classes than in regular classes (Schroth, 2008). On the other hand, there are negative issues arising from this type of class. Some students do not accept being separated physically and psychologically from other students (Davis and Rimm, 2004). *Part-time special classes* can serve to decrease the disadvantages of special classes. So gifted students can study in regular classes most of the time, and then attend special classes with more advanced content for some subjects, such as science.

Special Interest Groups and Clubs

Students can choose from several clubs or groups. Computer clubs, language clubs, science clubs and others are organized for all students. Research projects, field trips and competitions are planned by the teacher leader (Esam, 2006; Schroth, 2008). Clubs

(e.g. science clubs) could give the gifted the opportunity to meet some of their educational needs, but do not necessarily provide a good social environment because the gifted may want to learn with students of the same age; managing and providing different interesting clubs for each level may prove very difficult.

Pull-out Programmes

A common programme that is widely used cross the world is the Pull-out. In this type of programme, gifted children are taken out of their regular classroom to learn and work with a specialist teacher in gifted education in a particular room that has been prepared for gifted activities (Schroth, 2008; Davis and Rimm, 2010). This type of programme is usually focused on creativity, thinking skills and self-concept development (Schroth, 2008). The activities are usually held in a special room that is equipped with the materials that gifted children need. Benefits from a Pull-out Programme are that the gifted students learn a broad range of contents in depth. In addition, the gifted will sit together with other students at the same level of abilities, which could offer the students good opportunities to improve their skills. However, a problem behind this programme is that the gifted may feel uncomfortable being separated from their classmates, or may miss the regular content curriculum. On the other hand, the National Association for Gifted Children (2008) has recently reported on nine research studies that examined the Pull-out programmes for their effectiveness for gifted students, and these show that this form of education for the gifted has significant positive effects on gifted students' achievement, critical thinking and creativity.

Mentorship

This approach mainly includes connecting a gifted student with a professional tutor to work to meet particular needs. According to Siegle (2005), mentorship can provide students with skills, challenges and motivation with real life situations.

There are several areas in which gifted individuals can be provided with mentorship, such as academic mentoring and professional mentoring (workplace related) (Siegle, 2005). Good mentoring should have a clear goal for both the mentor and mentee. In addition, the mentee should have a strong interest to learn, and the mentor should also have real willingness to teach young people (Davis and Rimm, 2004).

In summary, programmes such as special schools, special classes, pull-out strategies and mentorship can be very effective in nurturing the gifted. In addition, the majority take place outside the classroom and are provided as additional programmes that are unrelated to the regular curriculum. This research study aims to consider how to provide an opportunity to meet the needs of gifted children in their normal classrooms.

3.6.1 The Need for Enrichment Programmes

Because gifted students have several problems in regular classrooms, such as the mismatch with the curriculum that is provided in schools, their abilities and giftedness could grow slowly and be limited (VanTassel-Baska, 2002). Then, they will lose the spirit of challenge, and have mental laziness (Suror, 2003). In addition, gifted students require specific provisions to meet their specific needs that are different from the normal curriculum that is provided for all students (Awanbor, 1991; Chan, 2001). Increasing attention towards providing special attention for gifted students has highlighted the urgent need for enrichment programmes. This necessitates the accurate preparation of these programmes, careful identification of students' needs and appropriate programmes (Chan, 2001). Gifted students have special academic and social needs, which require the adaptation of the public school curriculum and the creation of an appropriate environment for learning (Jarwan, 2004). Therefore, enrichment programmes have a prominent role in meeting those requirements and needs, and because they can have a profound effect on the success of the giftedness, educators and planners of such programmes should focus their attention and their priorities on them (Chan, 2001). Moreover, Suror (2003) alluded to the essential point from Renzulli (1986) that enrichment programmes are more acceptable to communities because of low cost and ease of application and they are useful for all students, not only the gifted.

From the discussion above, the justification for the existence of enrichment programmes points to two main issues. Firstly, the general curriculum cannot meet the academic and emotional needs of gifted students. Secondly, the general curriculum cannot challenge gifted students' abilities to encourage them to think at higher levels. Enrichment programmes fulfil specific needs for gifted students. They may also, however, as indicated by some of the researchers above, be used to enrich the

experience of normal students. Researchers consider that enrichment programmes can be provided either for gifted students, or for all students. However, this thesis focuses on gifted students, because of the recognition that the curriculum in Saudi Arabia is not meeting their specific needs (Arsheed *et al.*, 2003; Aljughaiman, 2005b; Majiney, 2008).

3.6.2 The Goals of Enrichment Programmes

Gifted education has three main goals: *to provide more – or more advanced knowledge, insights, and reasoning skills, to develop personality, and to establish a network of peer relationships* (Hany and Grosch, 2007:521).

Many educators and researchers state that the various gifted programmes that are provided have different goals, and these goals are diverse because of the differences among the programmes in aspects such as structure and organisation; for example, acceleration, enrichment and grouping (Hany and Grosch, 2007; McClure and Piggott, 2007). Davis and Rimm (2004:139) outline the objectives of enrichment as follows:

1. Maximum achievement in basic skills, based on needs, not age;
2. Contents and resources beyond the prescribed curriculum;
3. Exposure to a variety of fields of study;
4. Student-selected content, including in-depth studies;
5. High content complexity - theories, generalisations, applications;
6. Creative thinking and problem solving;
7. High level thinking skills, critical thinking, library and research skills;
8. Affective development, including self-understanding and ethical development;
9. Development of academic motivation, self-direction and high career aspirations;
10. Development of computer skills.

These goals or aims are general for all enrichment programmes or activities. Therefore, it is important that each enrichment programme has special aims that are specific to the needs of the particular gifted students. The goals of the most well-known enrichment models are briefly listed.

The Pyramid Project (Cox *et al.,* 1985) which aims to provide appropriate instruction for all capable students of all ages, from above average to the highly gifted, in all subjects every day.

Feldhusen and Kolloff in their "Purdue Three-Stage Enrichment Model" aim to promote many types of thinking skills, convergent problem solving, research skills and independent learning (Davis and Rimm, 2004).

The Autonomous Learner model aims to help *students become independent and responsible learners by giving them increased responsibility for their own learning* (Davis and Rimm, 2004:165).

However, Renzulli's enrichment models are probably among the most widely used programmes around the world (Renzulli, 2000). The goals of these models are illustrated below. Renzulli's enrichment models have different objectives. Type one enrichment aims to expose students to a range of areas, disciplines, events, hobbies, persons, places, interest areas and occupations that are not a regular part of the curriculum (Renzulli and Reis, 1994; Davis and Rimm, 2004). Type Two enrichment is aimed at promoting the development of a broad range of thinking and a feeling of progress (Renzulli and Reis, 2000). The purposes of Type Three enrichment are to help students: apply knowledge, motivation, and creativity to a self-selected problem or area of study; acquire advanced understanding of the content and methodology in a particular area; develop skills of self-directed learning; and develop self-confidence, tack commitment and feelings of accomplishment.

From the above, it may be deduced that the goals from the Pyramid Project, Purdue's Three-Stage Enrichment Model and the Autonomous Learner model are all focused on thinking skills, learning to learn skills, creative thinking and research and independent learning. In addition, the three types of enrichment programme from Renzulli have different phases. Types one and two aim towards general exploratory activities and group activities. Type three aims towards an original product. Whereby, *students should act as producers of knowledge and art, not just consumers* (Davis and Rimm, 2004:167).

To conclude, all these goals from the models and programmes emphasise developing a wide range of cognitive skills and independent, creative aspects of learning: which reflect the importance of meeting these needs for gifted people.

Standards in Gifted Programmes

This section will highlight the importance of standards to identify and meet the needs of gifted students that are used in different countries and schools. These will be taken into account in delivering the Proposed Enrichment Programme (PEP) to determine the structure and activities in gifted programmes.

Many countries take into account the importance of recognising highly able students because they believe they are the wealth of any society (Aljughaiman and Majiney, 2009). Defining giftedness, the identification of gifted pupils, and providing an appropriate learning environment that meets the needs of gifted students are essential issues that educators should be concerned with.

The question may be raised: why are programmes with standards for gifted students important? There are several answers to this question: schools should meet targets that are set by their education system, and effective education systems should meet the needs of all students, including the gifted (The National Academy for Gifted and Talented Youth, 2006). Moreover, the impact of using standards can benefit all learners and support the development of all schools.

Programmes with standards for gifted learners are used as guidance by designers in gifted education to inform them in to the design and implementation of gifted programmes, as well as providing designers with the tools to evaluate their programmes. The current study used some of these principles to help in designing the questionnaire of this study.

In the past decade, Standards in Gifted and Talented Education have been introduced in some developed countries such as the UK and the USA (Johnsen *et al.*, 2008; The National Association for Gifted Children, 2010). These include, for example, Arkansas Department of Education Standards (1999), the California State Board of Education Standards for Gifted and Talented Students (2005), and the Department of Education and Skills Standards in the UK (2007).

Given the acceptance and use of standards in these two countries, standards form a useful starting point for this study. Hence, two examples of Quality Standards for Gifted Education will be chosen from the UK and the USA.

These standards are chosen here for a number of reasons. First, they have been tested and evaluated as achieving high levels of success. Next, they have been

improved and developed to gain acceptance from schools, colleges, and society (VanTassel-Baska, 2006). In addition, they have been put to use as theoretical standards (The National Association for Gifted Children, 2010). (see Appendix A)

These quality standards were designed to fit or be appropriate for American and British schools, learners and education systems respectively. Thus, if these standards are applied in other nations or countries without modification, they may fail. Therefore, educators or designers who are planning to apply or use these standards should take into account differences in several factors such as education level and system, the economy and the culture.

However, these standards for gifted education may be used with modification. Because the current study will use standards for gifted programmes in Saudi Arabia to design an enrichment programme, it may be useful to build or select the criteria that are most relevant to the education system and Saudi culture from these standards. The reasons for using these standards from the UK and USA are that they have been used widely and applied many times, and they have been evaluated and developed over a long period of time (Johnsen *et al.*, 2008). Moreover, the standards are flexible to apply in diverse cultures or education systems. The current study will give an example that demonstrates that the standards can be flexible and suited to the community and the Saudi education system. In the Department of Education and Skills standards (IQS), element number 4 (see Appendix B), *Enabling curriculum entitlement and choice*, includes three levels; each of which can fit and be applied in the education system and Saudi culture. Thus, each level has the flexibility to have a high impact on learner attainment and achievement. The current study chose some suitable principles from both the USA and the UK standards to inform the development of the questionnaire.

The next section below explains the most widely used enrichment programme models

3.6.3 Enrichment Programme Models

The purpose of this section is to present a view of some models of enrichment programmes, because they are well known in many countries around the world.

There is a range of enrichment programme models that have been used by many schools and administrations in many countries, and this section aims to clarify several types or models of Enrichment Programmes for gifted students.

Enrichment and acceleration curricula for the gifted have become a centrepiece of programme activity as discussed earlier. VanTassel-Baska (2000) mentions several elements that any model developed for gifted students must have in order to provide a system for developing and designing appropriate curricula for a target population: the system must be flexible in respect of the age groups to which it would apply, and have relevance in multiple locations and learning settings.

Most of these models have been tested and evaluated in a wide range of schools and countries. The most applicable aspects of these models to gifted education in Saudi Arabia that are taken into account in this study are: designing the programme according the needs of learners and the educational environment of the gifted. Thus, this study will attempt to take advantage of these models to develop an enrichment programme which is consistent with the needs of Saudi students and their educational environment and life. The following models will be explained briefly.

1. The Schoolwide Enrichment Model (SEM) (Renzulli and Reis, 2000);
2. The Integrated Curriculum Model (ICM) (VanTassel-Baska, 1986);
3. The Autonomous Learner Model (Betts, 2003);
4. Programming at Four Ability Levels (Treffinger *et al.*, 2004);
5. Purdue's Three Stage Enrichment Model from Feldhusen and Kolloff (Davis, and Rimm, 2004);
6. The Oasis Enrichment Model (OEM) (Aljughaiman, 2005a).

The Schoolwide Enrichment Model (SEM)

The Schoolwide Enrichment Model (SEM) has been defined by Renzulli and Reis (2000:1) as

> *A detailed blueprint for total school improvement that allows each school the flexibility to develop its own unique programmes based on local resources, student demographics, and school dynamics as well as faculty strengths and creativity.*

The Centre for Gifted Education and Talent Development in The University of Connecticut in the USA reported that the Schoolwide Enrichment Model (SEM) is widely implemented as an enrichment programme used with academically gifted and talented students and as a magnet theme/enrichment approach for all schools interested in high-end learning and developing the strengths and talents of all students. The major goal of the SEM is the application of gifted education pedagogy to total school

improvement. The SEM provides enriched learning experiences and higher learning standards for all children through three goals: developing talents in all children, providing a broad range of advanced-level enrichment experiences for all students, and providing advanced follow-up opportunities for young people based on their strengths and interests (Renzulli and Reis, 2000). The SEM focuses on enrichment for all students through high levels of engagement and the use of enjoyable and challenging learning experiences that are constructed around students' interests, learning styles, and preferred modes of expression (Renzulli, 2000).

Separate studies (Renzulli and Reis, 1994; Adams *et al.*, 2008) on the SEM have established its effectiveness in schools with widely differing socioeconomic levels and patterns of programme organization.

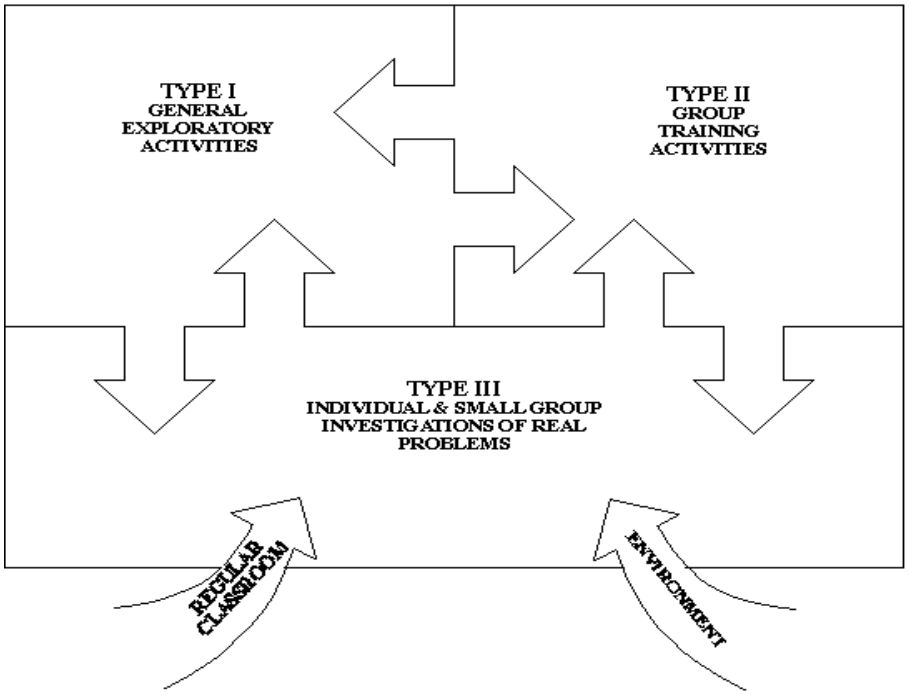


Figure 3.1: Schoolwide Enrichment Model.

(from Renzulli, 1986)

As shown above in Figure 3.1, the SEM has three types or levels that should help gifted students and all students in general. Types 1 and 2 are good for all students, but type 3 is focused on gifted and talented students.

The SEM is divided into three types - Type 1: general exploratory activities; Type 2: group training activities; and Type 3: individual and small group investigations of real problems. Each type has different purposes.

Type 1: general exploratory activities; the main purpose of this type is to expose students to a variety of topics, disciplines, events, hobbies, persons, places, interest areas, and occupations that would not be covered in the normal part of the curriculum (Renzulli and Reis, 2000).

Type 2: group training activities; the purpose of this type is to promote the development of a broad range of thinking and feeling processes (Davis and Rimm, 2004). Some of the activities in this type are provided to all students, but it should be the main goal of programme that it serves gifted and talented students (Renzulli, 1997). For instance, Renzulli (1997) illustrates some ideas that should support gifted students such as special skills that bring students to an advanced level, such as type 3 enrichment.

Type 3: Individual and small group; this type has several goals to help students by:

1. providing opportunities for applying interests, knowledge, creative ideas and task commitment to a self-selected problem or area of study;
2. acquiring advanced level understanding of the knowledge (content) and methodology (process) that are used within particular disciplines, artistic areas of expression and interdisciplinary studies;
3. developing authentic products that are primarily directed toward bringing about a desired impact upon a specified audience;
4. developing self-directed learning skills in the areas of planning, organization, resource utilization, time management, decision making and self-evaluation;
5. developing task commitment, self-confidence, and feelings of creative accomplishment. (Renzulli and Reis, 2000:370)

Many studies have examined the model and its effectiveness in over 20 years of research and field-testing, these include : (a) the effectiveness of the model as perceived by key groups, such as principals, teachers, students, and parents; (b) research related to student creative productivity; (c) research relating to personal and social development; (d) the use of SEM with culturally diverse or special needs populations; (e) research on student self-efficacy; (f) the use of SEM as a curricular framework; (g) research relating to learning styles and curriculum compacting; and (h) longitudinal research on the SEM (Renzulli and Reis, 2000:367). As a result of its effectiveness the SEM has been implemented in over 2,500 schools across the US, and

programmes using this approach have been widely implemented internationally (Renzulli, 1997).

From some features of this model, it could be said that types 1 and 2 in this model are good for all students. Furthermore, these types (1and 2) could be included in every class. A further advantage of this model is that the learners can move to any of the three types of enrichment any time if he or she needs to develop any personal skills for their particular interests.

The Integrated Curriculum Model (ICM) (Avery *et al*., 1997)

This model by the Centre for Gifted Education has been developed since its inception especially for high ability learners. Centre materials are grounded in the Integrated Curriculum Model, which is designed to respond to gifted learners' characteristics of precocity, passion and complexity. Its three dimensions; advanced content, higher level processes and product; and concept, issues, and themes dimensions formulate a curricular framework and set of teaching units in the areas of language arts, social studies and science (www.cfge.wm.edu, 2007).

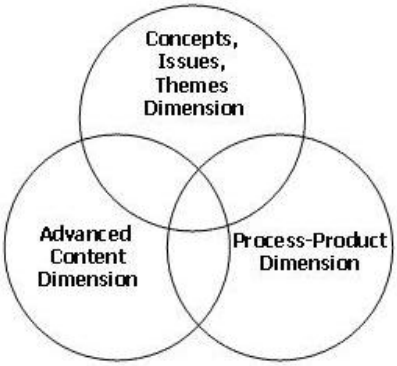


Figure 3.2: Three dimensions of advanced content, higher level processes and product improvement

(from www. Cfge.wm.edu)

The Autonomous Learner Model (ALM)

The Autonomous Learner Model (ALM) for the gifted and talented was developed specifically to meet the diversified cognitive, emotional and social needs of learners (Betts, 2003). Both the gifted and all learners are served by this model at all grade levels. Emphasis is placed on meeting the individualized needs of learners through the use of activities in the five major dimensions of the model (Betts, 2003). *The goal of*

the model is to facilitate the growth of students as independent, self-directed learners, with the development of skills, concepts, and positive attitudes within the cognitive, emotional, social, and physical domains (Betts, 2003:39). The model has been evaluated and revised to better meet the diversified needs of the gifted and talented from 1981by Betts and Knapp (VanTassel-Baska, 2000). Betts (2003) reports that the model contains five major dimensions:

Dimension One: Orientation

This dimension provides learners, teachers, administrators and parents with the opportunity to develop a foundation of the concepts of giftedness, talent, intelligence, creativity, and the development of potential. Learners discover more about themselves, and their abilities.

Dimension Two: Individual Development

This dimension of the model provides learners with the opportunity to develop the cognitive, emotional, social and physical skills, concepts, and attitudes necessary for life-long learning. In other words, learners become autonomous in their learning.

Dimension Three: Enrichment

The enrichment dimension of the Autonomous Learner Model is developed to provide learners with opportunities to explore content and curriculum that is usually not part of the prescribed school curriculum. The learners have the freedom of selecting the subject and the content in highest level learning. The students can choose any area in different levels such as design, implement, complete, and present a project with a mini-product.

Dimension Four: Seminars

The seminar dimension gives learners three to five opportunities to research a topic, present it as a seminar to the rest of the class and other interested people, and to assess it by criteria selected and developed by the learners.

Dimension Five: In-depth Studies

The in-depth study dimension of the Autonomous Learner Model empowers learners to pursue long-term in-depth studies in their areas of interest.

The Autonomous Learner Model is one of the most widely recognised and implemented models in the USA. (VanTassel-Baska, 2000; Betts, 2003; Davis and Rimm, 2004). In addition, the model has earned positive comments on its implementation from teachers (VanTassel-Baska, 2000).

Purdue's Three-Stage Enrichment Model from Feldhusen and Kolloaff

This model was pioneered as a course design for university students (VanTassel-Baska, 2000). It basically moves students from simple thinking experiences to complex independent activities. There are three stages within the model: stage 1 develops basic divergent and convergent thinking abilities, stage 2 provides more complex creative problem solving, and stage 3 focuses on independent projects via research skills and independent study (Davis and Rimm, 2004).

Programming at Four Ability Levels (Treffinger and Sortore)

Treffinger *et al*. (2004) provide the following illustrative levels of programming, which move from services that benefit all students to services that may be required by only a few students. The four levels stress that different talents and interests among students require diverse activities of programme (Treffinger *et al.*, 2004).

Level 1: Services for all students include creative and critical thinking, higher levels of Bloom's Taxonomy, independent projects, exploratory activities such as outside speakers and field trips, and activities based on students' interests.

Level 2: Services for many students include Great Books, future problem solving, young authors' conferences, computer labs, science fairs, maths competitions, clubs and academic interest groups, curriculum compacting, after school and/or summer enrichment courses.

Level 3: Services for some students include in-depth follow-up with guest speakers, drama or art lessons, cluster groupings to provide advanced instruction in content areas, community problem solving, individual or small group research projects on advanced themes or topics, participation in special classes in content or process areas, and participation in special programmes sponsored by colleges and universities.

Level 4: Services for a few students include mentorship with specialists, presentation of student projects to outside audiences, publication of student products in school or community sources.

According to Luna (2002), Treffinger's and Sortore's four-level model of programming for gifted education should be available in every school system and services at the "*few***"** level -four- should usually involve thorough adaptation of either content or the environment. Thus, the programme takes in account the content that the gifted choose from their environment. This model serves all students' abilities including higher level thinking skills and coverage of a wide range of new topics. Moreover, this model gives many students good opportunities to join some advanced activities which helps to meet the needs of gifted learners, such as *mentors, complex projects, and solving community problems* (Davis and Rimm, 2004:185).

The Oasis Enrichment Model (OEM) (Aljughaiman, 2005a)

During the last ten years a great number of experts and academics in the field of gifted education have participated in developing, assessing, piloting, experimenting with and evaluating The Oasis Enrichment Model (OEM) in public schools in Saudi Arabia (Aljughaiman and Majiney, 2009).

The Oasis Enrichment Model asserts the right of the gifted students to benefit from the pedagogical programmes, instructional styles and educational opportunities that nurture giftedness and excellence in a comprehensive, progressive and gradually-paced manner (Aljughaiman, 2010:3).

The experimentation with, and evaluation of this model have shown evidence of the validity, internal reliability and consistency of the model (Aljughaiman, 2005a; Ministry of Education in Saudi Arabia, 2008).

The OEM in its general construct has benefitted from the most important international, as well as local models in the field of gifted education. However, *three international models in particular have had a deep effect on the structure of OEM* (Aljughaiman and Majiney, 2009:4). These three models are Feldhusen and Kollof's Model (1979), Sandra Kaplan's Grid Model (1986) and Renzulli's Schoolwide Enrichment Model (SEM), (1998).

The OEM has been built based on the pullout approach where gifted students are gathered together outside the normal classes to enrol in systematic enrichment programmes either during the academic year or during the summer vacation.

The Main Aspects of the OEM Model

This model has five domains in general: motivation, thinking skills, learning skills, research skills, and affective traits (see Figure 3.3).

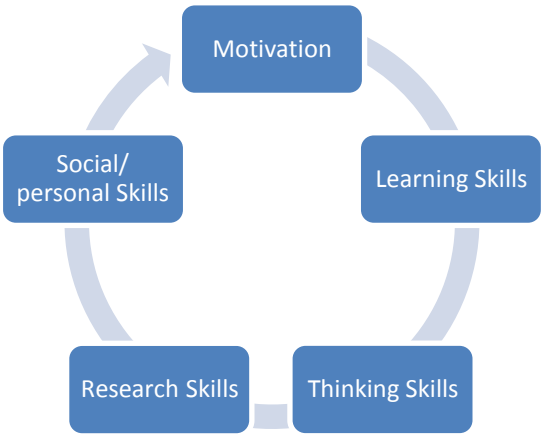


Figure 3.3: The Main Domains of the Oasis Enrichment Model.

(From Aljughaiman, 2010)

The OEM seeks to benefit the learners by developing his/her educational and learning abilities, such as higher order thinking skills, research skills, and learning skills through a scientific content (Aljughaiman, 2005a). According to Aljughaiman (2010:8) the OEM comprises of four levels:

First level: The preparation (Tools). The activities of this level are focused on necessary thinking skills, personal and social skills, and research skills.

Second level: Getting started (Power). In this level, gifted students start to work on more difficult tasks using more complicated tools.

Third level: Mastering planning (Vision). In this level, enrichment units are designed to help gifted students to develop their research, thinking, and social and personal skills in greater depth with more focus on planning for the future.

Fourth level: Getting ready to go (Scientist). In this level, students are required to use (in a comprehensive manner) all the skills that they have worked on during the last three levels.

This model presents different levels for gifted students which are of great benefit to them, but some research studies reported that the specific time of enrichment programmes is insufficient to nurture gifted students, and the teachers are unqualified to work in the enrichment programmes, especially with the continuously increasing

numbers of students identified as gifted (Aljughaiman *et al.*, In Press). Moreover, because this model is based on 'Pullout', some parents do not accept the pressure caused by additional burdens on their children after a full day at school. Furthermore, the OEM does not seem to be designed or applied to serve gifted students in their regular classroom.

Thus, the current study seeks to address the gap of not serving gifted students in their regular classrooms by developing a programme that can be implemented in the classroom, not out of it. However, the current study could benefit from some elements from the OEM model for several reasons. First, this model has been tested and examined many times to fit with Saudi schools and Saudi culture. Second, teachers of gifted students who participated in the current study have also used this model with their gifted learners. Thus, teachers of gifted in Saudi Arabia will be familiar with the proposed enrichment programme which will be built as a result of the findings of this study. Finally, gifted students who studied in the OEM during 4th and 5th grade will be ready to deal with the proposed enrichment programme (PEP) because they were familiar with the OEM out their classroom. Therefore, the PEP will allow students to study in their classroom with their peers rather than having to leave their classrooms as is the situation with the OEM.

To sum up, the most important aspect of these models is that all learners - the gifted and the non-gifted – are enabled to develop their skills and knowledge to a high level. In addition, most of these models, such as the ICM (Avery *et al.*, 1997), the SEM (Renzulli, 2000), the ALM (Betts, 2003) and the OEM (Aljughaiman and Majiney, 2009) have been tested and applied in many countries. Moreover, some of these models, because they have flexibility in their application can have an impact in diverse contexts. One major issue in applying any model is the capability of teachers, schools or organisations to implement it. For example, the SEM employed in many schools in the USA, faced problems in several areas, such as the training of teachers and the school environment. One of the major issues of the SEM model is that it requires all school systems to be involved during its implementation. Another problem can be how to modify specific models to take into account curriculum matters, the education system or the culture of the country. Thus, one model may be very effective in some regions or particular schools but not in others. Therefore, this study needs to take into account many factors that might supplement the effectiveness of an enrichment programme in Saudi Arabia.

In addition, this research study will use specific units from the primary level in the science curriculum that have been identified in Chapter Three. The enrichment programme in this study uses the framework of developing enrichment units that has been presented in the OEM (see above).

3.6.4 Planning and Designing Enrichment Programmes

Planning and designing gifted programmes has been a major issue in the field of education over the past 25 years (VanTassel-Baska, 2004). The three previous parts of this section illustrated four main issues, which are the definitions, needs, goals and standards of enrichment programmes that are provided for gifted students. This part will first look briefly at the situation of gifted programmes in some countries. Next, it turns to examine the specific areas of programme planning. Finally, the main body of this section explains the four components of planning programmes for gifted students, and will link these elements with the provision of gifted education in Saudi Arabia.

Our knowledge about educational planning and designing programmes for gifted children has been growing rapidly during the past several decades, and in recent years there has been a veritable explosion of new programmes for gifted students in many countries around the world (National Association for Gifted Children, 2008). Hence, in the USA and elsewhere, there are millions of programmes that have been served and applied in many schools in the last ten years (Barnett *et al.*, 2005).

However, this attention from administrations, researchers, schools or governments is still far from being an acceptable situation. Thus, Touron (2005:156) claimed that *the situation is unacceptable in many places*. Touron (2005:156) goes on to note that in North America, *which is the pioneer in gifted education services and research…..the situation is by no means satisfactory in many states.*

In addition, in many European countries the situation is even worse (Touron, 2005). Leroux (2000) and Touron (2005) divided the situation of gifted education in European countries into three distinct groups: one group with no legislation, another group with legislation, but with a lack of real attention in promoting the excellence of their most capable students, and the last group of countries with no legislation and no provision for their able students. Therefore, educators, parents or ministries of education should understand that a gifted education programme requires a

comprehensive focus, based on the right philosophical, theoretical, and empirical support.

Moreover, Arabic and other developing countries have several problems related to serving gifted students; one of these problems is planning programmes that can meet the needs of their able students (Jarwan, 2004). Saudi Arabia is trying to develop a curriculum for gifted students, and nowadays it has many programmes that are provided to this type of learner but these programmes do not meet the needs of all Saudi gifted students (Aljughaiman and Majiney, 2009).

Therefore, the situation in Saudi Arabia requires consistent work during the next few years, together with high-quality planning to consider the needs of gifted students (Aboznadh, 2006). Thus, it is important to note that even though many programmes are published and applied every year in Saudi Arabia this does not mean that provision for gifted students in Saudi is good (Aboznadh, 2006).

From the above, it is clear that there are different positions in fostering gifted education around the world, because *a strong and effective curriculum for the gifted is not easy to develop* (VanTassel-Baska, 2003:1). Thus, planning an appropriate curriculum for able students is essential even though this may be difficult to achieve.

The issues about planning and designing programmes for gifted students that should be considered when educators, schools or administrations are planning or designing programmes for gifted children are now considered.

It is important to acknowledge that there is no one right plan or design for all able students, all schools or all other services, because all able students are different and their abilities are not the same, and the schools do not have the same level of teaching or services. Moreover, the variety of cultures is another issue. Thus, the literature in the field of gifted education tells us that there is no single plan or design that can be used or applied to meet the needs of all gifted students (VanTassel-Baska, 1986; Maker and Nielson, 1995; Monks *et al.*, 2000). As, VanTassel-Baska (1994b:29) states *the process of curriculum planning and developing is complex, dynamic, and generative in nature*. For example, Southern and Jones (2004) found in their studies that there is a difference between a programme provided to serve gifted students in urban and rural schools in the same country, and there are also differences in the outcomes of the same programme when it is provided to both urban and rural schools.

Therefore, planning for gifted pupils should take into account the many factors that might impact on their plans in a negative way. The literature emphasises several issues that might be faced when planning any programmes for this type of student. For example, Hickey (1990); Starko (1990); and Davis and Rimm (2004) reported a number of problems that alienate educators and parents, or perhaps lead to the demise of programmes for gifted students, as follows: (Davis and Rimm, 2004:75)

1. The programme seems to be fun and games;
2. Parents believe that their children must have the best teachers;
3. The activities are not good for all children;
4. Programme participants become arrogant and snobbish;
5. The level of curriculum or programme puts much pressure on gifted students;
6. The programme creates problems of content repetition in the next grades;
7. Teachers of gifted students do not communicate with regular teachers about the programme.

It is clear that the problems illustrated could appear in three ways: from the programme itself, the gifted students and teachers of the gifted. Thus, to attain maximum impact, a gifted programme should be carefully planned, and take note of any guidelines that can inform the development of a successful programme.

There are numerous plans that could help educators and researchers to build or design programmes for gifted students (Kaplan, 1986; VanTassel-Baska, 2004; Davis and Rimm, 2010) and there are many examples of developing programmes for gifted students (Cropley and Urban, 2000; VanTassel-Baska, 2003; Davis and Rimm, 2004; National Association for Gifted Children, 2008).

In addition, many administrators and schools globally have their own specific plans because there is a belief that all students should have the opportunity to engage in the most suitable programmes that are specifically aimed to provide the experiences necessary for those able students, and that all students should have the right to choose programmes or subjects based on their abilities, needs and interests (Gifted Association of Missouri, 2004; Lawton Public Schools, 2006; Minnesota Department of Education, 2007). Thus, the enrichment programme must be designed to accommodate the specific needs of gifted students (Davis and Rimm, 2004). The Clearinghouse for Disabilities and Gifted Education (2003) mentioned more specifically that the flexibility and dynamicity, multiple levels and appropriate design should be

incorporated into any gifted programmes to meet the individual needs of each child who receives its services. However, it is not easy to tailor a programme to meet individual needs or the interests of each gifted student, but the designer of the programme could unravel this difficulty via giving the gifted pupils more options in activities from which to select (Aljughaiman *et al.*, In Press).

These programmes can help teachers, administrators and researchers to design and plan programmes for highly able students. In addition, the planning of programmes should also pay attention to the interface between the gifted and general education (Moon and Rosselli, 2000). Moreover, the programme developers for gifted students have designed programmes for specific subjects such as science or maths (Moon and Rosselli, 2000).

This study is a special project in science for elementary level, and it focuses on gifted children; thus it may be worth explaining some plans that might be used to inform building and designing the enrichment programme in this project.

Davis and Rimm (2004:55) outline four traditional components of a gifted programme. Then, they illustrate the main areas in programme planning. Here, the four components are enumerated as: (1) Philosophy and goals; (2) Definition and identification; (3) Instruction, with attention to students' needs, type of programme, personal, location, and timeline; (4) Programme evaluation. Other researchers do not fully agree with these components. Moon and Rosselli (2000) would argue against the position of Davis and Rimm and consider that culture, beliefs and values have a role in planning and designing programmes for gifted students.

According to Moon and Rosselli (2000), there are three stages that should be organized when developing a programme or building a new programme. The initial stage of programme development is a careful examination of both the conceptual fundamentals of the field of gifted education and the socio-cultural environment in which the curriculum will be implemented. The second stage includes strategic planning that result in a long-term action plan in a specific context. Finally, programme components are designed specially to develop giftedness in particular subpopulations of gifted and talented students in a specific context.

This study will benefit from these planning strategies. Moreover, these stages in planning a programme for gifted students are sensible and practical to apply. In addition, some elements that are present in planning any basic programme in this field

should include aspects such as: (1) needs assessment, (2) development of a shared philosophy, and (3) an action plan. Furthermore, each element contains several areas that could help programme developers.

The first element of the planning strategy is needs assessment. The purpose of the needs assessment is *to gather information on the programme development context* (Moon and Rosselli, 2000:508). Thus, Jarwan (2004) reports that all contextual elements should be assessed before beginning the design phase of a programme. These elements drawn from Moon and Rosselli (2000:508) are:

(a) Regional or national policies on gifted education or the lack thereof;
(b) Attitudes of stakeholders toward gifted education;
(c) The incidence of giftedness types and levels;
(d) Existing educational practices;
(e) Material and financial resources and constraints;
(f) Human resources and constraints.

Thus, the current study explores these elements to inform the gifted programme that will be provided to Saudi students. Most of the above factors were discussed in the background section in this study (see sections 2.1.1; 2.1.2; and 2.2), which discussed the education system in Saudi Arabia, incorporating governmental policies and departments of Gifted Education in the Ministry of Education. Also, Saudi Arabia has a special foundation for this type of student, called King Abdulaziz and his Companions Foundation for Giftedness and Creativity (KACFGC). Thus, researchers in gifted education could benefit from this foundation to support their programmes in schools or Universities because there are a large number of funded projects that provided to educators in this field in Saudi Arabia.

When the needs assessment has been completed, then the philosophy of gifted education should be adopted, but in Saudi Arabia the philosophy of gifted education is mandated by the education policy (Ministry of Education in Saudi Arabia, 2002).

The third step is the action plan that is a blueprint for the programme in a specific subject (Moon and Rosselli, 2000). Davis and Rimm (2004:77) emphasize the main information that should be included in the plan as:

1. Philosophy, rationale, and goals of programme should written and explained;

2. Statement of identification of the gifted pupils, instructional programme strategies and activities;
3. The type of programme or the options of activities that gifted pupils can select from;
4. Transportation needs;
5. In-service workshops, such as labs or techniques;
6. Budgetary needs and cost effectiveness must considered from the outset;
7. Programme evaluation is important for survival and growth.

It could be said that not all these elements are necessary for every gifted programme, as programmes should be based on the needs of their areas, schools, students, as discussed earlier. Therefore some factors have not been included in this study because it is difficult to cover all areas in planning a programme for gifted pupils in Saudi Arabia. The issues relating to the enrichment programme in science education such as programme format and the curriculum developed in this study are illustrated below. As indicated above, perhaps one could argue that all of these elements are necessary in planning a programme such as in-service workshops, or laboratory facilities and techniques, and budgetary needs and cost effectiveness (Davis and Rimm, 2004). However, budgetary needs, for example, might be a major issue in some countries but not others. Several countries, such as the USA, have national funding for special education (Moon and Rosselli, 2000).

In Saudi Arabia, programmes or activities for gifted education have high levels of governmental funding, and a contribution of money, or assistance from several sponsors, such as some universities and organisations (King Abdulaziz & His companions foundations for the Gifted, 2008). Thus, this project will not face problems in funding or in-service workshops because it will be implemented in public schools in Saudi Arabia that are linked with the Ministry of Education. The curriculum for gifted students should be built up with a clear understanding of theory, research and practice. Thus the process of curriculum planning is complex and dynamic (VanTassel-Baska, 1994a). Needs assessment and the development of a shared philosophy and an action plan are the main elements in planning strategies, and these include several factors that might lead to the growth or the demise of gifted programmes. In a country such as Saudi Arabia, programmes for gifted student are in a good position with regard to planning, which is funded by the Ministry of Education.

3.7 Enrichment Programmes in Saudi Arabia

Saudi Arabia is one of the nations that are moving rapidly to provide excellent programmes to gifted students. Thus, the education of gifted students in Saudi Arabia has undergone major changes in the last twenty years. First, this section explains the phases of the development of gifted programmes throughout the last 25 years. Next, it illuminates the foundations that have been established to foster gifted learners as well as their objectives. Then, it describes Saudi's programme of education for the gifted. Gifted education in Saudi Arabia has several stages, as follows: In the first stage**,** 1990 –1996, a research project was established in the King Abdul-Aziz City for Science and Technology and the Ministry of Education. It began to develop instruments for identifying gifted students followed by establishing programmes for them. As a result of this project, a national project appeared, called the Programme of Identifying and Nurturing Gifted Students (Aljughaiman, 2005b). In addition, the scheme included two enrichment programmes in science and mathematics as primer programmes for the gifted students. There were four stages of gifted programmes in Saudi Arabia (see 2.1.2).

The fourth stage, which started in 2003, was concerned with the expansion of provision for gifted students. In this stage, The General Administration for Gifted Education sought to provide a large number of Gifted Education Centres around the country. The number of Gifted Ecucation centres increasd from 9 Centers in 2001 to 42 Centers in 2010 (Budari and Bahebery, 2010).

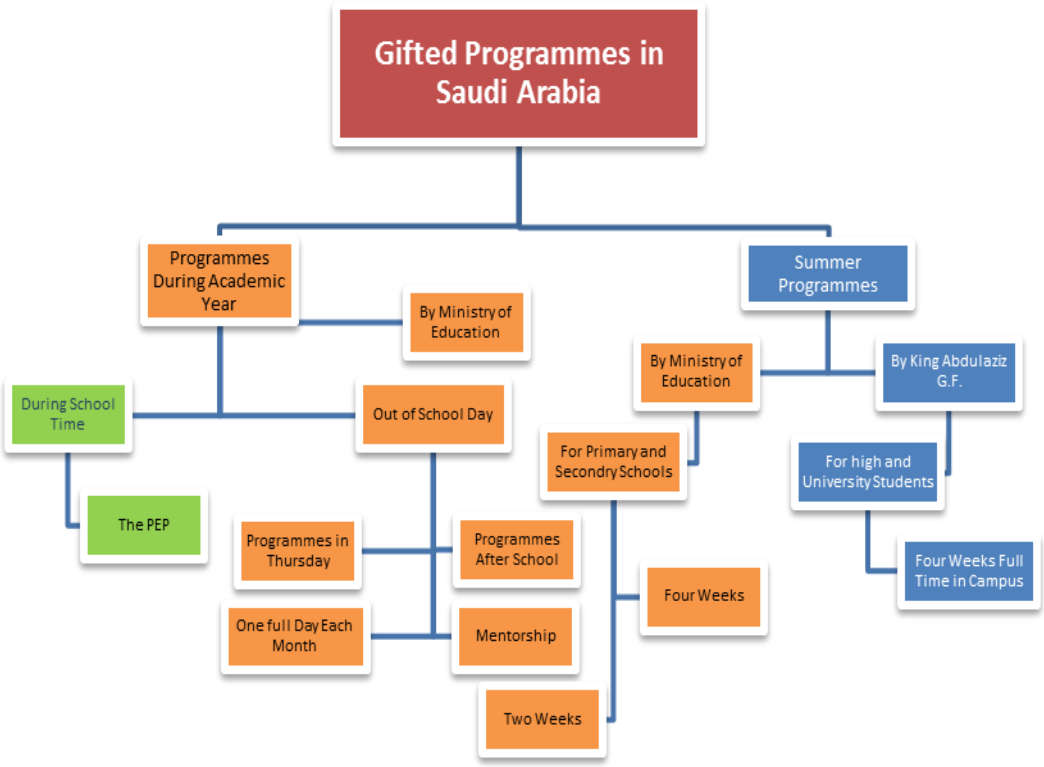


Figure 3.4: Gifted programmes in Saudi Arabia.

3.7.1 Institutions Involved in Gifted Programmes in Saudi Arabia

There are two institutions which provide different programmes for gifted students in Saudi Arabia: 1- General management of giftedness 2- King Abdulaziz and His Companions Foundations for the Gifted. (see Figure 3.4)

The general management of giftedness is overseen by a department in the Ministry of Education. The main goals of this administration may be determined as follows:

1. Promotion of national and religious affiliation of students and direction of their giftedness in order to do so;
2. The establishment of an appropriate education policy in Saudi Arabia regarding the fostering of gifted people;
3. Creating an educational environment that allows gifted people to highlight their capabilities and develop their potential and giftedness;
4. Creating an educational organization to nurture the giftedness of different students through the support of gifted programmes in schools and beyond;

5. Preparation and training of teachers and supervisors on methods to identify the talents and capabilities of students, and ways to enhance the strengths of all students in all areas;
6. Contribution to the provision of a variety of educational opportunities and fair means for all students to highlight their giftedness. (http://www.moe.gov.sa)

The goals of the other institution, the King Abdulaziz and His Companions Foundations for the Gifted, are:

1. To facilitate and foster giftedness, invention and creativity.
2. To create professional pathways in the areas of medicine, environmental science, communication, education, the arts, telecommunication, engineering science and technology.
3. To support and provide enriched educational activity for the gifted and talented students of the Kingdom.
4. To educate the population (parents, teachers, and employers) about methods of nurturing gifts and talents.
5. To assist educational and professional institutions across the Kingdom in the creation of a comprehensive programme for the gifted and talented. (http://www.mawhiba.org.sa)

It may be clearly noted that the difference between the goals of the two institutions lie in the target of the service: the Ministry of Education aims to provide gifted programmes to certain groups of people, namely students or educators, but the King Abdulaziz and His Companions Foundation for the Gifted aims to provide a service to the entire population of Saudi Arabia. However, the institutions cooperate well in providing programmes for the gifted. In addition, in many cases, there is a complementary relationship between them.

Before starting to describe the gifted programmes that are provided to students in Saudi Arabia, it might be worth illustrating briefly the methods that are used to identify students as gifted in Saudi Arabia.

Five methods are used to identify gifted students, and the student must pass three of them in order to be selected as gifted. The methods are: Academic achievement, Wexler IQ test, Torrance Tests of Creative Thinking, teacher's or parents' nomination by a checklist and the material produced by the student.

3.7.2 Types of Gifted Programmes in Saudi Arabia

The current study draws on the gifted programmes that have been applied in Saudi Arabia (see Figure 3.4).

Programmes during academic year

The programmes during the academic year are provided by the Ministry of Education. There are two types of such programmes:

1. During school time:

The programmes during school time aim to provide:

a) Specialized care for gifted students under the auspices of permanent members of the school staff;
b) Educational opportunities and equal opportunities for all students to demonstrate their giftedness;
c) The preparation of teachers specializing in the care of gifted people within each school, who are well aware of the methods of teaching gifted students and ways to enhance the strengths of all students in all fields.

The main type of programme served to the students is the pull-out programme. Pull-out programmes typically begin in the fourth grade in Saudi Arabia (Aljughaiman, 2005). Pull-out programmes in Saudi Arabia focus on enrichment, so they are concerned with depth and complexity rather than any specific skills not found in the regular curriculum (Schroth, 2008).

2. Out of school programmes:

These programmes represent the second service that is provided to gifted students during the academic year. There are four main programmes that are delivered to the gifted: the Thursday programme, the after-school enrichment programme, an enrichment programme that is delivered for one full day each month and the mentorship programme.

The goals of this type of programme are (Majiney, 2008):

a) Investment of students' time during the weekends through these programmes;

b) Training students to achieve certain skills, such as leadership and team work;
c) Discovering the capabilities of students, and familiarising them with the orientation;
d) Developing certain skills (e.g. creative thinking and problem solving).

From the above, it may be seen that the programmes delivered by the Ministry of Education focus on teaching gifted students outside regular classrooms or outside school hours. These useful programmes have had a great impact on the development of gifted education in Saudi Arabia (Aljughaiman, 2005b; Majiney, 2008). However, there is still a need to work hard to help and nurture gifted students within their regular classroom. There are several benefits from applying this type of programme. First: all students - gifted and non-gifted - will benefit from this curriculum (Majiniy, 2008; Schroth, 2008). Second: gifted students who are not able to attend pull-out or after-school programmes benefit from the programme within the regular classroom. Third: the programme will provide an opportunity for gifted students who have not been identified as being gifted.

Summer Programmes

King Abdulaziz and His Companions Foundation for the Gifted and The General Administration for Gifted Education are providing summer programmes for students in Saudi Arabia. The main goals of these programmes are (King Abdulaziz and His Companions Foundations for the Gifted, 2008):

a) To invest students' time during the summer vacation through the enrichment of their giftedness and preferences;
b) To develop the thinking skills and the promotion of mental ability of students in the area of creativity;
c) To give students practical skills;
d) To provide an opportunity for students to identify their abilities and preferences;
e) To increase the confidence of students in their community through their confidence in themselves and their abilities;
f) To increase the level of motivation and the promotion of freedom of self-learning.

The target group of the programmes provided by the Foundation for the General Management of Giftedness is primary and secondary students, while the target group of the summer programme from King Abdulaziz and His Companions Foundation for the Gifted is high school and university students. The subjects of these programmes are science and technology. The summer programmes range from a full day to four weeks. Many university professors are involved the planning, implementation and supervision of these programmes (King Abdulaziz and His Companions Foundations for the Gifted, 2008).

To sum up, there are only two institutions that foster gifted students in Saudi Arabia. There are many programmes that are applied in Saudi Arabia at different levels. The programmes served gifted students from fourth grade to university level. Although there are many different programmes for gifted people in Saudi Arabia, no programmes are offered to students within the regular classroom. Thus, this current study aims to provide evidence to inform the design of a programme for the gifted, which can be operated in their classrooms. In addition, this programme will aim to provide material that is accessible to all students so that they can also benefit from the proposed programme.

3.8 Summary

This chapter has reviewed the literature in the field of gifted education, in particular: (1) Definitions of giftedness. (2) The nature of enrichment programmes (3) Enrichment programmes. (4) Enrichment programmes in Saudi Arabia have been focussed on. From this review several factors come to light that are relevant to the current study. These include gifted students should not be labelled as "gifted" on the basis of a single criterion (e.g. intelligence or IQ test). There are other important factors that contribute to the development of giftedness such as creativity, motivation, personal skills, and task commitment.

The literature shows that the needs of gifted students include providing opportunities to help them develop their thinking (critical and creative), research, and learning skills as well as meeting their social and emotional needs.

There are many models and programmes for gifted students that have been tested and examined reflecting the growing attention and interest in gifted education during the last twenty-five years. Although they share similar objectives to help meet gifted

students' needs, they differ in how to deliver the services based on students' needs, flexibility of the school system, and the availability of resources and materials. All these models and programmes aim to help students developing their thinking and research skills, deal with more complex content, explore new areas of interest, and to be more motivated and challenged.

The literature shows that the programmes delivered to gifted students in Saudi Arabia still need further research and development, and that there continues to be a need for effective programmes both within and out of schools.

Chapter 4 Research Methodology

4.1 Introduction

This chapter will address the research design and methodology used in this study. In the first section, the nature of the research methods used will be explored then the data collection instruments used in the study will be presented in more detail. The main purpose of this research is to discover what is required in order to build an enrichment programme in the science curriculum that will serve gifted pupils in the 6th grade in the Kingdom of Saudi Arabia. Thus, this study will answer the following questions:

1. What are the contents of the science textbook in the sixth grade at public schools in Saudi Arabia in terms of learning demand?
2. To what extent does the science textbook in the sixth grade at public schools in Saudi Arabia meet the needs of gifted students?
3. What should the contents of the enrichment programme in the science curriculum be in the sixth grade to meet the needs of gifted students?

4.2 Research Design and Methodology

There is no one correct method of research design or planning. The purpose of research determines the methodology of research (Cohen *et al.*, 2007). This study, aims to explore the requirements needed to design an enrichment programme for gifted students at primary level. Thus, the methodology adopted in this study is descriptive.

From the research literature in social science, there are three concepts that might be confused. These are research methods, methodology and design. Cohen *et al*. (2007: 47) maintain that *methods are confused with methodology and methodology is confused with design.* First, it is worth pausing and considering at this point: what is the

difference between methods and methodology? According to Payne and Payne (2004:149) *Methods of social research are the technical practices used to identify research questions, collect and analyse data and present findings*. In other words, the methods are the tools and techniques that will be used to collect and analyse the data to answer the research questions, such as questionnaires and interviews, while methodology is the description and analysis of the research process itself, the research possibilities and the limitations of the study (Cohen *et al*., 2000). From the above, it may be said that the methodology refers to the way the research is conducted, whilst the research design is encompassed in the stages of research to reach the results of the study.

The current study involves several steps that will be explained in detail. Then, the research methods used to gather the data will be described and analysed. These methods were selected as appropriate techniques to answer the research questions.

The design of this study is based on the following main stages:

1. The first stage was analysing the textbook for the science curriculum in the 6th grade to answer Question One of this study.
2. The second stage involved collecting data from gifted students in the 6th grade about their current science textbook and about what should be in the proposed enrichment programme (PEP) to meet their needs, which will answer Questions Two and Three.
3. The third stage of this study involved gathering data from science teachers and supervisors of gifted education in Saudi Arabia via interviews, which will help to gain data, from a different perspective, about the current 6th grade science textbook and what should be in the PEP to meet the needs of gifted students at this age. This step will also answer Questions Two and Three.

According to Best cited in Cohen *et al.* (2007: 205) *descriptive research is concerned with how what is or what exists is related to some conditions or events.* Because this study explores and analyses the science curriculum, to determine the needs of 6th grade gifted students, an exploratory descriptive research design was used.

There are both quantitative and qualitative research elements in the study, which are based on a mixed methods approach. The types of data in this study are: data from the textbook for the science curriculum; data from the views of students; and data from views of teachers and supervisors.

First: the data from the textbook are both qualitative and quantitative.

Second: date from views of students is quantitative (questionnaire).

Third: data from views of teachers and supervisors is qualitative (interviews). The interviews with both teachers and supervisors focused on the current science curriculum and the proposed enrichment programme.

There are several reasons for the use of diverse methods in the components of this study. Mixed methods are the most suitable approach to increase the quality and validity of final results from this type of research (Axinn, 2006). Moreover, mixed methods give richness of data which is gathered from different perspectives.

4.3 Research Approach

In this section, quantitative and qualitative approaches will be explained. Then, the mixed methods approach will be discussed to illustrate the empirical part of this study.

4.3.1 Quantitative Approach

Muijs (2004:1) defines quantitative research as *explaining phenomena by collecting numerical data that are analysed using mathematically based methods in particular statistics*. Thus, it could be said that quantitative or numerical methods are the tools and techniques that can be used to describe and understand data, and quantitative research is based on numerical data that can be analysed statistically (Lewin, 2005).

According to the literature in education research, the most common quantitative research type used in social research is the survey (Corbetta, 2003; Cohen *et al.*, 2007). One of the most frequently used methods is the questionnaire survey. A questionnaire survey has numerous characteristics and several claimed attractions; typically it is used to scan a wide field of issues, populations, programmes etc. (Cohen *et al.*, 2007). Thus, this study used the questionnaire survey because it has some practical characteristics that help the researcher to achieve the following (Cohen *et al*., 2007: 206), in particular it can:

1. represent a wide target population;
2. produce numerical data;
3. provide descriptive and helpful information;

4. gather standardized information (i.e. all participants respond to the same instruments and questions);
5. capture information from multiple choice items, closed questions or scales, as this study has done;
6. produce accurate instruments through piloting and revision.

Muijs (2004) mentions the use of quantitative methods based on the type of data that the researcher would like to investigate. Moreover, researchers should take into account the main types of research questions that quantitative research is particularly suited to find an answer to (Muijs, 2004). Muijs (2004:7) highlights the types of research questions that particular types of studies should have, as follows:

1. When the answer is quantitative; for example, when the question is asking: "How many gifted students are served in primary schools?" In this case, quantitative research is needed. Qualitative and non-numerical methods obviously cannot provide us with the (numerical) answer.

2. When the research is studying numerical change. For example, are the numbers of programmes in our schools rising or falling? A quantitative study is needed to find the answer to this.

3. When the study wants to find out about the state of something, it often wants to explain phenomena. In the current study, for example, to what extent does the science curriculum in the sixth grade at public schools in Saudi Arabia meet the needs of gifted students? To analyse a large data set this kind of question can be studied successfully using quantitative methods. Quantitative data can be gathered using a questionnaire rating scale to discover Gifted students' views or opinions about the current curriculum in science across several themes (e.g. attitudes to the science curriculum, thinking skills, contents, and practice), as well as their opinions about the proposed enrichment programme.

Therefore, this study used a questionnaire survey as one of the appropriate methods that can help to answer research question numbers 2 and 3. However, because the study has different types of data that cannot be gathered via a single technique, it also employs qualitative approaches to answer the research questions as thoroughly as possible.

4.3.2 Qualitative Approach

In the 1980s and 1990s, qualitative research was used increasingly by many researchers (Tashakkori and Teddlie, 2003; Johnson and Onwuegbuzie, 2004). Dawson (2007) defines qualitative research as exploring attitudes, behaviour and experiences through such methods as observation and interviews; it also attempts to obtain information and views from participants. Under the umbrella of qualitative research, there are many different approaches, such as participant observation, interviews, focus group meetings, case studies and ethnographic research (Dawson, 2007)

Qualitative methods provide the researcher in this study with the ability to discover more detailed and in-depth information about the experience or the phenomenon (Ely *et al.*, 2003). Qualitative methods give participants the opportunity to respond in their own words, rather than forcing them to choose from fixed responses, which helps the researcher to gain rich and in-depth information (Mack *et al.*, 2005). Mack *et al*. (2005:4) mention a number of issues in which qualitative methods, such as the interview, have the ability to evoke responses, which could help the researcher to achieve data that are *meaningful and culturally relevant to the participant, unanticipated by the researcher and rich and explanatory in nature.* Moreover, the flexibility of qualitative methods allows a researcher to probe initial participant responses, by asking why or how questions (Mack *et al.*, 2005).

4.3.3 Mixed Methods Approach

The previous section highlighted the important issues regarding two types of research methods - quantitative and qualitative methods - and the nature of each type, followed by the main difference between the two approaches. This section is focused on the third major research approach or research paradigm: the mixed methods approach.

There are some significant differences between quantitative and qualitative methods, of which flexibility is the most important. In general, quantitative methods are fairly inflexible. In surveys and questionnaires, as an example of quantitative methods, researchers ask all participants the same questions in the same order. Mostly, the responses from which participants may choose are fixed. The advantage of this inflexibility is that it allows for meaningful comparison of responses across the entire

sample. However the current study also aimed to obtain more detailed and in-depth information and responses through the use of qualitative methods, such as interviews with teachers and supervisors.

Another difference between quantitative and qualitative methods is that *quantitative research is based on numerical data analysed statistically, while qualitative research uses non-numerical data* (Muijs, 2004:3).

Some researchers believe that quantitative and qualitative research are often placed against each other (Muijs, 2004). However, other researchers, such as Onwuegbuzie and Leech (2005), believe that the two approaches are treated as being complementary. In addition, some studies in research methods report that if researchers considered the two approaches to be complementary, they will stand to gain the strengths of both purposes and reduce the weaknesses of quantitative methods and qualitative methods. If the current study is taken as an example, given that it is looking for multiple data such as numerical data and in-depth views, it is preferable to use quantitative and qualitative methods side by side.

Creswell (2007) defines mixed methods research as a type of research where the researcher mixes or combines quantitative and qualitative research techniques, methods and approaches.

Mixed methods have been used increasingly as a means to combine the strengths of both quantitative and qualitative approaches (Lewin, 2005). Johnson *et al*. (2007) list 19 definitions of mixed methods, aiming to provide the researcher with a view of the history and the current definitions of this approach. Johnson *et al*. (2007) devised a definition from a thorough study based on an analysis of all definitions listed. They defined mixed methods as *the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches* (Johnson *et al*., 2007:123).

The aim of mixed methods research is not to replace either the quantitative or the qualitative approach, but rather to represent the strengths and minimize the weaknesses of both in single research studies and across studies (Johnson and Onwuegbuzie, 2004; Bryman *et al.*, 2008).

Lewin (2005) mentions a reason for the increase in the use of mixed methods. Mixed methods can control the strengths of both approaches and triangulate data. Moreover, mixed methods research as the third research paradigm could help to

connect the separation between quantitative and qualitative research (Johnson &Onwuegbuzie, 2004).

There are three steps of mixed methods research, which allows the researcher in this study to collect both quantitative and qualitative data. First, the researcher will collect quantitative data using a questionnaire and qualitative data using interviews. Second, the researcher will analyse these two types of data by analysing the quantitative data for percentages and the qualitative data for themes (e. g. Johnson *et al*., 2007). Finally, the two kinds of data will be used to support the findings of the other, meaningfully (e.g. by comparing and matching the results of the quantitative analysis with the qualitative thematic findings) ,and thus help to develop an overall understanding of the issues (Nagy *et al.*, 2008).

The researcher decided to use mixed methods within this study because *the two methods together result in a better understanding of the problem being studied*. (Nagy and Biber, 2008:365). Understanding of the research findings will be improved and raised when the complementary strengths of the quantitative approach, such as numbers, trends, and generalisation, and the qualitative approach, such as words, context and meaning, offset the different weaknesses of the two approaches (Nagy *et. al*., 2008). This variety of methods helps gain an in-depth understanding of the research questions.

Using multiple types of data to reach clear outcomes is frequently called triangulation (Berg, 2007)**.** According to Berg (2007), the use of triangulation is restricted to the use of a range of data gathering techniques to examine the same phenomenon.

Multiple data collection methods - for example, document analyses, questionnaire, and interviews – will be employed in this study. These sources should be used to complement one another, to avoid any bias or weakness of each method (Miles and Huberman, 1994). Multiple data collection methods, like document analysis, questionnaires, and interviewing will lessen the risk of drawing conclusions based on possibly biased evidence. Rossi reports that *the use of multiple methods, often referred to as triangulation, can strengthen the validity of findings if the results produced by the different methods are congruent* (Rossi *et al.*, 1999:423).

4.4 Instruments

This section will describe the data collection instruments that will be used in this study. Documentary analysis, questionnaires and interviews have been chosen as data collection methods to answer the research questions.

4.4.1 Documentary Analysis

This study uses documentary analysis as a tool to analyse the textbooks of the science curriculum. This instrument has been selected to answer research question one. The goal of the analysis is first to look at the contents of the textbook and to examine the extent to which the textbooks match cognitive demand, as defined by Bloom's Taxonomy (David R. Krathwohl *et al.*, 1964). The methodology used to analyse the selected science textbook is mixed (qualitative and quantitative). The steps in the analysis of textbook are:

1. Choosing the categories (Arsheed *et al*., 2003);
2. Comparing the categories with Bloom's Taxonomy;
3. Presenting results.

The following paragraphs explain the steps listed above in more details.

Choosing the categories: this step was undertaken by reading the textbook several times to develop an understanding of its form, structure and contents which gives the researcher a very good level of understanding of the content (Maslak, 2008) and the structure of the science curriculum.

The in-depth reading will enable the categories to be selected in the second step. The categories are derived from the analysis of the science textbook and from some studies which highlighted the principles of the components of a textbook (Arsheed *et al.*, 2003; VanTassel-Baska and Brown, 2007). The important issue here is that it should be possible for the categories to be used or applied by other researchers or readers who are looking at the same contents, such that they would obtain the same or comparable results (Berg, 2007; Devetak *et al.*, 2010). Thus, *this may be considered a kind of reliability of the measures and a validation of eventual findings* (Berg, 2007: 306). The analysis of documents (e.g. textbook) should also be related to the literature and the research questions (Berg, 2007).

Comparing the categories with Bloom's Taxonomy: Bloom's Taxonomy has been used as a guide to judge whether the textbook meet the six levels of cognitive demand. *Bloom's taxonomy has been widely adopted as a model for conceptualising higher level thinking skills for gifted learners* (VanTassel-Baska, 1994a:303). Thus, the current study has used Bloom's Taxonomy as a guide to judge whether the science textbooks meet the needs of gifted students. Intra-rater reliability is a type of reliability assessment in which the same assessment is completed by the same rater (www.medicine.mcgill.ca). To demonstrate intra-rater reliability, the researcher analysed two complete units of the science textbooks. After one month later, the researcher analysed the same units. The percentage of agreement was 90 %. These reliability indices adequately demonstrate dependability of the method in this study. The identified categories as a result of step 1 divide the science textbook into the following: 1- Objectives; 2- New Concepts and Definitions; 3- Illustrative Pictures and Descriptions; 4- Activities; 5- Evaluation. Then, the units (unit 5 and 6 of the science textbook of 6th grade) are compared with Bloom's Taxonomy of cognitive demand (Remembering, Understanding, Applying, Analysing, Evaluating and Creating (Taber, 2007) and (http://www.coe.uga.edu/epltt/bloom.htm) - see Figure 4.1 and Table 4.1).

Presenting results: The results are presented thematically both quantitatively using descriptive statistics: numbers and percentages, and via qualitative descriptions

The science textbook in the 6th grade contains six units. Each unit has two or three chapters and each chapter has a different number of lessons. Five units of the textbook have been analysed. Then, two units were chosen as a sample for this study. The selected units are Unit 5 ("Materials") and Unit 6 ("Science Helps Humans"). These units were selected based on the subjects covered. The content of Unit 5 is chemistry; this is the study area and background of the researcher. Unit 6 is about applications of science, within which the related subject is using chemistry in our lives (e.g. drugs); this also relates closely with the researcher's field of knowledge.

Table 4.1: Original and New Bloom's Taxonomies
(from www.iste.org)

Level	Original	New
1	(low) Knowledge	Remembering
2	Comprehension	Understanding
3	Application	Applying
4	Analysis	Analysing
5	Synthesis	Evaluating

6	(high) Evaluation	Creating

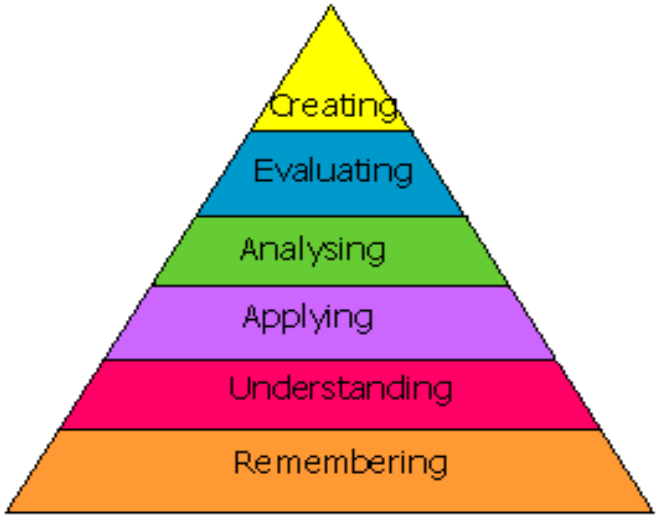


Figure 4.1: A new revision of Bloom's Taxonomy

(from Forehand (2005)

4.4.2 Questionnaire

The purpose of the questionnaires (Appendixes C and D) in this study is to reach as wide a range of gifted students as possible in order to gain an understanding of their opinions about the current curriculum in science in 6th grade and the proposed enrichment programme (PEP). A number of factors influenced the researcher's selection of this method. First, the researcher believes that such a questionnaire is the most suitable method to provide standardised information from this group of the population (Cohen *et al.*, 2000). The sample includes more than one hundred gifted students, so the questionnaire is one of the best methods available to provide data that will help to answer Questions Two and Three of this study (Cohen, *et al*., 2000). Moreover, there are fifty-six items that need answers and a questionnaire is the most efficient technique to collect a large amount of data (Oppenheim, 2005).

It would have been very difficult to reach all of the study participants face-to-face, because doing so costs time and money, and the sample has been chosen from different regions of Saudi Arabia: east, middle, and west to provide as representative a sample of the targeted population as possible (see Figure 4.2).

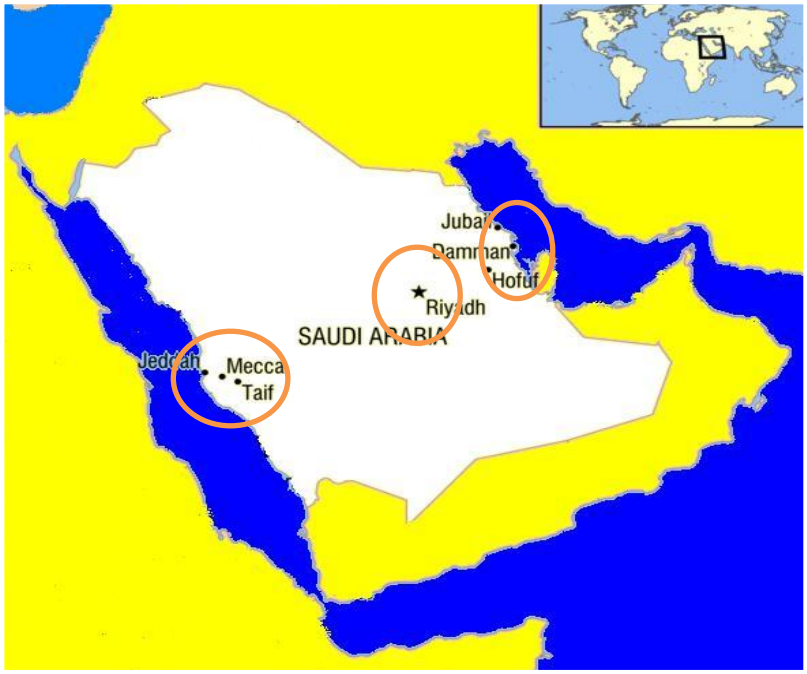


Figure 4.2: The three locations of the questionnaire participants.

Oppenheim (2005) points out that there are different ways to use the term 'questionnaire'. Some specialists would reserve the term completely for self-administered and postal questions, while others would include structured interview under the general rubric of questionnaires. Fellegi (2003) defines a questionnaire as the information from a respondent on a subject obtained by a group or arrangement of designed questions. The researcher criticizes this definition because it is very general, not complete, and does not include certain important factors, such as whether it is direct or indirect. (e.g. face to face or on-line). The current study chose the definition from Payne and Payne (2004:186) *Questionnaires are the printed sets of questions to be answered by respondents, either through face-to-face interviews or self-completion, as a tested, structured, clearly presented and systematic means of collecting data (mainly in the quantitative methods tradition.* This definition includes all the basic elements of the questionnaire and also includes some more modern ways to collect the data such as e-mail or the Internet.

In designing a questionnaire, a researcher should take into account many factors that will lead to the acquisition of good results and responses. Before starting to design a questionnaire, the researcher needs to have clear research questions. May (1999) points out several issues that a researcher should keep in mind when designing a questionnaire: he or she should know what information the questionnaire will provide, and is design the questions appropriately , and he / she should use simple and direct

language. However, the questions should not be too general or insufficiently specific. The respondents should understand the questions, so they must be clear and unambiguous. The vocabulary and wording of questions should be clear and in short sentences. In this study, the researcher takes into account the age of the respondents (11- 12 years) to simplify the sentences to avoid any confusion of the students. Fellegi (2003) suggests that a researcher should avoid double negatives in sentence structures because respondents will not know whether they agree or disagree. For example: "*Are you for or against not including enrichment programmes for gifted children in primary schools?"* This question is difficult because it contains a double negative: "against" and "not" are both negative words (Fellegi, 2003). The next important issue that May (1999) suggests, which any researcher should consider when writing questions, is to avoid leading questions; in other words, items in which the way the question is phrased has an influence on the response. For example: "You don't think that … do you?" Questionnaires should not ask sensitive questions that may lead to social desirability bias (Fellegi, 2003). The researcher should also avoid irritating questions or instructions (Cohen *et al.*, 2007).

In addition, double questions should be avoided because the respondent will perhaps agree with the first idea, while he/ she may disagree with the second. For example: "Do you think the enrichment programme is useful and easy to apply?" In this case, the respondent might think it is useful but not easy to apply. In this study, the researcher has attempted to design as an effective questionnaire as possible.

In general, different types of questions can be included in a questionnaire (Cohen *et al.*, 2007). Oppenheim (2005) claims that the use of closed questions has advantages in that they do not need extended writing and require little time. Moreover, there is no difference between articulate and inarticulate respondents. The most important factors are that they are less onerous in collecting and capturing the data relatively cheaply (Fellegi, 2003). On the other hand, there are several disadvantages to closed questions: *…by forcing the respondent to choose from given alternatives or by making the respondent select alternatives that might not have otherwise occurred* (Nachmias and Nachmias, 1981). Additionally, the use of closed questions may lead to the loss of spontaneous responses (Oppenheim, 2005).

An example of closed questions can be found in multiple choice questionnaires, such the agreement scale; this current study used this type of question because of the nature of the data that will be gathered. In addition, the agreement scale question is

obviously an easy form for respondents because the questionnaire can be answered by students aged from 11 to 12 years old if the researcher decides to ask respondents for their views about the science curriculum in Saudi Arabia, he may ask questions such as:

The science curriculum in Saudi Arabia meets the needs of gifted children:

1- Strongly agree 2- Agree 3- Disagree 4- Strongly disagree.

In the second type of question- open-ended questions - the respondents are not given a choice. In addition, there is the freedom and spontaneity of answers. Other advantages are useful for testing hypotheses about ideas or awareness (Oppenheim, 2005). Another advantage of open-ended questions is that respondents are given the opportunity for self-expression or elaboration (Fellegi, 2003). Thus, the questionnaire at the end should have a space for comments to give the opportunity for comments or explanation. In this study, the questionnaire included space for students to give their comments, suggestions, and any opinions about the current science textbook.

On the other hand, there are some disadvantages in using open-ended questions, such as respondents misinterpreting what is required in their response. Moreover, this type of response is time-consuming to code (Oppenheim, 2005). It is very costly and slow to process and may be unreliable. Furthermore, it demands more effort from respondents (Oppenheim, 2005). These types of questions are usually more appropriate with qualitative research

Another important component of any questionnaire is the covering letter (Appendix D) and/or questionnaire cover-sheet, the purpose of which is to set out the aim of the study and to inform the respondents of its importance (Cohen *et al*., 2000). Furthermore, it also assures respondents of confidentiality (Cohen *et al*., 2000). The introduction should be as short as possible. In this research study, the researcher followed the important guidelines set out by Cohen *et al*. (2000:259) in the covering letter:

1. Include the research title, the researcher's name, address, organization and any contact method: email and telephone;
2. Indicate the benefits of the research.

In addition, Fellegi (2003) suggests that the introduction to the questionnaire should elucidate how the data will be used, and that it will be kept confidential. (see Appendix D)

4.4.3 The Interview

Opdenakker (2006) reports that the purpose of the interview is to collect descriptions of the life-world of the interviewee, with respect to an understanding of the meaning of the elucidated phenomena. In addition, Cohen *et al*. (2007) report that one of the conceptions of the interview is that it has the capacity of a potential means of pure information transfer and gathering. However, Cohen *et al*. (2007) claim that an interview is not completely either subjective or objective, but is inter-subjective, and both the interviewer and interviewee affect the data gathered. Thus the data obtained from an interview cannot be regarded as objectively as perhaps data from a large scale survey. Thus, Cohen *et al*. (2007) set out the inherent features of interpersonal transactions, regarded as potential obstacles to sound research, which would need to be removed, controlled, or at least harnessed in some way. In fact, Corbetta (2003:285) defines an interview as a conversation that has the following characteristics: *It is elicited and guided by the interviewer; a substantial number of subjects are interviewed*; and *it has a cognitive objective* (Corbetta, 2003:285). It is increasingly common to find agreement among researchers on the definition of an interview. Nevertheless, the researcher has chosen the definition developed by Corbetta because it is most relevant to his study. Moreover, in the researcher's view, Corbetta's definition emphasises one particularly important point, which is that the interview is not an ordinary dialogue; it is a conversation which leads the interviewer to establish the subject and ensures that the interview is conducted according to the cognitive aims set.

One does not use an interview in qualitative research to find out how frequently people wash their hair, watch a television programme, or buy a particular product (Rubin and Rubin, 2005:2), but when the researcher wants to know what people think or feel about an idea, then an interview is the right approach. From these point view above, the current study chose the interview as a tool to find out opinions about the current science textbook in Saudi Arabia as well as what should be included in the proposed enrichment programme.

There are many reasons for using interviews in social science research. Researchers interview people to find out from them those things they cannot directly observe (Patton, 2002). Patton (2002:341) observes that:

1. researchers cannot observe everything -feelings, thoughts and intentions cannot be observed;

2. researchers cannot observe situations that preclude the presence of an observer;
3. interviews are also used to evaluate an instructional programme, acquire in-depth information or explore individual differences in experiences and outcomes;
4. the purpose of an interview is to allow us to enter into the other person's perspective.

This study will use interviews to: collect views about the existing situation of the science textbook of 6th grade in Saudi Arabia and ensure that the data collected could help to inform the design of the enrichment programme suitable for the gifted children in Saudi Arabia. The researcher is of the view that before choosing an interview as a tool in his or her research, there are two questions that should be considered:

- To what extent is the interview appropriate according to the objectives that were identified earlier?
- Will all the answers be obtained from the interview?

To answer this type of question, a researcher should design the interview based on the research questions, and should think of which type of data is needed. In this research study, the interview has been designed based on themes based upon questionnaire that will answer the research question. The themes have been chosen in light of the findings from the literature review and the questionnaire.

It is very well known that building a trusting partnership between the interviewer and the interviewee is a very important issue. Before going any further, it is necessary to know if it will be possible to secure the interviewee's permission to record the interview on tape (Oppenheim, 2005) which the researcher in this study did by using a digital recorder. Patton (2002) mentions that the period after an interview is very important for making sure that the interviewer has obtained all the information from the tape recorder by taking field notes. If for some reason, the tape not is clear or does not work, the interviewer should immediately make extensive notes of everything that can be remembered. If he/she finds things that do not quite make sense, he/she should check back with the interviewee as soon as possible for an explanation. In addition, the researcher in this study has undertaken several tasks that could help him to ensure the success of the interviews, such as:

1- The introduction to the interview: the interviewer considered the introduction as a guide to the interview;

2- Posing questions: the researcher endeavoured to pose questions clearly and in an understandable way because the quality of an interview will be defined by the skills of the interviewer;

3- Evaluating answers: the interviewer was very careful concerning the answers. It is possible that there were no answer at all, either because the informant did not understand the question or because the question was so sensitive;

4- Possible remedy: sometimes the interviewee might not understand what has been said, so he or she can ask the interviewer to repeat the question; for example:

I do not fully understand what you mean. Could you elaborate a little? (Cohen *et al.*, 2007:361)

Thus, keeping control over the interview without imposing oneself is an ability each researcher has to learn and it one that the researcher is keenly aware of.

4.4.4 Types of Interviews

There are several different types of interview: the diverse nature comes from the aims of the interview. Corbetta (2003) and Flick (2002) divided interviews into three basic types, which can be distinguished thus: structured, semi-structured and unstructured. However, Cohen *et al*. (2007) report that there are several types of standardized interview, these include: in-depth interviews, ethnographic interviews, elite interviews, life history interviews and focus groups. Patton (2002) outlines four types: informal conversational interviews, interview guide approaches, standardized open-ended approaches and closed-ended quantitative interviews. Finally, Oppenheim (2005) believes that there are essentially three types of interview: exploratory interviews, depth interviews and free-style interviews. There are standardized interviews such as those used, for example, in public opinion polls. As we have seen above, in social research there are different sorts of interview: unstructured, semi-structured, structured and focus group are the most common types (Dawson, 2007), Therefore, the researcher in this study will classify the interviews into three groups, which will be discussed here:

1- Structured interview: in this type all respondents will be asked the same questions with similar wording and in the same order (Corbetta, 2003). It is most useful when looking for very particular data (Patton, 2002).

2- Semi structured interview: this *lie(s) somewhere between the structured and unstructured* (Sarantakos, 2005:269). In semi-structured interviewing, are more flexible than structured interviews. Interviewers also have a bit freedom to be more friendly, also allow the participant to discuss what they feel is most important about the topic (Patton, 2002). This approach works very well with people who have limited time. Moreover, the interviewer is in control of what he/she wants from an interview (Bernard, 2000).

3- Unstructured interview: in-depth or unstructured interviews can be used for qualitative research only (Dawson, 2007). This type of interview gives maximum flexibility and freedom to the participant to answer the interview questions, and it is the most relaxed rules of the three. The communication between the subject and the interviewer is more like a conversation than an interview (Patton, 2002).

The current research study will use a semi-structured interview. The reason behind this is that this study will examine several themes using both questionnaires and interviews. Thus, it is a good technique to compare the responses from the questionnaires and interviews. Therefore, the researcher thinks that the semi-structured interview is an appropriate method with this type of research because '*Semi structured' interviews follow a form of interview schedule with suggested themes* (Willis, 2006:144). Thus, if the themes in the semi-structured interview relate to the theme in the questionnaire, this type of interview will help to compare the results from other tools (e.g. Questionnaire)

One further advantage of using interviews is that the interviewer does not need to wait for the data to come, as he/she has obtained the answers from the interviewee's responses, but with a questionnaire the researcher may take a long time to complete it, or he/she must send out two or three reminders.

4.5 Pilot Testing of Instruments

4.5.1 Translation and Validation of the Questionnaire

One of the main goals for conducting the pilot study was ensuring the validity of the questionnaire and obtaining broad judgments of the suitability of the questionnaires in the Arabic language. Another benefit of the pilot study was to make sure that are the questions were understood by the students.

Because the study took place in Saudi Arabia, where the language is Arabic, and the questionnaire was written in English, translation was needed. Several issues were considered in translating the questionnaire. The first was the guarantee of clear unambiguous language; the second was matching the meanings of each statement in both versions. Finally, it was essential to ensure that the use of Arabic did not change the meaning of the sentences and to guarantee that the words or concepts were understood by the students.

The huge differences between the Arabic Language and the English Language are related to sentence structure and additional words or phrases. To judge the translation of the questionnaire and to ensure validity, the researcher performed the following steps:

1. The instruments were translated by the researcher from English to Arabic;
2. Two Ph.D. staff in gifted education who are Arabs and speak Arabic and English fluently were asked to proofread the translation of the instruments into Arabic. The researcher's translation was checked with the original items;
3. The Arabic versions of the instruments were sent to three gifted educators in Saudi Arabia to assess the ability of the instrument-item to measure its objectives;
4. After receiving suggestions and feedback from those educators, the initial Arabic versions of the instruments were written;
5. The questionnaire was checked by a proof reader in the Arabic language to correct any mistakes in grammar. Next, three specialists in gifted education, two specialists in curriculum and two teachers of gifted education were chosen to validate the questionnaire (Table 4.2).

Then, a pilot study was conducted using this translated questionnaire on a sample of the population (10 gifted students).

Table 4.2: The validators of the pilot questionnaire

Position	Experience	Specialization	Degree
Administrator of gifted education in Eastern Region	11 years in teaching + 6 years teaching gifted students	Gifted Education	Bachelor
Teacher of Gifted Education	11 years teaching gifted students	Gifted Education	Master
Assistant Prof.	16 year Teaching in King Feisal Uni. and others	Gifted Education	PhD
Assistant Prof.	23 years teaching in different Universities	Curriculum	PhD
Associate Prof.	7 Years teaching in different Universities.	Gifted Education	PhD
Assistant Prof.	5 years teaching Gifted students	Curriculum	PhD
Assistant Prof.	20 years teaching in King Feisal University.	Curriculum	PhD

4.5.2 The Pilot Study using the Questionnaire

The sample for the pilot study was a population of 10 gifted students; three science teachers and science supervisors of gifted education were also selected for the pilot study to gain more feedback about the questionnaire and about the level of the difficulty to the students. The researcher conducted / administered the questionnaire himself with all students, teachers and supervisors who joined in the pilot study to increase the acquisition of information and comments.

Development of the Questionnaire

The development of this questionnaire involved several steps. The first step was to identify the potential themes related to the current curriculum and the proposed enrichment programme. This step required going over the research questions many times and brainstorming to identify the items. The second step was reviewing the literature to compare the items that had been developed with other questionnaires. The third step involved presenting these factors to some of the committee members and experts in the field for their review. The fourth step was modifying the factors and forming them into sentences. The fifth step was presenting the questionnaire to

specialists in the field. The sixth step was distributing the questionnaire to a limited number of gifted students and teachers of gifted education.

4.5.3 Findings of Pilot Study of the Questionnaire

1. As expected, teachers and supervisors did not face any problems in answering the questionnaire, while a number of students had some enquiries because they did not understand certain sentences;
2. Teachers and supervisors paid more attention than students in responding to the questionnaire, by giving more thought to the questions;
3. There were some written notes about the language of the questionnaire, as well as other oral comments from some teachers and supervisors;
4. Two teachers raised concern about sentence No. 22, "*Gives learners space and time to explore their own interests"*, because they believed that students in this age group are not capable of choosing appropriate subjects or materials to study and learn;
5. Minor changes were made to the Arabic questionnaire on the basis of the pilot study. The reason for revising these sentences is that the referees thought it necessary to simplify them so that they would be understood by students and to correct some grammatical mistakes. The most important of these were changes to questions 1, 2, 5, 11, 14, 21, 23, and 25;

The final version of the questionnaire was constructed based on the criteria of gifted education: attitudes of students, ability and skills, content and emotional and social needs. Table 4.3 shows the individual questions related to the themes of the questionnaire.

Table 4.3: The Themes of both Questionnaires on the Science Textbook and the Proposed Enrichment Programme.

Themes	No. of Items
Attitudes to Science	4
Abilities and Skills	7
Contents of Knowledge	8
Contents Of Practice	5
Emotional And Social Needs	4

4.5.4 The Pilot Interviews

Pilot interviews were carried out with two teachers. The goals of the pilot interviews were to ensure that the questions were appropriate to obtain rich and deep data from the interviewee. In addition, the pilot study gave the researcher a sense of the answers and the reaction of the teachers and supervisors, which could help the researcher to rephrase or modify the questions to obtain richer data during the field work. Moreover, through the pilot study, the researcher was able to check the translation of the questions from English to Arabic.

From the pilot study, one teacher who responded to question "*What kinds of research skills are developed by the current science curriculum?*" made clear statements showing his confusion between research skills and searching to find information via the internet or library.

Another teacher suggested that we should help teachers to understand the difference between research skills and searching to find information. The final version of the interview seemed to be appropriate and relevant to the criteria for gifted education. The themes of the main interview questions are: attitudes, thinking and abilities and contents. These themes were selected from the principles of the gifted programme that has been explained in Chapter Three, section 3.3.

4.6 The Main Study

4.6.1 The Sample

The sample for the current study focused on three kinds of participants**:**

First: gifted students were selected purposively via the administration of gifted education. Each of these students attended pull-out enrichment programmes in the previous academic year (years 4 and 5). The age of gifted boys in this study is 11 to 12 years old and includes a sample of all gifted students (boys) in the 6^{th} grade in Saudi Arabia who were identified as gifted by the administration of gifted education in Saudi Arabia. The total number of gifted students in primary and secondary schools in Saudi Arabia is 3,700 students. 220 (18%) gifted students were selected as a sample, from 1200 gifted students aged 11 to 12 years.

This study used the following Table (4.4) as a guide to sample size selection. According to the North Carolina State Department of Public Instruction Raleigh (1984), the sample size selection for a school survey should be based on the total number of gifted students in the schools.

Table 4.4: The minimum sample size for a survey of gifted education

(from Division for Exceptional Children, North Carolina State Department of Public Instruction Raleigh, North Carolina, 1984)

Total number of gifted students	Minimum number of sample
Less than 100	50
100 -300	60
301 -500	70
501-700	80
701-900	90
901-1100	100
1101-1300	110
1301-1500	120
1501-1700	130
1701-1900	140
1901-2100	150
Over 2100	175

Table 4.5 provides information about the population and the sample of gifted students who participated in the study.

Table 4.5: The Size of Population and the Sample of Gifted Students

(from Ministry of Education in Saudi Arabia 10.2008)

No.	Position	Total of Population	Size of Sample	Percentage
1	Gifted students in all schools	3700		
2	Gifted students aged 11 - 12	1200	220	18%

The sample size of this study fits with the guidelines above, because the minimum sample size is 110 (for a total of between 1101 and 1300) gifted students, while the sample for this study is 220 gifted students.

Second, 10 teachers of gifted education in science education responded to the interviews, representing 10.4% of a total of 96 teachers of gifted education in science from all gifted education centres. While 10 supervisors of gifted students in science education responded to the interviews, representing (21.7%) from 43 supervisors of gifted education in science from all gifted education centres, (see Table 4.6)

Table 4.6: The numbers of teachers and supervisors of gifted students in Saudi Arabia

(from Ministry of Education in Saudi Arabia, 2008)

No.	Position	Total of Population	Size of Sample	Percentage
1.	Teachers of gifted education	201	10	5%
2.	Supervisors of gifted education	102	10	9.8%
3.	Teachers of gifted education in science	96	10	10.4%
4.	Supervisors of gifted education in	43	10	21.7%

All twenty teachers and supervisors of the sample (i.e. ten teachers, ten supervisors) who were interviewed hold university degrees; three of them hold masters' degrees, and two hold Ph.D. degrees. All of them (teachers and supervisors) had between five and ten years of teaching experience, while 45% of them had eleven to fifteen years of experience and 35% had more than sixteen years of experience (see Table 4.7 and 4.8 and Appendix E). This sample is representative of the teacher and supervisor population for gifted students in Saudi Arabia.

Table 4.7: Teachers' and Supervisors' Experience

Experience of Teaching	Position		
	Teacher	Supervisor	Percentage
5-10 years	4(40%)	_	20%
11- 15	4(40%)	5(50%)	45%
16-20	2(20%)	5(50%)	35%
Total	10	10	100%

Table 4.8: Teachers' and supervisors' demographic information

No.	Code	Position	Experiences of Teaching	Degree	Region	Age
1.	S1	S	16	BA	Riyadh	36
2.	S2	S	18	BA	Jeddah	41
3.	S3	S	14	BA	Jeddah	36
4.	S4	S	18	BA	Dammam	40
5.	S5	S	19	MSc	Dammam	42
6.	S6	S	13	BA	Dammam	34
7.	S7	S	16	PhD	Riyadh	38
8.	S8	S	11	BA	Dammam	34
9.	S9	S	12	BA	Dammam	32
10.	S10	S	14	MSc	Dammam	36
11.	T1	T	9	BA	Dammam	34
12.	T2	T	12	BA	Jeddah	35

13.	T3	T	8	BA	Riyadh	32
14.	T4	T	11	BA	Jeddah	33
15.	T5	T	17	MSc	Dammam	38
16.	T6	T	14	BA	Dammam	32
17.	T7	T	8	BA	Dammam	32
18.	T8	T	18	BA	Riyadh	43
19.	T9	T	9	BA	Dammam	31
20.	T10	T	13	PhD	Jeddah	35

S: Supervisor T: Teacher

4.7 Data Collection

The data collection of this study involved two main phases. The first phase was the documentary analysis of selected topics from the science curriculum textbook in the 6th grade in Saudi Arabia. The second phase was administering the questionnaires and the interviews. The first phase is discussed in the "Document Analyses" section earlier in the chapter. This second phase started with the researcher contacting the head of general administration of gifted education in Saudi Arabia to obtain the statistical records which contained information about the number of gifted students aged 11 to 12 years, teachers of gifted students in science, and supervisors of gifted education in science. This information was used by the researcher to decide upon the number of students, teachers and supervisors that would be participating in the study.

In addition, this information provided the researcher with suitable places or regions from which to gather the data. Then, the researcher contacted the Ministry of Education in Saudi Arabia to obtain permission to contact the selected Centres of Gifted Education. Gifted students were chosen by the Centres of Gifted Education in each centre. At each Centre of Gifted Education, the researcher distributed the questionnaire to the head of the centre, and who then gave it to the teachers of gifted education in science.

The questionnaire was designed to gather information on the current science curriculum for the 6th grade in Saudi Arabia and the proposed enrichment programme (PEP) for the same curriculum. The questionnaire required each participant to indicate his agreement or disagreement with each item, based on a four-point Likert (strongly disagree, disagree, agree, and strongly agree) for the current curriculum, as well as the proposed enrichment programme. The questionnaires were mailed to three centres of gifted education to distribute to their gifted students. To ensure confidentiality, all gifted education centres were asked to return the completed questionnaires in the

official envelopes that were addressed to the National Research Centre for Giftedness and Creativity in King Faisal University, or by submitting the questionnaires to the researcher in person. The questionnaires were distributed to 220 subjects, of whom 182 (83%) returned their responses. The researcher contacted the general administration of gifted education for permission to conduct interviews with science teachers and supervisors of gifted education.

Collecting Data of Interviews

A list of 49 names, phone numbers, and schools of teachers and supervisors was provided from general administration of gifted education in Saudi Arabia in order to contact them to conduct the interviews (see Appendix F). The researcher contacted potential participants from the list in person by telephone before visiting. This is the most appropriate and the most formal way to seek their assistance. Ten science teachers of gifted education and ten science supervisors of gifted education from three major school districts in Saudi Arabia (Dammam, Riyadh, and Jeddah) agreed to be interviewed. All interviews were one-to-one and face-to-face. Interviews were held in a quiet and prepared environment. Most of the interviews were conducted in gifted education centres, and three of them were in three different schools. The current study's qualitative data was recorded during the individual interviews using a digital recorder. The interviews began with background questions before proceeding to experiential questions about the degree, age and work experiences (see appendix E).

4.8 Reliability and Validity

The concept of reliability is defined by Mitchell and Jolley (2001:157) as *the extent to which a measure produces stable, consistent scores.* In addition, *a measure can be reliable, but not valid* (Mitchell and Jolley, 2001:157).

One of the most common tests used to measure the reliability of questionnaire that is *Cronbach's alpha,* which measures the consistency of all items, both globally and individually (Gliner and Morgan, 2000). *It is typically used when the researcher has several Likert-type items (ratings from strongly disagree to strongly agree)* (Morgan *et al.*, 2006:246). *Cronbach's alpha* reliability coefficient normally ranges between 0 and 1 (Cohen *et al*., 2007*). Cronbach's alpha* test was run to establish the reliability of the two parts of the questionnaire. The researcher calculated the questionnaires reliability using SPSS (version 17). The results are summarised in Table 4.9. *Cronbach's alpha* of

the ST questionnaire was 0.89 and the PEP questionnaire was 0.88 (see Table 4.9 and Table 4.10).

Table 4.9: Reliability Statistics of the Questionnaires by Cronbach's alpha

Questionnaire	Cronbach's alpha	No. of Items
The Science Textbook	0.89	28
The proposed Enrichment Programme	0.88	28

Table 4.10: The Reliability level of Cronbach's the alpha coefficient

(from Cohen *et al*., 2007)

Cronbach's the alpha coefficient	Level of Reliability
>0.90	very highly reliable
0.80–0.90	highly reliable
0.70–0.79	Reliable
0.60–0.69	marginally/minimally reliable
<0.60	unacceptably low reliability

Another important measurement of any research instrument for data collection is validity. Content validity is summarized by Mitchell and Jolley (2001:157) as *the extent to which it represents a balanced and adequate sampling of relevant dimensions, knowledge and skills. It is important that before any test questions are written, the researcher should consult the established definition and theories of the concept he/she wants to measure*

Mitchell and Jolley (2010:301) emphasise that *spending a little time deciding how to code the questionnaire before you administer it can save a great deal of time later on.*

In this manner, the questionnaire in the current study was divided into five main themes: attitudes to science, abilities and skills, contents of knowledge, contents of practice, and emotional and social needs. These themes come from the literature in the field and the standards used for designing curricula (see section 3.2 and Appendix A and B). SPSS 17 programme was used to analyse the data in this study. Statistical processes were used to analyse the data (*Chi square*). *The Chi square* test was used to calculate the significant differences in responses from the participants for each item. This test is appropriate to deal with the nature of this research and this type of data because it deals with scales, not with scores or degrees (Dunn, 2008). The *Chi square* test has also been used to discover any significant differences between the themes in the two parts of the questionnaire.

4.9 Methods of Analyses

This study incorporated multiple stages of data analyses, and included analysis of the 6th grade science curriculum textbook in Saudi Arabia the questionnaires and the interviews. In brief, the methods of analyses are described below.

First, data from analysing the science textbook: the science textbook was analysed by dividing it into several categories (see section 4.4.1), and then all the categories were compared with Bloom's Taxonomy. Thus, the data derived from the textbook were analysed quantitatively using percentages. Some qualitative analyses were also used with the data drawn from the science textbook (see section 5.3).

Second, the data from questionnaires: The quantitative data from the questionnaires were entered and analysed using the computer-based statistical programme SPSS version 17. The questionnaires included several main sections that measured the attitudes to science, abilities and skills, the contents of knowledge and practice, and emotional and social needs (see Appendix D).

Third, the interview data from teachers and supervisors: All the interviews were recorded using a computer programme (Acoustica MP3 Audio Mixer v.2.471). Because the interviews were conducted in the Arabic language, all the interviews were translated into the English language and then transcribed into a computer programme (Microsoft Word). The data were divided into several themes, for example: attitudes of students to science, skills and ability, contents. These themes were in general related to the themes of the questionnaire.

4.10 Ethical Issues

The goal of ethical issues in research is to ensure that the participants will not be harmed at any stage of the research process (Flick, 2006). Thus, in conducting this study, the researcher avoided any act of unethical behaviour. In addition, the researcher gave attention to some ethical issues that could arise from the following: the research problem itself, the setting in which the research took place (e.g. schools), the method of data collection, (e.g. questionnaire), the kinds of people serving as research participants (e.g. children), and the type of data collected – sensitive, personal, or financial information (Nachmias and Nachmias, 1996).

Thus, in this research study, some basic steps were provided to protect the human participants by:

1. providing a full explanation of the purpose and objectives of the study to the respondents;
2. providing a written explanation before each questionnaire or interview;
3. informing the participants that they had the right to withdraw at any time;
4. gaining permission from all relevant parties (e.g. Schools);
5. informing the participants about how the data collected would be treated, its confidentiality, and that it would be used for research purposes only (Cohen *et al*., 2007).

The questionnaire did not require participants to sign or provide their names: thus there was no risk to their identity in completing the questionnaire. Also, no personal information was required. The cover letter of the questionnaire provided all information that the participants might need about the research study and the researcher (e.g. name of the researcher, the university, the school, and the time required to complete the questionnaire). Before embarking on the data collection the researcher gained the ethical approval from the University (see appendix G and H).

4.11 Summary

This chapter has explained the research design, methodology and research methods, including methods of analysis, sample, validity and reliability. It discussed how the study was piloted. Some important changes were made as a result of the pilot of the instruments (e.g. questionnaire and interview). This chapter has also clarified how the participants were obtained, design of questionnaire, collecting data, analysing data, and ethical issues. The findings of the study are revealed in the next chapter.

Chapter 5 Results/ Findings of the Study

5.1 Introduction

The purpose of this study is to examine the components of an enrichment programme in order to provide an appropriate science curriculum for sixth grade in primary schools in Saudi Arabia. Multiple methods, namely document analyses, questionnaires and interviews, have been employed to answer the following research questions:

1. What is the content of the science textbook in the sixth grade at public schools in Saudi Arabia in terms of learning demand?
2. To what extent does the science textbook in the sixth grade at public schools in Saudi Arabia meet the needs of gifted students?
3. What should be the content of the enrichment programme in the science curriculum in the sixth grade to meet the needs of gifted students?

Firstly in this chapter, quantitative descriptive data from the analyses of two chapters of the textbook (units 5 and 6) is discussed (see 4.4.1). The units are analysed by comparing them with the cognitive demand of Bloom's taxonomy. Secondly, the data from the questionnaires and the interviews will be analysed to answer research questions two and three. Thirdly, the important principles of the enrichment programme developed on the basis of the findings of the analysis of the science textbook, the questionnaires and the interviews are presented.

5.2 Research Question One

What are the contents of the science curriculum in the sixth grade at public schools in Saudi Arabia in terms of learning demand?

Science textbooks are the primary sources used by science educators throughout the world to guide them in teaching the content and skills prescribed in curricula (Stoffels, 2005). In Saudi Arabian schools, there is a considerable emphasis on textbooks in science classes, not only by teachers but also by students (Arsheed *et al.*, 2003). Science textbooks are regarded by the Ministry of Education as the primary source of information in all schools.

The goal of the analysis is to look at the contents of the textbook and to examine the extent to which it matches cognitive demand, as defined by Bloom's Taxonomy. In order to answer Research Question One, the study employed several steps: 1. Choosing the categories; 2. Comparing the categories with Bloom's Taxonomy; 3. Presenting results (section 4.4.1).

5.2.1 General Information about the Textbook

The nature of the Saudi grade 6 science textbook is discussed here to provide contextual information. The cover sheet contains one image, the title and the date of publication (Appendix I). The second page contains the names of the authors and the reviewers (Appendix I) and the remainder of the divided into several components.

The introduction to the textbook includes four main parts. The first part includes the major aims of science teaching in primary schools in Saudi Arabia and the goals of the science textbook at this level. The second part is directed to science teachers and focuses on their role in classes. The third part is directed to the parents and provides some advice on how to help and support their children in their study of the science textbook. The last part is directed to the student and includes some advice to encourage them how to be researchers and scientists.

There are six units in the science textbook. Each unit has several different chapters. The units cover different subjects in science (e.g. physics, biology, and chemistry). Some of these units consist of two or three chapters. Each chapter consists of several topics, which form the sub-sections of the chapter (see Table 5.1).

Table 5.1: The Subjects of each unit in the 6th grade science textbook

Unit	Chapter	Subject
(1) The Human Body	1	Skeleton
	2	Muscle and Movement
	3	Nervous System
(2) Reproduction	4	The Importance of Reproduction
	5	Reproduction of Birds and Mammals
(3) Our Environment	6	The Environment and Us
	7	The Effect of Humans on the Environment
	8	Relations between the Creatures in the Environment
(4) Electricity and Magnets	9	Electricity
	10	Magnets
(5) The Materials	11	Combined, Elements and Compounds
	12	Metals and Rocks
(6) Science Helps Humans	13	Science Helps Humans to Improve Telecommunication
	14	Science Helps Us to Save our Health

Table 5.2 below summarises the general features of the science textbook. Unit 4 consists of 33 pages of the textbook which accounts for 25% of the total text book, forming the biggest part of this book. Units 3 and 5 are the next biggest units, each consisting of 25 pages (22%). Unit 6 is the shortest unit at only 11 pages (8%). There are 59 topics: Units 1 and 4 each consist of 13 topics (22%). Unit 2 consists of 10 topics (17%), while units 3 and 5 each consist of only 9 topics (15%).

Units 5 and 6, on "Materials" and "Science Helps Humans" were chosen for analysis as they are the most relevant subjects to the researcher, as maintained in section 4.4.1. These units are long enough to be representative as a sample of the whole textbook and this proportion is acceptable given the nature of this research.

Table 5.2: General features of the science textbook

	Chapters		Topics		Pages	
	Chapters	% of Chapters of the textbook		%		%
Unit 1	3	21.5%	13	22%	21	16%
Unit 2	2	14%	10	17%	17	13%
Unit 3	3	21.5 %	9	15%	25	19%
Unit 4	2	14%	13	22%	33	25%
Unit 5	2	14%	9	15%	25	19%
Unit 6	2	14%	5	9%	11	8%
Total	14	100%	59	100%	132	100%

The following paragraphs provide details of the steps that were used to analyse the Science Textbook (ST).

Step1: Choosing the categories: the science textbook was read several times to develop an understanding of its form, structure and contents. This gave the researcher a very good level of understanding of the content and the structure of the science textbook. In addition, it helped him to think about the categories that would be selected. Decisions were made about the categories of analysis. It is important that the categories used in the analysis are replicable: i.e. that they can be used again by any researcher to give the same results when analysing the same contents.

The analysis of Units 5 and 6 of the textbook was performed through analysing both words and images. All the contents in Units 5 and 6 were divided into a number of categories (as explained and justified in section.4.4.1): 1- Objectives, 2- Definitions, 3- Illustrative and Description Pictures, 4- Activities, and 5- Evaluation.

Step 2: Comparing the categories with Bloom's Taxonomy: Bloom's Taxonomy was applied to the results of the analysis to identify the proximity of the units to this taxonomy. Later, because some of the contents did not fit into any categories, such as resources, learning independently, and using advanced technology, the study moved on to analyse these contents qualitatively. This step was chosen to cover all the materials and matters in the science textbook.

Step 3: presenting the results: the analysis of both Units 5 and 6 were presented against Bloom's Taxonomy.

5.2.2 Analysis of Unit 5

Table 5.3: Analysis of Chapters 11 and 12 of unit 5 against Bloom's Taxonomy

Categories	Remembering		Understanding		Applying		Analysing		Evaluating		Creating		Total
		%		%		%		%		%		%	
Objectives	11	57%	6	31%	2	10%		0%		0%		0%	19
Definitions	3	33%	3	33%	3	33%		0%		0%		0%	9
Images and pictures	1	8%	6	50%	5	41%		0%		0%		0%	12
Activities	1	5%	6	28%	12	57%	1	5%		0%	1	5%	21
Evaluation	5	71%	2	29%		0%		0%		0%		0%	7

Table 5.3 shows the analysis of Unit 5 according to Bloom's taxonomy. Unit 5 consists of two chapters (11 and 12). There are 19 objectives, 9 definitions, 12 images, 21 educational activities and 7 evaluation questions. Comparison has been made between these results and the cognitive demand of Bloom's Taxonomy. The majority of the objectives involve "remembering" (57%), while the level of "understanding" is 31% and the level of Applying is only 10%. At the same time, no objective is related to the higher levels of analysis, evaluating and creating, in this unit.

The levels of remembering, understanding and applying all have the same percentages (33%) in the category of definitions, while the percentages of the levels of analysis, evaluating, and creating are 0%. The levels of understanding and applying have good percentages (50% and 41%) in the category of images and pictures, while remembering accounts for only 8% of images and pictures in this unit. Most of the educational activities in this unit fall into the level of applying (57%), followed by understanding (28%), while, remembering, analysing and creating each account for only 5% of activities. The educational activities contain no cases at the level of evaluation. The evaluation element of this unit is focused only on the first two levels of Bloom's taxonomy, which are remembering and understanding (71% and 29% respectively). These are examples from the ST that will illustrate some level of thinking skills included;

Understanding: W*hat will be happened if we mix up the salt with water*?

Applying: *In our daily life, we use a lot of elements and mixtures, please fill the gaps with suitable answers in the Table below:*

Mixtures used in daily life		*Elements used in daily life*	
Name of mixture	*Use area*	*Name of element*	*Use area*

This indicates that most of the contents of unit 5 have been designed to meet the first three levels of thinking skills of Bloom's taxonomy. These levels are the lowest levels of thinking. Only two of the activities included in this unit meet the higher levels of thinking, namely analysis and creating. This suggests that unit 5 should be redesigned to give more opportunities for gifted students to expand their skills, especially in the higher levels of thinking. Furthermore, the unit does not include any content addressing the skills of evaluating.

Evaluation questions in this unit did not cover all the objectives, as some objectives were left without measuring some of these skills. For example, there are only 7 evaluation questions in unit 5, while there are 19 objectives.

5.2.3 Analysis of Unit 6

Table 5.4: The Analysis of Chapters 13 and 14 of unit 6 against Bloom's Taxonomy

Categories	Remembering		Understanding		Applying		Analysing		Evaluating		Creating		Total
		%		%		%		%		%		%	
Objectives	2	22%	3	33%	4	44%		0%		0%		0%	9
Definitions	2	33%	4	67%		0%		0%		0%		0%	6
Images and pictures		0%	1	33%	2	67%		0%		0%		0%	3
Activities		0%		0%	8	53%	4	27%	1	6%	2	13%	15
Evaluation	3	75%		0%	1	25%		0%		%		0%	4

Table 5.4 shows the analysis of unit 6 against Bloom's Taxonomy. Unit 6 consists of two chapters (13 and 14). There are 9 objectives, 6 definitions, 3 images, 15 educational activities and 4 evaluation questions. Most of the chapter's objectives are focused on the levels of applying and understanding (44% and 33% respectively),

followed by remembering (22%). There are no objectives related to the levels of analysing, evaluating or creating in this unit. The definitions in this unit meet only two levels of thinking, which are remembering and understanding (67% and 33% respectively).

The level of applying accounts for the largest percentage of material (67%) in the category of images and pictures, while understanding accounts for 33% of images and pictures in this unit. Most of the educational activities in this unit meet the level of applying (53%), followed by analysing (27%). Creating is third, with 13% of the activities falling into this category. Only 6% of the educational activities may be classed as meeting the level of evaluating.

The majority of the evaluation questions in this unit are focused on the lowest level of Bloom's Taxonomy, which is remembering (75%). The second level is applying, which accounts for 25% of the questions. None of the evaluation questions meet other levels of Bloom's Taxonomy.

These findings indicate that the majority of the contents of unit 6 have been designed to meet the first three levels of thinking skills of Bloom's taxonomy. These levels are the lowest levels of thinking. Some educational activities in this unit meet higher levels of thinking (e.g. analysis), which is represented in a reasonable number of activities. Moreover, the level of creating is found in two of the fifteen activities (13%), which is a good rate compared with other thinking skills in this unit. The results reveal that the unit's objectives do not include any thinking skills at the levels of analysing evaluating, or creating, although some of its activities give the students opportunities to practise these skills. This means that the objectives in this unit do not reflect the level of skills of the activities. For example, the textbook asks the student to:

> *"Discuss with older people about the diseases that affected people in the past, and how people were expected to deal with these types of diseases, and then write a report about what you find. Then, discuss your reports with your teacher and classmates"*.

This example contains some higher-order skills (e.g. applying, analysing and creating), which is good for the students. On the other hand, the objectives of this unit do not include or meet these levels of skill. This suggests that the textbook authors must ensure that outcomes of the textbook reflect the objectives. Unit 6 should give more opportunities for gifted students to expand their skills, especially the higher levels

of thinking. In addition, the unit does not include any content at the level of evaluating. For example, the objectives of the Unit 6 include three objectives which meet lower levels of thinking:

The students will be able to:

(Applying): *draw the shape of a wave;*

(Remembering): *remember how the sounds transfer throughout the air*

(Remembering and Applying): *remember how the sounds transfer throughout the TV, Radio, and phones*.

Overall, the quantitative analysis of Units 5 and 6 indicate that there are several important issues to be taken into account in designing a science textbook.

Both units have suitable numbers of activities that meet the first three levels of thinking (remembering, understanding and applying). Moreover, there are some activities that aim to develop higher levels of thinking (analysing, evaluating and creating). However, the numbers of tasks and activities are generally too low (see section 5.5). Most of the activities entail direct application of knowledge. Thus, the units should be redesigned to improve all levels of thinking, not only the lowest levels. In addition, there is a clear need to increase the number of evaluation questions to cover all the learning objectives. For example, the total number of evaluation questions in both units is 11, while the total number of objectives is 28. In addition, most of these questions focus on the first two levels of thinking, except for one, which meets the level of applying. Moreover, the level of evaluation should be included for all activities and all levels of thinking.

5.3 Qualitative Analysis of Science Textbook

Qualitative analysis was also adopted in this research study to analyse the textbook because this step will help to give a more holistic perspective. The criteria for the qualitative analysis of the textbook have been selected from the literature review (section 3.6.4) and have also been used in the questionnaire, and are coalesced as themes. The themes are *attitudes to science* and *contents and practice*. Each theme is divided into a number of sub-questions, which will determine the features of the analysis of the units. The questions are:

Table 5.5: Qualitative Questions to analysis the ST

Theme	Questions
Attitudes to science	1. How does the textbook encourage learners to give their opinion about any science subjects or problems? 2. How does the textbook encourage learners to try new activities?
Contents and Practice	3. How does the textbook provide opportunities to learn independently? 4. How does the textbook provide opportunities to learn in a group of similar learners? 5. How does the textbook encourage use of advanced technology and resources? 6. How does the textbook encourage practical laboratory work?

To answer the questions in Table 5.5, the researcher examined all the contents and materials of the units (Unit 5 & 6) selected as a sample of the textbook from a qualitative perspective. Some examples are provided to illustrate the qualitative analysis that follows.

5.3.1 Attitudes to Science

1: How does the textbook encourage learners to give their opinion about any science subjects or problems?

Units 5 and 6 of the textbook (those that have been analysed quantitatively) do not include any question or activity to encourage learners to give their opinions. This means that the students are not given any opportunity to articulate their opinions. This indicates that units in the textbook should give learners more learning opportunities to develop their attitudes to science.

2: Does the textbook encourage learners to try new activities?

Unit 6 asks the learners to try only one activity related to the topic. This is as follows:

Go with one of your family to visit a pharmacy close to your home and bring your textbook with you. Ask the pharmacist to show you some different types of medicines. Number these medicines. Discuss the effects of using these medicines with the pharmacist. Then, write a report about what you find.

There are many activities provided in the units but this is the only one that lets students try something related to the topic. The textbook does not provide any enrichment activities to meet the special needs of diverse learners in class. This indicates that the textbook should be improved to meet the needs of students to try new activities.

5.3.2 Contents of Knowledge and Practice

3: How does the textbook provide opportunities to learn independently?

4: How does the textbook provide opportunities to learn in a group of similar learners?

There are many activities provided to the students that give them opportunities to learn independently. The textbook gives the learners a great chance to learn independently. Most of the activities are designed to enable learning as individual independent tasks. On the other hand, the textbook includes few activities that focus on learning in groups. The instructions in the textbook have been written to learners as individuals, and not in terms of learning in groups or with others. This indicates that the content of the textbook does not encourage the use of cooperative learning in class. For example:

Take some pieces of stones, hydrochloric acid and a hand lens. Examine the stones using the hand lens, and then compare the stones in terms of: size, colour, weight, solidity and chemical interaction with the acid. Then, report your observations.

And this is activity is expected to be carried out individually without any class or group discussion

5: How does the textbook encourage use of advanced technology and resources?

The 6th grade science textbook does not include any advanced technology or resources. For example, teachers or learners are not encouraged to find any additional information about the topics in this textbook. Moreover, there are no suggestions of science books or websites for teachers or learners that are related to the topics. This indicates that there is a clear need to provide both teachers and learners with resources that will help to improve teaching and learning. The textbook should provide useful websites that will allow learners to try to apply science topics related to their level.

6: How does the textbook encourage practical laboratory work?

The 6th grade textbook has a good number of activities that encourage learners to use laboratory work. However, the majority of the activities don't give the learner opportunities to use higher levels of thinking. Most of them list the materials for each activity, then instructions for each step of the activity, and finally the learner gets the result or the answer directly. Concepts and new knowledge are delivered via practical laboratory work but without any challenge. The science textbook should be written in a way that meets learners' needs to be challenged or to learn new skills.

5.4 Research Questions Two and Three

5.4.1 Questionnaires

The questionnaire was designed to gather the views of gifted students in the sixth grade in Saudi Arabia about the current curriculum based upon the science textbook (ST) and the proposed enrichment programme (PEP).

The questionnaire was made up of 56 items. The first 28 items were about the current science textbook, and the next 28 items were about a suggested enrichment unit (Appendix D). Table 5.6 shows the data pertaining to the number and percentages of distributed and returned questionnaires

Table 5.6: Number and percentages of distributed and returned usable Questionnaires

Distributed Questionnaires	Returned Questionnaires	Percentage Returned	Usable Questionnaires	Percentage of Usable Questionnaires
220	182	83%	165	90.7%

Out of 182 returned questionnaires, only 17 were regarded as unusable. These were discarded because the respondents either missed ratings for a considerable number of questionnaire items or answered all the questionnaire items with the same rating.

Table 5.7 shows the themes of each questionnaire and the items in each theme. The themes are: Attitude to science, abilities and skills, content of knowledge, content of practice, and emotional and social needs. Each theme has several items. Participants were asked to indicate their level of agreement with each item by checking one of these responses: (Strongly Agree=4, Agree=3, Disagree=2, and Strongly Disagree=1). As

indicated in section (4.5.1) the language was simplified appropriately in the Arabic version for 11-12 year olds. The data were analysed in two phases. Firstly, the data were analysed and presented by items for both the current science textbook and the proposed enrichment programme. Secondly, comparisons were made among the themes in the ST questionnaire and PEP questionnaire by using *chi-square* test.

Table 5.7: The Themes and Items of the Questionnaires in the Science Textbook and the Proposed Enrichment Programme

Themes	Items
Attitudes to science	1. Develop positive attitudes to attempt new projects. 2. Encourage learners to examine all facts before making decisions. 3. Encourage learners to give their opinion about any science subjects or problem. 4. Encourage learners to try new activities.
Abilities and Skills	5. Encourage critical thinking. 6. Develop ability to think scientifically. 7. Encourage learners to design own tasks or topics. 8. Encourage free thinking. 9. Give learners choices to plan their work and time. 10. Help learners to evaluate their learning process and outcome. 11. Give learners opportunities to evaluate the textbook that they are using.
Contents of Knowledge	12. Give flexibility to learn based on individual abilities and interests. 13. Provide opportunities to challenge. 14. Allow learners to work in breadth, depth and pace suitable to their abilities. 15. Develop awareness of the world affairs and the last scientific knowledge. 16. Develop awareness of the physical life of the human being. 17. Develop awareness of the environment. 18. Allow work on a lot of different science topics. 19. Encourage new experiences and ideas.
Contents of Practice	20. Provide opportunities to learn independently. 21. Provide opportunities to learn in a group of similar learners. 22. Encourage use of advanced technology and resources. 23. Encourage practical laboratory work.

	24. Give learners space and time to explore their own interests.
Emotional and Social Needs	25. Give attention to cultural and social issues in learning science. 26. Increase learners' self-confidence. 27. Encourage learners to share their ideas with others. 28. Meet learners' individual needs.

5.4.2 Theme of Attitudes to Science

Overall, for this theme most of the gifted students indicated that the PEP would help them have a more positive attitude to science. By combining the percentage of the "strongly agree" and "agree" scales, the results show (Table 5.8) that students consider that the PEP would encourage and facilitate more positive attitudes towards science than the ST. While 66% of gifted students considered the ST to encourage positive attitudes to science, this figure increased to 90% agreement for the PEP (see Table 5.8).

Table 5.8: The Responses to the theme of attitudes in the ST and PEP

Agreement	ST		PEP	
	Frequencies	%	Frequencies	%
S-disagree	58		10	
Disagree	166		56	
Total	244	34 %	66	10%
Agree	270		242	
S-agree	164		353	
Total	434	66 %	595	90%

Chi – square analysis

Table 5.9 summarises the results of the analysis wherein all the items in this theme were examined by *Chi square* test to calculate whether there are any significant differences among each item in both questionnaires. The responses in this theme show that there is a significant difference at level ($p < 0.001$) in favour of the PEP. This finding means that gifted students are more likely to develop positive attitudes towards science using the PEP compared to the current ST. This suggests that in designing an enrichment programme for gifted students in the sixth grade, more attention should be paid to developing positive attitudes to science.

Table 5.9: Statistical comparison between students' responses to the ST and PEP on the theme "Attitudes to Science"

Theme		Items	Questionnaire	Mean	SD	*Chi*²	Sig. (p)	Order*
Attitudes	1	Develop positive attitudes to attempt new projects.	ST	2.86	0.88	38.88	0.001	3
			PEP	3.41	0.77			
	2	Encourage learners to examine all facts before making decisions.	ST	2.81	0.94	43.43	0.001	2
			PEP	3.42	0.71			
	3	Encourage learners to give their opinion about any science subjects or problem	ST	2.61	0.90	87.57	0.001	1
			PEP	3.48	0.66			
	4	Encourage learners to try new activities	ST	3	0.86	20.40	0.001	4
			PEP	3.38	0.68			

*Order of the items according to the value of *Chi*²

Items are discussed in order according to the value of *Chi*².

● Item 3 "*Encourage learners to give their opinion about any science subject or problem*".

The responses from the students showed that there is a significant difference at level (P< 0.001) between the ST (mean = 2.61) and the PEP (mean= 3.48). This difference suggests that gifted students were not satisfied with the ST, and indicates that there is a need to encourage them to "*give their opinion*" in the PEP.

● Items 1 and 2 "*Develop positive attitudes to attempt new projects*" and "*Encourage learners to examine all facts before making decisions*".

Even though the students believe that the ST gives them a positive attitude towards attempting new projects and examining all facts before making decisions, with mean scores of 2.86 and 2.81, the responses indicate that there is a need to give more attention to these attitudes in the PEP (with corresponding means of 3.41 and 3.42 respectively). This is the confirmed by the *Chi square* test, which shows a significant difference at level p< 0.001 in favour of the PEP.

● Item 4 "*Encourage learners to try new activities*"

The responses from gifted students revealed a significant difference at $p<0.001$ between the ST (mean=3) and the PEP (mean=3.38). This indicates that the gifted students are satisfied with the current curriculum but they would like the PEP to encourage them more to try new activities. In terms of the value of *Chi square*, gifted students rated item 3 as the highest value (Chi^2=87.57), which states "*Encourage learners to give their opinion about any science subjects or problem*" .The lowest rated item was item 4 (chi^2=20.40), which states "*Encourage learners to try new activities*".

To sum up, there was accord from the gifted students about the need to improve the ST to develop their attitudes. In addition, gifted students emphasised the need to increase some activities to give them opportunities to give their opinions and to examine all factors before making decisions in their study and that this could be improved in the PEP.

5.4.3 Theme of Abilities and Skills in the ST and the PEP

The second theme, "Abilities and Skills", consists of seven items in each questionnaire.

Table 5.10: The Responses to the theme of "Abilities and Skills" in the ST and PEP

Agreement	ST		PEP	
	Frequencies	%	Frequencies	%
S-disagree	159		63	
Disagree	330		126	
Total	480	42%	189	16 %
Agree	437		448	
S-agree	227		525	
Total	664	58%	973	84%

Generally, the majority of the gifted students' responses (84%) in this theme indicated that they would expect the PEP to develop their abilities and skills, while only 58% of the responses indicated that students consider that the ST can meet their needs for ability and skill development.

Table 5.11: Statistical comparison between students' responses to the ST and PEP on the theme "Abilities and Skills"

Theme	No.	Items	Questionnaire	Means	Std D.	*Chi²*	Sig. (p)	Order *
Abilities and skills	5	Encourage critical thinking	ST	2.34	0.91	54.72	0.001	2
			PEP	3.09	0.88			
	6	Develop ability to think scientifically	ST	2.99	0.84	36.90	0.001	4
			PEP	3.50	0.65			
	7	Encourage learners to design own tasks or topics	ST	2.59	0.98	20.31	0.001	7
			PEP	3.08	0.89			
	8	Encourage free thinking	ST	2.68	0.91	84.29	0.001	1
			PEP	3.53	0.70			
	9	Give learners choices to plan their work and time.	ST	2.66	0.88	43.68	0.001	3
			PEP	3.27	0.75			
	10	Help learners to evaluate their learning process and outcome.	ST	2.67	0.93	36.72	0.001	5
			PEP	3.25	0.78			
	11	Give learners opportunities to evaluate the textbook that they are using	ST	2.51	1.07	21.36	0.001	6
			PEP	3.04	0.76			

*Order of the items according to the value of *Chi²*

Table 5.11 shows that gifted students' responses in this theme, "abilities and skills", indicate that there is a significant difference at level $p<0.001$ among all items in the ST and the PEP.

Overall, students consider that the PEP will enable them to develop skills and abilities more readily than the ST. This finding means that gifted students think that the PEP should give more attention to critical thinking activities, how to think scientifically, enable them to design their tasks or topics, provide spaces for free thinking, and give freedom to allow them to choose how to plan their work and time. In addition, the PEP should give opportunities to evaluate their learning processes and outcomes. They consider that these aspects of the scientific process are not addressed adequately in the ST.

The differences among the means of the items in the ST in this theme show that there is a demand to develop the ST to meet gifted students' needs in skills. This suggests that the PEP should be built to give more opportunities for gifted students in sixth grade to expand their abilities and skills.

- Item 5, 8, and 9 "*Encourage critical thinking*", "*Encourage free thinking", and "Give learners choices to plan their work and time"*

Examination of the means indicates that the gifted students believe the ST to be have appropriate material to meet these needs but that it does not reach their expectations (means=2.34, 2.68 and 2.66) respectively. However, they would like to expand these skills in the PEP (means= 3.09, 3.53, and 3.27) respectively. Significant differences were also found among these items between the ST and the PEP in favour of the PEP (all at $p<0.001$)

- Item 6 "*Develop ability to think scientifically*".

Responses to this item indicate that the gifted students consider that the ST is reasonable in developing their ability to think scientifically (mean= 2.99); however, the mean of this item for the PEP indicates that the gifted students are looking for further support to develop this skill (mean= 3.50).

- Items 10 and 11 "Help learners to evaluate their learning process and outcome" and *"Give learners opportunities to evaluate the textbook that they are using".*

Responses to these items indicate that students think that the ST is not giving them enough opportunities to develop evaluate their learning (mean =2.67) and also that the ST should provide them with opportunities to participate in evaluating the textbook activities (mean = 2.51). This result is confirmed by students' responses toward what should be included in the PEP (means= 3.25 and 3.04). Moreover, the *Chi square* test shows a significant difference ($P< 0.001$) between the ST and the PEP which confirms students' desire to have opportunity to develop these abilities and skills.

- Item 7 "*Encourage learners to design own tasks or topics*".

The gifted students pointed out that there are limitations of the ST in terms of giving the ability to design their own tasks or topics (mean= 2.59), even though they indicate that there is modest need to increase this skill in the PEP (mean=3.08).

In general, the gifted students seemed to regard the ST as reasonable with respect to developing abilities and skills; on the other hand, , they would like the opportunity to develop these skills and abilities further and develop new skills especially the skills of free and critical thinking. The values of the means on this theme suggest that those constructing the PEP should bear in mind these two most important skills. In addition, gifted students should be given the opportunity to plan and evaluate the ST activities.

Moreover, more scientific activities to encourage students to design their own tasks should be included in the PEP.

5.4.4 Theme of Content of Knowledge of the ST and PEP

Generally, responses in this theme indicate that the ST does provide adequate content, as indicated by nearly 72% of respondents. However, responses (85%) indicate that gifted students would like to have more content of knowledge in the PEP (See Table 5.12).

Table 5.12: The Responses to the theme "Content of Knowledge" in the ST and PEP

	ST		PEP	
Agreement	Frequencies	%	Frequencies	%
S-disagree	71		34	
Disagree	306		139	
Total	377	28%	173	15%
Agree	593		541	
S-agree	357		605	
Total	950	72%	946	85%

Table 5.13: Statistical comparison between students' responses to the ST and PEP on the theme "Content of Knowledge"

Theme		Items	Questionnaire	Means	Std. D.	*Chi*²	Sign. (p)	Order *
Content of knowledge	12	Give flexibility to learn based on individual abilities and interests.	ST	2.88	0.73	46.80	0.001	1
			PEP	3.40	0.68			
	13	Provide opportunities to challenge.	ST	2.91	0.83	23.80	0.001	4
			PEP	3.33	0.74			
	14	Allow learners to	ST	2.70	0.90	46.10	0.001	2

		work in breadth, depth and pace suitable to their abilities.	PEP	3.28	0.73			
	15	Develop awareness of the world affairs and the latest scientific knowledge.	ST	3.03	0.83	12.20	0.01	5
			PEP	3.33	0.71			
	16	Develop awareness of the physical life of the human being.	ST	3.15	0.79	2.71	Not Sig.	8
			PEP	3.15	0.88			
	17	Develop awareness of the environment	ST	3.02	0.85	8.30	0.05	7
			PEP	3.26	0.80			
	18	Allow work on a lot of different science topics.	ST	2.93	0.86	8.86	0.05	6
			PEP	3.19	0.77			
	19	Encourage new experiences and ideas	ST	2.87	0.86	42.80	0.001	3
			PEP	3.6	0.70			

*Order of the items according to the value of *Chi*²

Table 5.13 shows the gifted students' responses in the theme of "content of knowledge" indicate significant differences between the ST and the PEP for most of the items. However, there is no significant difference for item 16.

● Items 12, 13, 14, and 19, "*Give flexibility to learn based on individual abilities and interests", "Provide opportunities to challenge", "Allow learners to work at a breadth, depth and pace suitable to their abilities*" and *"Encourage new experiences and ideas"*.

The means for the ST of each item are 2.88, 2.92, 2.70, and 2.87 respectively. The means of each item for the PEP are 3.40, 3.30, 3.28 and 3.46 respectively. All differences are significant. The responses of the gifted students indicate that there is reasonable material in the ST, but that they would like opportunities to be allowed to them to develop their content knowledge to meet their needs through the PEP.

● Items 15, 17, and 18, "*Develop awareness of world affairs and the latest scientific knowledge*", "*Develop awareness of the environment" and "Allow work on a lot of different science topics*".

The means of these items for the ST are 3.03, 3.02 and 2.93 respectively. These responses indicate that the students confirm that the ST does enable them to be more aware of last scientific knowledge and the environment. However, the corresponding means of the PEP are all higher, at 3.33, 3.29 and 3.19 ($p< 0.01, 0.05, 0.05$ respectively). These findings highlight that the gifted students would like to be given more appropriate subjects about *world affairs and latest scientific knowledge, the environment and science topics* via the PEP. Even though they regard the content and knowledge in the ST as reasonable, they believe that the PEP should include more content to meet their needs in these areas.

- Item 16 "*Develop awareness of the physical life of the human being*".

Examination of the means shows that there is no significant difference between the two questionnaires for this item: the mean is 3.15 for both scales. This finding indicates that the gifted students believe that the ST gives them enough information about their physical life.

To sum up, there are some indications of ways to improve the content of the ST. The flexibility to learn based on the individual abilities and interests should be supported and the opportunities to challenge should be further developed. Furthermore, provision should be made in the PEP to allow learners to work in breadth, depth and at a pace suitable to them.

5.4.5 Theme of Content of Practice of the ST and the PEP

The fourth theme, "content of practice" consists of five items in each questionnaire. Generally, the majority of the gifted students' responses (77%) in this theme indicated that they would expect the PEP to include practical activities, while only 56% of the responses indicated that the ST provides such activities (see Table 5.14)

Table 5.14: The Responses to the theme of content of practice in the ST and PEP

	ST		PEP	
Agreement	Frequencies	%	Frequencies	%
S-disagree	70		36	
Disagree	285		164	
Total	355	44%	200	23%
Agree	260		328	
S-agree	190		341	
Total	450	56%	669	77%

Table 5.15: Statistical comparison between students' responses to the ST and PEP on the theme "Content of Practice"

Theme		Items	Questionnaire	Means	Std. D.	*Chi*²	Sig. (p)	Order *
Content of practice	20	Provide opportunities to learn independently.	ST	2.31	0.88	32.70	0.001	4
			PEP	2.87	0.98			
	21	Provide opportunities to learn in a group of similar learners.	ST	2.68	0.82	52.70	0.001	2
			PEP	3.26	0. 69			
	22	Encourage use of advanced technology and resources	ST	2.53	0.96	62.90	0.001	1
			PEP	3.30	0.79			
	23	Encourage practical laboratory work.	ST	3.03	0.97	1.50	Not Sig.	5
			PEP	3.12	0.89			
	24	Give learners space and time to explore their own interests Independently	ST	2.78	..96	40.60	0.001	3
			PEP	3.37	0.72			

*Order of the items according to the value of *Chi*²

Table 5.15 shows that gifted students' responses in this theme "content of practice" indicate that there is a significant difference at $p< 0.001$ between the items from the ST and the PEP, with the exception of item 23, where there is no significant difference. Overall, the differences favour the PEP. This finding means that gifted students think that the PEP should provide more opportunities to learn in groups, to use advanced technology and resources, and to explore their interests in practical activities. The means of most of the items in the ST show that there is a demand to develop the ST to meet students' needs. This suggests that the PEP should be built to offer more opportunities for gifted students to be involved in practical activities in general.

● Item 22, "*Encourage use of advanced technology and resources*".

Responses to this item indicate that the gifted students are not satisfied with the opportunities to use advanced technology and resources in the ST (mean =2.53). The significantly higher value (mean=3.30, $p<0.001$) of this item in the PEP means that new resources and technology are a very important part of the practical content according to gifted students and that this should be an aspect of any enrichment programme.

● Items 21 and 24, "*Provide opportunities to learn in a group of similar learners*" and "*Give learners space and time to explore their own interests*".

These items are ranked as the second most important in this theme. The responses indicate that the ST lacks opportunities to use cooperative learning in class as well as opportunities for students to explore their own interests (means= 2.68 and 2.78 respectively). Therefore, the gifted students are looking for learning opportunities that will help them investigate their interests in a more flexible environment (mean= 3.37). In addition, the gifted students clearly call for the ST to be enhanced to try these teaching methods (such as cooperative learning). Hence, the gifted students would like to see similar methods in the PEP.

● Item 20 "*Provide opportunities to learn independently"*

The fourth most important item in this theme which gifted students consider for the PEP is that it should increase their opportunities to learn independently (mean =2.87). Gifted students believe that the PEP will allow them to learn independently more than with the ST (mean= 2.31). This item is the least important to gifted students.

● Item 23, "*Encourage practical laboratory work*"

Responses for this item show that there is no significant difference between the scores for the ST and the PEP. The mean values for this item in the ST and the PEP were both high (3.03 and 3.12 respectively). This finding indicates that the gifted students consider that the ST provides opportunities for good practical laboratory, but the gifted students believe that this is also an important aspect of the PEP.

This suggests that the PEP should be built to offer more opportunities for gifted students to be involved in practical activities in general, especially in using advanced technology. The second matter has been raised by the gifted students as a way to help them by increasing their interest through greater flexibility in the learning environment. In addition, gifted students emphasised the need to improve the practical issue in the PEP's activities to give them opportunities to study with similar learners.

5.4.6 Theme of Emotional and Social Needs of the ST and the PEP

The last theme, "Emotional and Social Needs", consists of four items in each questionnaire. Table 5.16 indicates that the majority of the gifted students' responses (87%) in this theme would expect the PEP to meet their emotional and social needs, and more than half (60%) of the responses showed that the ST does meet these needs. Gifted students' responses reflect the level of emotional needs that are met in the ST, which are lower that responses to these items in relation to the PEP. Thus, the responses indicate that gifted students have a strong requirement for their individual needs to be met; they also consider that the PEP will help them more effectively to meet some of these needs, such as self confidence and sharing ideas with others (See Table 5.16).

Table 5.16: The Responses to the theme of "Emotional and Social Needs" in the ST and PEP

Agreement	ST		PEP	
	Frequencies	%	Frequencies	%
S-disagree	75		13	
Disagree	192		65	
Total	267	40%	78	12%
Agree	249		255	
S-agree	144		314	
Total	393	60%	569	88%

The gifted students' responses in this theme show that there is a significant difference ($p < 0.001$) in favour of the PEP. These results suggest that the gifted students would like more attention to be given to cultural and social issues in the PEP. In addition, they expect that the PEP will increase the opportunities to share their ideas with others and to increase their self-confidence.

Table 5.17: Statistical comparison between students' responses to the ST and PEP on the theme "Emotional and Social Needs"

Theme	No.	Items	Questionnaire	Means	Std. D.	*Chi*²	Sign. (p)	Order*
Emotional and social needs	25	Give attention to cultural and social issues in learning science.	ST	2.65	0.94	20.16	0.001	4
			PEP	3.06	0.79			
	26	Increase learners' self-confidence.	ST	2.81	0.90	72.45	0.001	1
			PEP	3.55	0.63			
	27	Encourage learners to share their ideas with others.	ST	2.76	0.94	49.50	0.001	3
			PEP	3.42	0.70			
	28	Meet learners' individual needs	ST	2.67	0.94	50.54	0.001	2
			PEP	3.27	0.78			

*Order of the items according to the value of *Chi*²

- Item 26, "*Increase learners' self-confidence*".

Responses indicate that the ST has given the learners a reasonable level of self-confidence in science activities (mean= 2.81). However, the gifted students are looking for extra activities in the PEP, which can increase their confidence (mean= 3.55).

- Items 27 and 28, "*Encourage learners to share their ideas with others" and" Meet learners' individual needs*".

Responses to these items indicate that there is a failure to meet the individual needs and share ideas with their peers or others in the ST (means= 2.76 and 2.67) respectively. On the other hand, the students indicate that they would like to learn from their peers by exchanging their ideas, and they believe that the PEP should designed to meet the individual needs of each learner (means= 3.42 and 3.27 respectively).

- Item 25, "*Give attention to cultural and social issues in learning science*".

Responses to this item show the least significant difference in this theme. However, the means indicate that the ST does not provide enough opportunity for cultural issues or social subjects (mean= 2.65) and the gifted students would like to have important issues in culture and society included in the PEP (mean= 3.06)

5.5 Summary of the Statistical Results of all the Themes Covered in the ST and the PEP

Table 5.18 shows the statistical tests of all themes in this study between the questionnaires on the ST and the PEP. Significant differences between the ST and the PEP were found for all five themes, all at $p<0.001$. The examination of the means (Table 5.18) indicate that the gifted students believe that the ST provides suitable content and knoweldge material (mean = 23.50). However , the gifted students indicate that they currently have limited support in their emotional and social needs in the ST. Therefore, they would like to be given more opportunities to learn based on their individual abilities and interests. Furthermore, they would like to be allowed to work in breadth, depth and at a pace suitable to their independent abilities, and they are looking for development of their awareness of the environment. However, some results showed that a poor ST result doesn't always mean a good PEP result. For example, responses for item 23 "*Encourage practical laboratory work*" show that there is no significant difference between the scores for the ST and the PEP (section 5.4.5).

Table 5.18: Statistical comparison between students' responses to the ST and PEP of themes in both questionnaires (*Chi²*)

No.	Theme	Questionnaire	Means	Std. D.	*Chi²*	*Sig.*
1	Attitudes to Science	ST	11.26	2.59	166.71	0.001
		PEP	13.68	1.90		
2	Abilities and Skills	ST	18.47	3.98	258.99	0.001
		PEP	22.77	3.23		
3	Content of Knowledge	ST	23.50	3.58	144.56	0.001
		PEP	26.42	3.33		
4	Content of Practice	ST	13.34	2.67	93.10	0.001
		PEP	15.93	2.21		
5	Emotional and Social Needs	ST	10.80	2.52	178.5	0.001
		PEP	13.30	1.95		

Table 5.19 shows the order of importance of the themes according to the responses of the gifted students in the PEP questionnaire. The most important theme in the PEP for the gifted students is the content of knowledge (mean= 26.42). This reflects the students' views of the inadequacy of knowledge in the ST and their desire to further the development of content knowledge in the PEP. The theme of content knowledge contains a number of items for which the responses of gifted students reflected that they need flexibility in learning and in-depth study of scientific subjects to increase the

level of challenge and encourage environmental awareness and as well as trying new subjects.

The second most important theme is improving the abilities of gifted students to think critically, scientifically and freely, for which the mean score was (22.77). In addition, the gifted students would like the PEP to give learners the choice to plan their work and time and help them to evaluate their learning processes and outcomes. Gifted students expect that the PEP will give them more opportunities to design their own tasks and evaluate their activities to plan their work and time more than the ST does.

The third theme that the gifted students consider necessary in the PEP is practical content (mean=15.93). The students believe that they would like to be provided with opportunities to learn independently, to use advanced technology and resources and to engage in practical laboratory work.

The fourth most important theme which gifted students consider for the PEP is that it should increase their positive attitudes to science (mean = 13.68). Gifted students believe that the PEP will increase their positive attitudes to science more than the ST has done. They would like the PEP to develop their interest in attempting new projects and in trying new activities. They are also looking for encouragement to give their opinion on scientific topics. All these (e.g. attempting new projects and trying new activities) will increase students' attitudes to learn science because it will give them choice and greater ownership of their own learning.

The last theme that gifted students believe should be developed is emotional and social needs (mean=13.3). Even though emotional needs rank last among the themes, the students suggest that their needs require more attention than the current ST provides.

Table 5.19: Order of importance of themes based on the value of means in the PEP questionnaire

Order	Theme	Means
1	Content of Knowledge	26.42
2	Abilities and Skills	22.77
3	Content of Practice	15.93
4	Attitudes to Science	13.68
5	Emotional and Social Needs	13.3

5.6 Analysis of the Interviews with Teachers and Supervisors

The transcripts of interviews were content analysed on a question-by-question basis. Based on an initial reading and re-reading of the transcripts, a number of themes were established. The responses were re-read and assigned to one of the content themes (positive attitudes to science, thinking skills, and contents and activities). The following techniques were then used in the analysis of the interviews: analysis of words from respondents and *counting frequencies of occurrence (of ideas, themes, pieces of data, words)* (Cohen *et al*., 2007: 368). Using the latter technique, ideas which occurred frequently among the respondents were sought. The assumption behind this technique is that the repetition of words and ideas indicate that these ideas are important for the respondents. Generating meanings and classifying utterances was also used (Cohen *et al*., 2007). This technique helped establish themes based on teachers' and supervisors' perceptions of the current science textbook and what the proposed enrichment programme should contain.

5.7 Positive Attitudes to Science

Teachers and supervisors of gifted education were asked to respond to the following main question: **"**To what extent do you think that students in the sixth grade of primary schools have positive attitudes to science?" (Appendix K)

With regard to attitudes to science, the themes that have emerged from the responses of the teachers and supervisors are as follows:
In general, there are several factors which could promote positive attitudes towards science among 6^{th} grade students in Saudi Arabia, such as 1) including topics that are close to pupils' daily lives; 2) linking the science curriculum to the study of the environment; 3) presenting the science textbook in an interesting way; 4) The textbook should be more challenging; 5) the use of laboratories in teaching, where it conforms to the nature of the science curriculum; 6) allowing the students to choose the topics that will be studied, and 7) the Ministry of Education allowing teachers to add new topics.

Many teachers and supervisors pointed out that sixth-grade students in Saudi Arabia tend to have positive attitudes to the science curriculum. S5, a supervisor of gifted education (19 years' teaching experience) reported:

"I feel that the science curriculum is a beloved one for the primary and intermediate students and they like it. I do believe, as you do, in individual differences, but generally speaking the students have a positive attitude towards the curriculum."

Adesoji (2008:21) reports that students' positive attitudes to science correlate highly with their science achievement. S5 also mentioned the same point, as he explains:

"Generally speaking the students have a positive attitude towards the curriculum. This positive attitude is reflected in the grades achieved by students, which are high, and if the student loves the subject he will be attentive"

Another teacher (T2: 18 years' teaching experience) expressed his belief as follows:

"From my own experience, approximately 80% to 85% have positive attitudes towards the current science curriculum."

T5, a teacher of gifted students (17 years' teaching experience) went further by asserting that:

"From my experience in teaching students this curriculum, I believe that students have very positive attitudes and a love for science and they like it as much as the physical education classes"

T8, a teacher of gifted students (18 years in teaching), indicates a similar idea to T5:

"There are many pupils who are interested in science and react positively to it, and this is what I have noticed through my experience in teaching at primary, intermediate and secondary schools. I have noticed that the pupils are more interested in science than the other subjects."

However, S10, a supervisor of gifted education (14 years' teaching), highlighted an important factor that the teacher or educator should consider when using the science textbook from the perspective of pupils' needs:

"According to my experience in teaching, I noticed that the science curriculum is different because it contains different subjects (physics – chemistry – biology – geology). I know students attitudes differ to these subjects."

He went further to give more details of each area in science, and concluded that some of the content of the textbook is not attractive for students because of the differences in subject matter and difficulty:

> *"So we noticed that the pupils prefer biology more than physics and chemistry because it is relevant to their daily life. Generally speaking, science is not a favourite or attractive subject because it is very difficult for the pupils; the curriculum is very extensive and full of information. Therefore, the attitudes of the students are not positive."*

5.7.1 Including Topics that are Close to Pupils' Daily Lives

The majority of the teachers and supervisors mentioned the importance of linking the topics in the textbook to the daily life of pupils in order to increase positive attitudes to science. Many examples were given by the respondents to illustrate the importance of this matter. T1, T6, S10 and S9 are teachers and supervisors in gifted education who talked about the importance of linking science to everyday life for the students. For example, S9 stated:

> *"Science is considered as an interesting subject to the pupils, because it contains topics and subjects that are linked their real life, such as the parts of the human body. Therefore, these topics are interesting and easy to understand"*

S9 mentioned to important issues to increase positive attitudes to science such as the nature of science topics, and subjects are liked their real life.

S7 (16 years teaching experience), expressed his worry about the decline in pupils' interest and enthusiasm for science because of the way it is taught:

> *"From my experience, unfortunately their love for science doesn't last for long and the reason is the teaching methods. The pupils feel that science is a part of their daily life and expect it to be interesting and lively, but are shocked to find that science is taught like any other subject"*

From above, S7 stated that students will lose their interesting of studying science because they expect it to be linked with their daily life. In addition, He was concerned about this important issue of students' losing their positive attitudes and interest in science subjects because of the way it is taught. S5 was in agreement with S7. He stated,

"Also, the content is beloved to the students because the topics included in it exist in their lives and environment"

5.7.2 Linking the Science Curriculum to Students' Environment

A number of teachers and supervisors in gifted education stated that the teaching method and presentation of lessons is an important factor to increase positive attitudes and the students' interest in studying science subjects. Many examples were provided from their experience of teaching. Moreover, a number of educators expressed their concern about the traditional methods of teaching the science curriculum. In addition, some teachers talked about their dissatisfaction with the low level of thinking skills in the ST. Another teacher expressed his worry about two important things, which were that the textbook is not presented in an attractive way and the teaching methods fail to meet the needs of students at this level. T5, a teacher of gifted students, talked about the technique of teaching methods as well the presentation of knowledge in the textbook when he said:

"In fact, there are many effective methods that can be used to teach students science. For instance, I used to study genetics in the school garden and it was a great experience and enjoyable for students. Actually, most of the students showed enthusiasm for the lessons and continued to follow up their plants in their free time."

Another teacher (T8) supported his idea by expressing:

"I have noticed that the pupils are interested in science more than the other subjects. This is because of the subject itself and the role of the teacher, especially in the sixth grade, and the curriculum includes stimulating aspects."

S7 described in detail the layout of the science textbook and the teaching methods:

"Really, the answer to this question could be divided into two parts. The book: there has been development in the science books in last year in terms of meaning, content and form. From my experience, I think that all the pupils have a desire to learn science and that means they like it but the way of teaching doesn't help because teachers just concentrate on memorizing and defining concepts."

Here, the role of the textbook to improve student's attitudes to science is one of the main concerns because the students believe that scientific subjects are part of their daily

life and lessons should provide more practical experiences. T5 added further point, related to the earlier one:

> *"Science is not presented in an attractive way. The teaching methods do not attract the students and because of these methods, students feel that science is not linked to their daily life. So, I could say that from the beginning the attitude is positive and good. Some students like and love the subject and some don't because of the teacher and the teaching methods. Science is useful and attractive if it is presented in a good way"*

However, T1 (9 years' teaching) described his idea in a slightly different manner. He was satisfied with the textbook to some extent but he thinks that there is a need to add more stimulation in terms of the way in which the material is presented by the teacher. He stated,

> *"In most schools there is not an encouraging or exciting environment that increases the pupil's love and positive attitude towards science. But with regard to the curriculum itself, it is excellent, very beneficial for the pupils and the units included discuss the human body and the surrounding environment. In the curriculum content there are many exciting issues and topics, but we need more excitement through the application of these issues and topics in real life"*

T9 summed up this issue by saying:

> *"The problem doesn't lie in the textbook but in the person who presents it"*

5.7.3 Presenting the Science Textbook in an Interesting Way

Many factors could contribute to a student's attitude towards studying science (Adesoji, 2008:21). The first and most popular element of a positive attitude towards science that almost all teachers and supervisors mentioned was the application of knowledge is presented in an interesting and attractive way.

For example, T1, a teacher with 9 years in teaching, expressed his thought:

> *"In the curriculum content there are many exciting issues and topics, but we need more excitement through the application of these issues and topics in real life."*

S7 agreed with this perspective and offered more details about avoiding a purely demonstration-based approach to practical work, insisting that enabling students to experiment is important to improve their attitudes to the science curriculum. He stated:

> *"It is important to avoid theorizing and concentrate on experimentation. This is because the science student must try his best to be experimental. He must use his hands, do field work and conduct experiments. Experimentation and application are very important stimuli: they make the students love the subject and improve their attitudes towards it."*

T5 showed excitement and surprise when he talked about his experience. When he authorized the students to perform some experiments without interference from him, despite being hesitant to allow students to work without help because he thought that they would not be able to work on their own, this view was contradicted:

> *"I did not imagine that sixth grade students would be able to make a water purification device: I doubted their ability to complete the experiment, but their achievement surprised me."*

T5 identified a very important issue, which is that teachers should have confidence rather than contempt in the abilities of students. The description offered by T8, (18 years in teaching), is similar to T5's:

> *"The pupil will definitely love the subject when he conducts an experiment in the lab and sees its results."*

5.7.4 The Textbook should be More Challenging

Not surprisingly, some teachers and supervisors related positive attitudes toward science with the level of challenge in the textbook, especially with gifted students. It was also interesting to see that some supervisors and teachers had their own concepts of challenge. In addition, some teachers were able to provide examples of strategies they used to challenge their students. One supervisor highlighted the important factor that there is a lack of challenge in the curriculum. A teacher (T8) echoed this, saying: "*The curriculum lacks stimulation and challenge".* However, T7 stated that challenge comes through stimulation:

> *"Stimulation is usually through challenging the pupils either by applications or questions. The better the questions we present, the better the result we have."*

Moreover, several teachers and supervisors talked about the level of challenge to meet the needs of students, whether gifted or normal students. For example, T5, a teacher of gifted education, described this by saying:

> *"In fact, the current textbook doesn't help to increase positive attitudes towards science because the levels of thinking expected are low. The book contains low levels of thinking. You know, high level thinking skills are needed for normal students and gifted students."*

Another supervisor (S5) provided an example of the steps used in challenging students. The three steps are initiated by the teacher. These steps require a qualified teacher who has the ability and knowledge to motivate students to learn. He said,

> *"First, there should be an element of challenge. We could say to the students, for example ''I have a question, and whoever answers it is a really creative and gifted student''. By this, you are preparing the student to think and you start challenging them. ... For instance, we could give the sixth grade students information relevant to students in the first grade at intermediate level. Second, there should be an element of excitement. The students have high expectations of the teachers. ... It is better if the students are self-motivated to do and research things, not because you ordered them to do it. .... The third point, don't give him the information readymade. Let him search for it. These three points stimulate and challenge because dealing or working with the gifted is not an easy job."*

Meanwhile, S4 expressed his belief in the need to increase the challenge in the science textbook. He illustrated two issues that could help students to learn and love science topics. He stated:

> *In fact: there is no subject that the students love as much as science, but it still needs to challenge the students to learn more... The challenge is extremely weak in the science curriculum, so we have to add more challenge through open-ended questions and leave the students to ask"*

Moreover, he showed his commitment to developing students' thinking. He stated: *"We have to expect from our students more than we imagine"*. The description given by T10 is similar to S4's:

> "*If we recognise the abilities of students, we will discover abilities that we could take into account"*

T3 pointed out another important issue: "*All the students can find the answers easily. This means that there is no challenge".*

5.7.5 The Use of Laboratories in Teaching, Where it Conforms to the Nature of the Science Curriculum

In most interviews, it was stressed that the students are not given the chance or opportunity to use the lab. Very specific issues that were addressed by the interviewees indicate the lack of laboratories in some schools, the lack of tools and equipment needed for laboratory experiments, teachers' lack of confidence in the students' ability to conduct experiments, and finally, teachers' lack of ability to undertake experimental lessons. Many of the teachers and supervisors mentioned the importance of the laboratory for gifted students. A large number of teachers mentioned the importance of labs for gifted students in particular, and the importance of laboratories in teaching to avoid the didactic style of presentation and an entirely theoretical approach. Most teachers and supervisors commented on the nature of science topics and their compatibility with the use of a laboratory for teaching. S4 (14 years' experience), mentioned the importance of the laboratory in science subjects. He stated: *"All teachers and students love science and expect to use the lab"*. But he had a personal negative experience about using a school laboratory:

> *"I'll give you an example of a fact, my son has finished primary school and moved to the secondary school and to this day, he has not entered the science lab"*

Another teacher from this area expressed that some schools do not have science labs. He further pointed out the situation of some science labs. T5 stated:

> *"I know some schools where there is no lab that can operate the scientific experiments in the lessons. Unfortunately, we were using the school's kitchen for our scientific experiments"*

T2 (12 years in teaching), agreed with this viewpoint and offered more details. He stated: "*Approximately two-thirds of the schools have labs and the rest are not fully equipped".* S4 (18 years' experience), highlighted an important factor, which is an attempt to find a justification for teachers why they do not use the laboratory in science education when he said:

"The reason for non-use of the laboratory is the teacher's belief that students are not qualified to conduct experiments."

Another teacher highlighted from his experience that the nature of science subjects should insist on teachers to use the lab. Thus, he stressed that the right place to teach applied lessons is not in the classroom. He stated:

"If I have an applied lesson it shouldn't be presented in the classroom, it should be in the lab in order to be useful for the pupils."

5.7.6 Allowing the Students to Choose the Topics that will be Studied, and the Ministry of Education Allowing Teachers to Add New Topics

To some extent, the researcher found disagreement among the teachers' and supervisors' responses about giving the students some space to choose their topics in science. This disagreement came from the different beliefs about the students' abilities. Some believed that neither normal nor gifted students were qualified to choose topics. However, a large number of the interviewees suggested the opposite point of view. They showed confidence in the abilities of students when they were talking about the selection of science subjects. Therefore, several teachers were concerned about the loss of positive attitudes towards science subjects if the students were not given some space to choose new topics by themselves. Other interviewees showed their dissatisfaction towards some teachers who limit themselves to what is available in the textbook. In addition, some interviewees mentioned other important issues, namely the lack of time to include more topics in their lessons and the need for permission from the Ministry of Education to add more topics.

T5 (17 years of experience), talked about his experience in schools when he leaves space for students to select some topics related to the lessons, and has experienced a great deal of interaction from the students, especially gifted students. He stated:

"My experience was clear and enjoyable with students, particularly with gifted students. I start my lesson with the topic that is in the textbook, and then I suggest that my students try to add titles or subjects that are related to the lesson to study, whether in the garden or the laboratory. I have found great interest from my students in those lessons that are chosen by the students themselves. In fact, I have found positive changes; I have seen in their eyes a sense of freedom and interaction. They were great lessons."

S6, (13 years' experience), described his view, which is similar to T5's, and added further details:

> *"Our students – especially the gifted students - are waiting for the teacher to give them the opportunity to choose the topics: they are tired of remembering and answering direct questions. If our students are given the freedom to begin their learning with participation in the selection of lessons, you'll be surprised at what you see*".

Several teachers and supervisors talked about the importance of confidence in the ability of students to choose new topics for the science curriculum. One supervisor (S3) said:

> *"I think it is better that the students choose and suggest topics, despite the fact that we always think and say the students aren't qualified enough to choose topics and they may choose inappropriate topics."*

The same person pointed out another important issue, which is the need to change Saudi educators' beliefs about their students. He further expressed his worry about students not being allowed to choose. He said:

> *"I think if we keep saying the students aren't qualified to choose good topics, we will keep on with this system and we will not change, but if we give the students a chance they will suggest their topics, discuss them and eventually reach good topics. Our students are now aware of everything and have the common sense through which they can choose and determine what they need and work on it."*

Furthermore, the supervisor moved on to highlight an important factor, which is the educational system in Saudi Arabia, when he said: *"I do support this as a mechanism, but the educational system doesn't actually allow this".* S4, S10 and T8 agreed with this perspective and offered more details about the Ministry of Education and the completion of the curriculum. One teacher stated:

> *"We noticed that the schools administration and the Ministry of Education are very concerned about finishing the curriculum. So, the time factor doesn't permit the adding of topics to the curriculum*." (T8)

However, participants' overall reaction to the notion of allowing the students to choose their topics was mostly positive. For example, S8 (11 years' experience), mentioned that there is time to add material and to enrich the students' experience:

"The gifted student wishes that he would be given rich information and rich content … Yes, there is a chance, but the question is whether the school administration will accept it or not? I personally believe that the teacher and pupil in 45 minutes give a chance to adding more materials or topics."

However, he qualified his reply by raising a new problem with the three factors that have been given when he said:

"If we suppose that the students are capable, the time available, and the teacher qualified and all these are ok, but we have to take into account that the additional information that added from teachers or students may affect the basic information in the science textbook."

Thus, offering opportunities for choice does not necessarily mean that these choices should be completely different from the curriculum, but students should be able to add or suggest topics that are related to the main subject.

To sum up, most of the teachers and supervisors of gifted education were in agreement about the need to improve the current science textbook in order to develop positive attitudes towards learning science. In addition, they emphasise the need to increase some activities to give students opportunities to conduct experiments in practical lessons. There was also agreement from the majority (more than a half) of the interviewees that the gifted students should be challenged in their learning in science topics, which would increase the positive attitude to science.

From this theme 'positive attitudes to science', there are several important issues that should be considered in designing the PEP for gifted students in 6th grade to increase the attitudes to science. The topics should be close to the daily life of students and allow gifted students some opportunity to choose their science topics. Moreover, the PEP should be linked to the outside the classroom and include practical activities. Finally, the PEP should be presented in attractive way.

5.8 Thinking Skills

Teachers and supervisors of gifted education were asked to respond to the following main questions: "What kind of higher level thinking skills are encouraged in the current science textbook?" and "What kind of higher level thinking skills should be encouraged by the Proposed Enrichment Programme?" (Appendix K)

Responses from teachers and supervisors were varied, as they attempted to express their view about the science textbook according to their own experiences in teaching. From the teachers' and supervisors' responses, the researcher found several significant issues that may give some understanding about the levels of thinking skills that are included in the ST. Furthermore, these results could help in the design of the proposed enrichment programme. Of the responses that teachers and supervisors offered, the researcher found a combination of features that could shape an understanding of the elements of the skills in the enrichment programme.

In general, the thinking skills addressed by the science textbook do not meet the needs of normal or gifted students. Several major features were found from the teachers' responses: 1) Only lower-order thinking skills are contained in the textbook; 2) Research skills are weak, unsuitable for normal or gifted students and need to be developed; 3) The importance of developing personal skills; 4) Individual differences; 5) The role of teachers.

5.8.1 Only Lower-order Thinking Skills are contained in the Current Textbook

The first and most popular thought about thinking skills in the textbook, on which almost all teachers and supervisors agreed, is that the current science textbook consists only of remembering and understanding skills, which are in the lower order of Bloom's Taxonomy. T6 (14 years in teaching), explained:

> *"The current curriculum consists of reading and memorizing only, and there are no activities that make the pupil think at a high level."*

Another teacher's (T8) explanation clearly supports T6's opinion. He gave a comparison between the current situation in the textbook in Saudi Arabia and another country that has a similar culture. He stated:

> *"We notice that these skills are very weak and do not deal with the topics. For example, in Bahrain we find that they have the same topics that are in our school books and the same programme, but they have inserted thinking skills and topics that are more useful for the pupils."*

Several teachers and supervisors pointed out an important element: that the questions are easy to answer and the information is easy to acquire without any searching or in-depth thinking, which is not satisfactory for either normal or gifted

students. A number of interviewees, such as T1, T2, T5, S6 and S1, mentioned that the use of the textbook might be harmful to students' abilities and skills. For example, S1 stated: "*Unfortunately, the higher level thinking skills do not exist. There are attempts but they are slow and not encouraging*"

One supervisor (S10) expressed the same view when he said:

> *"The curriculum is far from covering these skills and there are only the skills of memorization, understanding and applying".*

Another supervisor S5 (19 years' experience) explained as follows:

> *"Students should know that memorization is important, but it is not everything. We want them to make use of the information and add to it, not just to memorize it."*

Most the interviewees showed their concern at the level of skills in the current textbook; however, the majority of them mentioned that the textbook had been improved in two ways. The first is the layout of the book, and the second is the addition of applications in some lessons and the updating of information. For example, T3 expressed that:

> *"The book looks beautiful and is designed in an excellent way. It attracts the student from outside, and it contains drawings and pictures. But once the student starts to read from the book, he doesn't find anything new".*

S10's description is similar to T3's but with more detail:

> *"The current curriculum is better than before to some extent. It contains intellectual and practical activities, but still it remains very simple and closed, and this is a problem because knowledge is renewable and changing. So we can't limit knowledge in a closed circle. Renewable and changing knowledge means changing the content of the subject. So, if you add a new topic or activity to the subject, that means you add knowledge, but the teacher is not allowed to do so"*

The teachers' and supervisors' responses reflect an important issue, which is the dated nature of the science textbook. This point reflects teachers' concern about the possibility of developing the science textbook for the 21st century.

Teachers' and supervisors' responses were varied as they described their concerns about the textbook's failure to provide basic skills such as analysis, synthesis and

evaluation and creativity. Some teachers and supervisors were surprised about the absence of these basic skills in the science textbook. Some of the supervisors believed that the current science curriculum contains some higher-level skills, but not enough.

For instance, S6 expressed his idea:

> *"Some skills, such as synthesis, don't exist. The teacher does the experiment and the student rarely does it. If the situation is like this, the teacher can't measure the student's creativity because the student just observes the teacher."*

The same person talked more about other skills:

> *"In fact, we should concentrate on the skill of analysis, because it leads the student to learn other skills such as synthesis and evaluation."*

This is confirmed by the following comment from another interviewee (T1):

> *"We always believe that the goal set by the teachers should surpass the primary skills in the classification of Bloom's Scale, such as memorization, recalling and remembering, to the skills of deduction and synthesis. These are the high levels of thinking skills that stimulate and interest the students. If we direct our goals to these skills, we are on the right track".*

This point reflects the limitations of the current textbook in addressing these higher skills, so the teacher went further:

> *"I don't consider myself as a curriculum expert, but some lessons encourage high level thinking skills. The problem is that it is only theoretical and there are no applications to reach the skills of deduction, analysis and evaluation."*

S9 went beyond this and mentioned the top level of thinking skills:

> *"In the science curriculum, creativity is a must. The teacher's main concern is to enter the class and present his subject, and then leave the class. However, if they had some teaching aids, they might be creative."*

5.8.2 Research Skills are Weak, Unsuitable for Normal or Gifted Students and Need to be Developed

The majority of the interviewees strongly expressed the need for research skills to be addressed in the science textbook. They agreed that research skills are essential at this level. Some interviewees, such as T3, T6, T8, and T9 and others mentioned the need to include research skills as essential in the science curriculum for all students at

all stages, whether gifted or others. Teachers and supervisors also believed that the heart of all skills in the science textbook should be research skills. In addition, they pointed out that these skills are very weak or absent in the current curriculum. Teachers and supervisors stressed that research skills are a pre-requisite in the education of the gifted especially, in science subjects.

S5 (19 years' experience), mentioned that:

> *"Scientific research is very important, but it is negatively thought of as something that is tiring and needs great effort. But, we have to research scientifically*"

S3 further stressed the importance of these skills:

> *"The most important skills to be included are research skills, designing skills and summarizing and presenting ideas."*

The same interviewee remarked:

> *"No, our books don't give the student a chance to research. The book is just a group of questions and activities that lead to a direct result. If the student is given a chance to research and the research skill is developed gradually, the education will be better."*

T8 also expressed a similar view: "Really it is very weak in the current curriculum because we are too far from using technology, and our curricula don't develop this aspect of learning"

From some of the interviewees' responses, the researcher found that teachers emphasise the importance of two types of skills, namely scientific research skills and personal skills. Teachers and supervisors believe that these skills are important and should be included in the textbook, as well as in the Enrichment Programme. The responses to these skills occupy a very important issue in science teaching. In addition, they believe that these skills will build the character of the student, especially the gifted. However, some teachers and supervisors believe that personal skills are more important than scientific research skills.

Scientific Skills

The teachers' responses indicated the importance of scientific research skills, and that that these skills should be included in the textbook. In addition, there was an agreement by most of the teachers that scientific research skills are weak in the

textbook, or do not exist. There was disagreement between the interviewees as to the level of these skills that should be included in the science textbook. Some argued that the scientific research skills should be central to the textbook, because they think that this is one of the most important features of science subjects at all stages and not only the primary stage.

Some teachers showed indifference when they talked about research skills. S5 described this when he said: *"No, no, scientific research skills don't exist and I don't expect it to".*

Another teacher (T8) took a softer stance toward (S5)'s idea, though he also believed that:

> *"Really it is very weak in the current curriculum because we are too far from using technology, and our curricula don't develop this aspect."*

Moreover, some teachers stressed the importance of those skills for gifted students. Some of the teachers expressed the difficulty of designing a curriculum for gifted students without the assistance of experts in the field of gifted education. For example, T6 described this as follows:

> "*The curriculum will do this if it is realistic. The student should learn the thinking skills and apply them at home. We should also relate the skills of scientific research with thinking. Finally, it isn't easy to design a curriculum for gifted learners and merge the scientific research skills with thinking. To design a curriculum for the gifted you should seek the help of experts and specialists in this field."*

The same interviewee remarked that:

> *"The scientific skills research is very important, so we have to research scientifically. I think the book fails to stimulate and encourage scientific research in an attractive way."*

Some teachers and supervisors gave examples of the real situation in their schools. These examples clearly showed their disappointment towards science education as well the science textbook. For example, S8 explained:

> ***"****The current curriculum never encourages scientific research skills. If we need the pupil to learn scientific research skills, these skills must be distributed in the curriculum. We could start by specifying the problem, and then the way of*

collecting data from the research sources such as the school, the Internet, scientific books, periodicals, magazines and teachers. In this way, research skills can be spread in the subject of science, but I don't think science as a subject encourages the students to do scientific research. "

Three teachers, T1, S8 and S5, mentioned a similar company (ARAMCO) as an example of the possibility of teaching students research skills in Saudi Arabia. For example, S8 said:

"*If we speak realistically, I could say that companies such as ARAMCO and other companies are participating in enriching the information and the parents themselves are interested in the scientific side. In addition to this, if I want to present scientific subjects, I should surf the internet to collect the information to present to the pupils, but at the same time the pupils themselves are innovative and could collect facts and information that I can't."*

S10, T1 and S8 were able to give many examples to illustrate types of research skills. S8 expressed that:

"Data collection is one of the skills, so we should supply the pupils with all the tools and means of data collection such as the teachers, books, the internet and specialized visitors. The pupils themselves are highly skilled in data collection, and from my experience I know that the family, fathers and mothers, participate in data collection."

5.8.3 The Importance of Developing Personal Skills

From interviewees' responses, a group of skills emerged, such as dialogue, accepting criticism, discussion and cooperative learning. Some teachers called these personal skills, while others did not recognize those skills as a group.

For instance, T6 talked clearly about the needs of gifted students to develop their personal skills. In addition, he provided examples of some personal skills that could be developed in gifted students. He stated:

"The gifted learner may be weak in some personal skills. So, if he is given opportunities to develop such skills, they will encourage him. Many pupils have no ability for group work and this is a very important matter in their personality. If it is included in the curriculum, it will also encourage and benefit them. The book doesn't deal with this issue, and dialogue between the pupils is

not expected in the current textbook. It is only the teacher who does such activities."

An attempt to explain the importance of both the skills of scientific research and personal skills was offered by S1. He stated:

"From my personal experience, the skills of scientific research are not developed in the current textbook, but I think personal skills are more important than scientific skills. Examples of personal skills are communication, dialogue and argument. Even the teachers of gifted learners are very concerned about personal skills".

S1 also pointed out another important issue which is the teachers are not willing to develop personal skills of their students:

"We notice that the system and the time allow the development of personal skills, but the teachers are ignorant about this aspect and the trainers do not draw their attention to it."

S3 and S6 expressed ideas similar to those of S1 in more detail. (S3) said:

"As I have said before, we should determine the skills, whether they are research skills or personal skills. Then the students master and acquire these skills. Then when the students begin to present the information, it will be in the form of dialogue and discussion."

From the above, if the student has acquired research skills or personal skills, he will be able to apply them in other environments. For example, these skills (e.g. dialogue or research skills) could be used in other areas of the curriculum and throughout their life.

5.8.4 Individual Differences

S5 (19 years' experience) stressed a number of issues when he talked about how the science textbook fails to take account of individual differences and is designed in such a way as to ignore two important things, namely the needs of talented students and individual differences in the class. He also added the effect on the behaviour of gifted students if the textbook does not meet their needs:

"I know that the students who finish it in a week will feel that the book is boring and they turn into troublemakers. Research has proved that 70% of gifted students are troublemakers. They understand more than others, and then they

don't know what to do. So, I don't feel that the science textbook stimulates thinking for all students, and it also neglects individual differences. I should present the idea to all the students, and then give special attention and care to the gifted students. Definitely in any class the students are not the same. Some students are better and unfortunately the science curriculum doesn't respond to their needs".

Another supervisor went beyond this when he spoke about all the skills in the textbook. He believed that all skills in the textbook must be designed on the basis of the differences between the students, and that the students themselves should choose the most suitable skills or activities. S9 said:

"Skills depend mainly on individual differences which exist among the gifted learners. It would be better if we could present all kinds of skills and let the students master them according to their mental capabilities."

From above, teachers and supervisors believe that the ST doesn't respect the individual differences between the students and the PEP should be built to respond to the needs of all students including the gifted.

5.8.5 The Role of Teachers

Most of the teachers and supervisors believed that science teachers have a major role in bringing the contents of the textbook to life. However, some of them assumed that it is an excellent science textbook that contains activities that meet the needs of gifted students and others, but that the teacher does not do those activities effectively. Then again, a number of interviewees spoke with a sigh and expressed resentment about the negative role played by some teachers who fail to pay attention to the needs of the student.

For example, S9 described his idea about what teachers were doing in their class in Saudi Arabia as follows: *"The teacher's main concern is to enter the class and present his subject, and then leave".* However, S8 described his view differently:

"*The curriculum has skills that enrich the pupils and he could apply, analyse and synthesize, but the main problem is still the teacher."*

The description offered by S4, is similar but provides more details:

"In fact, the teacher has to possess the abilities and skills to enable them to attract students to science, as well as to enable students to acquire important skills in research and learning. The teacher can expand the students' knowledge if he or she is able to do so, but unfortunately, some teachers do not have those skills."

Moreover, one teacher (T3) raised an important issue, which is the need to train science teachers to deal with gifted students and to identify their needs:

"This depends on the teacher, because he plays an important role in presenting the information, following up the students and knowing about their individual differences. Therefore, the science teacher needs a training course to understand and concentrate on the gifted learners."

On the other hand, one teacher (T7) claimed that the teaching methods pursued in teaching do not fit the nature of science. He said:

"Most of the teachers concentrate on the theoretical side. The teachers should pay special attention to using teaching aids such as videos, graphics, real objects and pictures. In this way they make use of the five senses to reinforce the information in the student's mind."

A very specific issue that was addressed by several of the interviewees is the fact that teachers could develop some skills that are not included in the current textbook. T3 said: *"I don't think the curriculum develops research skills. This depends on the teachers, though: they could do so if they wished."* This notion is supported by another interviewee (T9) who comments specifically on this idea:

"This mainly depends on the teacher because the book doesn't contain research skills. For example, when the teacher asks the pupils to do some research, this will develop the pupils' enrichment. So if the teacher doesn't touch this skill, the curriculum will not develop it."

In summary, most of the interviewees believe that the current science textbook contains reasonable material. On the other hand, they would like to pay more attention to skills such as analysis, synthesis, evaluation and creativity, Moreover, there are some important skills should be considered especially scientific and research skills. The results of this theme suggest that in building the PEP, it is important to take into account a further important issue, which is free thinking. Furthermore, the interviewees stressed that the ST doesn't include some essential skills such as high order thinking and researching scientifically, nor does it address individual needs. Therefore, they

consider that the PEP should be designed to address the individual differences among all students and to develop the personal skills of gifted students such communication, dialogue and argumentation skills.

5.9 Contents and Activities

Science teachers and supervisors of gifted education were asked to respond to the following main questions: "What kinds of activities already exist in the science curriculum that you think are appropriate for gifted learners?" "What kinds of activities should be included in the proposed enrichment programme that you think would be appropriate for gifted learners in 6th grade?" (Appendix K)

The researcher gained a broad picture of the activities in the 6^{th} grade science textbook from the eyes of the science teachers and supervisors in gifted education. The interviewees' responses indicated that they were satisfied to some extent with the content and activities in the textbook, but that it was not sufficient to meet the needs of gifted students. Hence, they also mentioned the need to develop the activities in the textbook for all students, whether normal or gifted. A number of interviewees expressed their dissatisfaction with the level of the activities. They gave evidence to support their claims that all students in the class were bored, especially the gifted. Interviewees further focused on the level of application of activities in the textbook to develop students' abilities and skills.

Moreover, the researcher was hoping to discover how he might make changes in the PEP to meet the gifted students' needs more adequately. A large number of the interviewees expressed positive feelings about the benefits of the proposed enrichment programme, which may help to overcome the disadvantages of the activities in the current textbook**.** They also hope that the enrichment programme will help to meet the needs of gifted students. The most important features of the suggestions from the interviewees were: 1) giving students more freedom in activities, and increasing the element of challenge in the presentation of scientific materials, 2) experimental activities, 3) avoiding ready-made information.

5.9.1 Giving Students more Freedom in Activities, and Increasing the Element of Challenge in the Presentation of Scientific Materials

In general, all interviewees strongly expressed their views about the weakness of the activities in the science textbook. Without exception, they all agreed that the level of most of the activities was a problem. For example, S5 stated, *"Frankly speaking, they are not suitable for them."* This is confirmed by the following comment from another interviewee (T2): *"The activities don't suit the gifted students. The gifted students need more and extra activities".* The same person remarked on a further issue, which reflects the effect of the education system on students' learning:

> *"There are no attractive activities. I mean the activities are not stimulating, and the students work just for the sake of getting marks."*

However, S3 described his view differently:

> *"From my own experience, seven years, I could say that some activities are good, but they aren't properly activated by teachers."*

This notion is supported by one interviewee (T2) who comments specifically on the way of supporting students in their activities. He stated:

> *"Teachers have to make an effort in order to make the students self motivated when doing activities. So, I think, the book doesn't stimulate and encourage scientific research in an attractive way."*

Two supervisors, S2 and S5, talked about the importance of the freedom to be involved in the class and mentioned the appreciation of the confidence given to the gifted, which enabled these students to become self-reliant. S5 said:

> *"I didn't grant freedom its right, because there is a side that is not applied in all our schools. It is learning through playing. This means the pupil learns and enjoys himself at the same time. He is not compelled to learn, but is highly motivated to do so. As teachers, we should give the students a sense of confidence and freedom of expression, and express himself".*

5.9.2 Experimental Activities

A number of interviewees pointed to the weakness of experimental activities in the textbook. Some of the interviewees further focused on the importance of

experimental activities in developing students' abilities. Most of the interviewees strongly expressed the need for experimental activities to be addressed in the science textbook. Moreover, some interviewees mentioned particular types of activities and applications that should be included. A number of interviewees stated that in the present situation, the activities are not up to the aspirations of normal and gifted students. Some teachers went even further, putting the blame on parents and school administrators, and not only on teachers. In addition, one teacher mentioned the teaching methods that are used in the science class.

T3, T6 and T9 talked about practice in classes. T9 said:

> *"The activities are theoretical and there are no practical applications. If there are practical applications as well as tours or visits, the student will be curious. He will also try to raise questions and make inferences"*

A supervisor in this area (S4) provided more details:

> *"To be honest with you, I believe that only 5% of teachers use practical application in the teaching of students in our schools. These types of teaching honestly disappoint most of the students. I do not blame only the teachers or the textbook, but I believe that there is a continuous cycle of supervisors, parents, and head teachers".*

S4 would like to say that the students are disappointed in science classroom because the absence of the practical activities. In addition, S4 believes that the weaknesses of the practical applications on teaching science came from several factors as teachers, textbook, supervisor, head teacher, and parents.

S5 shared the same opinion and pointed out another important issue: *"There is no application, and the teachers attribute this to the lack of equipment in the school".*

Another teacher (T3) from this area expressed that:

> *"Some governmental schools have labs that help teachers to conduct experiments, but even then, I have noticed that they are carried out by the teachers and the students just observe. What I mean is that the student himself should carry out the experiment."*

Again, S4 explained clearly about the loss of students' enthusiasm because of the nature of the activities in the textbook. He said:

> *"Activities in the textbook of science are not alive: they are static. So I can say they do not enhance students' learning. let me give you an example: the*

school has no science fair activities, and the subjects offered to students deal only with the theoretical side, without practical application"

5.9.3 Avoiding Readymade Information

Here, the researcher found that the conversation moved to the simplicity of activities provided for gifted students. A few teachers believe that there are very few appropriate activities, and at the same time, that the material does not try to examine the abilities of students. One of the teachers provided some examples that could help students to develop their skills. Some teachers suggested solutions to help students in their learning.

S8 described his opinion of the suitability of science activities to all students when he said:

"The activities should be suitable and appropriate for all students, but there are no appropriate subjects and topics because they are unexceptional and very simple."

This notion was supported by one supervisor (S10), who commented:

"The curriculum is designed for the ordinary learner, not for the gifted learner. Therefore, it does not satisfy the gifted learner because the activities are simple and shallow. They do not encourage imagination or thinking"

S9 emphasized that from his experience with gifted students, *"The activities that are appropriate to the gifted are very few, very simple and do not stimulate the gifted learner"* and went on to say, "*The activities that challenge the gifted learner are the ones that we need because they will stimulate them."*

Again, S10 explained how to overcome the simplicity of the activities:

"The solution lies in changing the curriculum in order to match the aims and have detailed objectives that can be reached by all"

This was confirmed by the following comment from S5, providing some examples:

"Yes, such as studentship, interviews, communication and competitions. When these activities are added to the curriculum, they will develop the pupils' skills? and stimulate them".

To sum up, the teachers and supervisors agree that there are some weaknesses in the ST which lead to the loss of enjoyment in learning. Furthermore, students could not improve their scientific and research skills because the contents presented in theoretical teaching and with readymade information. Thus, they suggest some ideas to overcome these problems, such as providing more opportunities for gifted students to try more experimental activities and increasing the level of challenge in the PEP by using higher level of thinking.

5.10 Summary

The findings of the analysis of the ST showed that the majority of its contents only meet the first three levels of thinking skills of Bloom's taxonomy. This indicates that the PEP should be designed to give more opportunities for gifted students.

In addition, the questionnaire data showed that the most important theme in the PEP for the gifted students is the "content of knowledge" This reflects the students' views of the inadequacy of knowledge in the ST and their desire to further the development of content knowledge in the PEP. The second important theme in the questionnaires is improving the abilities of gifted students to think critically, scientifically and freely, and gifted students expect that the PEP will give them more opportunities to design their own tasks and evaluate their science activities as well as being able to plan their work and time. The third theme that the gifted students consider necessary in the PEP is practical content.

The data from the interviews elicited several themes; attitudes to science, skills and abilities, and contents and activities. In general, the teachers and supervisors of gifted education clarified different important issues about the ST and the PEP. They suggest that: the topics should be close to the daily life of students and allow gifted students to choose their science topics; the PEP should be linked to the students' learning about their environment; the PEP should be presented in an attractive way; the PEP should pay more attention to the development of skills, such as analysis, synthesis, evaluation, creativity, scientific and research skills in science subjects.

In general, all the data from students and teachers and supervisors indicated that the ST needs to be improved to meet the needs of gifted students in two main areas: the level of thinking skills (e.g. evaluating and creating), and that the topics should be close

to students' daily life and their environment. On the other hand, the data from teachers and supervisors indicated that there is a need to provide more practical laboratory work in the ST, while the findings from students' data revealed that the ST provides opportunities for good practical laboratory work. The next chapter will discuss the results in a way which will facilitate the design of enrichment units for Saudi gifted students.

Chapter 6 Discussion

6.1 Introduction

This study set out to identify the required components of an enrichment programme for gifted 6th grade students in primary schools in Saudi Arabia. In order to address this aim, the study attempted to answer three questions:

1. What is the content of the science textbook in the sixth grade at public schools in Saudi Arabia in terms of learning demand?
2. To what extent does the science textbook in the sixth grade at public schools in Saudi Arabia meet the needs of gifted students?
3. What should be the content of an enrichment programme in the science curriculum in the sixth grade to meet the needs of gifted students?

The research study utilized three data collection tools to answer these questions. Firstly, document analysis of units 5 and 6 of the sixth grade science textbook was carried out using a mixed quantitative and a qualitative approach (sections 5.2 and 5.3). Secondly, two questionnaires were given to 182 gifted students, the first of which was about the current science textbook (ST) and the second about the Proposed Enrichment Programme (PEP). *Chi square* tests were used to compare responses to the questionnaires. The questionnaires were divided into five themes: attitudes to science, abilities and skills, contents, practice, emotional and social needs. Thirdly, interviews were undertaken with ten science teachers and ten supervisors of gifted education in Saudi Arabia. The interview questions were focused on the following themes: attitudes to science, abilities and skills, contents and practice, and mostly reflect those in the questionnaire. There are slight differences among the themes in the questionnaire and interviews, because no data were sought from the interviewees about the cultural issues.

In the previous chapter, the results were presented thematically based on the research questions of this study. The findings of this study have revealed the reality of using of the ST in 6th and what students and teachers think should be in the PEP to meet the needs of Saudi gifted students at this level of education.

This chapter discusses the results in a way that will facilitate the design of enrichment units for gifted Saudi students. Sample materials resulting from the PEP (one lesson each unit) in the light of the analysis of the ST and the students', teachers' and supervisors' views can be found in Appendix L. The researcher is pursuing a systematic discussion of the results in a logical sequence in order to provide evidence and a rationale for the design of the enrichment programme. This approach will help to characterise the elements of the enrichment unit presented at the end of this study. This discussion will identify the needs of gifted students that are met in the PEP (see Appendix L), as well as identify the most important elements that will help to build the PEP from the beliefs and opinions of teachers and supervisors of gifted education in Saudi Arabia.

The researcher will consolidate the findings of this study in this chapter by discussing the data from the three sources (i.e. documentary analysis, student questionnaires, and teacher/supervisor interviews). The following themes have been identified: attitudes to science in general; opportunity for students to give their opinions; flexibility; presenting subjects in attractive ways; emotional needs and cultural and social issues; learning objectives that reflect the level of the activities; level of thinking skills; individual needs; different types of skills: research, personal, scientific and critical thinking skills; the role of teachers in developing skills and abilities; content of knowledge; environmental awareness; resources and advanced technology; experimental activities; teaching methods; and evaluation. These themes clustered into the following five categories: attitudes to science, learning objectives, skills and abilities, contents and activities, and evaluation. Table (6.1) shows the categories and themes which driven from the findings of this study. These were derived from the findings of this study and according Tyler Model and Vantassel-Baska Model (Kind, 2007; Coll, 2007) which contain the main components of curriculum design.

Table 6.1: The categories and themes which driven from the findings of this study.

	Category	Theme
1	Attitudes to Science in General	1. Opportunity for Students to Give their Opinions 2. Flexibility 3. Presenting Subjects in Attractive Ways 4. Emotional Needs and Cultural and Social Issues
2	Learning Objectives that Reflect the Level of the Activities	
3	Skills and Abilities	1. Level of Thinking Skills 2. Individual Needs 3. Different Types of Skills: Research, Personal, Scientific and Critical Thinking Skills. 4. The Role of Teachers in Developing Skills and Abilities
4	Contents and Activities	1. Content of Knowledge 2. Environmental Awareness 3. Resources and Advanced Technology 4. Experimental Activities 5. Teaching Methods
5	Evaluation	

6.2 Category 1: Attitudes to Science in General

All data sources showed that the ST improves gifted students' attitudes to science (section 5.4.2). Furthermore, the findings also showed that gifted students believe that more attention to developing positive attitudes to science should be included in the ST.

The quantitative responses from the gifted students using the ST showed that 69% had a positive attitude to science This is an encouraging percentage, especially with this group of students (gifted students), who need special attention to meet their needs. A possible explanation for the high level of positive attitudes might be that the ST contains a variety of subjects to increase the motivation to learn science, and deals with several issues such as the environment and the human body, thus applying science in their lives (Table 5.1).

However, 90% of the students in this study expect to further improve their attitudes to science (Table 5.8). This reflects the nature and the characteristics of gifted students, who are interested in new topics and enjoy trying new activities, and these findings are similar to those of Jarwan (2002) and Davis and Rimm (2004).

Whilst teachers and supervisors indicated that the ST fosters positive attitudes to science, at the same time, they believed that there is an urgent need to increase positive attitudes to encourage further learning of science. This is partly because of the nature of science, which is different from other subjects. A group of teachers and supervisors expressed this view, as the following quotes exemplify:

> *"According to my experience in teaching, I have noticed that the science curriculum is different because it contains different subjects (physics – chemistry – biology – geology). As I know, these subjects differ in their popularity"* (S10).
>
> "*There are many pupils who are interested in science and react positively to it, and this is what I have noticed through my experience in teaching at primary, intermediate and secondary schools. I noticed that the students are more interested in science than the other subjects*" (T8).

This category is divided into the following themes based on the findings from this study to provide a more detailed discussion.

6.2.1 Theme 1: Opportunity for Students to Give their Opinions

Giving the students more opportunities to express what they think in science topics might increase their positive attitudes to science, and accords with Suror (2003), who emphasises the importance of improving the skills required in expressing ideas and opinions in designing any effective programme for the gifted.

The quantitative data showed that gifted students were not satisfied with the science textbook in this respect, and indicate that there is a need to encourage them to "*give their opinions*" (see Appendix D) in the PEP. In the questionnaire, the gifted students ranked this as the most important item in the theme of 'attitudes to science' (see Table 5.9). The students' views were supported by the data from the analysis of the ST, in that the ST does not expect students to give their opinions.

At the same time, none of the teachers and supervisors mentioned giving their students opportunities to express their opinions in any science subjects. This omission may be an indication that educators in gifted education in this study do not have enough faith in the abilities of their students in this respect, or that they consider that students do not have the right to express their views. For example, Jarwan (2004) mentions that one of the barriers faced in teaching gifted students are a teacher who does not support or allow students to explain their ideas and opinions. This explanation was indicated by one teacher when he said:

> "*At first, I doubted their ability to complete the experience, but at the end it was a surprise to me to see their achievement…We have to expect more than we imagine from our students.*" (T5)

Therefore, it is vital for the PEP to incorporate opportunities for students to give their opinions, and it must also be emphasised to the teachers that they should allow this. For example, the gifted students should be encouraged to evaluate or share their ideas in a science subject.

6.2.2 Theme 2: Flexibility

The second theme of this category is the importance of the flexibility of the science curriculum to develop positive attitudes to science. The quantitative data from gifted students showed that learners were satisfied with the way the current curriculum encourages them to try new activities but they would like more opportunities (section 5.4.2). Moreover, the qualitative data from the educators in this study supported this view. For example "T5: *If our students are given the freedom to begin their learning with participation in the selection of lessons, you'll be surprised at what you see*". This is consistent to some extent with the analysis of the ST, which contains materials that stimulate students to try new activities. At the same time, the gifted students in this study would like the PEP to encourage them even more to try new activities. Perhaps, this reflects the nature of the gifted in their need to try new activities that provoke the motivation to learn. This is consistent with the literature in the field of gifted education (see, for example, Renzulli, 2000; Arsheed *et al*., 2003; Vantassel-Baska, 2004; Davis and Rimm, 2004) and the Minnesota Department of Education (2007) points out that all students should have opportunities to choose subjects or activities based on their abilities, needs and interests.

According to the results of qualitative analysis, teachers and supervisors indicated that the current book does not give gifted and average students enough opportunities to choose or try new activities (section 5.7.6). A possible explanation for the teachers' and supervisors' views might be that they think this would bring a great deal of responsibility, the teachers and supervisors are restricted by time limitations, the education system does not allow such opportunities and the schools suffer from a lack of equipment. It could be argued that the teachers and supervisors should request that more space is provided for students to try activities that are flexible in the light students' interest and abilities. In addition, the data suggests that schools in Saudi Arabia lack laboratory equipment to help teachers in their teaching.

One unanticipated finding mentioned by the educators in gifted education was regarding the issue of whether the Ministry of Education in Saudi Arabia would allow teachers to add or suggest topics (section 5.7.6.). There was disagreement about this issue between teachers and supervisors. Some teachers thought that the Ministry of Education did not allow new topics to be added or suggested; whilst supervisors considered that there is a possibility for teachers and students to propose or add topics.

This difference in opinion reflects a lack of clarity in the interpretation of the objectives within the educational system from some educators in Saudi Arabia. The education system determines that one of the goals of science education at the primary stage is *Development of a love of reading and the use of scientific references and scientific activities* (Ministry of Education in Saudi Arabia, 1988). Some teachers argue that the system does not allow them to do this because of time limitations, or they consider that the purpose of teaching is to finish the book.

A teacher said: *"We noticed that the schools' administration and the Ministry of Education are concerned very much about finishing the curriculum. So, the time factor doesn't permit us to add topics to the curriculum".* (T8)

A supervisor said*: "I do support this as a mechanism, but the educational system doesn't actually allow this"* (S3)

The quantitative findings showed that students should be offered more space and freedom to select and add items that suit them and meet their needs. Thus, the PEP should be designed with more flexibility for learners to choose or try new activities based on their interests or needs (Stein and Poole, 1997; Renzulli, 2000; Davis and Rimm, 2004).

6.2.3 Theme 3: Presenting Subjects in Attractive Ways

Many teachers and supervisors mentioned the importance of the mode of presentation of topics, whether by the teacher or in the ST. Some educators in this study expressed concerns about the traditional methods of teaching the science curriculum. Educators in the current study linked increasing positive attitudes towards science with the avoidance of traditional teaching methods that do not allow students to participate during lessons (section 5.7.3). A possible explanation for this might be that the teachers believe that science is a part of students' daily life and therefore expect it to be naturally interesting and lively for their students (Fredricks *et al.*, 2010). Teachers of gifted students showed their concerns about dissatisfaction of gifted students when the science subjects are taught in a traditional manner like other subjects. For instance, "*I believe that only 5% of teachers use practical application in the teaching of students in our schools. These types of teaching honestly disappoint most of the students"* (S4).

Thus, this suggestion reflects the importance of choosing appropriate methods for any lesson especially with science lessons. The teachers and supervisors in this study stressed the need for an element of excitement in teaching and in the design of the enrichment programme. These findings are consistent with others' research: for example, Maker and Nielson (1995) and Mrnks *et al.* (2000) found that there is not one right approach to lessons for all gifted students because all students are different and their abilities are not the same. Moreover, Geake and Gross (2008) has pointed to the role of the Ministry of Education, which has the responsibility for publishing science textbooks for schools, and which should pay extra attention to the formulation of objectives and activities and the forms in which materials and skills are presented to meet learners' needs.

Another factor linked to this theme is the use of images and illustrations. Quantitative analysis of the ST showed that it contains a good number of illustrations and images related to the objectives and topics of the ST (sections 5.2.2 and 5.2.3). This shows the importance of using images to help students to learn because teachers take much less time to prepare and illustrate lessons via images and pictures for class presentation and teaching.

Others have also demonstrated the importance of the inclusion of images in scientific subjects to support the learning process (Hsu and Yang, 2007). In addition, Stylianidou's (2002:279) findings suggested that *more attention needs to be paid to the*

construction of such images, if they are to function more effectively. The PEP will include some images and pictures related to the lessons that could help students to learn more effectively. (Appendix L)

6.2.4 Theme 4: Emotional Needs and Cultural and Social Issues

The quantitative data showed that gifted students would like to have important issues in culture and society included in the PEP (see section 5.4.6 and Table 5.16). They would also like to increase their self-confidence, and they indicated a need to share their ideas with others. These findings reflect the lack of the ST to meet their needs in these respects, 88% of gifted students expect the PEP to meet their needs in terms of culture and emotional issues while only 60% believe that the ST meets their needs for the same issue.

These findings are partly supported by the findings from Arsheed *et al*. (2003). They found agreement from researchers, teachers and supervisors that the science curriculum in Saudi Arabia at the primary stage gives the environment special attention, but social problems are not given the same attention. There is also an issue that the teachers and supervisors in the current study did not mention: the importance of cultural issues to the student, while they did express their concerns about the emotional needs of all students (section5.4.6). A possible explanation for this might be that the teachers and supervisors think that there are issues that are more important than the cultural issues, which the education system in Saudi Arabia should consider improving as a matter of urgency. Furthermore, they might believe that some other parts of the curriculum address these issues and that this is sufficient to meet the needs of students. The PEP could be built by linking the scientific subjects with Saudi culture and social issues and help to meet their emotional needs such as self confidence or expressing their opinions by sharing their opinions with peers. Furthermore, the PEP would help learners to link their daily live with science topics (see Appendix L : Unit 6).

6.3 Category 2: Learning Objectives that Reflect the Level of the Activities

Learning objectives must be clear and must include all contents and activities. The objectives in any curriculum for gifted students should be designed based on their needs (VanTassel-Baska and Brown, 2007).

Overall, qualitative and quantitative data from the ST in both units (5 and 6) showed that the objectives are not related to the activities in either unit (sections 5.3.1 and 5.3.2). This means that the objectives have been designed separately from the activities and are therefore not always related to the activities. This may be explained by the poor design of the textbook.

The findings are supported by a range of research in gifted education, including Purcell *et al*. (2002), Arsheed *et al*. (2003) Davis and Rimm (2004), and Vantassel-Baska and Brown (2007). For example, Purcell *et al*. (2002:310) point out that *the effectiveness of any curricular unit is built upon strong instructional objectives*" and add that *curricular units with clear objectives receive higher scores than those with vague objectives that require interpretation regarding the learning or student outcomes*. Thus, the PEP should be built with clear objectives which reflect the contents and activities of the PEP.

6.4 Category 3: Skills and Abilities

The third category in this chapter is skills and abilities. The most important findings from the data in this category are: levels of thinking, individual needs, different types of skills (e.g. research, personal, scientific, critical skills) and the role of teachers.

In general, the textbook analysis and the responses from gifted students, teachers and supervisors demonstrated that the ST should be improved to develop gifted students' thinking skills (sections 5.2.2, 5.2.3, and 5.6). Quantitative and qualitative data also revealed a significant need to provide opportunities to expand thinking skills of all students in the 6th grade through the ST (sections 5.8.1 and 5.8.2).

Overall, the responses from the quantitative data from gifted students showed that 84% of these students consider that the PEP will enable them to develop their skills and

abilities more readily than the ST, while only 58% think that the current textbook is adequate to develop their abilities and skills.

6.4.1 Theme 1: Level of Thinking Skills

The findings reflected the importance of developing the abilities and skills of gifted students, which are confirmed by the high percentage (84%) of gifted students who indicated that they hoped to improve their skills through the PEP. This finding is consistent in general with both the qualitative data from teachers' and supervisors' views and the analysis of the ST. It might be the case that all the results reflect the demand to develop skills further in the modern era. There is a need to develop some types of skills and abilities more than ever, especially in the field of science and technology, in the new era of communication. Thus, Halpern (2003:2) states that *the information explosion is yet another reason why we need to provide specific instruction in thinking*. Thomson (2006) emphasised that the development of gifted education is necessary to ensure that students have opportunities to develop their abilities and skills to become the future intellectual, social, economic and cultural leaders.

There was agreement across all the findings of the current study that the thinking skills contained in the ST do not exceed the lower order of Bloom's Taxonomy. Some teachers and supervisors were disappointed about the absence of the basic skills of "*analysis, synthesis and evaluation and creativity*" in the science textbook. This highlights the need to improve the ST to meet the higher level of thinking required by our gifted students. The concern from the teachers and supervisors is consistent with the findings from the analyses of the ST, which showed that the majority of the skills in the ST are focused on remembering, understanding and applying.

The analysis of the ST showed that more than 50% of the materials are at the level of applying (sections 5.2.2 and 5.2.3). However, Unit 5 contains few materials that address the levels of analysing, evaluating or creating. On the other hand, Unit 6 has a good level of material at the levels of analysing and creating (see Tables 5.3 and 5.4). This implies that the majority of skills are lower than the students require.

Accordingly, the PEP should contain all basic thinking skills, including those at higher levels, for the benefit of all students, gifted and non-gifted. This will help to overcome the failure of the ST to meet gifted students' needs and improve their thinking skills. This is in line with Purcell *et al.* (2002), who found that *the gap*

between current curricular units and learning needs of gifted and talented learners is immense. Many programmes have been established to develop gifted students' thinking skills, but these aspects are not included in science textbooks (Purcell *et al.*, 2002; Adams and Pierce, 2008). VanTassel-Baska *et al*. (2007) examined eleven different programmes designed to meet the needs of gifted students. One of the main purposes of these programmes was to increase the level of thinking skills of all students, including gifted students. The programmes showed *some evidence of effectiveness with gifted learners* (VanTassel-Baska, 2007:351). Furthermore, Gady (2006) mentioned that there were many reasons to include and develop higher order thinking skills in gifted programmes, because these programmes would prepare students for their real life, improve learners' social lives and help students to cope with the complexity of life and decision-making. Based on the above view, the importance of higher-order thinking skills is clear, and students should be enabled to participate in lessons and practical experiments that include a range of these skills (Gady, 2006).

Challenge is one of the most important factors in the field of gifted education. Teaching for gifted learners should support them to develop thinking skills in science by providing appropriate levels of challenge (Renzulli, 2000; Davis and Rimm, 2004; Cigman, 2006). The qualitative data showed that many teachers and supervisors expressed their concerns about the lack of challenge in the ST (section 5.8.1). Some of them said that "*challenge is extremely weak*" in the ST and they considered that the role of teachers of gifted students is to provide opportunities to challenge learners' abilities to make more progress.

The analysis of the ST showed that there are no objectives relative to higher levels of thinking. It is difficult to explain this result, but it might be related to failings in the design of the Saudi Curriculum in light of the goals in the education system in Saudi Arabia. It could be argued that the primary science curriculum should be designed in the light of the goals of *primary level* in Saudi Arabia, as well as on the needs of normal and gifted students.

Findings suggest that gifted students require a certain degree of challenge and the opportunity for higher levels of thinking. These interpretations are compatible with Arsheed's *et al*. (2003) and Phillips and Lindsay's (2006) findings. Arsheed *et al*.'s study examined the science curriculum in Saudi Arabia for the primary level. They found that the scientific goals of science curriculum at the primary level in Saudi Arabia do not take into account students' needs to think at a higher level. This

explanation corroborates the findings of CCEA (2006), Collins (2007) and Silverman (2008), which emphasize the needs of all students, not just gifted students, for challenge and opportunities for high levels of thinking to improve their attitudes to learning. Thus, the PEP should provide more opportunities to improve the level of challenge in the science curriculum by including contents and activities that gifted students do not use in their regular science lessons.

This finding concurs with the most recent research about the element of challenge in the curriculum to stimulate gifted students in the classroom (Purcell *et al.*, 2002; Smith, 2005; Taber, 2007; Briggs *et al.*, 2008; Hockett, 2009; Fredricks *et al.*, 2010). Purcell *et al.* (2002:309) stressed in their study that *we must increase the challenge level of curricula for all students, especially students who are advanced learners*. Eyre and Mcclure (2001) suggested some useful ideas for creating challenge in the classroom for gifted students in primary schools, such as using a range of information, role play, decision making, no correct answer, and involving students in planning.

The PEP will increase the level of challenge to meet gifted students' needs and interests and increase their learning by engaging them in activities that challenge their abilities as higher level thinking (see Appendices L). The PEP should help them to think deeply not just copy things down and take notes, memorize, then regurgitate information for exams (Gallagher, 2000).

These findings reflect the limitations and the inability of the ST to meet the needs of all students, not just the gifted. This indicates that the ST needs to be developed and re-built to meet these needs. The responses from the students in the current study confirm this. Students were looking toward the development of the PEP to meet their needs. An important issue here is the nature of science, which requires scientific activities and specific skills that should be developed by the educational process. Taber (2007:13) supports these explanations when he points out that *science should emphasise questions that enable the learners to analyse, synthesise, or evaluate.* Researches in gifted education stress the importance of giving learners opportunities to think more deeply in order to increase their learning outcomes (Salama, 2002; Jarwan, 2004; Hany and Grosch, 2007; VanTassel-Baska and Brown, 2007).

6.4.2 Theme 2: Individual Needs

Overall, the findings of this study showed that there is a need to account for *individual needs* in building the PEP (section 5.8.4). The ST fails to pay special attention to the diversity of learners or to individual needs. This finding concurs with Renzulli (1986), Davis (2009) and Gentry (2009), all of whom have emphasized the need to focus on a wide range of gifts and talents among students of different needs when developing appropriate services for them. This is not surprising, since many studies of gifted programmes stress the need to adapt the curriculum to meet the different needs to gifted students.

Freeman and Josepsson (2002), Davis and Rimm (2004), Smith (2006), and Purcell and Leppien (2009.) all found that research studies frequently reported that the needs of gifted students are different than those of other students. The curriculum must be adapted or designed to serve the distinct needs of the gifted. In general, many teachers and supervisors of gifted education in the current study showed their concern about the shortcomings of the ST in meeting the individual needs of the gifted. This finding is supported by Mariychuk and Petrus (2003:213), who stated that an *education programme must be formed in accordance with the individual demands and interests of the child*. Furthermore, Cooper (2009:285) stressed that each student approaches learning differently from other students, and it is not fair to teach all children the same way, so we should teach children according to their individual abilities. He went further when he said: *To teach all children the same way is patently not fair! A child is an individual with a unique history, ability to learn, and personal style of doing so*. Some supervisors in the current study expressed that there are individual differences in students: *Skills depend mainly on individual differences which exist among the gifted learners. So it is better if we could present all kinds of skills and let the students master them according to their mental capabilities* (S9). But they showed their dismay about the ST - as one supervisor expressed: *Definitely in any class the students are not the same. Some students are better and unfortunately the science curriculum doesn't respond to their needs* (S5).

This result may be explained by the existing system in the Ministry of Education in Saudi Arabia. The science textbooks in all schools in Saudi Arabia are the same and are designed and published by the Ministry of Education. Thus, there is no difference among the textbooks in all schools around the country, which has fourteen regions.

Furthermore, the Ministry of Education demands that all teachers finish the whole textbook, ignoring other important issues such as providing the learners with differentiated activities to develop basic skills. For example, a teacher mentioned this problem when he said: *"We noticed that the schools administration and the Ministry of Education are concerned very much about finishing the curriculum*". (T8)

This may also be due to time limitations and the large number of subjects to be covered. This is consistent with Purcell *et al.*'s. (2002:319) finding in USA schools: *the gap between current curricula units and the leaning needs of gifted learners is immense…. And we welcome suggestions for additions or revisions in the original design*. It might be that the best solution to this problem is the PEP. The PEP will provide appropriate materials to build a bridge between the gap in the ST and the different needs of gifted students.

The PEP will provide gifted students with opportunities to meet their individual needs and make the most of their unique abilities by building the lessons based on their different abilities.

6.4.3 Theme 3: Different Types of Skills: Research, Personal, Scientific and Critical Thinking Skills.

The findings from the quantitative and qualitative data in this study demonstrated two important issues in relation to research, scientific and critical thinking skills. First, the ST doesn't have enough space to develop these skills. (section 5.8.2 and 5.8.3). Secondly, there is a particular need to increase and develop these specific skills among gifted students through the PEP (section 5.8.3 and 5.8.4).

Gifted students in this study showed that they currently regarded the ST as adequate to develop their ability in research skills, personal skills and critical thinking. At the same time, however, they would not wish to stop at this level in their ST but they expect that the PEP should pay more attention to improving their skills. This is also the opinion of the interviewees; one supervisor expressed his view about the shortcomings of the 6th grade textbook with regard to research skills as follows: *"No, our books don't give the student a chance to research. The book is just a group of questions and activities that lead to a direct result. If the student is given a chance to research and the research skill is developed gradually, the education will be better."*(S3)

Another teacher said about the scientific skills: *"Really, scientific research skills are very weak in the current curriculum"* (T8)

This final quote is from a supervisor who talks about personal skills:

> *"From my personal experience, the skills of scientific research aren't developed in the current textbook, but I think personal skills are more important than scientific skills. Examples of personal skills are communication, dialogue and argument. Even the teachers of gifted learners are very concerned about personal skills."* (S1)

Thus, it could be said that there is an agreement among most of the teachers and supervisors that scientific, research and personal skills are weak or non-existent in the textbook.

In light of these findings, it is reasonable to declare that the 6th grade ST is not a suitable textbook to meet the needs of students, including the gifted, with regard to these skills. This finding supports the demands to provide extra attention to expand these specific skills for among gifted students in the science curriculum (Feldhusen, 1994; Chan, 2001). It also concurs with Arsheed *et al*.s' (2003) findings that the research and scientific skills in science textbooks in primary schools in Saudi Arabia do not go beyond the needs of normal students.

This finding has important implications, including opportunities to develop skills through the PEP by redesigning the contents and the activities to meet the needs of all students in the classroom. However, it might be difficult to achieve this if we still have time limitations and inadequate facilities in labs and libraries (Arsheed *et al*., 2003). In addition, there were negative responses from the teachers about improving these skills. There are several possible reasons for this: first, the lack of qualification of science teachers to meet the gifted students' needs (VanTassel-Baska and Johnsen, 2007; Hertberg-Davis, 2009; Tomlinson, 2009), and second, the reluctance of science teachers, because they believe that it is not their responsibility to develop the personal skills. In addition, time limitations do not allow sufficient opportunities to be given to the gifted (Davis and Rimm, 2004).

The PEP will provide some solutions to overcome this problem. Gifted students in this study will find further support to develop these and more opportunities to reach their maximum potential, because the PEP will be built according to their needs and interests (Kaplan, 2009). (see appendix L)

6.4.4 Theme 4: The Role of Teachers in Developing Skills and Abilities

A number of studies in gifted education have reported that teachers should play a major role in overcoming the obstacles faced when developing scientific and research skills among gifted students in their classrooms (VanTassel-Baska and Johnsen, 2007; Geake and Gross, 2008; Hertberg-Davis, 2009).

Several studies in the gifted education literature have identified obstacles that teachers of gifted students face, such as a lack of sustained training, time limitations, lack of equipment, an unsuitable environment, large numbers of responsibilities, and excessive class sizes (Hertberg-Davis, 2009; Sisk, 2009; Burney, 2010). In this study, the qualitative data from the teachers and supervisors showed their concerns about some of these obstacles (section 5.8.5). They mentioned time limitations, the large amount of content and the lack of knowledge and training of some teachers. Teachers and supervisors rationalised the failure to provide adequate help for students to develop their skills and meet their needs in the classroom by thinking the Ministry of Education does not allow them to do this because and is not considered to be their responsibility. Furthermore, teachers and supervisors may assume that the ST contains excellent activities that meet the needs of gifted students and others, but many teachers do not actually do those activities.

For example a supervisor claimed, "*The curriculum has skills that enrich the pupils and that they could apply, analyse and synthesize, but the main problem is still the teacher"* (S8)

A possible explanation for this might be that the authorities have placed many responsibilities on teachers' shoulders, such as finishing the textbook (Hertberg-Davis, 2009). Moreover, they may perceive giving gifted students more attention as highly time consuming and that it takes longer to plan and teach as a result (Hertberg-Davis, 2009). In addition, some science teachers don't have the skills to meet the needs of their students (Sisk, 2009). These findings have important implications, highlighting the need to provide more training programmes for science teachers to enable them to meet the needs of gifted students.

Many teachers also have to improve their knowledge and skills in teaching to avoid focusing only on theoretical aspects in the classroom (VanTassel-Baska and Johnsen,

2007), as this approach does not fit with the nature of the science curriculum (Melber, 2003).

6.5 Category 4: Contents and Activities

This fourth category will be divided into several themes that have emerged from the quantitative and qualitative data. The term "*contents and activities"* used here refers to all the materials that are included in the 6th grade ST in Saudi Arabia, such as concepts, images, questions and activities.

6.5.1 Theme 1: Content of Knowledge

Overall, the quantitative and qualitative data from the analysis of the ST, the questionnaires and the interviews showed that there is agreement about the weakness of the activities in the 6th grade science textbook, and there is a need to develop the contents in the ST to meet the needs of gifted students (sections 5.4.4, 5.4.5, and 5.9.2). The quantitative data from gifted students showed that the most important issue for them, which should be developed in the PEP, is content of knowledge (see Table 5.19). The majority of gifted students (85%) indicated that they would like to have more content knowledge in the PEP, while nearly (77%) of the gifted students would expect the PEP to include practical activities (see Tables 5.12 and 5.14).

In general, these findings reflect the need to provide gifted students with more content and activities in their science curriculum, which is one of the characteristics of gifted students' needs: "*Allow learners to work in breadth, depth and pace suitable to their abilities*" (see Appendix D and Table 5.15). This is supported by several research studies. Gallagher (2000:689) emphasised that modified content should use the same curriculum goals but the material is extended and more in-depth. Monks and Mason (2000) reported that topics or contents should provide a space for gifted students to think in depth and breadth. Davis and Rimm (2004) and Shavinina (2009) reported that gifted students need both depth and breadth of subjects in their curriculum. The PEP will provide content to the learners to think with more depth and breath. (see Appendix L)

6.5.2 Theme 2: Environmental Awareness

The responses from gifted students confirmed that the ST does enable them to be more aware about environmental knowledge, but they believe that the PEP should include more content to meet their needs in these areas (section 5.4.4 and Table 5.13)**.** The possible explanation for this is that gifted students mostly *show a deep interest, they want to understand the everyday phenomena in depth* (Herskovits, 2003:44).

Gady (2006) referred to the development of the skills from his enrichment programme: the contents contain activities that come from real life and the interests of gifted students and provide opportunities to solve real problems that these students might face during daily life or in the future.

The analysis of the ST in the present study showed that there are various subjects that relate to students in their world. For example, the ST contains topics such as *"The Environment and Us, Science Helps Humans to Improve Telecommunication, and Science Helps us to Protect our Health"* (see Table 5.1).

Thus, these diverse subjects will help to meet the need for enjoyment in learning and allow gifted students to have contact with real-world problems (Fredicks *et al*, 2010). The qualitative data from teachers in the current study concurs with this view: for example, one supervisor mentioned*: "The students feel that science is a part of their daily life and expect it to be interesting and lively*". (S7*)*

These findings suggest that there are significant issues that are important to include in the science curriculum: more topics that stimulate learners to discover their world, and trying to solve real local environmental problems in their environment. Furthermore, the demands of gifted students and teachers in this study to improve the contents and activities can be met by building the PEP according to local problems and environment in Saudi Arabia. For example, gifted students regard the content and knowledge in the ST as reasonable, but at the same time, they believe that the PEP should include more content to meet their needs in these areas (see Table 5.13).

6.5.3 Theme 3: Resources and Advanced Technology

The qualitative analysis of the ST found that it does not include any reference to advanced technology or resources (section 5.3). Furthermore, quantitative data from the questionnaire showed that gifted students are not satisfied with their use of advanced

technology and resources (section 5.4.5 and Table 5.15). Some teachers and supervisors showed that there was a lack of opportunities to use technology and resources: *"Really it is very weak in the current curriculum because we are too far from using technology, and our curricula don't develop this side*". (T8)

From the above, it is clear that there was a concurrence among the analysis of the ST among students, teachers and supervisors regarding the weakness of the ST in developing the use of resources or technology. The main responsibility for this problem might lie with the designers of the ST for primary schools in Saudi Arabia, who have ignored the needs of students to use resources or technology (Arsheed *et al*., 2003), the lack of training and of science teachers who are qualified to improve their teaching by using these resources (Tomlinson, 2009), and the weak communication between the resource rooms in schools and regular classroom teachers.

There is clearly a need to provide the teacher and the learner with resources that can help them to improve the teaching and learning process, such as websites, related articles, books or videotapes (Purcell, 2002), and the findings indicate a demand that the PEP should provide opportunities to use advanced technology and resources in teaching and learning.

6.5.4 Theme 4: Experimental Activities

The qualitative data from the analysis of the ST showed that the ST has a good number of laboratory activities, and the student responses showed they seemed satisfied with the laboratory experiments in the ST (sections 5.2.2; 5.2.3; and 5.3.2). On the other hand, the majority of the students wanted more attention paid to lab work in the PEP. Teachers and supervisors indicated that students are not given the opportunity to use the science lab (section 5.9.2).

They raised some issues that contribute to the lack of lab work in science lessons in primary schools. Some schools do not have labs and others are poorly equipped. Moreover, some teachers believed that the students are not sufficiently capable to conduct experiments.

The disagreement between the findings from gifted students and teachers about scientific experiments in lessons is somewhat surprising (sections 5.4.5; 5.7.5 and 5.9.2 and Table 5.15). It is difficult to explain this result, but it might be that experimental activities in the ST are taught in theory, not in an experimental way, because of the lack

of equipment (Arsheed *et al*., 2003). Thus, it might be said that the experimental activities exist in the ST but without application in the lab. This finding is supported by some teachers in this study:

> *"I know some schools where there is no lab that can be used to run scientific experiments in lessons. Unfortunately, we have been using the school's kitchen for our scientific experiments*" (T5)
>
> *"There is no application and the teachers attribute this to the lack of equipments in the school"* (S6)

So a number of factors prevent some students from doing laboratory experiments: the lack of laboratories in schools and equipment in the laboratory (Arsheed *et al*., 2003); teacher's lack of qualification in the implementation of practical work with students (Sisk, 2009) and the fact that some teachers and supervisors do not recognise the importance of laboratory work. These factors were raised by some of the teachers in this study (section 5.9.2). Thus, shortcomings in schools and teacher training might be hindering the provision of opportunities that could help teachers make effective use of laboratories. The concerns of teachers and supervisors in this study should be acknowledged because one of the most important features of science is experimentation (Adams and Pierce, 2008; D'Amico *et al.*, 2010). Therefore, losing this vital advantage of the science curriculum will be very damaging to the motivation and positive attitudes of students. Thus, the PEP will provide more opportunities, based on the interests and needs of the students, for all teachers and students to use the lab in their lessons.

6.5.5 Theme 5: Teaching Methods

The data from teachers and supervisors in this study demonstrated important issues that must be addressed to meet the educational needs of gifted students (section 5.9.3). They elucidated that the activities and topics in the ST should be taught by avoiding theoretical teaching, using experimental activities, and using cooperative learning in the regular classroom (Purcell *et al*., 2002). The interviewees in this study understood that science subjects *should be thought of as a mode of enquiry and not simply a body of knowledge to be learnt* (Coates and Wilson, 2001:97). This idea from Coates and Wilson is consistent with the views expressed by both teachers and supervisors in this study:

> *"From my experience, I think that all the students have a desire to learn science and that they like it. But unfortunately their love for science doesn't last for long and the reason is the teaching methods… the students feel that science is a part of daily life and expect it to be interesting and lively, but they are shocked to find that science is taught like any other subject*" (S7).

Gifted students, teachers and supervisors expected that the PEP would provide more opportunities to develop experimental activities because science is a unique subject. This finding is supported by Coates and Wilson (2001:91), who state that science is an ideal subject to provide motivation in the primary school, and *it should be obviously different from any other subject*. Therefore, science subjects should use a range of appropriate teaching methods to meet the nature of science such as teaching students how, *the scientific ideas contribute to technological change impacting on business and medicine and improving the quality of life* (Grevatt *et al.*, 2007:29).

The qualitative data from the analysis of the ST showed that it provides many activities that give students opportunities to learn independently, but includes few activities that focus on learning in groups (section 5.8.5). Thus, it could be said that the instructions in the ST in 6th grade have been written for the learner as an individual, and not for learning in groups or with others. However, the majority of gifted students would like the PEP to provide them with opportunities to learn in a group of similar learners and to give them a chance to share their ideas with others (see Tables 5.15 and 5.17). This finding is consistent with Kubilius and Whalen (2000:391), who reported that it is important to increase the cooperative and participative teaching of gifted students in *order to create possibilities to negotiate knowledge through the interactions of the learner with other learners, and teachers*.

6.6 Category 5: Evaluation

The term "evaluation" means measuring the progress of students, by programme directors, teachers or students themselves, to assess whether the aims or goals have been met (Davis and Rimm, 2004). Evaluation is *one of the basic components of any curriculum and plays a pivotal role in determining what learners learn and also plays a central role in deciding what teachers teach and how they teach* (Agrawal, 2004:361). The quantitative data from the analysis of the ST and the questionnaire responses from gifted students showed that there are not enough opportunities for

students to evaluate their own work in the current 6th grade curriculum (sections 5.2.2 and 5.2.3). These findings illustrated that the majority of the evaluation elements in both units (5 and 6) are focused on the lowest level of Bloom's taxonomy, which is remembering (around 75%). The second level is applying, which accounts for around 25% of the evaluation material in the units. There are no evaluation questions in either unit that meet the other levels of Bloom's Taxonomy (applying, analysing, and creating).

These findings reflect the need to improve the level of evaluation in the ST. Evaluation should be based on two factors. First, it should consider the learning objectives. Second, it should be built to reflect the achievement of the learning process outcome (Tomlinson, 2009).

In this study, the gifted students expect that the PEP should give them opportunities to evaluate their learning processes and outcomes (section 5.4.3). In addition, they think that the PEP should provide them with opportunities to participate in evaluating the textbook content and activities (section 5.4.3). Davis and Rimm (2004) and (Tomlinson, 2009) reported that an effective programme should have mechanisms for on-going evaluation of programme processes and outcomes. Arsheed *et al*. (2003) found that students were not given enough opportunities to become involved in the evaluation of the science curriculum in Saudi Arabia. The findings in the present study suggest that the PEP should give gifted students more opportunities to participate in evaluating the programme and their learning processes, as recommended by Davis and Rimm (2004) and Watts and Jesus (2007).

6.7 Summary

This chapter has discussed the most important findings of the study which will help to identify the basic elements that should be included when building the PEP for gifted students in light of the needs of these students and the views of teachers and supervisors.

A number of problems and obstacles related to the ST have emerged from the data. One of the most important factors is not giving enough opportunity for learners to express their opinions and share their views with others (peers or teachers). It is hoped that the PEP will help give students adequate opportunities to increase their self-confidence and participation with others, and to suggest new topics. According to the

views of teachers, the goals should be planned and formulated very carefully, which should help to develop the learning outcomes and increase positive attitudes to science.

The discussion in the current study also showed that the PEP should be built to further develop positive attitudes to science among gifted students. Furthermore, the learning objectives of the PEP should not only be designed in light of the general goals of the education system in Saudi Arabia, but also based on the individual needs and interests of gifted students, such as levels of thinking, key skills, and elements of challenge. In addition, the PEP should provide gifted students with more freedom to express their opinions on any subjects in science, and should also provide flexibility to choose topics according to their abilities and skills.

Another important factor is the crucial need to develop certain types of skills and abilities, especially in the field of science and technology, as we are living in a new era of communication and expanding information. It is hoped that the PEP will help to provide adequate opportunities to increase all basic thinking skills, including higher levels of thinking, for all students - gifted or not. This will help to overcome the failure of the ST to develop and meet gifted students' needs. According to the views of teachers, the ST does not pay special attention to the diversity of learners or address individual needs. Thus, the PEP will provide appropriate materials to bridge the gap between the ST and the different needs of gifted students. Moreover, science teachers should have opportunities to provide more training programmes to meet these needs of gifted students, in such areas as scientific and personal skills (section 5.8.5).

The quantitative data showed that the majority of gifted students in this study would like to have more content knowledge in the PEP. The gifted students also hoped for improved activities to meet their need for advanced content in the PEP. Moreover, the findings showed that the PEP should include content containing activities that come from real life and the interests of gifted students, thus providing opportunities to solve real problems that they might face during daily life, or in the future. In addition, this study showed that gifted students need more challenge to stimulate them to learn. This finding suggests that contents and activities in the PEP should be designed on the basis of increasing the element of challenge in the presentation of scientific materials. Furthermore, the findings from gifted students, teachers and supervisors demand that the PEP should provide opportunities to use advanced technology and resources in teaching and learning, as well as more active teaching methods.

The PEP should provide opportunities for gifted students to think deeply and use higher orders of thinking such as analysing, evaluating, and creating. The contents and activities in the PEP should be built to: provide awareness about environmental knowledge, students' real lives and their environment, provide opportunities to use advanced technology and resources, allow gifted students to do more experimental activities and lab work, and help them to learn in groups.

Finally, the evaluation elements of the PEP should provide opportunities to evaluate students' learning and progress in light of the unit objectives. The evaluation questions in the PEP should focus on all levels of thinking, and not just on the lowest levels.

Chapter 7 Conclusions and Recommendations

7.1 Introduction

The main objective of the present study was to contribute to the gifted education programmes in Saudi Arabia by exploring to what extent the 6th grade science textbook meets the needs of gifted students in the classroom, and what should be done to address these needs via the Proposed Enrichment Programme (PEP). In this study, a mixed-methods approach was used via the analysis of the 6th grade science textbook, questionnaires and interviews. There were three main research questions within this study:

1. What is the content of the science textbook in the sixth grade at public schools in Saudi Arabia in terms of learning demand?
2. To what extent does the science textbook in the sixth grade at public schools in Saudi Arabia meet the needs of gifted students?
3. What should be the content of the enrichment programme in the science curriculum in the sixth grade to meet the needs of gifted students?

This chapter presents conclusions, recommendations and suggestions for future research. It also acknowledges the limitations of the study.

The conclusions of this research emerged from a fair consideration of the data analysis and discussion of findings.

The research presented in the previous chapters has outlined the history of gifted education, the definitions of giftedness, gifted programmes and gifted education in Saudi Arabia. A number of studies have indicated the importance of differentiation programmes to meet the needs of gifted students, and have advocated that these programmes should be presented within their social sphere in the community, and not

in isolation from the natural environment. Studies have shown that programmes for gifted students should be integrated naturally into the school environment, and that students should undertake these programmes alongside their peers in age and grade. Thus, these gifted education programmes are more likely to have a deep impact on gifted students, both within and outside the school. In short, gifted programmes should meet students' psychological needs within their social environment, not in isolation from the community in which the gifted student lives.

Many programmes in different subjects are offered to gifted students. The most important and most widely used programmes are enrichment programmes and those that offer acceleration and guidance. Enrichment programmes can be arranged within or outside school. Enrichment programmes within the school take place either during or outside school hours, either after school or at the weekend. Some enrichment programmes are held in dedicated gifted education centres or on university campuses during the summer.

There are many established programmes in Saudi Arabia, both within and outside schools. Most of these programmes serve all students at all levels in public schools. However, all gifted programmes in Saudi schools are delivered to gifted students outside their regular classrooms. Thus, the aim of the current study is to gather evidence in order to create units for an enrichment programme to be delivered to gifted students within their classrooms.

This study has attempted to determine the most important elements and features of an enrichment programme for the 6th grade science curriculum in Saudi Arabia. Three main tools have been used to collect the data: analysing the 6th grade science textbook, eliciting gifted students' views through questionnaires, and eliciting teachers' and supervisors' views through interviews. Samples of gifted students, science teachers and supervisors of gifted education were asked to give their views about the current 6th grade science textbook and what should be included in the PEP to meet the needs of gifted students at this level. The results were presented thematically based on the research questions of this study. The findings have revealed the reality of using of the standard science textbook (ST) in the sixth grade, and what students and teachers think should be in the PEP to meet the needs of Saudi gifted students at this level.

7.2 The Main Findings and the Contributions of this Study

This section provides an overview of the key findings and the contributions of this study to answer the research questions. A number of issues have emerged from the discussion of the data. The findings of the current study have sixteen themes which were explained in details in Chapter 6. The themes are: 1. attitudes to science in general; 2. more opportunity for students to give their opinions; 3. flexibility; 4. presenting subjects in attractive ways; 5. emotional needs and cultural and social issues; 6. the learning objectives that reflect the level of the activities; 7. level of thinking skills; 8. individual needs; 9. different types of skills: research, personal, scientific and critical thinking skills; 10. the role of teachers in developing skills and abilities; 11. content of knowledge; 12. environmental awareness; 13. resources and advanced technology; 14. experimental activities; 15. teaching methods; and 16. evaluation.

One of the most important shortcomings identified in the current textbook is that it does not give enough space for learners to express their opinions and share their views with others (peers or teachers) in order to develop positive attitudes to science. Therefore, the PEP should give students plenty of opportunities to increase their self-confidence, to collaborate with others and to suggest new topics. Moreover, teachers' views emphasised that the goals and learning objectives, should be planned and formulated very carefully if they are to help to develop the learning outcomes and encourage positive attitudes to science in the PEP.

To help our gifted students to further develop positive attitudes to science in their science curriculum and the PEP, there is an urgent need for the following intensive work:

First, the PEP should have flexible learning objectives, have an interesting design and build its learning objectives in accordance with cultural issues. Second, Saudi science teachers need more training in teaching gifted students to meet the needs of the gifted students. Third, the 6^{th} grade ST requires urgent modification to develop the level of thinking through the learning objectives, and to provide increased levels of challenge: it is hoped that this will be achieved in the PEP.

Another important issue is the need to develop the use of advanced technology and resources, especially in the field of science and technology, in order to equip students for their lives in this era of advanced communication.

To overcome the shortcomings of the ST in meeting gifted students' needs in terms of developing thinking skills, the PEP should provide adequate opportunities to increase all basic thinking skills, including higher levels of thinking, for all students, gifted or non-gifted. Because the ST does not pay special attention to the diversity of learners or individual needs, the PEP should provide appropriate materials to bridge the gap between the ST and the different needs of gifted students.

The findings of this research study showed agreement across all instruments regarding the weakness of the activities in the 6th grade science textbook. Thus, it is necessary to develop the contents and activities in the ST to meet gifted students' needs to think in broadly and deeply.

The findings of this study showed that the contents and activities of the ST are weak because they have been built to meet the first three levels of thinking skills of Bloom's taxonomy (i.e. remembering, understanding, and applying). Thus, the PEP should be based on two important factors: *advanced scientific content knowledge and a variety of higher order thinking skills* (Yoon , 2009: 205). Therefore, this study considers that in order to enable gifted students to fulfil their potential when teaching science in the regular classroom, it is necessary to provide further contents and activities that require high levels of thinking, as provided by the PEP.

The gifted students believe that the PEP should include more content about the students' environment in order to meet their needs in these areas, because they believe that the ST does not fully enable them to be more aware of these issues**.** Thus, the PEP should contain activities that come from real life and reflect the interests of gifted students, and should give them opportunities to deal with problems that they might face during daily life or are likely to encounter in the future.

Furthermore, the findings from gifted students and teachers in this study showed a demand to improve the contents and activities in the science curriculum via the PEP to reflect daily life that may include local problems and the environment in Saudi Arabia.

There was agreement among the interviewees and gifted students in this study about the lack of challenge in the activities in the 6th grade ST. The findings in this study clearly showed that there is a need for more challenge to stimulate gifted learners to learn.

There was concurrence among the findings from the qualitative analysis of the ST and the interviews with gifted students, teachers and supervisors about the ST's

inability to develop the use of resources or technology. It could be said that this weakness is caused by a lack of teacher training in this area and a shortage of science teachers who are qualified in this regard (Tomlinson, 2009).

The findings from teachers and supervisors also showed that students are not given opportunities to use science labs, because some schools do not have labs and others are not fully equipped. Moreover, many teachers believe that the students are not qualified to conduct experiments. For example, one teacher said *"I know some schools where there is no lab that can operate the scientific experiments in the lessons. Unfortunately, we have had to use the school's kitchen for our scientific experiments"* (T5).

Finally, the majority of the evaluation elements in both units 5 and 6 of the ST are limited to the lowest level of Bloom's taxonomy (i.e. remembering, understanding, and applying). There are no evaluation questions to meet the higher levels of Bloom's Taxonomy (e.g. analysing and creating).

These findings suggest that the PEP should give gifted students opportunities to evaluate their learning processes and outcomes, participate in evaluating the textbook and contribute to the evaluation of the enrichment programme.

7.3 Recommendations and Future Work

The findings of this study and the literature review of gifted education lead to the following recommendations related to enrichment programmes in science for gifted students. Further research is needed to extend the work in this study, not just within the science curriculum but also in all other subjects. For instance, T3 suggested "*If we design a programme in one book which included some other subjects such as unit for science, Arabic and units from all the curricula, it will be more beneficial if we present all the enriching units to all the students"*. Furthermore, it would be worthwhile to conduct similar studies in secondary and high schools. This study was conducted in gifted boys' schools in Saudi, which might, therefore, call for further research in gifted girls' classrooms.

Furthermore, the study's results suggested several areas that need further research, such as studies in universities on other subjects. The Ministry of Education in Saudi Arabia should provide science teachers with more training in teaching gifted students. For example, T3 said: "*Therefore, the science teacher needs a training course to know about and concentrate on the gifted learners*".

Therefore, the continuous professional development master plan for teachers in Saudi Arabia should include topics related to gifted education. These topics should cover: use appropriate teaching strategies (including differentiation strategies), integrating thinking and research skills into the academic content, link the curriculum with the problems of their communities and environments, and provide a learning environment that encourages creativity. Moreover, Ministry of education in Saudi Arabia should qualify and train teachers of the gifted to have the necessary teaching skills to implement these strategies.

There is an obvious need to review the qualification programmes for science teachers to help them to meet the needs of gifted students in primary schools in Saudi Arabia (section 5.8.5 and 6.4.4). In addition, the qualification programmes for science teachers should help them to recognise and address the individual needs of gifted students. Furthermore, there is a need to review and improve the contents and activities of the science textbooks in primary schools in Saudi Arabia to meet the needs of all students, including those who are gifted in this area. The findings of this research study show a clear vision about what should be done to improve the current science curriculum in Saudi Arabia to assimilate the gifted students.

The findings of this research study show that there is a need to accommodate gifted students to be challenged in the science curriculum and nurture research, thinking, and personal skills.

Future work may be needed to try out and evaluate the PEP materials with students in 6th grade and teachers.

7.4 Limitations of Study

This study has several limitations. This study is limited to gifted students (boys) in the 6th grade who have been identified as gifted by the Ministry of Education, and to science teachers and supervisors (male) of gifted education. Thus, participation in this study was limited to male gifted education centres because that was the only population to which the researcher could have access. The results of the study cannot be generalised for the entire population (female and male) of Saudi students and educators.

Another limitation of this study derived from the number of volunteers who participants were chosen by the Administration of Gifted Centres in Ministry of Education. Therefore, it is important for future studies to increase the number of

respondents of teachers and supervisors from other regions of Saudi Arabia. In addition, the gifted students who participated in this study were chosen by the Administration of Gifted Centres in Ministry of Education. This study is limited to the 6th grade science textbook for public schools in Saudi Arabia. Thus, the results of this study are limited to science and not other subjects in the curriculum. The original intention in this study was to try out some of the PEP materials with teachers and students. This would have been advantageous, but this did not prove possible under the circumstances.

Summary

Finally, this study sought to find out the most important elements and features of a science enrichment programme for 6th grade in Saudi Arabia via examining the current science textbook and understanding gifted students' and educator's view. The current study showed that there is a requirement action to meet gifted students needs in science curriculum in their classroom. Hopefully, the PEP would bridge the gap between the shortcoming of the ST and Saudi gifted students' needs.

References

ABOZNADH, N. 2006. Experience of Gifted Programmes in Science: the Difficulties and Challenges. *Regional Scientific Conference for Giftedness.* Jeddah, Saudi Arabia.

ADAMS, C., CHAMBERLIN, S., GAVIN, M. K., SCHULTZ, C., SHEFFIELD, L. J. & SUBOTNIK, R. 2008. The STEM Promise: Recognizing and Developing Talent and Expanding Opportunities for Promising Students of Science, Technology, Engineering and Mathematics. Washington, DC: National Association for Gifted Children.

ADAMS, C. M. & PIERCE, R. L. 2008. Science, elementary. *In:* PLUCKER, J. A., CALLAHAN, C. & M., M. R. (eds.) *Critical issues and practices in gifted education.* Waco, TX:: Prufrock Press.

AGRAWAL, M. 2004. Curricular reform in schools: the importance of evaluation. *Journal of Curriculum Studies,* 36**,** 361 - 379.

AL-HAKEEL, S. 2003. *The education policy of Saudi Arabia.*, Dar Am Al Kutub.

ALJUGHAIMAN, A. 2005a. *The School Enrichment Model.,* Alriyadh, KACFG.

ALJUGHAIMAN, A. 2005b. *The School Programme to Foster the Gifted.,* Alriyadh, The Ministry of Education.

ALJUGHAIMAN, A. 2010. The Effect of the Oasis Enrichment Model on the Creative Thinking Skills of Gifted Students.

ALJUGHAIMAN, A. & MAJINEY, O. 2009. An evaluation of the gifted enrichment program in the Saudi public education schools in the light of the criteria of enrichment programs quality.

ALJUGHAIMAN, A., MAJINEY, O. & BARAKAT, A. In Press. The role of Oasis Enrichment Model in Developing General Classroom Performance, thinking and research skills of gifted students in Saudi public education schools. *JOURNAL OF THE SOCIAL SCIENCES, Aliman MUhamma bin Saud Islamic University*.

ALSONBLE, A., ALKATEEP, M., MOTOALY, M. & ABDULJAWAD, N. 2004. *System Of Education In Kingdom of Saudi Arabia,* Riyadh, Daar Alkhareji.

ANDERSON, L. W., KRATHWOHL, D. R., AIRASIAN, P., CRUIKSHANK, K., MAYER, R., PINTRICH, P., RATHS, J. & WITTROCK, M. C. 2001. A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives,(Abridged Edition). *New York: Longman***,** 302.

ARMSTRONG, T. 2009. *Multiple Intelligences in the Classroom* Alexandria, ASCD.

ARSHEED, A., BASAHI, A., ALOWAIS, A., ALRWAISHED, M., ALRWAILY, M. & ALSUAIK, H. 2003. *Study of Teaching science in both elementary and Middle schools stages in Boys and Girls schools in Saudi Arabi,* Riyadh, King Abdulaziz City for Science and Technology.

ATAS, H. & TWFEEK, H. 2006. King Fahad University Experience of Apply Enrichment Programme in Summer 2004. *Regional Scientific Conference For Giftedness.* Jeddah. Saudi Arabia.

AVERY, L. D., VANTASSEL-BASKA, J. & O'NEILL, B. 1997. Making evaluation work: One school district's model. *Gifted Child Quarterly***,** 28-37.

AWANBOR, D. 1991. Teachers and Their Gifted Children in the Classroom: A Perceptual Analysis. *Gifted Education International,* 7**,** 82-84.

AXINN, W. 2006. *Mixed Method Data Collection Strategies,* CAMBRIDGE, CAMBRIDGE UNIVERSITY PRESS.

BARNETT, L., ALBERT, M. E. & BRODY, L. 2005. The Center for Talented Youth talent search and academic programs. *High Ability Studies,* 16**,** 27-40.

BERG, B. 2007. *Qualitative research methods for social science.,* U.S.A, Pearson education.

BETTS, G. T. 2003. The Autonomous Learning Model for High School Programming. *Gifted Education Communicator: A Journal for Educators and Parents*.

BRIGGS, C. J., REIS, S. M. & SULLIVAN, E. E. 2008. A National View of Promising Programs and Practices for Culturally, Linguistically, and Ethnically Diverse Gifted and Talented Students. *Gifted Child Quarterly,* 52**,** 131-145.

BRYMAN, A., BECKER, S. & SEMPIK, J. 2008. Quality Criteria for Quantitative, Qualitative and Mixed Methods Research: A View from Social Policy. *International Journal of Social Research Methodology.,* 11**,** 261 - 276.

BUDARI, N. & BAHEBERY, M. 2010. Saudi Arabia Eexperience of Gifted Education Ministry of Education in Saudi Arabia

BURNEY, V. H. 2010. High Achievement on Advanced Placement Exams: The Relationship of School-Level Contextual Factors to Performance. *Gifted Child Quarterly,* 54**,** 116-126.

CALIFORNIA STATE BOARD OF MINISTRY OF EDUCATION. 2005. *Recommended Standards for Programs for Gifted and Talented Students* [Online]. California. Available: http://www.lausd.net/lausd/offices/GATE/gate05standards.pdf [Accessed 12 10.2010].

CHAN, D. W. 2001. Learning Styles of Gifted and Nongifted Secondary Students in Hong Kong. *Gifted Child Quarterly,* 45**,** 35-44

CHEN, J., MORAN, S. & GARDNER, H. 2009. *Multiple intelligences around the world,* Jossey-Bass.

CIGMAN, R. 2006. The Gifted Child: a Conceptual Enquiry. *Oxford Review education,* 32**,** 197-212.

CLARK, P. B. & GONZALEZ , V. 2002. *A validated model for the identification of gifted bilingual students.*, NABE News.

CLEARINGHOUSE ON DISABILITIES AND GIFTED EDUCATION. 2003. *Gifted and Talented Programmes* [Online]. Available: http://www.hoagiesgifted.org/eric/index.html [Accessed 03 2007].

COATES, D. & WILSON, H. 2001. science. *In:* EYRE, D. & MCCLURE, L. (eds.) *Curriculum Provision for the Gifted and Talented in Primary School.* Oxon: A NACE/Fulton Publication.

COHEN, L., MANION, L. & MORRISON, K. 2000. *Research Metodes in Education,* London, RoutledgeFalmer.

COHEN, L., MANION, L. & MORRISON, K. 2007. *Research Methods In Education,* Oxon, Routledge.

COHEN, L. M. 1990. Meeting the Needs of Gifted and Talented Minority Language Students. *In:* COUNCIL FOR EXCEPTIONAL CHILDREN, R., VA (ed.). ERIC Clearinghouse on Handicapped and Gifted Children, Reston, VA.

COLEMAN, L. & CROSS, T. 2000. *Social Emotional development and the Personal Experience of Giftedness International Handbook of Giftedness and Talent.,* U.K, Elsevier Science Ltd.

COLL, R. K. 2007 Opportunities for gifted science provision in the context of a learner-centred national curriculum. *In:* TABER, K. S. (ed.) *Science Education for Gifted and Talented.* Oxon: Routledge.

COLLINS, S. 2007. The Unserved, Under-Served, and Inappropriately Served: educating gifted and Talented Minority Students. *Gifted Education Press Quarterly,* 21**,** 4-9.

COOPER, C. R. 2009. Myth 18: It is Fair to Teach all Children the Same Way. *Gifted Child Quarterly,* 53**,** 283-285.

CORBETTA, P. 2003. *Social Research Theory, Methods and Techniques,* London, SAGA.

COTTRELL, S. 2005. *Critical Thinking Skills Developing Effective Analysis and Argument,* Basingstoke, PALCRAVE MACMILLAN.

COX, J., DANIEL, N. & BOSTON, B. 1985. *Educating Able Learners,* Austin, University of Texas Press.

CROPLEY, A. J. & URBAN, K. K. 2000. Programs and Strategies for Nurturing Creativity. *In:* HELLER, K. A. (ed.) *International Handbook of Research and Development of Giftedness and Talent.* 2nd ed. Oxford: Elsevier Science Ltd.

CUREBAL, F. 2004. *Gifted Students' Attitudes Towards Science and Classroom Environment Based on Gender and Grade Level.* THE DEGREE OF MASTER OF SCIENCE, MIDDLE EAST TECHNICAL UNIVERSITY.

D'AMICO, J., GALLAWAY, K. & SHERWOOD, D. L. 2010. *Differentiated Instruction for the Middle School Science Teacher Activities and Strategies for an Inclusive Classroom,* San Francisco, JohnWiley & Sons, Inc.

DAI, D. 2009. Essential Tensions Surrounding the Concept of Giftedness. *In:* L, S. (ed.) *International Handbook on Giftedness.* Canada: Springer

DANNENBERG, A. C. 1984. Meeting the Needs of Gifted & Talented Bilingual Students: An Introduction to Issues and Practices. *In:* EDUCATION, Q. M. D. O. (ed.). Office for Gifted and Talented.

DAVID R. KRATHWOHL, BENJAMIN S. BLOOM & BERTRAM B. MASIA 1964. *Taxonomy of Educational Objectives the Classification of Educational Goals Handbook: Affective Domain*, Longmans, Green and coltd.

DAVIS, G. & RIMM, S. 2010. *Education of the gifted and talented,* Needham Heights, MA, Allyn and Bacon.

DAVIS , G. A. & RIMM, S. B. 2004. *Education of The Gifted and Talented.,* Boston, Person Education, Inc.

DAWSON, C. 2007. *A Practical Guide to Research Methods a User-Friendly Manual fo Mastering Research Techniques and Projects.,* U.K., How to Books Ltd.

DE BONO, E. 1999. *Six Thinking Hats.,* StIves plc., Clays, Ltd.

DEPARTMENT FOR EDUCATION IN THE UK. 2007. Available: www.education.gov.uk/ [Accessed 10. 12. 2007].

DEVETAK, I., VOGRINC, J. & GLAŽAR, S. A. 2010. States of matter explanations in Slovenian textbooks for students aged 6 to 14. *International Journal of Environmental & Science Education,* 3**,** 217- 235.

DUNN, D. 2008. *Research Methods for Social Psychology*, A John Wiley and Sons, Ltd, Publication.

ELY, M., ANZUL, M., FRIEDMAN, T., GARNER, D. & MCCORMACK STEINMETZ, A. 2003. *Doing Qualitative Research,* Philadelphia, The Falmer Press.

ESAM, A. 2006. The Strategic of Discovering the Gifted Students in Arts. . *In:* ARABIA., K. A. H. C. F. F. T. G. S. (ed.) *Regional Scientific Conference for Giftedness.* Saudi Arabia. Jeddah.: King Abdulaziz & His Companions Foundations for the Gifted. Saudi Arabia.

EYRE, D. & MCCLURE, L. (eds.) 2001. *Curriculum Provision for the Gifted and Talented in Primary School: English, Maths, Science and ICT.*

, London: David Fulton Publishers Ltd,.

FELDHUSEN, J. 1994. *Strategies for Teaching the Gifted. Comprehensive Curriculum for Gifted Learners,* U.S.A., A Longwood Professional Book.

FELDHUSEN, J. E. & JARWAN, F. A. 2000. Identification of Gifted and Talented Youth for Educational Programs. *In:* HELLER, K. A. (ed.) *International Handbook of Research and Development of Giftedness and Talent.* 2nd ed. Oxford: Elsevier Science Ltd.

FELDHUSEN, J. F. & KOLOFF, M. B. 1979. A three-stage model for gifted education. *Gifted Child Today,* 1**,** 53-58.

FELLEGI, P. 2003. *Survey Methods and Practices,* Canada, Ministry of Industry.

FLICK, U. 2002. *An Introduction to Qualitative Research,* London, Saga Publications.

FOREHAND, M. 2005. *Bloom's Taxonomy: Original andRevised* [Online]. Available: http://projects.coe.uga.edu/epltt/ [Accessed 10. 05. 2010].

FREDRICKS, J. A., ALFELD, C. & ECCLES, J. 2010. Developing and Fostering Passion in Academic and Nonacademic Domains. *Gifted Child Quarterly,* 54**,** 18-30.

FREEMAN, J. & JOSEPSSON, B. 2002. A Gifted Programme in Iceland and its Effects. *High Ability Studies,* 13**,** 35-46.

GALLAGHER, J. J. 2000. Changing Paradigms for Gifted Education in the United States

In: HELLER, K. A. (ed.) *International Handbook of Research and Development of Giftedness and Talent.* 2nd ed. Oxford: Elsevier Science Ltd.

GEAKE, J. G. & GROSS, M. U. M. 2008. Teachers' Negative Affect Toward Academically Gifted Students: An Evolutionary Psychological Study. *Gifted Child Quarterly,* 52**,** 217-231.

GENTRY, M. 2009. Myth 11: A Comprehensive Continuum of Gifted Education and Talent Development Services: Discovering, Developing, and Enhancing Young People's Gifts and Talents. *Gifted Child Quarterly,* 53**,** 262-265.

GIFTED ASSOCIATION OF MISSOURI 2004. A Guide For Developing Gifted Curriculum Documents. Missouri: Gifted Association of Missouri.

GLINER, J. A. & MORGAN, G. A. 2000. *Research methods in applied settings: an integrated approach to design and analysis*, Lawrence Erlbaum.

GREVATT, A., GILBERT, J. & NEWBERRY, M. 2007. Challenging able science learners through models and modelling. *Science education for gifted learners***,** 85–99.

GRIGORENKO, E. L. 2000. Russian Gifted Education in Technical Disciplines" Tradition and Transformation. *In:* HELLER, K. A. (ed.) *International Handbook of Research and Development of Giftedness and Talent.* Oxford: Elsevier Science Ltd.

HALPERN, D. F. 2003. *Thought and Knowledge: An Introduction to Critical Thinking* New Jersey, Lawrence Erlbaum Associates, Inc.

HANY, E. & GROSCH, C. 2007. Long-Term Effects of Enrichment Summer Courses on the Academic Performance of Gifted Adolescents. *Educational Research and Evaluation,* 13**,** 521-537.

HELLER, K., MONKS, F. & PASSOW, A. 1993. Development of Giftedness and Talent. *International Handbook of research and Development of Giftedness and Talent.* England.: Pergamon.

HERSKOVITS, M. 2003. Developing Programmes for Science Minded Children at the Age of 7-12 *In:* CSÉRMELY, P. & LEDERMAN, L. M. (eds.) *Science education: talent recruitment and public understanding.* Budapest: IOS Press.

HERTBERG-DAVIS, H. 2009. Myth 7: Differentiation in the Regular Classroom Is Equivalent to Gifted Programs and Is Sufficient: Classroom Teachers Have the Time, the Skill, and the Will to Differentiate Adequately. *Gifted Child Quarterly,* 53**,** 251-253.

HEWTON, J. 2002. *Definitions of Giftedness,* The Queensland Association for Gifted and Talented Children Inc, .

HICKEY, M. G. 1990. Classroom teachers' concerns and recommendations for improvement of gifted programs. *Roeper Review,* 12**,** 265-267.

HOCKETT, J. A. 2009. Curriculum for Highly Able Learners That Conforms to General Education and Gifted Education Quality Indicators. *Journal for the Education of the Gifted,* 32 394-440.

HSU, P.-L. & YANG, W.-G. 2007. Print and image integration of Science texts and reading comprehension: A systematic function linguistics perspective. *nternational Journal of Science and Mathematics Education,* 5**,** 639-659.

HTTP://WWW.COE.UGA.EDU/EPLTT/BLOOM.HTM. [Accessed 01.03. 2010].

ISAKSEN, S., DORVAL, K. & TREFFINGER, D. 2000. *Creative Problem Solving: An Introduction*, Prufrock Press.

JARWAN, F. 2002. *Creativity.,* Amman, Daar Alfiker.

JARWAN, F. 2004. *Giftedness, Talented, and Creartivity,* Amman, Daar Alfiker.

JOHNSEN, S., VANTASSEL-BASKA, J. & ROBINSON, A. 2008. *Using the National Gifted Education Standards for University Teacher Preparation Programs*, Corwin Press.

JOHNSON, R. B. & ONWUEGBUZIE, A. J. 2004. Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher, ,* 33**,** 14-26.

JOHNSON, R. B., ONWUEGBUZIE, A. J. & TURNER, L. A. 2007. Toward a Definition of Mixed Methods Research. *Journal of Mixed Methods Research,* 1**,** 112-133.

KAPLAN, S. 1986. The grid: A model to construct differentiated curriculum for the gifted. *In:* RENZULLI, J. S. (ed.) *Systems and models for developing programs for the gifted and talented.*

KAPLAN, S. N. 2009. Myth 9: There Is a Single Curriculum for the Gifted. *Gifted Child Quarterly,* 53**,** 257-258.

KIND, V. 2007. Context-based science: a 'gift horse' for the talented. *In:* TABER, K. S. (ed.) *Science Education for Gifted Learners.* Oxon: Routledge.

KING ABDULAZIZ & HIS COMPANIONS FOUNDATIONS FOR THE GIFTED, K. 2008. Annual Report. Riyadh: King Abdulaziz & His companions foundations for the Gifted

KRATHWOHL, D. 2002. A Revision of Bloom's Taxonomy: An Overview',. *Theory Into Practice,* 41**,** 212 - 218.

KUBILIUS, P. O. & WHALEN, S. P. 2000. The Education and Development of Verbally Talented Students. *In:* KURT, A. H. (ed.) *International Handbook of Research and Development of Giftedness and Talent.* 2nd ed. Oxford: Elsevier Science Ltd.

LAWTON PUBLIC SCHOOL. 2010. *Gifted and Talented Information* [Online]. Available: http://www.lawtonps.org/news.shtm [Accessed 02.01. 2011].

LAWTON PUBLIC SCHOOLS 2006. GIFTED EDUCATION PLAN. *In:* BARRY, B. (ed.). Lawton: STATE DEPARTMENT OF EDUCATION.

LEROUX, J. A. 2000. A Study of Education for High Ability Students in Canada: Policy, Programs and Student

Needs. *In:* HELLER, K. A. (ed.) *International Handbook of Research and Development of Giftedness and Talent.* 2nd ed. Oxford.

LEWIN, C. 2005. *Elementary Quantitative Methods. Research Methods In The Social Sciences.,* London., Sage Publications.

LIPMAN, M. 2003. *Thinking in Education,* Cambridge, Cambridge University Press.

LUNA, T. 2002. Gifted and Talented Primary-age Students: Recommendations for Identification and Service. Idaho: Idaho State Department of Education.

MACK, N., MACQUEEN, C., GUEST, G. & NAMEY, E. 2005. *Qualitative Research Methods: A Data Collector's Field Guide. ,* U.S.A, Family Health International.

MAJINEY, O. 2008. *Arab and international experiences in fostering gifted people.* [Online]. ALECSO. Available: http://www.alecso.org.tn/lng/index.php?lang=en [Accessed 02. 09.2008].

MAKEL, M. C. & PLUCKER, J. A. 2008. Creativity *In:* PFEIFFER, S. I. (ed.) *Handbook of Giftedness in Children.* New York: Springer Science.

MAKER, C. J. & NIELSON, A. B. 1995. *Teaching Models in Education of the Gifted,* Texas, Pro-ed.

MARIYCHUK, R. & PETRUS, V. 2003. Specialities of Gifted Children Education in Post-Soviet Countries. *In:* CSÉRMELY, P. & LEDERMAN, L. M. (eds.) *Science Education: Talent Recruitment and Public Understanding.* Amestrdam: IOS Press.

MASLAK, M. 2008. School as a site of Tibetan ethnic identity construction in India? Results from a content analysis of textbooks and Delphi study of teachers' perceptions. *Educational Review,* 60**,** 85 - 106.

MAY, T. 1999. *Social Research: Issues, Methods and Process,* Bukingham, Open University Press.

MCCLURE, L. & PIGGOTT, J. 2007. *Meeting the Needs of Your Most Able Pupils: MATHEMATICS,* Oxon, Routledge.

MELBER, L. M. 2003. Partnerships in Science Learning: Museum Outreach and Elementary Gifted Education. *Gifted Child Quarterly,* 47**,** 251-258.

MILES, M. B. & HUBERMAN, A. M. 1994. *Qualitative data analysis: An expanded sourcebook,* SAGE publications, Inc.

MINISTRY OF EDUCATION 2009. *Science textbook of 6th grade in Saudi Arabia,* Riyadh, Ministry of Education.

MINISTRY OF EDUCATION. 2010. Saudi Arabia: Statistics Department,. Available: http://www.moe.gov.sa/openshare/englishcon/Statistics/Projected-Summary-Statistics-for-the.htm_cvt.html [Accessed 10. 10. 2010].

MINISTRY OF EDUCATION IN SAUDI ARABIA 1997. *Teacher's Guide,,* Riyadh, Ministry of Education.

MINISTRY OF EDUCATION IN SAUDI ARABIA. 1998. Ministry of Education. Available: www.moe.gov.sa [Accessed 03. 07.2007].

MINISTRY OF EDUCATION IN SAUDI ARABIA 2002. The General educational Objectives Document. Riyadh: Department of Development.

MINISTRY OF EDUCATION IN SAUDI ARABIA 2008. Annual Report. Ministry of Education.

MINISTRY OF EDUCATION IN SAUDI ARABIA 2008 National Report on Education Development In The Kingdom of Saudi Arabia. Riyadh: Ministry of Education.

MINNESOTA DEPARTMENT OF EDUCATION 2007. Strategic Plan for Improving Minnesota's Gifted and Talented Education Services for Students Strategic Plan Initiatives

In: BEHRENS, W. A. (ed.). Minnesota.

MITCHELL, M. & JOLLEY, J. 2001. *Research Design Explained.*, Taxas, Harcourt College Publishers.

MITCHELL, M. & JOLLEY, J. 2010. *Research Design Explained,* U.S.A, WADSWORTH Cengage learning.

MONKS, F. J., HELLER, K. A. & PASSOW, A. H. 2000. The Study of Giftedness: Reflections on Where We Are And Where We Are Going. *In:* HELLER, K. A. (ed.) *International Handbook of Research and Development of Giftedness and Talent.* Oxford: ELSEVIER SCIENCE Ltd.

MOON, S., M. & ROSSELLI, H., C. 2000. Developing Gifted Programs. *In:* KURT, A. H. (ed.) *International handbook of giftedness and talent.* 2nd. ed. Oxford: Elsevier Science Ltd.

MORGAN, G. A., GLINER, J. A. & HARMON, R. J. 2006. *UNDERSTANDING AND EVALUATING RESEARCH IN APPLIED AND CLINICAL SETTINGS,* New Jersey, Lawrence Erlbaum Associates, Inc.

MUIJS, D. 2004. *Doing Quantitative Research in Education with SPSS,* London, Sage Publications.

NACHMIAS, C. & NACHMIAS, D. 1981. *Research Methods in the Social Sciences,* U.S.A, ST Martin's Press.

NACHMIAS, C. & NACHMIAS, D. 1996. *Research methods in the social sciences,* London, Edward Arnold.

NAGY, S. & BIBER, H. 2008. Innovation in research methods Design and analysis. *Handbook of Emergent Methods.* Guilford press.

NAGY, S., BIBER, H. & LEAVY, P. 2008. Historical Context of Emergent Methods and Innovation in the Practice of Research Methods. *In:* SHARLENE NAGY HESSE-BIBER & PATRICIA, L. (eds.) *Handbook of Emergent Methods.* New York: The Guilford Press.

NATIONAL ASSOCIATION FOR GIFTED CHILDREN. 2008. *The History of Gifted and Talented Education* [Online]. USA: National Association for Gifted Children. Available: http://www.nagc.org/index2.aspx?id=607&terms=marland [Accessed 02.03 2009].

OGILVIE, E. 1973. *Gifted Children in Primary schools. Schools Council Research Studies,* Basingstoke, London., Macmillan.

OLENCHAK, F. R. & RENZULLI, J. S. 1989. The Effectiveness of the Schoolwide Enrichment Model on Selected Aspects of Elementary School Change. *Gifted Child Quarterly,* 33**,** 36-46.

ONWUEGBUZIE, A. J. & LEECH, N. L. 2005. On Becoming a Pragmatic Researcher: The Importance of Combining Quantitative and Qualitative Research Methodologies. *International Journal of Social Research Methodology.,* 8**,** 375-387.

OPDENAKKER, R. 2006. Advantages and Disadvantages of Four Interview Techniques in Qualitative Research. *Qualitative Social Research* [Online], 7.

OPPENHEIM, A. 2005. *Questionnaire Design, And Attitude Measurement.,* London., Continuum.

PASSOW, A. H. 1981. The nature of giftedness and talent. *Gifted Child Quarterly,* 25**,** 5-10.

PATTON, M. Q. 2002. *Qualitative Research and Evaluation Methods,* Thousand Oaks, Calif, Sage Publications.

PAYNE, G. & PAYNE, J. 2004. *Key Concepts in Social Research,* London, SAGE Publications Ltd.

PERKINS, D. 1990. *The Nature and Nurture of creativity, Dimensions of Thinking and Cognitive Instruction,* Routledge.

PERSSON, R. S., JOSWIG, H. & BALOGH, L. 2000. Gifted Education in Europe: Programs, Practices, and Current Research. *In:* HELLER, K. A. (ed.) *International Handbook of Research and Development of Giftedness and Talent.* 2nd ed. Oxford: Elsevier Science Ltd.

PHILLIPS, N. & LINDSAY, G. 2006. Motivation in gifted students. *High Ability Studies,* 17**,** 57-73.

PLUCKER, J. A. 2003. *Human intelligence: Historical influences, current controversies,* [Online]. Available: http://www.indiana.edu/~intell [Accessed 12.05 2008].

PLUCKER, J. A. & BARAB, S. A. 2005. The Importance of Contexts Theories of giftedness Learning to embrace the Messy joys of Subjectivity. *In:* STERNBERG, R. & DAVIDSON, J. (eds.) *Conceptions of Giftedness.* 2nd ed. Cambridge.UK.

PURCELL, J. H., BURNS, D. E., TOMLINSON, C. A., IMBEAU, M. B. & MARTIN, J. L. 2002. Bridging the Gap: A Tool and Technique to Analyze and Evaluate Gifted Education Curricular Units. *Gifted Child Quarterly,* 46**,** 306-321.

PURCELL, J. H. & LEPPIEN, J. H. 2009. *Parallel Curriculum Units for Language Arts, Grades 6-12,* Corwin Press.

RENZULLI, J. S. 1986. *Joseph S Renzulli. Systems and Models for Developing Programs for the Gifted and Talented,* Connecticut., Creative Learning Press.

RENZULLI, J. S. 1997. The Multiple Menu Model: A Successful Marriage for Integrating Content and Process. *NASSP Bulletin. ,* 81**,** 51-58.

RENZULLI, J. S. 1998. *The Three-Ring Conception ofGiftedness* [Online]. The National Research Center on the Gifted and Talented. Available: .http://www.sp.uconn.edu/~nrcgt/sem/semart13.html [Accessed 01. 08.2007].

RENZULLI, J. S. 2000. Gifted Dropouts: The Who and the Why Joseph S. Renzulli. *Gifted Child Quarterly,* 44**,,** 261-271.

RENZULLI, J. S. & REIS, S. M. 1994. Research Related to the Schoolwide Enrichment Triad Model. *Gifted Child Quarterly,* 38**,** 7-20.

RENZULLI, J. S. & REIS, S. M. 2000. The Schoolwide Enrichment Model. *In:* HELLER, K. A. & STERNBERG, R. J. (eds.) *International Handbook of Research and Development of Giftedness and Talent.* 2nd ed. Oxford: Elsevier Science Ltd.

RILEY, T., BEVAN-BROWN, J., BICKNELL, B., CARROLL-LIND, J. & KEARNEY, A. 2004. Gifted and Talented Education in New Zealand Schools. Wellington: Minisrty Of Education.

ROSSI, P. H., FREEMAN, H. E. & LIPSEY, M. W. 1999. *Evaluation. A Systematic Approach,* London, Sage Publications Inc.

RUBIN, I. & RUBIN, H. 2005. *Qualitative Interviewing the Art of Hearing Data.,* London. , Saga Publications.

RUDNITSKI, R. A. 2000. National/Provincial Gifted Education Policies: Present State, Future Possibilities. *In:* KURT, A. H. (ed.) *International handbook of giftedness and talent.* 2nd ed. Oxford: Elsevier Science Ltd.

RUNCO, M. & SAKAMOTO, S. 2007. Experimental Studies of Creativity. *Handbook of Creativity.* 10th ed.: Cambridge University Press.

SALAMA 2002. *Teaching Science and Thinking Skills* Amman, Daar Alfikr.

SARANTAKOS, S. 2005. *Social Research,* London., Macmillan.

SCHROTH, S. T. 2008. Levels of service. *In:* PLUCKER, J. A. & CALLAHAN, C. M. (eds.) *Crtical issues and practices and gifted education.* Waco, Texas: Prufrock press Inc.

SIEGLE, D. 2005. *Developing Mentorship programs for Gifted Students. ,* Waco, TX, Prufrock Press.

SILVERMAN, L. 2008. *Why Do We Need Gifted Education?* [Online]. Gifted Development Center.Western Colorado Association for Gifted and Talented. Available: www.gifted51.org [Accessed 13. 02.2009].

SIMONTON, D. 2009. Encyclopedia of Giftedness, Creativity, and Talent. *In:* KERR, B., WELLS B. AMBROSE D., CLAIBORN C., COHN, S., COLANGELO, N., CROSS, T., DELISLE, J., DIXON, F., FRIDMAN-NIMZ, R., FRIEDRICHS, T., KANEVSKY, L., LOHMAN,D., MATTHEWS, D., PIIRTO, J., REIS, S., ROBINSON, A., SCHULTZ, R., SRIRAMAN, AND B., BASKA, J., (ed.) *Encyclopedia of Giftedness.* SAGE Publications, Inc.

SISK, D. 2009. Myth 13: The Regular Classroom Teacher Can "Go It Alone". *Gifted Child Quarterly,* 53**,** 269-271.

SMITH, C. M. M. 2005. *Teaching Gifted and Talented Pupils in the Primary School A Practical Guide*.

SMITH, C. M. M. 2006. *Including the Gifted and Talented Making inclusion work for more gifted and able learners.,* Abingdon, Routledge.

SOUTHERN & JONES. 2004. Types of Acceleration; Dimensions and Issues *In:* COLANGELO, N., G., A. S. & GROSS, M. (eds.) *A Nation Deceived :How Schools Hold Back America's Brightest Students 5-12.* Washington: National Association for Gifted Children.

STARKO, A. J. 1990. Life and death of a gifted program: Lessons not yet learned. *Roeper Review,* 13**,** 33-38.

STARKO, A. J. 2005. *Creativity.in.the.Classroom*, Lawrence.Erlbaum.Associates.

STEIN, G. & POOLE, P. 1997. Meeting the Interests and Needs of Gifted Children: A Strategy for Teaching and Learning. *Early Child Development and Care,* 130**,** 13-19.

STERNBERG, R. J. 1995. *Triarchic Approach to Giftedness,* The University of Connecticut. the U.S. A., The Natioal Research Center on the Gifted and Talented.

STERNBERG, R. J. 1999. The Theory of Successful Intelligence. *Review of General Psychology,* 3**,** 292-316.

STERNBERG, R. J. 2005. The Theory of Successful Intelligence. *Journal of Psychology,* 39**,** 189-202.

STERNBERG, R. J. & DAVLDSON, J. E. 2005. *Conceptions of Giftdness,* Cambridge Cambridge University Press.

STOEGER, H. 2009. The History of Giftedness Research. *In:* SHAVININA, L. V. (ed.) *International Handbook on Giftedness.* Canada: springer.

STOFFELS, N. T. 2005. There is a worksheet to be followed': a case study of a science teacher's use of learning support texts for practical work. *African journal of research in mathematics, science and technology education,* 9**,** 147-157.

STYLIANIDOU, F. 2002. Analysis of science textbook pictures about energy and pupils readings of them. *International Journal of Science Education,* 24**,** 257-283.

SUROR, A. 2003. *Introduction to Gifted Education.,* Jordan, Daar Alfeker.

TABER, K. S. 2007. Science education for gifted learners. *In:* TABER, K. S. (ed.) *Science Education for Gifted and Talented.* Oxon: Routledge.

TABER, K. S. & CORRIE, V. 2007. Developing the thinking of gifted students through science. . *In:* TABER, K. S. (ed.) *Science Education for Gifted Learners.* Oxon: Routledge.

TASHAKKORI, A. & TEDDLIE, C. 2003. *Mixed methodology : combining qualitative and quantitative approaches,* London, Sage, Thousand Oaks, Calif.

THE COLLEGE OF WILLIAM AND MARY CENTER FOR GIFTED EDUCATION. 2007. *The Integrated Curriculum Model (ICM)* [Online]. Williamsburg: Center for Gifted Education. Available: www. Cfge.wm.edu [Accessed 12.01. 2011].

THE COUNCIL OF CURRICULUM EXAMINATIONS AND ASSESSMENT (CCEA) 2006. Gifted and talented children in (and out) of the classroom

UK.

THE NATIONAL ACADEMY FOR GIFTED AND TALENTED YOUTH. 2006. Uk: NAGTY. Available: www.warwick.ac.uk/gifted [Accessed 12. 05.2007].

THE NATIONAL ASSOCIATION FOR GIFTED CHILDREN 2010. Pre-K-Grade 12 Gifted Program Standards. . Washington DC: National Association for Gifted Children.

THE NORTH CAROLINA STATE DEPARTMENT OF PUBLIC INSTRUCTION RALEIGH 1984. Division for Exceptional Children. North Carolina.

THOMSON, M. 2006. *Supporting Gifted and Talented Pupils in the Secondary School*.

TOMLINSON, C. A. 2009. Myth 8: The "Patch-On" Approach to Programming Is Effective. *Gifted Child Quarterly,* 53**,** 254-256.

TOURÓN, J. 2005. What has been done, what has yet to be done. *High Ability Studies,* 16**,** 155-158.

TOWNSEND, M. 1996. Enrichment and Acceleration: Lateral and Vertical Perspectives in Provisions for Gifted and Talented Children. *In:* MCALPINE, D. & MOLTZEN, R. (eds.) *Gifted and Talented: New Zealand Perspectives.* Palmerston North, NZ: Massey University E.R.D.C. Press.

TREFFINGER, D. J., YOUNG, G. C., NASSAB, C. A. & WITTIG, C. V. 2004. *Enhancing and expanding gifted programs: The levels of service approach,* Waco, TX, Prufrock Press.

TYLER, R. W. 1969. *Basic principles of curriculum and instruction.,* Chicago, The University of Chicago Press.

VANTASSEL-BASKA, J. 1986. Effective curriculum and Instructional Modle for Talented students. *Gifted Child Quarterly,* 30**,** 164-169.

VANTASSEL-BASKA, J. 1994a. *Comprehansive Curriculum for Gifted Learners,* Boston, Allyn and Bacon.

VANTASSEL-BASKA, J. 1994b. *A Curriculum Framwork in Language Arts for High Ability Learners K-8,* Washington, College of William and Mary: School of Education, Center of Gifted Education.

VANTASSEL-BASKA, J. 2000. *Curriculum Planning & Instructional Design for Gifted Learners*, Love Publishing Company.

VANTASSEL-BASKA, J. 2002. *Planning Effective Curriculum Experiences for Gifted Learners Open Space Communications, Understanding Our Gifted* [Online]. Available: http://www.cybersource.org/Record.aspx?NavID=13_11,13_11&rid=12933. [Accessed].

VANTASSEL-BASKA, J. 2003. *Introduction to Curriculum for Gifted and Talented Students: A 25-Year Retrospective and Prospective* [Online]. The College of William and Mary electronic resource. Available: http://www.corwinpress.com/upmdata/7157_tassel_intro.pdf [Accessed].

VANTASSEL-BASKA, J. 2004. *National Association for Gifted Children: Curriculum for gifted and talented students,* Corwin Press.

VANTASSEL-BASKA, J. 2005. Gifted Programmes and Services: What Are the Nonnegotiables? *Theory into Practice,* 44**,** 90- 97.

VANTASSEL-BASKA, J. 2006. A Content Analysis of Evaluation Findings Across 20 Gifted Programs: A Clarion Call for Enhanced Gifted Program Development. *Gifted Child Quarterly,* 50**,** 199-215.

VANTASSEL-BASKA, J. & BROWN, E. F. 2007. Toward Best Practice: An Analysis of the Efficacy of Curriculum Models in Gifted Education. *Gifted Child Quarterly,* 51**,** 342-358.

VANTASSEL-BASKA, J. & JOHNSEN, S. K. 2007. Teacher Education Standards for the Field of Gifted Education: A Vision of Coherence for Personnel Preparation in the 21st Century. *Gifted Child Quarterly,* 51**,** 182-205.

WATTS, M. & JESUS, H. P. D. 2007. Asking questions in classroom science *In:* TABER, K. S. & CORRIE, V. (eds.) *Science Education for Gifted Learners.* Oxford: Routledge

WILLIS, K. 2006. Interviewing *In:* DESAI, V. & POTTER, R. B. (eds.) *Doing Development Research.* London: SAGE Publications.

YOON, C. H. 2009. Self-Regulated Learning and Instructional Factors in the Scientific Inquiry of Scientifically Gifted Korean Middle School Students. *Gifted Child Quarterly,* 53**,** 203-216.

ZIEGLER, A. & HELLER, K. A. 2000. Conceptions of Giftedness from a Meta-Theoretical Perspective. *In:* HELLER, K. A., MONKS, F. J., STERNBERG, R. J. & SUBOTNIK, R. E. (eds.) *International Handbook of Giftedness and Talent.* 2nd ed. Oxford: ELSEVIER SCIENCE Ltd.

ZITON, A. 1994. *Science Teaching Methods,* Amman, Daar Alshoroq.

Appendices

NAGC Pre-K-Grade 12 Gifted Programming Standards

A Blueprint for Quality Gifted Education Programs

NATIONAL ASSOCIATION FOR Gifted Children

November 2010

Table of Contents

November 1, 2010

Dear Gifted Education Supporter:

On behalf of NAGC, I am extremely pleased to present the *2010 Pre-K-Grade 12 Gifted Programming Standards*. The revised programming standards update the initial program standards developed in 1998.

Program standards provide a structure for defining important benchmarks and for identifying practices that are the most effective, in this case, for students with gifts and talents. A common set of standards helps to ensure consistency among schools and school districts so that all students who require advanced services receive ***quality*** services. Standards can guide our continual progress toward excellence and equity.

The 2010 programming standards have been developed with input from a variety of stakeholders over the past two years and integrate principles and concepts from the initial program standards and the national NAGC-CEC/TAG teacher preparation standards. You will note an increased focus on diversity and collaboration – two powerful principles that guide high quality programs and services. The new standards use student outcomes, rather than teacher practices, as goals. Both revisions create stronger standards and align them with current thinking in education standards generally.

With new standards come numerous questions from concerned gifted education professionals. This booklet addresses many of the frequently asked questions about the new programming standards to give us all a running start. In addition, NAGC will be delivering online and print resources in the coming year to assist school districts in implementing the new standards. We welcome your suggestions on the resources that will be most helpful.

My deepest thanks go to Susan Johnsen of Baylor University, chair of the standards revision workgroup, for her leadership and commitment. Thank you, also to the Pre-K-Grade 12 workgroup members: Alicia Cotabish, University of Arkansas at Little Rock; Todd Kettler, Coppell (TX) ISD; Margie Kitano, San Diego State University; Sally Krisel, Hall County (GA) Public Schools; Wayne Lord, Augusta State University; Michael S. Matthews, University of North Carolina at Charlotte; Chrystyna Mursky, Wisconsin Department of Public Instruction; Christine Nobbe, Center for Creative Learning (MO); Elizabeth Shaunessy, University of South Florida; and Joyce VanTassel-Baska, College of William and Mary who gave both their expertise and time to producing the new standards. The group continues its work as they make presentations and develop resources to accompany the standards.

NAGC looks forward to working with educators across the country in using these standards to improve services for our most able learners. In advance, I thank you for your commitment to serving students with gifts and talents with the best possible programs and services.

Sincerely,

Ann Robinson, Ph.D.
Center for Gifted Education
University of Arkansas at Little Rock
President

An Introduction to the Gifted Programming Standards

Why does gifted education need standards?

Standards provide a basis for policies, rules, and procedures that are essential for providing systematic programs and services to any special population. While standards may be addressed and implemented in a variety of ways, they provide important direction and focus to the endeavor of program development. They also help define the comprehensiveness necessary in designing and developing options for gifted learners at the local level. Because these standards are grounded in theory, research, and practice paradigms, they provide an important base for all efforts on behalf of gifted learners at all stages of development.

How may the standards be used?

There are a variety of ways in which the *2010 Pre-K-Grade 12 Gifted Programming Standards* may be used in schools and districts across the country. The uses fall into six categories:

- Assess, evaluate, and improve local plans and programming
- Plan curriculum
- Provide professional development
- Advocate
- Develop, improve, and evaluate state standards
- Approve gifted plans and programs and monitor for compliance with state regulations

How were these standards developed?

In 2007, the NAGC Board created the Professional Standards Committee to align the 1998 Gifted Program Standards with the NAGC-CEC Teacher Preparation Standards. After an initial alignment, a Pre-K-Grade 12 Gifted Program Standards Revision Workgroup was formed to undertake the revision. In revising the standards, the workgroup was guided by these principles:

1. Giftedness is dynamic and is constantly developing; therefore, students are defined as those with gifts and talents rather than those with stable traits.
2. Giftedness is found among students from a variety of backgrounds; therefore, a deliberate effort was made to ensure that diversity was included across all standards. Diversity was defined as differences among groups of people and individuals based on ethnicity, race, socioeconomic status, gender, exceptionalities, language, religion, sexual orientation, and geographical area.
3. Standards should focus on student outcomes rather than practices. The number of practices used or how they are used is not as important as whether or not the practice is effective with students. Consequently, the workgroup decided not to identify acceptable vs. exemplary standards. Moreover, such a distinction would be difficult to support with the research.
4. Because all educators are responsible for the education of students with gifts and talents, educators were broadly defined as administrators, teachers, counselors, and other instructional support staff from a variety of professional backgrounds (e.g., general education, special education, and gifted education).
5. Students with gifts and talents should receive services throughout the day and in all environments based on their abilities, needs, and interests. Therefore, the Workgroup decided to use the word "programming" rather than the word "program," which might connote a one-dimensional approach (e.g., a once-a-week type of program option).

How are these standards different from the 1998 Program Standards?

The major differences between the 1998 Gifted Program Standards and the *2010 Pre-K-Grade 12 Gifted Programming Standards* center on the following areas:

1. The revised programming standards focus on student outcomes.
2. The revised programming standards reflect a stronger emphasis on diversity.
3. The revised programming standards emphasize stronger relationships between gifted education, general education, and special education and integrate cognitive science research.
4. The revised programming standards emphasize evidence-based practices that are based on research.

(See: Matthews & Shaunessy, 2010)

How do the programming standards relate to other professional standards?

The 2010 programming standards adhere very closely to the language in the NAGC-CEC/TAG Teacher Preparation Standards and the 1998 Gifted Program Standards and integrate the two sets of standards within evidence-based practices. The 2010 Programming Standards include areas from the NAGC-CEC/TAG teacher preparation standards that were minimally addressed or were omitted in the 1998 Gifted Program Standards, such as language and communication, learning environments and social interaction, diversity, collaboration between gifted education and special education, and ongoing assessment. Moreover, the 2010 Programming

Standards retain criteria that were not addressed in the NAGC-CEC/TAG teacher preparation standards such as program evaluation and professional development.

(NOTE: See the NAGC website for tables illustrating the relationship and alignment among the 2010 Pre-K-Grade 12 Gifted Programming Standards*, the 1998 Gifted Program Standards, and the NAGC-CEC/TAG Teacher Preparation Standards.)*

How are the standards supported by research and current effective practices?

The field of gifted education has evolved since the original gifted program standards were developed in 1998. The 2010 standards include only evidence-based practices that support the corresponding student outcomes. This support falls into three categories: (a) research-based, (b) practice-based, and (c) literature-based.

Research-based studies provide the most compelling evidence and are peer-reviewed, use qualitative or quantitative methodologies to address questions of cause and effect, and have been independently replicated and found to be effective. Practice-based strategies are practices that have been used widely with success, so there is a professional assumption that the practice is effective. Practice-based studies also include strategies that classroom teachers use and validate through some degree of action research. Literature-based studies are those that are based on theories or philosophical reasoning.

(NOTE: See the NAGC website for the research citations and references for all of the recommended practices.)

My school/district doesn't have a formal gifted education program, although we do offer services in several grades to advanced students. How can we use these standards? My school/district's gifted education program is just being launched. How do you recommend we get started with these standards?

The early stages of program planning and development are ideal times to study and use the 2010 Programming Standards. Before you get too far along in a journey that, without careful planning, may not serve gifted and talented students well or, in the worst-case scenario, may actually diminish support for gifted education in your school or district, use the 2010 Programming Standards to conduct an internal analysis of the comprehensiveness and defensibility of your plans/program at this point in time. If a school doesn't have a gifted education program or is just getting started, the stan-

GAP ANALYSIS CHART

Standard	Evidence-Based Practices	What We Do To Support This Practice	Desired Student Outcomes	What Evidence do We Have that Current Practices are Leading to Desired Student Outcomes?	What Additional Evidence do We Need? (Gaps)

dards will help document the need for the program and/or justify the case for a particular programming approach. As the program grows, the standards will help identify program strengths and weaknesses, focus on potential trouble spots, determine new directions or new components, or provide support to maintain current programs and services. Schools may continue to use the standards as a roadmap for evaluation or to set goals and plan strategically for meeting those goals.

My school district uses the 1998 Program Standards. How might we transition to the new standards?

The *1998 Gifted Program Standards* have been aligned with the *2010 NAGC Pre-K-Grade 12 Gifted Programming Standards*, and this alignment demonstrates that all of the 1998 standards are represented in the 2010 document. The revised standards, however, are framed as student outcomes instead of best practices. So all the work school districts have done with the 1998 standards is not wasted; rather it will serve as the foundation for continuous improvement. The revised standards will elucidate the next steps toward excellence in gifted programming by helping school districts move beyond the focus on practices alone to the relationship between certain practices and desired student outcomes. The 2010 standards invite educators to address these important questions related to student outcomes in each area:

- What is it that individuals with gifts and talents need other than the excellent core curriculum we want all students to have in school?
- If these unique needs are met, how is school and life better for students with gifts and talents?
- What do those changes look like in terms of student behavior?

In other words, what difference does gifted education programming make in the lives of participating students?

To summarize the progress districts have already made using the 1998 standards and chart a course for continued program improvement, program personnel might elect to use a gap analysis chart and the related action planning chart below. These two tools will help planners acknowledge specific strategies/activities already used for each evidence-based practice, identify gaps, and develop an action plan to address those gaps.

The decision to focus on student growth mirrors current practice in most schools, so the 2010 standards should connect without difficulty to state and local ini-

ACTION PLAN CHART

Standard	Evidence-Based Practices	Desired Student Outcomes	Identified Gaps	Information To Be Collected	Person(s) Responsible	Timeline

tiatives. This approach is the key to using the *2010 Pre-K-Grade 12 Gifted Programming Standards*.

How can my school/district use these standards for program evaluation purposes?

The student outcomes and evidence-based practices in the programming standards serve as criteria on which to collect data to make informed judgments about the quality and effectiveness of their programming for learners with gifts and talents. Once the data is in hand, school leaders may establish benchmarks or set goals and timelines to ensure that they are on track to achieving the desired student outcomes.

How do we know that the student outcomes are being met?

The task of assessing the standards' student outcomes becomes a major part of program design and development annually through the use of appropriate and varied measures. In general, use off-level measures to assess the achievement level of gifted students. To assess deeper and more complex learning behaviors, more tailored performance-based or product-based instruments should be employed. To assess critical and creative thinking, the use of tests that focus on these higher skills would be recommended. Finally, if one wants to assess affective behavioral change, the use of products (i.e. journals, written essays, talent development plans), examined over time in a pre-post or portfolio model may be most desirable. Assessing gifted student learning also requires matching the desired outcome to the student's knowledge and skills and level of interest. Exams like AP and IB are carefully crafted performance-based assessments that tap into advanced learning in traditional and free response modes. They may be used as models for thinking about appropriate approaches at earlier stages of development in a gifted program as would other examples of Performance-Based Assessments (e. g., see the College of William and Mary Units of study).

What resources does NAGC have and will develop to assist in implementing the 2010 standards?

A new publication to accompany the 2010 Programming Standards is underway. However, NAGC has resources available now to assist school leaders in implementing the new standards.

- The NAGC website contains the full glossary of terms used with the 2010 Programming Standards as well as tables that show the relationship and alignment among the 2010 programming standards, the previous gifted program standards, and the NAGC-CEC/TAG Teacher Preparation Standards. See the "Standards in Gifted Education" section of the website at www.nagc.org.
- The NAGC website also contains information and links to references for many of the strategies recommended in the 2010 programming standards. The online bookstore includes publications that address special populations of gifted students, best practices in gifted education, designing services in P-12, and assessments of gifted learners, among other key topics.
- A guidebook for P-12 educators that was developed to implement the teacher education standards is available in the online bookstore. See Kitano, M., Montgomery, D., VanTassel-Baska, J., & Johnsen, S. (2008). *Using the national gifted education standards for PreK-12 professional development.* Thousand Oaks, CA: Corwin Press.
- A publication on CD is available in the online store that addresses critical state policies in gifted education, such as identification, personnel preparation, and programs and curriculum, and includes links to actual state policies in each key area. See Clinkenbeard, P. R., Kolloff, P. B., & Lord, E. W. (2007). *A guide to state policies in gifted education*. Washington, DC: National Association for Gifted Children.
- NAGC plans a series of webinars in 2011 that will focus on each of the standards to provide additional support for implementation.

NAGC Pre-K-Grade 12 Gifted Programming Standards

Gifted Education Programming Standard 1: Learning and Development

Introduction

To be effective in working with learners with gifts and talents, teachers and other educators in PreK-12 settings must understand the characteristics and needs of the population for whom they are planning curriculum, instruction, assessment, programs, and services. These characteristics provide the rationale for differentiation in programs, grouping, and services for this population and are translated into appropriate differentiation choices made at curricular and program levels in schools and school districts. While cognitive growth is important in such programs, affective development is also necessary. Thus many of the characteristics addressed in this standard emphasize affective development linked to self-understanding and social awareness.

STANDARD 1: LEARNING AND DEVELOPMENT

Description: *Educators, recognizing the learning and developmental differences of students with gifts and talents, promote ongoing self-understanding, awareness of their needs, and cognitive and affective growth of these students in school, home, and community settings to ensure specific student outcomes.*

STUDENT OUTCOMES	EVIDENCE-BASED PRACTICES
1.1. Self-Understanding. Students with gifts and talents demonstrate self-knowledge with respect to their interests, strengths, identities, and needs in socio-emotional development and in intellectual, academic, creative, leadership, and artistic domains.	1.1.1. Educators engage students with gifts and talents in identifying interests, strengths, and gifts. 1.1.2. Educators assist students with gifts and talents in developing identities supportive of achievement.
1.2. Self-Understanding. Students with gifts and talents possess a developmentally appropriate understanding of how they learn and grow; they recognize the influences of their beliefs, traditions, and values on their learning and behavior.	1.2.1. Educators develop activities that match each student's developmental level and culture-based learning needs.
1.3. Self-Understanding. Students with gifts and talents demonstrate understanding of and respect for similarities and differences between themselves and their peer group and others in the general population.	1.3.1. Educators provide a variety of research-based grouping practices for students with gifts and talents that allow them to interact with individuals of various gifts, talents, abilities, and strengths. 1.3.2. Educators model respect for individuals with diverse abilities, strengths, and goals.
1.4. Awareness of Needs. Students with gifts and talents access resources from the community to support cognitive and affective needs, including social interactions with others having similar interests and abilities or experiences, including same-age peers and mentors or experts.	1.4.1. Educators provide role models (e.g., through mentors, bibliotherapy) for students with gifts and talents that match their abilities and interests. 1.4.2. Educators identify out-of-school learning opportunities that match students' abilities and interests.
1.5. Awareness of Needs. Students' families and communities understand similarities and differences with respect to the development and characteristics of advanced and typical learners and support students with gifts and talents' needs.	1.5.1. Educators collaborate with families in accessing resources to develop their child's talents.
1.6. Cognitive and Affective Growth. Students with gifts and talents benefit from meaningful and challenging learning activities addressing their unique characteristics and needs.	1.6.1. Educators design interventions for students to develop cognitive and affective growth that is based on research of effective practices. 1.6.2. Educators develop specialized intervention services for students with gifts and talents who are underachieving and are now learning and developing their talents.
1.7. Cognitive and Affective Growth. Students with gifts and talents recognize their preferred approaches to learning and expand their repertoire.	1.7.1 Teachers enable students to identify their preferred approaches to learning, accommodate these preferences, and expand them.
1.8. Cognitive and Affective Growth. Students with gifts and talents identify future career goals that match their talents and abilities and resources needed to meet those goals (e.g., higher education opportunities, mentors, financial support).	1.8.1. Educators provide students with college and career guidance that is consistent with their strengths. 1.8.2. Teachers and counselors implement a curriculum scope and sequence that contains person/social awareness and adjustment, academic planning, and vocational and career awareness.

Gifted Education Programming Standard 2: Assessment

Introduction

Knowledge about all forms of assessment is essential for educators of students with gifts and talents. It is integral to identification, assessing each student's learning progress, and evaluation of programming. Educators need to establish a challenging environment and collect multiple types of assessment information so that all students are able to demonstrate their gifts and talents. Educators' understanding of non-biased, technically adequate, and equitable approaches enables them to identify students who represent diverse backgrounds. They also differentiate their curriculum and instruction by using pre- and post-, performance-based, product-based, and out-of-level assessments. As a result of each educator's use of ongoing assessments, students with gifts and talents demonstrate advanced and complex learning. Using these student progress data, educators then evaluate services and make adjustments to one or more of the school's programming components so that student performance is improved.

STANDARD 2: ASSESSMENT

Description: *Assessments provide information about identification, learning progress and outcomes, and evaluation of programming for students with gifts and talents in all domains.*

STUDENT OUTCOMES	EVIDENCE-BASED PRACTICES
2.1. Identification. All students in grades PK-12 have equal access to a comprehensive assessment system that allows them to demonstrate diverse characteristics and behaviors that are associated with giftedness.	2.1.1. Educators develop environments and instructional activities that encourage students to express diverse characteristics and behaviors that are associated with giftedness. 2.1.2. Educators provide parents/guardians with information regarding diverse characteristics and behaviors that are associated with giftedness.
2.2. Identification. Each student reveals his or her exceptionalities or potential through assessment evidence so that appropriate instructional accommodations and modifications can be provided.	2.2.1. Educators establish comprehensive, cohesive, and ongoing procedures for identifying and serving students with gifts and talents. These provisions include informed consent, committee review, student retention, student reassessment, student exiting, and appeals procedures for both entry and exit from gifted program services. 2.2.2. Educators select and use multiple assessments that measure diverse abilities, talents, and strengths that are based on current theories, models, and research. 2.2.3 Assessments provide qualitative and quantitative information from a variety of sources, including off-level testing, are nonbiased and equitable, and are technically adequate for the purpose. 2.2.4. Educators have knowledge of student exceptionalities and collect assessment data while adjusting curriculum and instruction to learn about each student's developmental level and aptitude for learning. 2.2.5. Educators interpret multiple assessments in different domains and understand the uses and limitations of the assessments in identifying the needs of students with gifts and talents. 2.2.6. Educators inform all parents/guardians about the identification process. Teachers obtain parental/guardian permission for assessments, use culturally sensitive checklists, and elicit evidence regarding the child's interests and potential outside of the classroom setting.
2.3. Identification. Students with identified needs represent diverse backgrounds and reflect the total student population of the district.	2.3.1. Educators select and use non-biased and equitable approaches for identifying students with gifts and talents, which may include using locally developed norms or assessment tools in the child's native language or in nonverbal formats. 2.3.2. Educators understand and implement district and state policies designed to foster equity in gifted programming and services. 2.3.3. Educators provide parents/guardians with information in their native language regarding diverse behaviors and characteristics that are associated with giftedness and with information that explains the nature and purpose of gifted programming options.
2.4. Learning Progress and Outcomes. Students with gifts and talents demonstrate advanced and complex learning as a result of using multiple, appropriate, and ongoing assessments.	2.4.1. Educators use differentiated pre- and post- performance-based assessments to measure the progress of students with gifts and talents. 2.4.2. Educators use differentiated product-based assessments to measure the progress of students with gifts and talents. 2.4.3. Educators use off-level standardized assessments to measure the progress of students with gifts and talents. 2.4.4. Educators use and interpret qualitative and quantitative assessment information to develop a profile of the strengths and weaknesses of each student with gifts and talents to plan appropriate intervention. 2.4.5. Educators communicate and interpret assessment information to students with gifts and talents and their parents/guardians.
2.5. Evaluation of Programming. Students identified with gifts and talents demonstrate important learning progress as a result of programming and services.	2.5.1. Educators ensure that the assessments used in the identification and evaluation processes are reliable and valid for each instrument's purpose, allow for above-grade-level performance, and allow for diverse perspectives. 2.5.2. Educators ensure that the assessment of the progress of students with gifts and talents uses multiple indicators that measure mastery of content, higher level thinking skills, achievement in specific program areas, and affective growth. 2.5.3. Educators assess the quantity, quality, and appropriateness of the programming and services provided for students with gifts and talents by disaggregating assessment data and yearly progress data and making the results public.
2.6. Evaluation of Programming. Students identified with gifts and talents have increased access and they show significant learning progress as a result of improving components of gifted education programming.	2.6.1. Administrators provide the necessary time and resources to implement an annual evaluation plan developed by persons with expertise in program evaluation and gifted education. 2.6.2. The evaluation plan is purposeful and evaluates how student-level outcomes are influenced by one or more of the following components of gifted education programming: (a) identification, (b) curriculum, (c) instructional programming and services, (d) ongoing assessment of student learning, (e) counseling and guidance programs, (f) teacher qualifications and professional development, (g) parent/guardian and community involvement, (h) programming resources, and (i) programming design, management, and delivery. 2.6.3. Educators disseminate the results of the evaluation, orally and in written form, and explain how they will use the results.

Gifted Education Programming Standard 3: Curriculum Planning and Instruction

Introduction

Assessment is an integral component of the curriculum planning process. The information obtained from multiple types of assessments informs decisions about curriculum content, instructional strategies, and resources that will support the growth of students with gifts and talents. Educators develop and use a comprehensive and sequenced core curriculum that is aligned with local, state, and national standards, then differentiate and expand it. In order to meet the unique needs of students with gifts and talents, this curriculum must emphasize advanced, conceptually challenging, in-depth, distinctive, and complex content within cognitive, affective, aesthetic, social, and leadership domains. Educators must possess a repertoire of evidence-based instructional strategies in delivering the curriculum (a) to develop talent, enhance learning, and provide students with the knowledge and skills to become independent, self-aware learners, and (b) to give students the tools to contribute to a multicultural, diverse society. The curriculum, instructional strategies, and materials and resources must engage a variety of learners using culturally responsive practices.

STANDARD 3: CURRICULUM PLANNING AND INSTRUCTION

Description: *Educators apply the theory and research-based models of curriculum and instruction related to students with gifts and talents and respond to their needs by planning, selecting, adapting, and creating culturally relevant curriculum and by using a repertoire of evidence-based instructional strategies to ensure specific student outcomes.*

STUDENT OUTCOMES	EVIDENCE-BASED PRACTICES
3.1. Curriculum Planning. Students with gifts and talents demonstrate growth commensurate with aptitude during the school year.	3.1.1. Educators use local, state, and national standards to align and expand curriculum and instructional plans. 3.1.2. Educators design and use a comprehensive and continuous scope and sequence to develop differentiated plans for PK-12 students with gifts and talents. 3.1.3. Educators adapt, modify, or replace the core or standard curriculum to meet the needs of students with gifts and talents and those with special needs such as twice-exceptional, highly gifted, and English language learners. 3.1.4. Educators design differentiated curricula that incorporate advanced, conceptually challenging, in-depth, distinctive, and complex content for students with gifts and talents. 3.1.5. Educators use a balanced assessment system, including pre-assessment and formative assessment, to identify students' needs, develop differentiated education plans, and adjust plans based on continual progress monitoring. 3.1.6. Educators use pre-assessments and pace instruction based on the learning rates of students with gifts and talents and accelerate and compact learning as appropriate. 3.1.7. Educators use information and technologies, including assistive technologies, to individualize for students with gifts and talents, including those who are twice-exceptional.
3.2. Talent Development. Students with gifts and talents become more competent in multiple talent areas and across dimensions of learning.	3.2.1. Educators design curricula in cognitive, affective, aesthetic, social, and leadership domains that are challenging and effective for students with gifts and talents. 3.2.2. Educators use metacognitive models to meet the needs of students with gifts and talents.
3.3. Talent Development. Students with gifts and talents develop their abilities in their domain of talent and/or area of interest.	3.3.1. Educators select, adapt, and use a repertoire of instructional strategies and materials that differentiate for students with gifts and talents and that respond to diversity. 3.3.2. Educators use school and community resources that support differentiation. 3.3.3. Educators provide opportunities for students with gifts and talents to explore, develop, or research their areas of interest and/or talent.
3.4. Instructional Strategies. Students with gifts and talents become independent investigators.	3.4.1. Educators use critical-thinking strategies to meet the needs of students with gifts and talents. 3.4.2. Educators use creative-thinking strategies to meet the needs of students with gifts and talents. 3.4.3. Educators use problem-solving model strategies to meet the needs of students with gifts and talents. 3.4.4. Educators use inquiry models to meet the needs of students with gifts and talents.
3.5. Culturally Relevant Curriculum. Students with gifts and talents develop knowledge and skills for living and being productive in a multicultural, diverse, and global society.	3.5.1. Educators develop and use challenging, culturally responsive curriculum to engage all students with gifts and talents. 3.5.2. Educators integrate career exploration experiences into learning opportunities for students with gifts and talents, e.g. biography study or speakers. 3.5.3. Educators use curriculum for deep explorations of cultures, languages, and social issues related to diversity.
3.6. Resources. Students with gifts and talents benefit from gifted education programming that provides a variety of high quality resources and materials.	3.6.1. Teachers and administrators demonstrate familiarity with sources for high quality resources and materials that are appropriate for learners with gifts and talents.

Gifted Education Programming Standard 4: Learning Environments

Introduction

Effective educators of students with gifts and talents create safe learning environments that foster emotional well-being, positive social interaction, leadership for social change, and cultural understanding for success in a diverse society. Knowledge of the impact of giftedness and diversity on social-emotional development enables educators of students with gifts and talents to design environments that encourage independence, motivation, and self-efficacy of individuals from all backgrounds. They understand the role of language and communication in talent development and the ways in which culture affects communication and behavior. They use relevant strategies and technologies to enhance oral, written, and artistic communication of learners whose needs vary based on exceptionality, language proficiency, and cultural and linguistic differences. They recognize the value of multilingualism in today's global community.

STANDARD 4: LEARNING ENVIRONMENTS

Description: *Learning environments foster personal and social responsibility, multicultural competence, and interpersonal and technical communication skills for leadership in the 21st century to ensure specific student outcomes.*

STUDENT OUTCOMES	EVIDENCE-BASED PRACTICES
4.1. Personal Competence. Students with gifts and talents demonstrate growth in personal competence and dispositions for exceptional academic and creative productivity. These include self-awareness, self-advocacy, self-efficacy, confidence, motivation, resilience, independence, curiosity, and risk taking.	4.1.1. Educators maintain high expectations for all students with gifts and talents as evidenced in meaningful and challenging activities. 4.1.2. Educators provide opportunities for self-exploration, development and pursuit of interests, and development of identities supportive of achievement, e.g., through mentors and role models. 4.1.3. Educators create environments that support trust among diverse learners. 4.1.4. Educators provide feedback that focuses on effort, on evidence of potential to meet high standards, and on mistakes as learning opportunities. 4.1.5. Educators provide examples of positive coping skills and opportunities to apply them.
4.2. Social Competence. Students with gifts and talents develop social competence manifested in positive peer relationships and social interactions.	4.2.1. Educators understand the needs of students with gifts and talents for both solitude and social interaction. 4.2.2. Educators provide opportunities for interaction with intellectual and artistic/creative peers as well as with chronological-age peers. 4.2.3. Educators assess and provide instruction on social skills needed for school, community, and the world of work.
4.3. Leadership. Students with gifts and talents demonstrate personal and social responsibility and leadership skills.	4.3.1. Educators establish a safe and welcoming climate for addressing social issues and developing personal responsibility. 4.3.2. Educators provide environments for developing many forms of leadership and leadership skills. 4.3.3. Educators promote opportunities for leadership in community settings to effect positive change.
4.4. Cultural Competence. Students with gifts and talents value their own and others' language, heritage, and circumstance. They possess skills in communicating, teaming, and collaborating with diverse individuals and across diverse groups[1]. They use positive strategies to address social issues, including discrimination and stereotyping.	4.4.1. Educators model appreciation for and sensitivity to students' diverse backgrounds and languages. 4.4.2. Educators censure discriminatory language and behavior and model appropriate strategies. 4.4.3. Educators provide structured opportunities to collaborate with diverse peers on a common goal.
4.5. Communication Competence. Students with gifts and talents develop competence in interpersonal and technical communication skills. They demonstrate advanced oral and written skills, balanced bilitеracy or multiliteracy, and creative expression. They display fluency with technologies that support effective communication.	4.5.1. Educators provide opportunities for advanced development and maintenance of first and second language(s). 4.5.2. Educators provide resources to enhance oral, written, and artistic forms of communication, recognizing students' cultural context. 4.5.3. Educators ensure access to advanced communication tools, including assistive technologies, and use of these tools for expressing higher-level thinking and creative productivity.

[1] *Differences among groups of people and individuals based on ethnicity, race, socioeconomic status, gender, exceptionalities, language, religion, sexual orientation, and geographical area.*

Gifted Education Programming Standard 5: Programming

Introduction

The term programming refers to a continuum of services that address students with gifts and talents' needs in all settings. Educators develop policies and procedures to guide and sustain all components of comprehensive and aligned programming and services for PreK-12 students with gifts and talents. Educators use a variety of programming options such as acceleration and enrichment in varied grouping arrangements (cluster grouping, resource rooms, special classes, special schools) and within individualized learning options (independent study, mentorships, online courses, internships) to enhance students' performance in cognitive and affective areas and to assist them in identifying future career goals. They augment and integrate current technologies within these learning opportunities to increase access to high level programming such as distance learning courses and to increase connections to resources outside of the school walls. In implementing services, educators in gifted, general, special education programs, and related professional services collaborate with one another and parents/guardians and community members to ensure that students' diverse learning needs are met. Administrators demonstrate their support of these programming options by allocating sufficient resources so that all students within gifts and talents receive appropriate educational services.

STANDARD 5: PROGRAMMING

Description: *Educators are aware of empirical evidence regarding (a) the cognitive, creative, and affective development of learners with gifts and talents, and (b) programming that meets their concomitant needs. Educators use this expertise systematically and collaboratively to develop, implement, and effectively manage comprehensive services for students with a variety of gifts and talents to ensure specific student outcomes.*

STUDENT OUTCOMES	EVIDENCE-BASED PRACTICES
5.1. Variety of Programming. Students with gifts and talents participate in a variety of evidence-based programming options that enhance performance in cognitive and affective areas.	5.1.1. Educators regularly use multiple alternative approaches to accelerate learning. 5.1.2. Educators regularly use enrichment options to extend and deepen learning opportunities within and outside of the school setting. 5.1.3. Educators regularly use multiple forms of grouping, including clusters, resource rooms, special classes, or special schools. 5.1.4. Educators regularly use individualized learning options such as mentorships, internships, online courses, and independent study. 5.1.5. Educators regularly use current technologies, including online learning options and assistive technologies to enhance access to high-level programming. 5.1.6. Administrators demonstrate support for gifted programs through equitable allocation of resources and demonstrated willingness to ensure that learners with gifts and talents receive appropriate educational services.
5.2. Coordinated Services. Students with gifts and talents demonstrate progress as a result of the shared commitment and coordinated services of gifted education, general education, special education, and related professional services, such as school counselors, school psychologists, and social workers.	5.2.1. Educators in gifted, general, and special education programs, as well as those in specialized areas, collaboratively plan, develop, and implement services for learners with gifts and talents.
5.3. Collaboration. Students with gifts and talents' learning is enhanced by regular collaboration among families, community, and the school.	5.3.1. Educators regularly engage families and community members for planning, programming, evaluating, and advocating.
5.4. Resources. Students with gifts and talents participate in gifted education programming that is adequately funded to meet student needs and program goals.	5.4.1. Administrators track expenditures at the school level to verify appropriate and sufficient funding for gifted programming and services.
5.5. Comprehensiveness. Students with gifts and talents develop their potential through comprehensive, aligned programming and services.	5.5.1. Educators develop thoughtful, multi-year program plans in relevant student talent areas, PK-12.
5.6. Policies and Procedures. Students with gifts and talents participate in regular and gifted education programs that are guided by clear policies and procedures that provide for their advanced learning needs (e.g., early entrance, acceleration, credit in lieu of enrollment).	5.6.1. Educators create policies and procedures to guide and sustain all components of the program, including assessment, identification, acceleration practices, and grouping practices, that is built on an evidence-based foundation in gifted education.
5.7. Career Pathways. Students with gifts and talents identify future career goals and the talent development pathways to reach those goals.	5.7.1. Educators provide professional guidance and counseling for individual student strengths, interests, and values. 5.7.2. Educators facilitate mentorships, internships, and vocational programming experiences that match student interests and aptitudes.

Gifted Education Programming Standard 6: Professional Development

Introduction

Professional development is essential for all educators involved in the development and implementation of gifted programs and services. Professional development is the intentional development of professional expertise as outlined by the NAGC-CEC teacher preparation standards and is an ongoing part of gifted educators' professional and ethical practice. Professional development may take many forms ranging from district-sponsored workshops and courses, university courses, professional conferences, independent studies, and presentations by external consultants and should be based on systematic needs assessments and professional reflection. Students participating in gifted education programs and services are taught by teachers with developed expertise in gifted education. Gifted education program services are developed and supported by administrators, coordinators, curriculum specialists, general education, special education, and gifted education teachers who have developed expertise in gifted education. Since students with gifts and talents spend much of their time within general education classrooms, general education teachers need to receive professional development in gifted education that enables them to recognize the characteristics of giftedness in diverse populations, understand the school or district referral and identification process, and possess an array of high quality, research-based differentiation strategies that challenge students. Services for students with gifts and talents are enhanced by guidance and counseling professionals with expertise in gifted education.

STANDARD 6: PROFESSIONAL DEVELOPMENT

Description: *All educators (administrators, teachers, counselors, and other instructional support staff) build their knowledge and skills using the NAGC-CEC Teacher Standards for Gifted and Talented Education and the National Staff Development Standards. They formally assess professional development needs related to the standards, develop and monitor plans, systematically engage in training to meet the identified needs, and demonstrate mastery of standard. They access resources to provide for release time, funding for continuing education, and substitute support. These practices are judged through the assessment of relevant student outcomes.*

STUDENT OUTCOMES	EVIDENCE-BASED PRACTICES
6.1. Talent Development. Students develop their talents and gifts as a result of interacting with educators who meet the national teacher preparation standards in gifted education.	6.1.1. Educators systematically participate in ongoing, research-supported professional development that addresses the foundations of gifted education, characteristics of students with gifts and talents, assessment, curriculum planning and instruction, learning environments, and programming. 6.1.2. The school district provides professional development for teachers that models how to develop environments and instructional activities that encourage students to express diverse characteristics and behaviors that are associated with giftedness. 6.1.3. Educators participate in ongoing professional development addressing key issues such as anti-intellectualism and trends in gifted education such as equity and access. 6.1.4. Administrators provide human and material resources needed for professional development in gifted education (e.g. release time, funding for continuing education, substitute support, webinars, or mentors). 6.1.5. Educators use their awareness of organizations and publications relevant to gifted education to promote learning for students with gifts and talents.
6.2. Socio-emotional Development. Students with gifts and talents develop socially and emotionally as a result of educators who have participated in professional development aligned with national standards in gifted education and National Staff Development Standards.	6.2.1. Educators participate in ongoing professional development to support the social and emotional needs of students with gifts and talents.
6.3. Lifelong Learners. Students develop their gifts and talents as a result of educators who are life-long learners, participating in ongoing professional development and continuing education opportunities.	6.3.1. Educators assess their instructional practices and continue their education in school district staff development, professional organizations, and higher education settings based on these assessments. 6.3.2. Educators participate in professional development that is sustained over time, that includes regular follow-up, and that seeks evidence of impact on teacher practice and on student learning. 6.3.3. Educators use multiple modes of professional development delivery including online courses, online and electronic communities, face-to-face workshops, professional learning communities, and book talks. 6.3.4. Educators identify and address areas for personal growth for teaching students with gifts and talents in their professional development plans.
6.4. Ethics. Students develop their gifts and talents as a result of educators who are ethical in their practices.	6.4.1. Educators respond to cultural and personal frames of reference when teaching students with gifts and talents. 6.4.2. Educators comply with rules, policies, and standards of ethical practice.

Glossary of Terms

An abridged version of the glossary used in the NAGC Pre-K-Grade 12 Gifted Programming Standards

(Note: a full glossary is available at www.nagc.org)

Ability. Capacity to develop competence in an area of human endeavor; also referred to as 'potential'. Abilities can be developed through appropriate formal and informal education experiences and typically are assessed by measures such as intelligence tests, though environmental factors such as schooling, self-concept, and trust can lead to inaccurate results.

Aptitude. Ability to learn material at advanced rates and levels of understanding in a specific area (e.g., humanities, mathematics, science). Measured by tests of knowledge, speed and accuracy in reasoning, and information retrieval in the content area (Reis & Housand, 2008).

Assessment. Process of gathering data or using instruments for this purpose, typically to determine an individual's status with respect to a characteristic or behavior. Strictly speaking, assessment refers to the data that are collected or the collection process, while evaluation refers to making a judgment of some kind based on the assessment data.

Cognitive and affective growth. Cognitive growth refers to the development of concepts and thinking skills, while affective growth relates to the development of social-emotional needs.

Collaboration. Stakeholders purposefully working together and sharing responsibility for achieving a common goal; reaching out to engage others in responding to needs (e.g., educators responsible for G/T and bilingual education together planning instruction for English language learners with gifts and talents).

Coordinated services. Instruction and resources within and outside of programming specifically for students with gifts and talents (e.g., general, special, bilingual, or arts education) that are intentionally connected and articulated with each other to effectively support learners with gifts and talents.

Cultural competence. Skills and dispositions for establishing and maintaining positive relationships and working effectively with individuals and communities from diverse backgrounds. Includes an open mind, willingness to accept alternative perspectives, critical self-examination, and acquisition and use of information (Shaunessy & Matthews, 2009).

Culturally relevant. Describes elements (e.g., curriculum, materials) within culturally responsive classrooms that are rigorous and multicultural, engage culturally different students and have meaning for them, and enable them to connect new learning with their interests (Ford, 2010).

Differentiated assessment. The practice of varying assessment in such a way that it reflects differentiation in the curriculum and/or the instruction. Differentiated assessment implies that as students experience differences in their learning, they should experience differences in their assessment. For example, students with gifts and talents may require off level/above grade-level tests to accurately assess their level of ability or achievement.

Differentiated curriculum. Adaptation of content, process, and concepts to meet a higher level of expectation appropriate for advanced learners. Curriculum can be differentiated through acceleration, complexity, depth, challenge, and creativity (VanTassel-Baska & Wood, 2008).

Differentiated instruction. Multiple ways to structure a lesson so that each student is challenged at an appropriate level. Differentiated instruction may include such features as learner centeredness; planned assignments and lessons based on pre-assessment; and flexible grouping, materials, resources, and pacing (Tomlinson & Hockett, 2008).

Diversity. Differences among groups of people and individuals based on ethnicity, race, socioeconomic status, gender, exceptionalities, language, religion, sexual orientation, and geographical area (Matthews & Shaunessy, 2008; NCATE, 2010).

Identification. A needs assessment whose primary purpose is the placement of students into educational programs designed to develop their intellectual, emotional, and social potential (Richert, 2003). The identification process moves from screening to placement (Matthews & Shaunessy, 2010) and involves use of multiple measures to assess high-level ability, aptitude, achievement, or other constructs of interest in one or more areas of learning (Johnsen, 2008).

Individual learning options. Specific and unique academic plans developed for a student to include a range of possibilities such as grade acceleration, advanced study of a particular academic area, off-campus instruction, or resource programs. Individualized learning options may be called IEPs in some states; they generally include goals, outcomes, and assessments for each student with gifts and talents and are reviewed and revised annually.

Off-level/above-grade level. Tests normed for students at a higher grade level than the students who are being tested. Widely used in talent search testing (Matthews, 2008) to provide an accurate picture of the relative ability level of students whose abilities exceed those that can be measured using on-grade level instruments. Individually administered assessments such as IQ tests often can also provide this information.

Programs/programming. Formally structured, regularly scheduled, ongoing services provided to students with gifts and talents in school or community settings (e.g., museum, laboratory, or university). Programming includes goals, student outcomes, strategies to accomplish them, and procedures for assessing and evaluating these over time. The Committee prefers the term "programming" because it indicates the ongoing nature of these services, while "program" could refer to a one-time event.

Qualitative instruments. Measures that use primarily words rather than numbers to describe or investigate student, teacher, parent, or other stakeholders' reactions to or perceptions of strengths or weaknesses of gifted programming and related phenomena. Interviews and portfolios (Johnsen, 2008) are two commonly used types of qualitative instruments.

Quantitative instruments. Measures that use numerical data (Johnsen, 2008) to describe performance in relation to others (e.g., norm referenced intelligence tests) or in relation to a standard of performance (e.g., criterion referenced achievement tests).

Services/servicing. Educational and related interventions that are provided to students in or outside of the regular school setting. A given service may be one-time-only, annual, or ongoing, and may be provided even in the absence of formal gifted programming. Examples may include counseling, tutoring, and mentoring.

Social competence. The ability to interact effectively with others. Component skills include creating and maintaining positive interpersonal relationships, communicating, listening, and feeling empathy. Related dispositions include appreciation of human diversity, commitment to social justice, and holding high ethical standards (Moon, 2008).

Socio-emotional development. Those factors from a psychological perspective that assert an affective influence on an individual's self-image, behavior, and motivation; issues such as but not limited to peer relationships, emotional adjustment, stress management, perfectionism, and sensitivity (Moon, 2003).

Special Educator. In a handful of states, gifted education is included within special education (NAGC, 2009) and teachers of students with gifts and talents in these states are special educators. In other locations, state law does not consider gifted education to be a part of special education and teachers of students with gifts and talents are not considered special education staff.

Students with gifts and talents. This phrasing is currently preferred over "gifted and talented students" because it emphasizes the person rather than the exceptionality and is consistent with usage in the field of special education. It includes those students whose abilities are latent as well as students whose abilities already are manifest. Individuals with gifts and talents also includes 'gifted and talented students,' 'high-ability students,' 'academically advanced students,' 'gifted students with potential,' and so on.

Technical adequacy. This term refers to the psychometric properties of an assessment instrument. Instruments with technical adequacy demonstrate validity for the identified purpose, reliability in providing consistent results, and minimal bias, and have been normed on a population matching the census data (Johnsen, 2008).

Twice exceptional. A learner who evidences high performance or potential in a gift, talent, or ability area combined with one or more disabilities that may affect achievement (e.g., learning disability, attention deficit hyperactive disorder, Asperger's syndrome, or a physical or sensory disability).

Underachieving. This term refers to students who demonstrate a discrepancy between ability and performance (Reis & Housand, 2008). Underachieving students exhibit a severe discrepancy between expected achievement as measured by standardized assessments and actual achievement as measured by class grades or teacher evaluations (McCoach & Siegle, 2003). The discrepancy must persist over time and must not be the direct result of a diagnosed learning disability.

Glossary References

Ford, D. Y. (2010). Culturally responsive classrooms: Affirming culturally different gifted students. *Gifted Child Today, 33*(1), 50-53.

Johnsen, S. K. (2008). Identifying gifted and talented learners. In F. A. Karnes & K. R. Stephens (Eds.), *Achieving excellence: Educating the gifted and talented* (pp. 135-153). Upper Saddle River, NJ: Pearson.

Matthews, M. S. (2008). Talent search programs. In J. A. Plucker & C. M. Callahan (Eds.), *Critical issues and practices in gifted education: What the research says (*pp. 641-654). Waco, TX: Prufrock Press.

Matthews, M. S., & Shaunessy, E. (2008). Culturally, linguistically, and economically diverse gifted students. In F. A. Karnes & K. R. Stephens (Eds.), *Achieving excellence: Educating the gifted and talented* (pp. 99-115). Upper Saddle River, NJ: Pearson.

Matthews, M. S., & Shaunessy, E. (2010). Putting standards into practice: Evaluating the utility of the NAGC Pre-K —Grade 12 Gifted Program Standards. *Gifted Child Quarterly, 54*, 159-167.

McCoach, D. B., & Siegle, D. (2003). Factors that differentiate underachieving gifted students from high-achieving gifted students. *Gifted Child Quarterly, 47*, 144-154.

Moon, S. M. (2003). Counseling families. In N. Colangelo & G. A. Davis (Eds.), *Handbook of gifted education* (3rd ed., pp. 388-402). Boston, MA: Allyn & Bacon.

Moon, S. (2008). Personal and social development. In F. A. Karnes & K. R. Stephens (Eds.), *Achieving excellence: Educating the gifted and talented* (pp. 83-98). Upper Saddle River, NJ: Pearson.

National Association for Gifted Children & Council of State Directors of Programs for the Gifted. (2009). *2008-2009 State of the States in Gifted Education* [CD]. Washington, DC: Author.

National Council for Accreditation of Teacher Education (2010). Unit Standards Glossary downloaded 8/22/10 from http://www.ncate.org/public/glossary.asp?ch=155.

Reis, S. M., & Housand, A. M. (2008). Characteristics of gifted and talented learners: Similarities and differences across domains. In F. A. Karnes & K. R. Stephens (Eds.), *Achieving excellence: Educating the gifted and talented* (pp. 62-81). Upper Saddle River, NJ: Pearson.

Richert, E. S. (2003). Excellence and justice in identification and programming. In N. Colangelo & G. A. Davis (Eds.) *Handbook of gifted education* (3rd ed., pp. 146-158). Boston, MA: Allyn & Bacon.

Shaunessy, E., & Matthews, M. S. (2009). Preparing culturally competent teachers of the gifted: The role of racial consciousness. In Castellano, J.A. (Ed.), *Perspectives in Gifted Education: Diverse Gifted Learners* [monograph series], *4*, 5-26. Denver, CO: University of Denver, Institute for the Development of Gifted Education.

Tomlinson, C. A., & Hockett, J. A. (2008). Instructional strategies and programming models for gifted learners. In F. A. Karnes & K. R. Stephens (Eds.), *Achieving excellence: Educating the gifted and talented* (pp. 154-169). Upper Saddle River, NJ: Pearson.

VanTassel-Baska, J., & Wood, S. (2008). Curriculum development in gifted education: A challenge to provide optimal learning experiences. In F. A. Karnes & K. R. Stephens (Eds.), *Achieving excellence: Educating the gifted and talented* (pp. 209-229). Upper Saddle River, NJ: Pearson.

NATIONAL ASSOCIATION FOR
Gifted Children

1331 H St., NW, Suite 1001, Washington, DC 20005
202-785-4268 | www.nagc.org

Appendix B
NATIONAL QUALITY STANDARDS IN GIFTED AND TALENTED EDUCATION

Generic Elements	Entry		Developing		Exemplary	
A- Effective teaching and learning strategies						
1. Identification	i. The school/college has systems to identify gifted and talented pupils in all year groups and an agreed definition and shared understanding of the meaning of 'gifted and talented' within its own, local and national contexts		i. Individual pupils are screened annually against clear criteria at school/college and subject/topic level		i. **Multiple criteria** and **sources of evidence** are used to identify gifts and talents, including through the use of a broad range of quantitative and qualitative data	
	ii. An **accurate record** of the identified gifted and talented population is kept and updated.		ii. The record is used to identify under-achievement and **exceptional achievement** (both within and outside the population) and to track/review pupil **progress**		ii. The record is supported by a comprehensive monitoring and reporting system which all staff regularly share and contribute to	
	iii. The identified gifted and talented population broadly reflects the school/college's **social and economic composition**, gender and ethnicity		iii. **Identification** systems address issues of **multiple exceptionality** (pupils with specific gifts/talents and special educational needs)		iii. **Identification** processes are regularly reviewed and refreshed in the light of pupil performance and value-added data. The gifted and talented population is fully representative of the school/college's population	
Evidence						
Next steps						
2. Effective provision in the classroom	i. The school/college addresses the different needs of the gifted and talented population by providing a stimulating learning environment and by extending the teaching repertoire		i. Teaching and learning strategies are diverse and flexible, meeting the needs of distinct pupil groups within the gifted and talented population (e.g. able underachievers, exceptionally able)		i. The school/college has established a range of methods to find out what works best in the classroom, and shares this within the school/college and with other schools and colleges	
	ii. Teaching and learning is differentiated and delivered through both individual and group activities		ii. A range of challenging learning and teaching strategies is evident in lesson planning and delivery. **Independent learning** skills are developed.		ii. Teaching and learning are suitably challenging and varied, incorporating the **breadth**, **depth** and **pace** required to progress high achievement. Pupils routinely work independently and self-reliantly	
	iii. Opportunities exist to extend learning through **new technologies**		iii. The use of **new technologies** across the curriculum is focused on **personalised learning** needs		iii. The innovative use of **new technologies** raises the achievement and motivation of gifted and talented pupils	
Evidence						
Next steps						

Glossary definition provided for words and phrases shown in bold in the accompanying Quality Standards' User Guide
QS Model October 2005

Generic Elements	Entry		Developing		Exemplary	
3. Standards	i. Levels of **attainment** and **achievement** for gifted and talented pupils are comparatively high in relation to the rest of the school/college population and are in line with those of similar pupils in similar schools/colleges		i. Levels of **attainment** and **achievement** for gifted and talented pupils are broadly consistent across the gifted and talented population and above those of similar pupils in similar schools/colleges		i. Levels of **attainment** and **achievement** for gifted and talented pupils indicate sustainability over time and are well above those of similar pupils in similar schools/colleges	
	ii. Self-evaluation indicates that gifted and talented provision is satisfactory		ii. Self-evaluation indicates that gifted and talented provision is good		ii. Self-evaluation indicates that gifted and talented provision is very good or excellent	
	iii. Schools/colleges gifted and talented education programmes are explicitly linked to the achievement of SMART outcomes and these highlight improvements in pupils' attainment and achievement					
Evidence						
Next steps						
B - Enabling curriculum entitlement and choice						
4. Enabling curriculum entitlement and choice	i. Curriculum organisation is flexible, with opportunities for enrichment and increasing subject/topic choice. Pupils are provided with support and guidance in making choices		i. The curriculum offers opportunities and guidance to pupils which enable them to work beyond their age and/or phase, and across subjects or topics, according to their aptitudes and interests		i. The curriculum offers **personalised learning pathways** for pupils which maximise individual **potential**, retain flexibility of future choices, extend well beyond test/examination requirements and result in sustained impact on pupil **attainment and achievement**	
Evidence						
Next steps						
C- Assessment for learning						
5. Assessment for learning	i. Processes of data analysis and pupil assessment are employed throughout the school/college to plan learning for gifted and talented pupils		i. Routine progress reviews, using both qualitative and quantitative data, make effective use of prior, predictive and value-added **attainment** data to plan for progression in pupils' learning		i. **Assessment data** are used by teachers and across the school/college to ensure challenge and sustained progression in individual pupils' learning	
	ii. Dialogue with pupils provides focused feedback which is used to plan future learning		ii. Systematic oral and written feedback helps pupils to set challenging curricular targets		ii. Formative assessment and individual target setting combine to maximise and celebrate pupils' achievements	
	iii. Self and peer assessment, based on clear understanding of criteria, are used to increase pupils' responsibility for learning		iii. Pupils reflect on their own skill development and are involved in the design of their own targets and tasks		iii. Classroom practice regularly requires pupils to reflect on their own **progress** against targets, and engage in the direction of their own learning	
Evidence						
Next steps						

Generic Elements	Entry		Developing		Exemplary	
6. Transfer and transition	i. Shared processes, using agreed criteria, are in place to ensure the productive transfer of information from one setting to another (i.e. from class to class, year to year and school/college to school/college)		i. Transfer information concerning gifted and talented pupils, including parental input, informs targets for pupils to ensure **progress** in learning. Particular attention is given to including new admissions		i. Transfer data concerning gifted and talented pupils are used to inform planning of teaching and learning at subject/aspect/topic and individual pupil level, and to ensure progression according to ability rather than age or phase	
Evidence						
Next steps						
D – School/College organisation						
7. Leadership	i. A named member of the governing body, Senior Management Team and the lead professional responsible for Gifted and Talented education have clearly directed responsibilities for motivating and driving gifted and talented provision. The Head teacher actively champions gifted and talented provision		i. **Responsibility** for gifted and talented provision is **distributed,** and evaluation of its impact shared, at all levels in the school/college. Staff subscribe to policy at all levels. Governors play a significant supportive and evaluative role		i. Organisational structures, communication channels and the deployment of staff (e.g. workforce remodelling) are flexible and creative in supporting the delivery of **personalised learning.** Governors take a lead in celebrating achievements of gifted and talented pupils	
Evidence						
Next steps						
8. Policy	i. The gifted and talented policy is integral to the school/college's inclusion agenda, feeds into and from the single school/college improvement plan and is consistent with other policies		i. The policy directs and reflects best practice in the school/college, is regularly reviewed and is clearly linked to other policy documentation		i. The policy includes input from the whole school/college community and is regularly refreshed in the light of innovative national and international practice	
Evidence						
Next steps						

Generic Elements	Entry		Developing		Exemplary	
D – School/College organisation						
9. School /College ethos and pastoral care	i. The school/college sets high expectations, recognises achievement and celebrates the successes of all its pupils		i. The school/college fosters an environment which promotes positive behaviour for learning. Pupils are listened to and their views taken into account.		i. An ethos of ambition and achievement is agreed and shared by the whole school/college community. Success across a wide range of abilities is celebrated	
	ii. The school/college identifies and addresses the particular social and emotional needs of gifted and talented pupils in consultation with pupils, parents and carers		ii. Strategies exist to counteract bullying and any adverse effects of social and curriculum pressures. Specific support for able underachievers and pupils from different cultures and social backgrounds is available and accessible		ii. The school/college places equal emphasis on high achievement and emotional well being, underpinned by programmes of support personalised to the needs of gifted and talented pupils. There are opportunities for pupils to use their gifts to benefit other pupils and the wider community	
Evidence						
Next steps						
10. Staff development	i. Staff have received training in meeting the needs of gifted and talented pupils		i. The induction programme for new staff addresses gifted and talented issues, both at whole school/college and specific subject/aspect level		i. There is **ongoing audit of staff needs** and an appropriate range of training and professional development in gifted and talented education. Professional development is informed by research and collaboration within and beyond the school/college	
	ii. The lead professional responsible for Gifted and Talented education has received appropriate training		ii. Subject/aspect and phase leaders have received specific training in meeting the needs of gifted and talented pupils		ii. Priorities for the development of gifted and talented provision are included within a professional development entitlement for all staff and are monitored through performance management processes	
Evidence						
Next steps						
11. Resources	i. Provision for gifted and talented pupils is supported by appropriate budgets and resources		i. Allocated resources include school/college based and nationally available resources, and these have a significant and measurable impact on the progress that pupils make and their attitudes to learning		i. Resources are used to stimulate innovative and experimental practice, which is shared throughout the school/college and which are regularly reviewed for impact and best value	
Evidence						
Next steps						

Generic Elements	Entry		Developing		Exemplary	
D – School/College organisation						
12. Monitoring and evaluation	i. **Subject and phase audits** focus on the quality of teaching and learning for gifted and talented pupils. Whole school/college targets are set using prior **attainment** data		i. Performance against targets (including at pupil level) is regularly reviewed. Targets include qualitative pastoral and curriculum outcomes as well as numerical data		i. Performance against targets is rigorously evaluated against clear criteria. Qualitative and quantitative outcomes inform whole school/college self-evaluation processes	
	ii. Elements of provision are planned against clear objectives within effective whole-school self-evaluation processes		ii. All elements, including non-academic aspects of gifted and talented provision are planned to clear objectives and are subjected to detailed evaluation		ii. The school/college examines and challenges its own provision to inform development of further experimental and innovative practice in collaboration with other schools/colleges	
Evidence						
Next steps						
E - Strong partnerships beyond the school						
13. Engaging with the community, families and beyond	i. Parents/carers are aware of the school's/college's policy on gifted and talented provision, contribute to its **identification** processes and are kept informed of developments in gifted and talented provision through the annual School Information Profile		i. Progression of gifted and talented pupils is enhanced by home-school/college partnerships. There are strategies to engage and support hard-to-reach parents/carers		i. Parents/carers are actively engaged in extending provision. Support for gifted and talented provision is integrated with other children's services (e.g. Sure Start, EAL, traveller, refugee, **LAC** Services)	
	ii. The school/college shares good practice and has some collaborative provision with other schools, colleges and the wider community		ii. A coherent strategy for networking with other schools, colleges and local community organisations extends and enriches provision		ii. There is strong emphasis on collaborative and innovative working with other schools/colleges which impacts on quality of provision locally, regionally and nationally	
Evidence						
Next steps						
14. Learning beyond the classroom	i. There are opportunities for pupils to learn beyond the school/college day and site		i. A coherent programme of enrichment and extension activities complements teaching and learning and helps identify pupils' latent gifts and talents		i. Innovative models of learning beyond the classroom are developed in collaboration with local and national schools/colleges to further enhance teaching and learning	
	ii. Pupils participate in dedicated gifted and talented activities (e.g. summer schools) and their participation is recorded		ii. Local and national provision helps meet individual pupils' learning needs e.g. NAGTY membership, accessing outreach, local enrichment programmes		ii. Coherent strategies are used to direct and develop individual expert performance via external agencies e.g. HE/FE links, on-line support, and local/regional/national programmes	
Evidence						
Next steps						

national*strategies.****standards****.dcsf.gov.uk/node/171630*

Appendix C

(1) First Draft of Questionnaire in Arabic

عزيزي الطالب وفقه الله

أنا الباحث عبدالحميد العرفج ادرس في مرحلة الدكتوراه في تربية الموهوبين في جامعة ساوثهوبتون في بريطانيا، أقوم بإعداد رسالة الدكتوراه بعنوان "تصميم برنامج اثرائي يلحق بمقرر العلوم للصف السادس الابتدائي في المملكة العربية السعودية" محاولة مني في مساعدة وتلبية حاجات الطلبة الموهوبين في هذه المرحلة .

آمل أن تجد فسحة من وقتك الثمين للمشاركة في الإجابة عن فقرات هذه الاستبانة و سأكون ممتنا لك لمساعدتي في بحثي عن طريق الاستجابة لهذه الاستبانة.

الاستبانة تتكون من قسمين : القسم الأول هو استكشاف وجهة نظرك حول مقرر العلوم كطالب ، والقسم الثاني الحصول على رأيك حيال ماذا يمكن أن يُعمل و يُضمن في البرنامج الاثرائي للطلبة الموهوبين .

المطلوب منك فقط هو الاستجابة لهذه الاستبانة التي يفترض أن لا تأخذ من وقتك أكثر من 25 دقيقة.

استجابتك تطوعية و ستكون محل التقدير والامتنان.

جميع المعلومات ستكون في سرية تامة وستستخدم لأغراض البحث العلمي فقط

شكرا جزيلا لمساعدتك و لوقتك

الباحث

عبد الحميد بن عبد الله العرفج

طالب دكتوراه

كلية التربية

جامعة ساوثهامبتون

بريطانيا

بريد الكتروني alarfaj1@hotmail.com

تعليمات

1. **رجاء ملاحظة أن الاستبيان مكون من قسمين: الأول حول مقرر العلوم الحالي للصف السادس، القسم الثاني حول البرنامج الاثرائي المؤمل تصميمه**
2. **رجاء إجابة جميع الأسئلة**
3. **التقسيم في الأسفل يشير إلى مدى موافقتك.**

موافق بشدة	موافق	لا أوافق	أعترض بشدة

مثال للتوضيح : **رجاء الإشارة إلى مدي موافقتك حيال:**

أعتقد أن	مقرر العلوم الحالي				البرنامج الاثرائي (المؤمل تصميمه) ينبغي أن			
	موافق بشدة	موافق	لا أوافق	اعترض بشدة	موافق بشدة	موافق	لا أوافق	اعترض بشدة
يحث الطلبة الموهوبين على التفكير النقدي			✓			✓		

الاستجابة أعلاه تشير إلى أن المستجيب يعتقد أن مقرر العلوم الحالي لا يساعد الطلبة الموهوبين لتطوير قدراتهم في التفكير الناقد بدرجة كافية ، بينما يعتقد أن البرنامج الاثرائي يفترض أن يساعد على تطوير تلك القدرات لدي الطلبة الموهوبين

استبانة الطالب

أعتقد أن	مقرر العلوم الحالي للصف السادس الابتدائي				البرنامج الاثرائي (المؤمل تصميمه) ينبغي أن			
	موافق بشدة	موافق	لا أوافق	اعترض بشدة	موافق بشدة	موافق	لا أوافق	اعترض بشدة
1. يعطى مرونة للمتعلم حسب قدرات ورغبات الفرد								
2. يعطى المتعلم فرص مناسبة للتعلم بالاحساس بالتحدي								
3. يوفر فرص للتعلم المستقل (بشكل منفرد)								
4. يوفر فرص للتعلم في مجموعات صغيرة								
5. يزيد(يطور) اتجاه ايجابي لتبني مواضيع (مشاريع) جديدة								
6. يسمح للمتعلم للعمل بتعمق واتساع في المواضيع بما يتناسب مع سرعتهم و قدراتهم								
7. يزيد وعي المتعلم حول الظواهر و المعلومات العلمية في العالم								
8. يشجع المتعلم على مراعاة و فحص جميع العوامل قبل اتخاذ القرار								
9. يزيد من الوعي والدراية بجسم الإنسان								
10. يزيد من الوعي بالبيئة								
11. يحث على استخدام تقنية متقدمة و المصادر (المراجع)								
12. يحث على التفكير الناقد								
13. يطور القدرة على التفكير العلمي								
14. يسمح تعلم مواضيع متخلفة ومتنوعة في العلوم								
15. يحث على استخدام المختبر و أدواته								
16. يحث على تعلم و البحث عن خبرات و أفكار جديدة								
17. يحث على تنظيم الواجبات والمواضيع من تلقاء انفسهم								
18. يهتم بالعادات و القضايا الاجتماعية في تعليم العلوم								

أعتقد أن	مقرر العلوم الحالي للصف السادس الابتدائي				البرنامج الاثرائي (المؤمل تصميمه) ينبغي أن			
	موافق بشدة	موافق	لا أوافق	اعترض بشدة	موافق بشدة	موافق	لا أوافق	اعترض بشدة
19. يزيد من ثقة المتعلمين بأنفسهم								
20. يحث على حرية التفكير								
21. يحفز (يحث) يشجع المتعلمين على إبداء أرائهم في أي موضوع أو مشكلة في العلوم بدون تردد								
22. يعطي المتعلمين الفرصة الكافية لشرح وتفسير ما يهتمون به و يحبونه								
23. يحث ويشجع المتعلمين على تجريب و محاولة أنشطة جديدة								
24. يعطي المتعلمين خيارات لتنظيم وتخطيط أعمالهم وأوقاتهم								
25. يحث المتعلمين على المشاركة وعرض آرائهم وأفكارهم مع الآخرين								
26. يلبي الحاجات الفردية لكل متعلم								
27. يساعد المتعلمين على تقييم انفسهم و انتاجهم بأنفسهم								
28. يعطي المتعلمين فرص لتقييم كتاب العلوم الذي يدرسونه								

شكرا جزيلا على إكمال الاستبانة

(2) Final Draft of Questionnaire In Arabic

عزيزي الطالب وفقه الله

أنا الباحث عبدالحميد العرفج ادرس في مرحلة الدكتوراه في تربية الموهوبين في جامعة ساوثهوبتون في بريطانيا، أقوم بإعداد رسالة الدكتوراه بعنوان "تصميم برنامج اثرائي يلحق بمقرر العلوم للصف السادس الابتدائي في المملكة العربية السعودية" محاولة مني في مساعدة وتلبية حاجات الطلبة الموهوبين في هذه المرحلة .

آمل أن تجد فسحة من وقتك الثمين للمشاركة في الإجابة عن فقرات هذه الاستبانة و سأكون ممتنا لك لمساعدتي في بحثي عن طريق الاستجابة لهذه الاستبانة.

الاستبانة تتكون من قسمين : القسم الأول هو استكشاف وجهة نظرك حول مقرر العلوم كطالب ، والقسم الثاني الحصول على رأيك حيال ماذا يمكن أن يُعمل و يُضمن في البرنامج الاثرائي للطلبة الموهوبين .

المطلوب منك فقط هو الاستجابة لهذه الاستبانة التي من الممكن أن لا تأخذ من وقتك أكثر من 25 دقيقة.

استجابتك تطوعية و ستكون محل التقدير والامتنان.

جميع المعلومات ستكون في سرية تامة وستستخدم لأغراض البحث العلمي فقط

شكرا جزيلا لمساعدتك و لوقتك

الباحث

عبد الحميد بن عبد الله العرفج

طالب دكتوراه

كلية التربية

جامعة ساوثهامبتون

بريطانيا

بريد الكتروني alarfaj1@hotmail.com

1. **رجاءً ملاحظة أن الاستبيان مكون من قسمين: الأول حول مقرر العلوم الحالي للصف السادس، القسم الثاني حول البرنامج الإثرائي المؤمل تصميمه**

2. **رجاء إجابة جميع الأسئلة**

3. **التقسيم في الأسفل يشير إلى مدى موافقتك.**

موافق بشدة:	**موافق:**	**لا أوافق:**	**أعترض بشدة:**
أي أنك توافق تماما على مضمون العبارة	أي أنك توافق على مضمون العبارة من نواحي كثيرة	أي أنك لا توافق على مضمون العبارة من نواحي كثيرة	أي انك لا توافق نهائيا على مضمون العبارة

مثال للتوضيح : **رجاء الإشارة إلى مدي موافقتك حيال:**

أعتقد أن	**مقرر العلوم الحالي**					**البرنامج الإثرائي (المؤمل تصميمه) ينبغي أن**			
	موافق بشدة	**موافق**	**لا أوافق**	**اعترض بشدة**		**موافق بشدة**	**موافق**	**لا أوافق**	**اعترض بشدة**
يحث الطلبة الموهوبين على التفكير النقدي			✓				✓		

الاستجابة أعلاه تشير إلى أن المستجيب يعتقد أن مقرر العلوم الحالي لا يساعد الطلبة الموهوبين لتطوير قدراتهم في التفكير الناقد بدرجة كافية ، بينما يعتقد أن البرنامج الاثرائي يفترض أن يساعد على تطوير تلك القدرات لدي الطلبة الموهوبين

أدناه الطالب رجاء ملء الجدول

تاريخ الميلاد	**المرحلة الدراسية (للطالب)**

استبانة الطالب

أعتقد أن	مقرر العلوم الحالي للصف السادس الابتدائي				البرنامج الاثرائي (المؤمل تصميمه) ينبغي أن			
	موافق بشدة	موافق	لا أوافق	اعترض بشدة	موافق بشدة	موافق	لا أوافق	اعترض بشدة
1. يعطى للمتعلم مرونة حسب قدراته ورغباته								
2. يعطى المتعلم فرص مناسبة للاحساس بالتحدي في التعلم.								
3. يوفر فرص للتعلم المستقل (بشكل منفرد)								
4. يوفر فرص للتعلم في مجموعات صغيرة								
5. يزيد اتجاه ايجابى لتبنى مواضيع و مشاريع جديدة								
6. يسمح للمتعلم للعمل بتعمق واتساع في المواضيع بما يتناسب مع سرعته و قدراته								
7. يزيد وعى المتعلم حول الظواهر و المعلومات العلمية في الحياة								
8. يشجع المتعلم على مراعاة و فحص جميع العوامل قبل اتخاذ القرار								
9. يزيد من الوعي والدراية بجسم الإنسان								
10. يزيد من الوعي بالبيئة								
11. يحث على استخدام تقنية متقدمة و مصادر المعلومات								
12. يحث على التفكير الناقد								
13. يطور القدرة على التفكير العلمي								
14. يسمح تعلم مواضيع مختلفة ومتنوعة في العلوم								
15. يحث على استخدام المختبر و أدواته								
16. يحث على التعلم و البحث عن خبرات و أفكار جديدة								
17. يحث المتعلم على تنظيم واجباته ومواضيعه من تلقاء نفسه								
18. يهتم بالعادات و القضايا الاجتماعية في تعليم العلوم								

أعتقد أن	مقرر العلوم الحالي للصف السادس الابتدائي				البرنامج الاثرائي (المؤمل تصميمه) ينبغي أن			
	موافق بشدة	موافق	لا أوافق	اعترض بشدة	موافق بشدة	موافق	لا أوافق	اعترض بشدة
19. يزيد من ثقة المتعلمين بأنفسهم								
20. يحث على حرية التفكير								
21. يحفز (يحث) يشجع المتعلمين على إبداء أرائهم في أي موضوع أو مشكلة في العلوم بدون تردد								
22. يعطي المتعلمين الفرصة الكافية لشرح وتفسير ما يهتمون به و يحبونه								
23. يحث ويشجع المتعلمين على تجريب أنشطة جديدة								
24. يعطي المتعلمين خيارات لتنظيم وتخطيط أعمالهم وأوقاتهم								
25. يحث المتعلمين على عرض آرائهم وأفكارهم و مشاركتهم مع الآخرين								
26. يلبي الحاجات الفردية لكل متعلم								
27. يساعد المتعلمين على تقييم تقدمهم في التعلم و إنتاجهم بأنفسهم								
28. يعطي المتعلمين فرص لتقييم كتاب العلوم الذي يدرسونه								

. ملاحظات ترغب في ذكرها حول مقرر العلوم الحالي:

.....
.....
.....
.....
.....
.....
.....
.....

شكرا جزيلا على إكمال الاستبانة

Appendix D Students Questionnaire

Dear Students

My name is Abdulhamid Alarfaj and I am a PhD student in gifted Education at University of Southampton.

I would appreciate it if you could participate in my research and help responding to the questionnaire attached.

My PhD research is entitled "An enrichment programme attached to the course of science in the elementary school of sixth grade concerning the gifted in Saudi Arabia". I am trying to develop an enrichment programme that can meet the needs of gifted students.

One major part of the research is to explore your view as Gifted Students. The second part of the research is to have your opinion about what should be done and what should be included in the proposed enrichment programme.

All you need to do is to respond to the questionnaire attached which should not take more than 25 minutes. Your participation is voluntary and highly appreciated. If you do not wish to participate, simply discard the questionnaire. The data collected will be treated confidently and will be used in research purposes only.

Thank you for your input and time

The Researcher

Abdulhamid Alarfaj

PhD Student

School of Education

University of Southampton

United Kingdom

Alarfaj1@hotmail.com

Instructions

Please note that the questionnaire has two parts. First part is about the science curriculum in 6th grade that you are studying, the second part is about the proposed enrichment programme.

1- Please answer each question.

2- The scales below to indicate the extent to which you agree

SA	A	D	SD
Strongly Agree	Agree	Disagree	Strongly Disagree

3- Please indicate the degree to which you agree with the following sentences; e.g.

Do you think that:	Current Science Curriculum					Enrichment programme should			
	SA	A	D	SD		SA	A	D	SD
Encourages gifted learners to think critically			√				✓		

The response above is indicating that the participant thinks that the current science curriculum is not helping students to develop their critical thinking skills enough, while he thinks that the enrichment programme for gifted students should work to help gifted students to develop their critical thinking skills.

Students Questionnaire

As a students do you think that		The Current Science Textbook				Proposed Enrichment Programme			
		SA	A	D	SD	SA	A	D	SD
1.	Gives flexibility to learn based on individual abilities and interests.								
2.	Provides opportunities to challenge.								
3.	Provides opportunities to learn independently.								
4.	Provides opportunities to learn in a group of similar learners.								
5.	Develops positive attitudes to attempt new projects.								
6.	Allows learners to work in breadth, depth and pace suitable to their abilities.								
7.	Develops awareness of the world affairs and the lasts scientific knowledge.								
8.	Encourages learners to examine all facts before making decisions.								
9.	Develops awareness of the physical life of the human being.								
10.	Develops awareness of the environment.								
11.	Encourages use of advanced technology and resources.								
12.	Encourages critical thinking.								
13.	Develops ability to think scientifically.								
14.	Allows work on a lot of different science topics.								
15.	Encourages practical laboratory work								

As a student do you think that		The Current Science Textbook				Proposed Enrichment Programme			
		SA	A	D	SD	SA	A	D	SD
16.	Encourages new experiences and ideas.								
17.	Encourage learners to design own tasks or topics.								
18.	Gives attention to cultural and social issues in learning science.								
19.	Increases learners' self-confidence.								
20.	Encourages free thinking								
21.	Encourages learners to give their opinion about any science subjects or problem.								
22.	Gives learners space and time to explore their own interests.								
23.	Encourages learners to try new activities.								
24.	Gives learners choices to plan their work and time.								
25.	Encourages learners to share their ideas with others.								
26.	Meets learners' individual needs.								
27.	Helps learners to evaluate their learning process and outcome.								
28.	Gives learners opportunities to evaluate the textbook that they are using.								

Any comments about the Current Science Textbook:

……
……
……

Thank you

Appendix E

United Kingdom
University of Southampton
School of Education

المملكة المتحدة
جامعة ساوثهامبتون
كلية التربية

استمارة معلومات Information Form

□ معلمTeacher □ مشرف موهبة Supervisor

المنطقة التعليمية educational District	تاريخ الميلاد DOB
الدرجة العلمية : Degree	
Date of Degree	
الخبرات التربوية العامة/ الخبرات التربوية في رعاية الموهوبين : Educational Experiences	
معلومات إضافية : Other Information	

رقم الاستمارة .Form No ( )

Appendix F

Example of the list of educators of gifted education from the Ministry of Education

No.	Name	Possession	Subject	Phone
1.	Mohammad Ahmed	Supervisor	Physics	
2.	Ahmed Mohammad	Administrator of Gifted Education Centre	Science	
3.	Abdul Abdul	Teacher	Biology	
4.	Abdul Mohammad	Teacher	Chemistry	
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				

Appendix G

UNIVERSITY OF Southampton

Mr Abdulhamid Alarfaj
School of Education
University of Southampton
University Road
Highfield
Southampton
SO17 1BJ

RGO Ref: 6024

27 January 2009

Dear Mr Alarfaj

Project Title An Enrichment Programme Attached to the Course of Science in the Elementary School of Sixth Stage Concerning the Gifted in Saudi Arabia

This is to confirm the University of Southampton is prepared to act as Research Sponsor for this study, and the work detailed in the protocol/study outline will be covered by the University of Southampton insurance programme.

As the sponsor's representative for the University this office is tasked with:

1. Ensuring the researcher has obtained the necessary approvals for the study
2. Monitoring the conduct of the study
3. Registering and resolving any complaints arising from the study

As the researcher you are responsible for the conduct of the study and you are expected to:

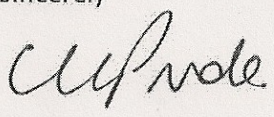
1. Ensure the study is conducted as described in the protocol/study outline approved by this office
2. Advise this office of any change to the protocol, methodology, study documents, research team, participant numbers or start/end date of the study
3. Report to this office as soon as possible any concern, complaint or adverse event arising from the study

Failure to do any of the above may invalidate the insurance agreement and/or affect sponsorship of your study i.e. suspension or even withdrawal.

On receipt of this letter you may commence your research but please be aware other approvals may be required by the host organisation if your research takes place outside the University. It is your responsibility to check with the host organisation and obtain the appropriate approvals before recruitment is underway in that location.

May I take this opportunity to wish you every success for your research.

Yours sincerely



Dr Lindy Dalen
Research Governance Manager

Tel: 023 8059 5058
email: rgoinfo@soton.ac.uk

Appendix H

A letter to the Director of Gifted education

بسم الله الرحمن الرحيم

سعادة مدير عام رعاية الموهوبين بوزارة التربية والتعليم وفقه الله

الأستاذ / نبيل محمد البدير

السلام عليكم ورحمة الله وبركاته و بعد :

أكتب لساعدتكم بشأن طلب المساعدة في الحصول على موافقة لإجراء مقابلات شخصية و توزيع استبانات على المعلمين و المشرفين برعاية الموهوبين بالوزارة، وكذا الحصول على موافقة لتوزيع استبانات على الطلاب في المرحلتين الصف السادس و الأول متوسط المصنفين كموهوبين لديكم. حيث أني أحد أعضاء هيئة التدريس بجامعة الملك فيصل بالأحساء كلية المعلمين المبتعثين لبريطانيا للحصول على درجة الدكتوراه و حيث أن رسالتي عن "تصميم برنامج اثرائي في مقرر العلوم للطلبة الموهوبين في الصف السادس الابتدائي في المملكة العربية السعودية".

شاكرا لسعادتكم سلفا حسن استجابتكم و تعاونكم ..

الباحث

عبدالحميد بن عبدالله العرفج

جامعة الملك فيصل / كلية المعلمين بالاحساء

كلية التربية بجامعة ساوثهامبتون / المملكة المتحدة

Alarfaj1@hotmail.com

جوال السعودية 00966540207808

جوال بريطانيا 00447515462048

Appendix I

المملكة العربية السعودية
وزارة التربية والتعليم
التطوير التربوي

وزارة التربية والتعليم
MINISTRY OF EDUCATION

Science

العلوم

للصف السادس الابتدائي

(بنين)

For sixth Grade (Boys)

١٤٢٩ - ١٤٣٠ هـ
٢٠٠٨ - ٢٠٠٩ م

2009

المملكة العربية السعودية
وزارة التربية والتعليم
التطوير التربوي

وزارة التربية والتعليم
MINISTRY OF EDUCATION

قررت وزارة التربية والتعليم تدريس
هذا الكتاب وطبعه على نفقتها

كتاب العلوم

للصف السادس الابتدائي

(بنين)

المؤلفون

محمد بن عبدالعزيز الثويني
خالد بن عبدالله باكرمان
سليمان بن محمد الحبيب
صالح بن علوان الشمراني
عبدالعزيز بن محمد السالم
صالح بن عبدالله العبد الكريم
أحمد بن سليمان الدامغ
خالد بن صالح القريشي

أيمن بن عبدالعزيز أبو عباة

لجنة المراجعة والتعديل

خالد بن صالح القريشي
فهد بن ناصر العقيل
عبدالعزيز بن محمد السالم
أسماء بنت محمد السويدان

طبعة ١٤٢٩هـ - ١٤٣٠هـ
٢٠٠٨م - ٢٠٠٩م

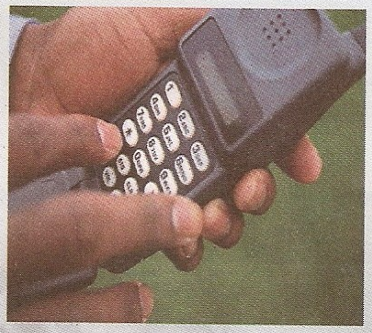
يوزع مجانا ولا يباع

الوحدة الخامسة

Unit five

المواد حولنا

The Materials



الوحدة السادسة

Unit Six

العلوم في خدمة الإنسان

Science That Helps Human

Appendix K Interview Questions and Sample of Two Interviews

Themes	The Current Science Textbook	The Proposed Enrichment Programme
السمات	منهج العلوم الحالي	البرنامج الإثرائي الملحق (المصمم)
Attitudes الاتجاهات	1. To what extent do you think that pupils in 6th grade like(have a positive attitudes) to Science curriculum	2. How would the proposed enrichment programme increase pupils' attitudes toward science curriculum
	إلى أي مدى تعتقد أن الطلاب في الصف السادس الابتدائي لديهم اتجاهات ايجابية نحو منهاج مقرر العلوم الحالي	كيف يمكن زيادة اتجاه الطلاب نحو منهج العلوم عن طريق البرنامج الاثرائي المصمم
	To what extent do you think that ST. stimulates gifted learner to learn more about the subject	How would the proposed Enrichment Programme stimulate gifted learner to learn more about the subject?
	إلى أي مدى تعتقد أن مقرر (منهج) العلوم في الصف السادس يحث (يحفز) الطلبة الموهوبين للتعلم اكثر في مواضيع العلوم	كيف يمكن للبرنامج الاثرائي أن يحث (يحفز) الطلبة الموهوبين للتعلم أكثر في (عن) مواضيع العلوم
Thinking and Abilities التفكير والقدرات	What kind of higher level thinking skills are encouraged in the current ST?	What kind of higher level thinking skills should be encouraged by the pro-posed enrichment Programme?
	ما مهارات التفكير العليا التي تشجع (تستحث) في مقرر العلوم الحالي	ما مهارات التفكير العليا التي يفترض تحث (تشجع) عن طريق البرنامج الاثرائي
	What kind of research skills that are de-veloped by current ST?	What kind of research skills that are should be included in the proposed Enrichment Programme
	ما مهارات البحث التي ُتنمى (ُتطور) عن طريق المقرر الحالي	ما مهارات البحث التي يفترض تواجدها (تضمن) في البرنامج الاثرائي
Contents	What kinds of activities that are already existed in the science curriculum that you think are appropriate for gifted learners?	What kind of activities that should be in the proposed enrichment programme that you think are appropriate for gifted learners in 6th grade?
	ما الأنشطة الموجودة في المقرر الحالي في اعتقادك تناسب الطلبة الموهوبين	ما الأنشطة التي يفترض وجودها في البرنامج الاثرائي التي تعتقد أنها تناسب الطلبة الموهوبين في الصف السادس

Appendix K Sample of the Interviews

Interviewee S5

S5

Experience:

1/ I have worked with the gifted for (8) years since the foundation of the centre in the Eastern Region in 2000.

2/ Supervisor of the gifted centre in the Eastern Region.

Current job: Headmaster of King Fahad University for Petroleum and Mineral Resources Schools, elementary and secondary stage.

(Q1) Could you brief us about how you joined the gifted programme?

Joining the programme started as an idea initiated in Riyadh by Dr. x who conducted a research with his colleagues Dr. x and Dr. x . They presented it as a national research encouraged and supported by the higher education policy which one of its items is sponsoring the gifted. Then the research has been approved and a good budget has been allocated for it. Then we have been summoned as representative for six regions among which was the Eastern Region. We came to Riyadh and had a two month training course. We were taught by Dr. x Dr. x , Dr. x and others. In this training course we studied the fundamentals of the basic programme. The name of this programme is **Discovering the Gifted**. On the lights of this programme we were familiar with the tests of discovering the gifted like Wickseler's test, General Cognitive Abilities test and Creativity test. All these tests have been adapted to the Saudi environment by the educators. We were trained for two month on these programmes, then we went

back to our regions and we started the journey of discovering the gifted on the basis of these scales. This was the beginning, and then the need for the next step, which is sponsoring the gifted, has arisen. To sponsor the gifted, the doctors started with the mathematics programme. Then the programme transferred to a directorate that was founded specially for this purpose during the Minster Alrasheed era. The name of the directorate is The General Directorate for the Gifted. The directorate was concerned with discovering and sponsoring the gifted. So the Directorate came up with the sponsoring programmes which were concentrated on the science and mathematics programmes. Then the sponsoring developed with the coming of Dr. x and the presentation of the School Comprehensive Enriching Programme. It is an integrated programme that addresses the most important issue which is how to support the gifted students in their normal schools. There were problems related to sponsoring them in the evening. The main issue was how to sponsor them while they are at school. So, we have worked on this programme for four or five years by getting the gifted students out of the class and this was main principle underline meeting the needs of the gifted. The idea of the programme was under the leadership of Dr. which started the real seed of building a programme for the gifted and discovering them as well.

(QI) To what extent do you think that the students in the sixth grade like, or have a positive attitude towards the current science curriculum?

Really, I don't have real statistics for my answer to be more valid than my feelings, but I feel that the science

ok

curriculum is a beloved one for the primary and intermediate students and they like it. I do believe as you do in the individual differences, but generally speaking the students have a positive attitude towards the curriculum. This positive attitude is reflected in the students' achievement grades which are high, and if the student loves the subject he will be attentive. Also, the content is beloved to the students because the topics included in it exist in their environment.

(Q2) Does the current science curriculum actually constitute a positive attitude to the students?

The problem lies in the in the way of teaching. The way of teaching may distort the content. The subject in itself is a beloved one, because it attempts the environment in which the students live. I noticed that the subject is excellent but the way it is presented is no interesting and exciting. You know, we love the subject, because we love its teacher. So whatever the subject is still the teacher, the presentation and the way of teaching play an important role. This is a very important element we have to put in mind when we deal with the gifted.

(Q3) How would the proposed enrichment program increase the students' attitude toward science curriculum? What are the things that I should include to increase their love to the curriculum?

First, there should be an element of challenge. We could say "I have a question, who answers it is really a creative and gifted student". By this you are preparing the student to think and you start challenging them. The mind includes billions of cells. If not activated, they not developed, and we have to activate them. Challenging means giving students information

that is a step beyond their levels and age. For instance, we could give the six grade student information relevant to the student in the first grade in the intermediate level. Second, there should be an element of excitement. The students came and they are expecting much from the teachers. Teachers should plan and prepare how to actually present the subject in an interesting and exciting way. It is better if the students are self motivated to do and research things not because you ordered them to do this. For instance, we could start asking questions like this: Who suffers from diabetes in your family? My father. Don't you wish to help him? Could you bring me a research about diabetes? In such case he will be self motivated to do the research. It is much better than telling him to do the research and I will give extra five marks. He will just react for the sake of the marks. The third point, don't give him the information readymade. Let him search for it. These three points stimulate challenges and dealing or working with the gifted is not an easy job. It is very difficult.

(Q4) You have mentioned that you don't like the student to memorize the information, but memorisation is important and they must have the information. What is your opinion?

Students should know memorisation is important, but it is not everything. We want him to make use of the information and add to it, but not just to memorise it. I don't like him to know one plus one equals two. I want him to go to the supermarket and know that one Riyal plus one Riyal equals two Riyals. In such case he will make use of the information. In addition, educationists admit that memorisation has a problem and should not be the students only resort. They should go

More and More

further to the levels of understanding analysis and application as the case in Bloom classification.

Bloom

(Q5) To what extent do you think the science curriculum stimulates and encourages the gifted students to learn the higher level learning skills?

You know when a curriculum is designed; it is mainly for the average group. In this regard I don't blame the Ministry of Education because this something customary everywhere. Those who designed and prepared the book know for certain that some students will finish it in a week. They also know for certain that this book takes a year to be finished, but they could nothing in this regard. I know that the students who finish it in a week will feel that the book is boring and they turn to be trouble makers. Researches proved that 70% of the gifted students are trouble makers. They understood more than others, and then they don't know what to do. So, I don't feel that science curriculum stimulate thinking for all students and saying that means I cancel the individual differences. I should present the idea for all the students, and then give special attention and care to the distinguished students. Definitely in any class the students are not the same. Some students are better and unfortunately the science curriculum doesn't respond to their needs. Thanks God know the programmes have been designed for the gifted. The gifted will along with the curriculum what will satisfy their mental, social and psychological needs.

MOE

Individual Differences

Students Need

(Q6) How would we stimulate them and what are the higher skills?

It is a must to do preliminary general survey for the students according scales such as Weksler test and Lwrance test. Then we look at the personal characteristics. We could refer to the teacher, families and classmates to know about the student's personal characteristics.

(Q7) You didn't answer my question. What are the higher thinking activities?

The skills of thinking remain as instruments that I adapt according to the situation. Any skill should be based on these principles: Challenging, stimulation and searching for information;

The common mistake we learned from Dr. x is that we always concentrate on the skill for the sake of the skill. We make the skill an end not a means. I think it is better if we start with the student by giving him a project, then we give him the skill that help him in doing the project. I want the student to develop the skill. I have to make him understand that I gave you the skill to make use of it for the sake of your project. Finally and after using or exploiting the skill, the student has to come with a product.

(Q8) Do we find the skill of the scientific research in the current curriculum?

No, it doesn't exist and I don't expect it exists.

(Q9) Should it exist in the curriculum?

Of course it should. The scientific research is very important, but it is negatively thought of as something tiring and needs great effort. But, we have to research scientifically.

Researcher: That means the science book doesn't include specifying the problem and then putting solutions to it.

As far as I know, in normal class, it doesn't include.

(Q11) What kinds of activities that are already existed in the science curriculum that you think appropriate for the gifted learners?

There are no attractive activities. I mean the activities are not stimulating, and the students work just for the sake of getting marks.

Researcher: That means the problem lies in the system.

No, it lies in the book.

Researcher: But the marks are from the system.

It is true that the system says if the student does and bring a research, will get marks but teachers have to exert an effort in order to make the students self motivated when doing research. So, I think, the book doesn't stimulate and encourage scientific research in an attractive way.

(Q11) To what extent do you think the current science curriculum provides the pupils with a chance to practice what they learn?

I feel it doesn't. I feel there is a separation between the curriculum and the actual reality that reaches 70%.

Researcher: Why do you feel so?

Because, I judge the curriculum by its products. We teach the students about the traffic, and you see them cross the red

signal. They don't practice what they learn. We have to link the curriculum with the reality.

practice

(Q12) How?

By taking into partnership the concerned authorities. I bring to the class a person from the concerned body (the traffic) and say to the student apply what you study outside and this person will teach you about the traffic and give you advice. The second example is pollution, and as we know smoking is one of the causes of pollution. Now in England the system prohibits smoking in closed areas. If we keep teaching the students that smoking is dangerous and prohibited, the result will be poor. It is better for example to bring a clinic to the school. We actually did this and spoke about the bad effects of smoking. We discovered 50% smoke and later 30% stopped smoking.

Examples

Examples of subjects that linked to real life : smoking and pollution

مثال / ربط الحياة بالعلوم

التلوث - المرور - التلوث

Sample of Interviews

Interviewee T1

T1)

The discussion will be about the science curriculum for the primary sixth grade and the proposed enriching program. Teacher 1 has been given an idea about the research topic and has shown his willingness to help the researcher.

(Q1) To what extent do you think that pupils in the sixth grade have appositive attitude to science curriculum in its present form?

If we make a comparison between the science curriculum in the previous years and now, of course, there is a big difference with regard to the scientific subject matter, the teaching aids used in presenting the science subject and the enriching sides in the same units. The only difference is that, science curriculum needs an environment. Few schools are equipped with labs for conducting experiments, five may be, and in most cases it is a matter of personal endeavor from some teachers. In most schools there is no an encouraging or exciting environment that increases the pupils love and positive attitude towards the science subject. But with regard to the curriculum itself, it is excellent, very beneficial for the pupils and the units included in it discuss human body and the surrounding environment. In the curriculum content there are many exciting things and topics, but we need more excitement through the application of these things and topics in real life.

S.c history

lab

Schools doesn't help students to love science

(Q2) If you were asked to participate in designing a proposed enrichment program, how would this program increase the

pratics + contents + application

Real Life

pupils' attitude towards science curriculum? What are the things you put in mind to increase the pupils' love and positive attitude towards the subject?

The science teacher, in particular, should concentrate on three main points. First, making use of the available technology inside the class and education centers. In doing so, the teacher provides a different direction and trend by keeping himself away from the routine. So, instead of, the teacher, comes to the class, opens the book and explains the lesson with the help of some teaching aids, he could, for example, teach the blood circulatory system through the internet. This helps in approximating the meaning and the concept and conveys a more effective picture than the teacher's speech. This technological side should be applied and the teachers should acquaint themselves with the basic technological background that helps them in these applications such as the Word, Excel and Surfing the net. Some teachers, when we ask them about these applications, know only 25% or less and definitely who he doesn't have can't give.

Let me mention an example that I applied myself. It is getting in contact with the students through the net. I got the idea from the TV that some students communicate with their teachers out of work hours through the net. The idea was not to waste time on homework, questions that relate to the lesson and assignment. I just send it to the students' email, who in their turn send me the answers that I correct and comment on. This is a very simple idea, and most teachers know about it, but who applied it?

(2) The second point is the element of interest and excitement in the subject. If the stimulus is strong, it will attract the students' attention and they love the subject. What kinds of stimulus appeal to the sense of sight, hearing and all other senses? Definitely, it is the visual stimulus (the pictures). The sound is stimulus, but it is less effective than the visual stimulus. If you deliver a lecture, 20% of it will be digested and the rest will disappear, but if we use the visual stimulus (the picture) this percentage will increase.

(3) The third point is practicing and applying what is taught from the side of the students in their environment.

Researcher: The third point leads us to the next question.

(Q3) To what extent does the present science curriculum provide the pupils with opportunities to practice what they learn?

Again the APPLI-CATIONS

The curriculum is good, but needs a companion for the applications. The application follows the theoretical lesson, and it is not necessary to be carried by the pupils inside the school. The pupils could be taken to any centre outside the school which is in fact, a part of the pupils' environment, and the environment is not only the laboratories in the school. The entire world is a field in which the pupils could practice what they learn. For instance if the lesson is about pollution, I could take the pupils to the factories and to the cars that cause pollution. This what will stick to the pupils memory and never forgotten. It is also possible to bring a specialist in the field of pollution to the pupils in the school.

(T 1)

(Q4) To what extent do you think the present science curriculum stimulates the gifted learners to learn more about the subject?

I'm talking from my own personal experience. Some teachers added an enriching program to the curriculum and they, themselves, are not familiar with the basics of the enriching program. It is just a matter of persona endeavor. Of course there are good sides in the program, but I have had a look at a program that doesn't satisfy or meet the gifted student needs. We are doing our best, but we can't say that this satisfies the needs of the gifted students. The curriculum is deficient and not integrated. I have to put in mind many things when applying the enriching program. For instance, its suitability to the age group and the time. In addition to that, when I apply the enriching program, I have to connect it with the lessons in the curriculum. This because the main point is mastering – mastering the skills taught before. After that the student will come up with a product.

(Q5) Do you have topics that could be added to the enriching programme?

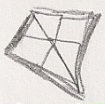
There are special programs for some units. I have to plan for each unit, and it shouldn't be temporary or reactionary planning. We are talking about the strategy which doesn't exist. Not every teacher has a vision and a message.

(Q6) From your own teaching, what are the most topics that the students should study outside the school and spend more time on them?

Teachers

Sometimes, we have a topic, but the teacher regards it as an unexciting one. For instance ' ARAMCO company' is a good example and the students in the eastern region can reach it directly. In other parts of the Kingdom ARAMCO doesn't exist, but, it does exist for us and therefore presenting this topic is regarded stronger. On the other hand, when I talk about a topic like the water, anyone in everywhere will be interested in this topic. This topic is not restricted to a particular place. How could the students apply and practice this topic? And what is the point? What is my goal? To build a factory? The goal is to acquire a skill and then to apply it. So we have to concentrate on the practical side and give the student a chance to visit these places in real situations. Showing films is also possible, but transferring the student to these places is more effective. They will feel free and raise questions.

(Q7) What kind of higher level thinking skills are encouraged in the current science curriculum?



We always believe that the goal set by the teachers should surpass the primary skills in the classification of Bloom Scale such as memorization, recalling and remembering to the skills of deduction and synthesis. These are the high levels thinking skills that stimulate and interest the students. If we direct our goals to these skills, we are on the right track.

Researcher: What is the situation in the current curriculum?

I don't consider myself as a curriculum expert, but some lessons encourage high level thinking skills. The problem is that it is only theoretical and there are no applications to reach the skills of deduction, analysis and evaluation.

Researcher: Do you see that the curriculum encourages the student to be creative, to analyze and to evaluate?

The curriculum is far from these things. Is evaluation a matter of memorizing information? Definitely, no.

(Q8) What kind of activities that should be in the proposed enrichment programme that you think appropriate to the gifted learner in the sixth grade?

The skills of writing report when the students go for scientific trips. This is something rudimentary for gifted learner. He should record things and take photos. He should also know what kind of report to write (analytical, descriptive etc)

Ammonia	Water	Common salt (sodium chloride)
NH_3	H_2O	NaCl
		

The Materials

The Enrichment Programme (Unit 5 – Lesson one) Attached with

the Science Textbook of 6th Grade in Primary Schools in Saudi Arabia

Overview

This unit is designed to educate students about the Materials.

In addition, students will learn about the, Elements and Compounds.

Students will gain an understanding of the importance of the elements and compounds in human life. Students will have the opportunity to engage in activities that promote divergent thinking skills.

Students will work independently, as well as in small groups and as a whole class. Students will have the opportunity to Engage in research

Goals

Students will be able to:

- **Define Mixtures, Elements and Compounds.**
- **Understand the use of some important elements and Compounds (e.g. salt, water, and gold).**
- **Create a cognitive map of one or more element or compound.**
- **Speak confidently in class.**
- **Work and learn with peers as a team.**

Thinking skills (analytical and creative skills)	Scientific skills	Research skills	Social and emotional skills
Analysing Evaluating Fluency	Observation Collect data Analyse data Conclude	Collect data Analyze data Report	Team working Leadership Self-confidence Communication skills

Contents

Average students	Gifted students
The materials include elements, compounds, and mixtures. We use materials in daily life. The materials are in our food and the human body	The materials include elements, compounds, and mixtures. We use materials in daily life. The materials are in our food and human body. (in depth: e.g. history of some materials, economy and materials, and social life and materials)

Process (Activities)

Role of Students and the Teacher

1. Warm up. Asking students: (e.g. what would happen if all the seas were solid? (2 min)
2. Introduction. The teacher can ask these questions: (3 min.)

Which tools we use to cook our food?

What is the difference between salt and water?

Why do we use (e.g. salt / sugar in our food?

3. Presenting a video show about how we make kitchen tools from Aluminium, and students have to have notes about what is: interesting, strange, suitability of the machines. (7 min)

4. Forming teams according to students' abilities and asking them to write as many alternatives for (5 min)

- names of elements and compounds as possible
- Tools that we use in our life made from as many elements as possible.
- Tools that we use in our life made from as many compounds as possible.

5. Students, in their teams, will do the following activities: (15 min)

- **For gifted students**:

Create (design) your cognitive map of one element or compound including: usage, health, economy, social life, and others.

- **For average students**:

Find 20 materials (Elements and Compounds) that are in your classroom, then classify them as you want, and explain why.

- **For gifted students**:

6. Students will collect newspaper and magazine articles and write about a mixture, an Element, or a Compound. Students will then make posters about this material (e.g. what is it? history, important, usage), and value, using the articles and making their own illustrations and lettering.

- **For average students**:

label a diagram of the human body with the location of the Materials (elements and compounds) to be found on and in human body.

Evaluation

- Students use some contents in their classroom or houses to distinguish among the properties of compounds and elements.
- Students classify several elements or compounds in 10-15 things, through observation of similarities and differences in state (e.g. gas, solid), color, texture, hardness conductivity.
- Students create their own model which includes a cognitive map of a compound or element which is important in their lives.

Indication

- Students show their harmony as a team.
- Students want to study different materials in more depth.

Resources

School library (books, newspaper, and articles), internet, teachers, and parents.

Science that Helps Humans

The Enrichment Programme (Unit 6 —Lesson one) Attached with the Science Textbook of 6th Grade in Primary Schools in Saudi Arabia

Overview

This unit is designed to educate students about how science and technology have affected their immediate lives. In addition, it allows students to become aware in using some equipment. Students will gain an understanding of the importance of the role of science in human life (e.g. phones, computers, satellites, navigation, and video games). Students will have the opportunity to engage in activities that promote divergent thinking skills. Students will work independently, as well as in small groups and as a whole class. Students will have the opportunity to engage in research skills.

Goals

Students will be able to:

- **Define waves.**
- **Understand the applications of magnetic waves. (e.g. in medicine, communications, facilitating our life).**
- **Understand the applications of using science to detect diseases**
- **Create a cognitive map of one or more of equipment that is used in daily life.**
- **Speak confidently in class.**
- **Work and learn with peers as a team.**

Thinking skills (analytical and creative skills)	Scientific skills	Research skills	Social and emotional skills
Applying Analysing Evaluating Fluency Elaboration	Observation Collect data Analyse data Use the microscope	Collect data Analyse data Report	Team working Self-confidence Communication skills

Contents

Average students	Gifted students
Sound, water and light travel in waves. All three have troughs and crests. Medicine, diseases (use of waves to detect diseases), causes of diseases (e.g. viruses, bacteria)	Sound, water and light travel in waves. All three have troughs and crests. (in depth) Medicine, diseases (use of waves to detect diseases), causes of diseases (e.g. viruses, bacteria)

Process (Activities)

Role of Students and the Teacher

1. Warm up. Asking students: (e.g. give different ways people can communicate with each other? (2 min)

2. Introduction. The teacher can ask these questions: (2 min.)

- What was the history of innovation of the computer?
- What could we do if there were no computers?
- What is the importance of this innovation?
- Could you give similar ideas?

3.Each student will select one idea of using science of interest to him and write a brief description of it. (2 min)

4. Presenting a video show about 'how satellites work', and students have to have notes about what is: interesting, strange, the future. (10 min)

5. Forming teams according to students' abilities and asking them to write as many alternatives for: (5 min).

- names of equipment that are used in their school .
- new ways of connections that we use in our life .

6. Students list all they know about any applications of science found on the school, then choose two or three pieces of equipment to discuss giving reasons, and evaluate the effect of it on human life.

7. Students, in their teams, will do the following activities: (15 min)

8. Students provided with microscopes to discover the parts of it, then they are encouraged to use it to see some slides.

For gifted students:

- Discuss with others what you found?
- Design a diagram of common diseases that were discovered by microscopes.
- Create your own poster to tell your class and school about one technological tool: its history, what is it, scientific idea, and your future view.

For average students:

- Discuss with others what you found in your samples?
- Choose a piece of mechanical equipment, and then write about: history, places you can use it in, and your opinion of it.

9. Raising the following assignments as a homework: (research skills)

- **For gifted students**:

  Students publish their own little book (e.g. sounds, waves, medicines, and diseases) or imagine a tool (e.g. how it works, scientific ideas, what are its features) and make several copies.

- **For average students**:

  Students make a list of machines or equipment used in their houses, categories them based on scientific ideas, and draw a table to show the product to the class and school.

Evaluation

- Students use the microscope perfectly.
- Students write a critical report about their video film.
- Students create their own book about one scientific idea or product.
- Students share their ideas with peers confidently.

Indication

- Students show their harmony as a team.
- Students want to study different materials in more depth.
- Students ask many questions about other technological tools.
- Students want to be provided more information about diseases.
- Students show their interest when they observe their slides under the microscope.

Resources

School library (scientific books, newspaper, and articles), Internet, teachers, and parents.