Investigating Science Teachers’ Beliefs about Science and Science Teaching: 
Struggles in Implementing Science Education Reform in Saudi Arabia

Saleh A. M. AL-Abdulkareem

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Pat Obenauf, Ed.D., Chair
Ron Iannone, Ed.D.,
Eric Pyle, Ph.D.,
Sam Stack, Ph.D.,
Joe Evans, Ed.D.

Department of Educational Theory and Practice

Morgantown, West Virginia
2004

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Abstract

Investigating Science Teachers’ Beliefs about Science and Science Teaching: Struggles in Implementing Science Education Reform in Saudi Arabia
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The purposes of this quantitative, descriptive study were to investigate Saudi science teachers’ beliefs about science and science teaching, and to determine how do Saudi science teachers view educational reform in science and how do they view change in education. In addition, the study sought to establish whether Saudi science teachers would be able to participate in implementing science education reform in Saudi Arabia.

A questionnaire was used to collect data, addressing personal characteristics of the participant, teachers’ beliefs about science and nature, about school science, about teacher – student relations in the classroom, and environmental factors affecting teaching science. Finally, the questionnaire ended with three open-ended questions about teacher’s belief regarding: science and nature, teaching science, and reforming science curriculum. The sample was 329, consisting of 298 science teachers and 31 supervisors.

The data were analyzed using SPSS (Statistical Package for the Social Studies). The data are analyzed and reported in percentages, means, standard deviations, and frequencies. The responses to open-ended questions were analyzed using the qualitative method. The responses were categorized in subsets using the coding method.

Based on the review of the literature and the findings of this research, it was apparent that differences exist between teachers’ beliefs about science and teaching and their teaching methods. Although Saudi science teachers presented inquiry-based views about science, nature, and teaching science, they do not practice these views in science class. The findings of the study imply that educational reform in science education must simultaneously address all the components of an educational system and the concept of systemic reform, as well as the need for a standards-based learning system and establishing Benchmarks for science in Saudi education.

The conclusions of the study indicated that a curriculum reform project needs to set Benchmarks for science curriculum in Saudi, and the structure of the reform should apply to a network base instead of to the hierarchy system. School-based ongoing workshops for teachers, and reshaping students and teachers’ evaluation procedures, are also suggested.
To
my mother
to
my wife, my children: Abeer, Abdullah, Abdulrhman, and Lama
to
my brothers, sisters, and friends,
and to
Dr. Khaled Alawad
for their unlimited encouragements, prayers, and passions
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Vita

October 26, 1965 ........................................... Born, Dawadmi, Saudi Arabia (Official)
April 4, 1965 .................................................. Born, Shaqra, Saudi Arabia (Actual)

1985-1990 .................................................. Bachelor of Education in Science (Biology)
"A" with High Honor Degree. King Saud University - Riyadh, Saudi Arabia

1990-1993 .................................................. High School Science Teacher “Biology”
Riyadh, Saudi Arabia.

1992 .................................................. Teaching in (Discovering & Sponsoring
Gifted student in Saudi) Pilot Study.

1993 .................................................. Participating in (Discovering & Sponsoring
Gifted student in Saudi) Experimental Program. (Teaching & Evaluating)

1993-1997 ............................................. Educational Supervisor of Science, Riyadh.

1994-1997 ............................................. Assessment Manager of Educational
Supervision Center.

1995-1997 ............................................. Partial work in Education Supervision
Department in the Ministry of Education.

1997-1999 ............................................. Curriculum Educational Supervisor,
Ministry of Education.


2002-Present ............................................. Doctoral Candidate, WVU
& Curriculum Educational Supervisor.
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People learn best from active engagement with others and they are unlikely to hold one view for all situations or contents. According to Stallings (1998), teachers involved in a curriculum reform must understand the nature of the proposed change and be willing to invest time and resources into making the reform work. Having an understanding of the perspectives and needs of each group involved in the change is essential. Stallings referred to a study by Christiansen, Goulet, Krentz, & Maeers (1997), which showed that collaboration does not just naturally occur; it requires practice to mature. These authors maintained that all parties must have the opportunity to demonstrate their knowledge and competence. From findings of Christiansen et.al. (1997), true collaboration occurs within a climate of caring in both a personal and professional sense.

Over the past decade, much research in science education has focused on reform efforts. Much of the research, however, does not provide a holistic picture of interactions among teachers and curriculum developers in an environment that encourages not only cooperation, but also discussion of scientific thinking. In the current environment of reform in science, it is important to examine such interactions.

Public concern about the quality of education is at an alltime high and the public confidence that educators are able to fix the problems is at an alltime low (Schlechty, 1997). Yet, few educational systems have moved to include teachers in their planning, decision-making and assessment. Schoetzau (1998) stated, "Much has been said of the need for vision within organizations whose success as an enterprise is based on the productiveness and effectiveness of its members" (p.14). Schoetzau, who built her statement on Barth (1990), comments that those who value public education and those
who hope to improve our schools should be worried about the lack of professional growth of teachers.

Schoetzau (1998) maintains that though there may be some disagreement on how best to create a shared vision and how to foster that vision in other members of the organization, there is agreement that teacher leadership is a function of a common vision and an understanding that all stakeholders will work toward those ends. I believe that the first step to work toward in science curriculum reform is to know how teachers think about science. "The beliefs that teachers hold about the appropriate roles and responsibilities of teachers shape the ways they teach and the ways they think about teaching" (Tiberius, 2001, p.1).

Science teachers’ views about the nature of science are crucial in the present efforts to reform science education. Research in science education found that teachers’ reluctance to change creates a difficulty in the implementation of innovations in science classes (Nesper, 1987; Bloom, 1989; Parjares, 1992). Teacher preparation programs in the Arab countries mostly focus on teaching about the body of scientific knowledge accompanied by selected education courses. An exception is a small unit in a methodology course that deals with the nature of science mostly from the traditional Baconian view (Haidar, 1999). This fact reveals some factors that shape science teachers’ beliefs in Saudi Arabia.

When planning this study, I drew on my experiences as a former science teacher and educational supervisor for science teachers. Throughout my teaching, supervision, and study in the graduate program, I considered questions about science teaching and learning. I reflected on my former students and wondered about the learning experiences I had tried to provide for them. Also, I reflected on what I found from other teachers during my
supervision visits. To place these experiences in action, I would put all of that in two categories; the first one is what teachers believe about science and science teaching, and how these beliefs shape their practices in dealing with students. The second one is how we would consider these beliefs in reforming science education in order to make sustainable reform in our educational system in Saudi Arabia.

In the U.S.A., after the release of the report A Nation at Risk (1983), a document which raised serious questions about the efficiency and effectiveness of the American education system, a number of different reforms were introduced, which have focused on the increasing centralization of authority, especially in regards to the delivery of the curriculum (Oerlemans, 2001). The Carnegie Task Force on Teaching as a Profession (1986) and the Holmes Group (1986) recommended that teachers be given more opportunities to share in the decisions affecting their work (Schoetzau, 1998). Changes in England have included the introduction of Local Management of Schools (LMS), an aspect of the Education Reform Act 1988 (Oerlemans, 2001). These reports and other studies raise the concern of reforming public education not only in the U.S. but also worldwide regardless of the agreements on the details of these reports.

As science educators, we must view the changing nature of society brought on by technology and the global nature of society as an impetus to re-examine the nature of science instruction. We have been bestowed with the responsibility to educate students on a variety of topics that less than two decades ago did not exist (Pedersen & Totten, 2001).

Why are we reforming curriculum in Saudi Arabia? The Ministry of education in Saudi Arabia answers this question in the Annual Report (2001) by giving three justifications. First, the internal justification, where the current curricula were designed a long time ago, and they were suitable for the social conditions pertaining at that time.
Since then, they have played a remarkable role serving the society for many years. Yet a rapid advance occurred in the Saudi contemporary society at cultural, economical and technological levels, together with the change happening in people daily lives, and all require a parallel educational change. Second is the external justification. The ministry believes that a country can no longer live as an isolated island. All countries are deeply affected by global advance and development, even if such influence differs from one country to another. The communications and the transportation revolution have transformed the international society into a global village. The third justification is the scientific and research justifications, where the Ministry believed that the development of manpower and its rehabilitation, as deemed by experts, is a type of investment in a nation’s human resources and at the same time is a utilization of the future.

Implementing and examining reform in science curriculum is a continual process. Educators involved in reform efforts often attempt to or are encouraged to shift curriculum and instruction in ways that propose to enhance student learning with increased scientific understanding. Science teachers at all levels are being asked to reform their instruction by creating learning environments. But what are the conditions in science classroom in which the teacher embraces reform-oriented ideas? What challenges does the teacher encounter in attempting to change the patterns of teaching? We would be able to answer such questions by investigating teachers’ beliefs about science.

Beliefs are defined as statements considered to be true or false, regardless of whether they are; beliefs are explicit or implicit cognitive predictions with varying degrees of strength and certainty (Brophy & Evertson, 1981). In relation to this view, Benson (1989) states that the gap between what teachers say they believe about the nature of science and what they do in practice is apparent.
Research shows that beliefs about content, about pedagogy, and about teacher education are central to teachers' development (Woller, 1995). Ball (1988) and Noddings (1992) identify the culture of teachers as a significant factor in the development of teachers' beliefs. In fact Ball (1993) argues that previous classroom experiences shape the very nature of content knowledge. Shaw (1992) indicates that science methods classes have an impact on teachers' beliefs about the teaching and learning process. Brickhouse & Bodner (1992) report the importance of beginning science teachers' beliefs about science and science teaching on classroom instruction.

Britzman (1991) suggests that teachers come to the classroom with deeply held beliefs about what teaching is. She further argues that most teachers think the role of teacher is not very complex. According to Vinz (1991), the teachers' triumphs, struggles, and memories served as an evaluative structure. From this frame, the teachers judged their current teaching and were compelled to change, adapt, or adopt reading practices and to grow and change as teachers.

From the findings of a study by Wentworth & Pinnegar (1996), teachers often made projections from their past experiences as students about how they would be or want to be in the future when they would be teachers. Learning to teach can be enhanced through reflection on beginning practice and reflection on past experiences, since these influence teachers' beliefs about the complex roles and relationships involved in teaching.

To understand science education in Saudi Arabia, we need to know about the structure of the Saudi educational system. Curriculum design and planning in The Ministry of Education depends on separate subject curriculum in which the curricula are divided into a number of subjects such as science, grammar, history, and geography. The method is based on a philosophy that sees knowledge as an important part of the cultural
heritage of humanity. Thus, it focuses heavily on the textbook as the major source of knowledge and a major means by which knowledge is conveyed from one generation to another. In this respect, the student studies a number of different and separate subjects logically arranged and prepared in advance (National Report, 2001).

The National Report (2001) gives the major features of the separate subject curriculum in Saudi Arabia, some of which are:

♦ The textbook is a major pillar of study.
♦ The teacher plays a very important role as he/she lectures and directs the discussion and the activities.
♦ Concentration is on the oral interaction since the best way to transfer knowledge is achieved through linguistic communication (p.121).

In this report, The Ministry of Education confirmed that “The scientific content/knowledge is not intentionally aimed at, but the method adopted to acquire such knowledge” (p.123).

What happens when science teachers attempt to change their strategies to foster effective interaction within their classrooms? The complexity of classroom environments and teachers’ sense of efficacy when relying on traditional, tried practices appear to compound the difficulty of reform.

In our educational system, in Saudi Arabia, students see science class as a mean to pass exams only; so they are to know science content at least for a short time for exam purpose. This situation led our students to be unable to connect electrical wires although they studied physics in all k-12 school years (Meshaige, 1989). We should ask ourselves if it is the student’s fault, teacher’s fault, or system’s fault.
In the past the teacher was seen as a knowledge transporter or carrier to students, who are to memorize the knowledge and information they got. For this reason the ministry of education was known as the ministry of knowledge (Qaraqrah, 1996). I think the last ministry having this name is the Ministry of Education in Saudi Arabia, and it just changed in May 2003.

**Statement of the Problem**

Tell me and I forget, show me and I remember, involve me and I understand (Chinese Proverb). I would apply this proverb to teachers as well as students.

I would agree with Lewin’s (1995) statement where he emphasized: “The developing world is littered with educational reform proposals that either have not been seriously implemented or that were overtaken by events before their effects were transparent” (Feiter & Ncube, 1999).

One of my concerns in education is to know how science teachers think about science and science teaching, and whether they are capable of carrying curriculum reform. In the Ministry of Education in Saudi Arabia, we have a huge project to change our curriculum. But I do believe that there are some missing points in this effort related to teachers' opinions and beliefs that shape their practices in implementing curriculum reform. This concerns presented in researches about education (Bin Salamah, 2001; Musharraf, 2000). Generally speaking the Ministry of Education in Saudi Arabia is working away from the field, and I want to see whether our teachers participate in such change.

This study, in particular, focuses on teachers' beliefs about science and science teaching, and how have these beliefs relate to curriculum reform in Saudi Arabia.
Purpose of the Study

The purpose of this study is to document and analyze Saudi science teachers' beliefs about science and science teaching, as well as to investigate recommendations for the science curriculum reform in Saudi Arabia based on the findings of this study.

I hope the findings of this research provide guidance for the educators in the Ministry of Education in Saudi Arabia as they work toward curriculum reform to accomplish sustainable reform in science education in Saudi Arabia.

Justification for the problem

First:

Haidar (1999) and Altwaijeri (1988) state that Arab culture is mostly shaped by the Islamic worldview. Although Arab science educators have been exposed, more or less, to other views, they are not expected to accept any of them without internalization (Naser, 2003). And to shed light on the Islamic view about science, Haidar gives a brief description of this view where he said that the Arabic word “ilm”, that is commonly used in Arabic to correspond to the English word “science” has a different connotation. Consequently, the word “ilm” does not convey the same meaning intended by the word “science”. Ilm is much broader than the English word “science”. “Ilm” includes all forms of knowledge (e.g., religious, political, social, natural and biological knowledge). The corresponding word to “science” in Arabic is “Al-Ulum Al-Tabieyah” (natural sciences); however, it is rarely used.

Nonetheless, from my experiences with science textbooks in Arab countries, the Islamic view about science is not introduced in science education. There might only be individual efforts, or a form of hidden curriculum, in which science educators insert certain verses of the Holy Qur’an and/or the prophetic tradition.
Second:

When examining science classrooms in the current system, many seem to be introducing more nonroutine problems and activities, but there are few widespread examples of ones that are engaging in solutions to problems. Many still are largely teacher-directed following traditional patterns of teaching.

Third:

Through much of world, country’s educational system is modeled on that of industry, i.e., on a top-down vision of the school. This fact is visible in the Saudi educational system more than the U.S educational system. No one would be an expert on everything and perform all the roles of even ministries or associations. In any school one can find teachers who are leaders in educational reform.

Fourth:

Lortie (1975) offered evidence that developing programs and reforms have never been considered the work of teachers. Instead, it has been the teacher's job to carry out plans and programs developed by others at higher levels in the school hierarchy (Schoetzau, 1998). Teachers' beliefs about the nature of science influence the ways they teach science.

Throughout our lives we develop understandings as we interact with others; we need to enhance communicative interactions with science teachers. Imagine a situation in which teachers' ideas are solicited and valued as important contributions to developing an understanding of concepts and problems in science education. In this situation, the teacher becomes a collaborating member and the curriculum reform evolves as a result of interaction among the teacher and the Ministry of Education as they engage in the reform.
Lederman and Niess (1997) questioned the ability of science teachers, who hold traditional views about science, to implement reform in science education. Consequently, if the current reform of the science curriculum in Saudi Arabia is to succeed, the Ministry of Education needs to be well-informed about teachers’ beliefs about the nature of science.

**Fifth:**

Teachers are already redesigning the curriculum in their classrooms. Their impact will make or break any serious attempts to reform instruction and curriculum. Whether they are becoming involved in formal decision-making processes, curriculum innovations, or modified instructional delivery models, teacher contributions to the quality of instruction are significant (Schoetzau, 1998). Teachers would need to feel that their ideas and questions were valued, so that sharing their reasoning would become a reform norm.

**Sixth:**

Another purpose for teacher participation in science reform is to draw on teachers' expertise and experiences as a resource for curriculum reform. Sorensen (1991) affirms that teachers want participation in decision-making if it is directly related to their teaching.

**Seventh:**

I believe that there are not enough interactions between science teachers and curriculum developers in the Ministry of Education in Saudi Arabia. Furthermore, the Ministry of Education doesn’t have a clear view about science teachers philosophies related to science and teaching (Bin Salamah, 2001).

**The Emerging Research Questions**

The following questions guided the study:

1. How do science teachers in Saudi Arabia view science?
2. How do science teachers in Saudi Arabia view teaching and their roles as teachers?
3. How do science teachers in Saudi Arabia view learning?
4. What are the teachers' beliefs about the physical learning environment and laboratory activities?
5. What are the teachers' beliefs about their students’ roles in science class?
6. How aware are the science teachers of the science education research literature on curriculum and teaching?
7. How are the science teachers' ideas changing with regard to the science curriculum and the teaching of science?
8. What elements need to be changed in the science curriculum?
9. What are the missing points of the science curriculum in Saudi Arabia?

While answering these questions, I am looking to see how would we propose finding out whether the teachers are involved in the reform? And what are the appropriate recommendations for science reform in Saudi Arabia?

**Significance of the Study**

The research is significant because it will provide new data for the Ministry of Education related to teachers' beliefs about science and teaching. The research will assist future plans for reforming science education.

In addition, the research is significant because I am investigating science teachers in counties, where we have small Education Directories. Those teachers seldom participate in such studies. Previously the massive studies were made only in huge regions in Saudi Arabia, where General Education Directories is found, especially Riyadh Region. By engaging science teachers in more rural areas, I am expecting to get better results from them especially in open-ended questions because they are enthusiastic to participate in such studies, while teachers in cities are overwhelmed with more studies.
Limitations

The study is limited to male science teachers in public schools in all levels (elementary, intermediate and secondary), and to science educational supervisors who are former teachers in Riyadh Region (Riyadh City and its counties).

This area has over two thousand public schools in all levels, with a total of thirty thousand teachers. Riyadh City has a nation variance, where teachers are from different regions in Saudi Arabia, and have various qualifications from several colleges and universities all over the country. All these factors qualify this area to meet the purpose of the study.

Methodology and Instrument

My methodology is a quantitative method using a questionnaire as an instrument for the study. The sample of the study was 500 science teachers and educational supervisors. Teachers are from public schools in Riyadh City and from remote areas in Riyadh Region that seldom to participate in educational studies.

The questionnaire has two parts. The first part is adopted from a study made in Australia and Taiwan in 1997, by Chung-Chi Chen, Peter Taylor and Jill Aldridge. The study title was “Development of a Questionnaire for Assessing Teachers’ Beliefs about Science and Science Teaching in Taiwan and Australia” with some changes. It would be a good chance for me to compare results between my finding and their findings in my future works. The rest is a modified version from a questionnaire for a study made in the U.S. by Andrew T. Lumpe, Jodi J. Haney, Charlene M. Czerniak in 2000. The study title was “Assessing Teachers’ Beliefs about Their Science Teaching Context.” I contacted the two teams asking for permission to use their instrument in my questionnaire, and I received their approval. (See Appendix C).
The questionnaire ended with three open-ended questions about science, science teaching, and curriculum reform.

I am dealing with the statements in my questionnaire as a set of statements covering the same point (Domain), representing the finding of these questions in charts representing teachers’ responses to each point, followed by statistical analysis focusing on frequencies, means, and standard deviations. I end with a conclusion of the finding for each set. And I use the key point method with the open-ended questions.

Three major areas are covered by the questionnaire; nature of science, teaching and learning, and reforming science education. During my discussion I focus mainly on these areas.

Table 1-1

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<th>Question Number in the Study</th>
<th>Covered in the Questionnaire by Statements numbered</th>
<th>Total Statements for the Question</th>
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<td>9</td>
<td>54, 55, 63, 66, 68, 72, 73</td>
<td>7</td>
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</tbody>
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Because I consider teachers’ beliefs about the nature of science, teaching, and learning as the pillars of my study I decided to dedicate more statements for questions number one, two, and three.
Pilot Study

To put my ideas in a real practice, and to test my instrument, I decided to do a pilot study using my questionnaire, for the same population, science teachers and science supervisors in Riyadh Region and its counties. I received 68 questionnaires from 80 questionnaires distributed in Riyadh City and two counties, Dawadmi and Qowaieiah. The findings of the pilot study are represented in Chapter IV.

Definitions of Terms

Science

Science is the study of the natural world in order to understand the nature of life, matter, and natural forces. Science is a way of knowing that is characterized by empirical criteria, logical argument, and skeptical review. Students should develop an understanding of what science is, what science is not, what science can and cannot do, and how science contributes to culture.

The view of science should consider the intersection of scientific thought with the History, philosophy, and sociology of science. The nature of science involves the role of logic, methods, knowledge production, law and theory development and their status, paradigms, revolutions, competing views, and research programs in science. Also included is the relationship between science and society and the psychological basis for scientific discovery and knowledge.

Science Education

Science education is a program, which is designed to develop students’ understanding of the nature of science, of scientific activity, and of important scientific findings and principles in a manner that shows their relevance to the individual and to society. In
dealing with the science education concept, I would like to keep in mind the principles of
the National Science Education Standards in the U.S., which states that:

- Science is for all students.
- Learning science is an active process.
- School science reflects the intellectual and cultural traditions that characterize the practice of contemporary science.
- Improving science education is part of systemic education reform.

In the National Science Education Standards, the term “active process” implies physical and mental activity. Hands-on activities are not enough; students also must have "minds-on" experiences. Science teaching must involve students in inquiry-oriented investigations in which they interact with their teachers and peers. Students establish connections between their current knowledge of science and the scientific knowledge found in many sources; they apply science content to new questions; they engage in problem solving, planning, decision making, and group discussions; and they experience assessments that are consistent with an active approach to learning.

**Curriculum and Content**

Curricula form a plan of instruction that details what students are to know, how they are to learn it, what the teacher’s role is, and the context in which learning and teaching will take place.

I will use the National Science Education Standards to view content and curriculum. The content of school science is broadly defined to include specific capacities, understandings, and abilities in science. The content standards are not a science
curriculum. Curriculum is the way content is delivered: it includes the structure, organization, balance, and presentation of the content in the classroom.

**Content Standards**

Content standards are broadly stated expectations of what students should know and be able to do in particular subjects and grade levels. Content standards define for teachers, schools, students, and the community not only the expected student skills and knowledge, but what schools should teach. An example of a science standard is: “Fourth-grade students will be able to gather information for a report using sources such as interviews, questionnaires, computers, and library centers” (CRESST, 2003).

**Science Educator**

A science educator is a person with an appropriate educational and experiential background including both practical teaching experience and knowledge of the history and trends in science teaching and learning. Science educators are interested in improving the general welfare of society through science teaching, as well as promoting science-related vocational and avocational interests. Science educators can be found in classrooms, museum/science centers, environmental centers, government agencies, corporations, etc. (Rossier, 2003).

**The Ministry of Education in Saudi Arabia**

Was previously known as the Ministry of Knowledge(s), until May 2003. Education in Saudi Arabia is segregated by sex and divided into three separately administered systems: general education for boys, education for girls, and traditional Islamic education (for boys). The Ministry of Education, established in 1952, presides over general education for boys, and education for girls comes under the jurisdiction of the General Presidency for Girls’ Education. In 2002 the General Presidency for Girls’
Education was annulled and the Ministry of Education became responsible for both boys and girls. Both sexes follow almost the same curriculum and take the same annual examinations.

General education in the Kingdom consists of kindergarten, six years of primary school and three years each of intermediate and high school. The Ministry of Education sets overall standards for the country’s educational system and also oversees special education for the handicapped

**School Reform**

Is a generic term encompassing all kinds of efforts that are taking place to improve schools. Reform efforts focus on all aspects of schooling, from how schools are governed to what curriculum is taught in the classroom. I like to deal with reform from the Freireian view, where the change should come from inside rather than forcing development on the society from an outer resource.

**Teachers’ Beliefs**

Include how teachers see the nature of science, and how they think about the process and methods to obtain scientific knowledge. These beliefs shape teachers' attitude and behaviors related to science.

**Ideas Changing**

Refer to the change in teachers’ beliefs as they are exposed to new situations that require rethinking about previous beliefs and conceded ideas.

**Public School**

There are four levels of education in Saudi Arabia preceding higher education. The first level is pre-school, which is a small sector currently limited to larger cities in the first instance. The second level is elementary school for children aged 6 to 12. The third level
is intermediate for students aged 12 to 15. And the fourth stage is secondary (high) school for students aged 15 to 18, which prepares students wishing to continue their studies at the university level.

Public education in Saudi Arabia is open to every citizen and legal resident; the system provides students with free education, books and health services.

**Saudi Administrative Region**

In Saudi Arabia there are thirteen Administrative Regions: Al-Baha, Al-Jouf, Asir, Eastern, Hail, Jizan, Madinah, Makkah, Najran, Northern Border, Qasim, Riyadh, and Tabouk. Each region is responsible for a number of counties. In these regions there are General Educational Directories.

**Saudi County (Preservation)**

There are twenty-nine Educational Directories in the counties. These directories refer to the General Directory in the same region.

**Organizing the Study**

The study consists of six chapters. The first one starts with a rational ending with the research problem and purpose of the study, followed by the justification of the problem and addressing research questions. Then the researcher represents the significance, limitations, methodology and instrument of the study, along with the pilot study. The chapter ends with definitions of terms used in the study.

In the second chapter there is the background of the study about Saudi education. Using a historical approach, the researcher represents the development of education in Saudi Arabia before the establishment of the country until the present, covering the structure of general education in Saudi Arabia and educational authorities. A review of
educational policy in Saudi Arabia follows, and the chapter covers new programs to develop curriculum in Saudi Arabia.

The third chapter is a comprehensive literature review about the philosophical and fundamental basics of knowledge, science, nature, and education in Islam. The chapter discusses curriculum development approaches and perspectives in the U.S and Saudi Arabia. The chapter terminates with the status of science education in Saudi Arabia today.

The fourth chapter represents the research methodology, including the procedures of preparing the instrument and collecting data.

The fifth chapter contains data analysis. The researcher discusses the results and findings of the study, based on participants’ responses to the questionnaire statements. Represented are Saudi science teachers’ beliefs about science, nature, teaching science, and reforming science curriculum obtained from the answering of research questions.

The sixth chapter gives the summary of the study, findings, discussions, conclusions and recommendations.

Finally the study concludes with the bibliography and appendixes.
Chapter II: Background of the Study: Saudi Education

The Saudi state began in central Arabian Peninsula in 1745. A local ruler, Imam Muhammad bin Saud (1697-1765), joined forces with a local Islamic reformer, Shiekh Muhammad bin Abd Al-Wahhab (1703-1792), to create a new political entity. Over the next 150 years, the fortunes of the Saud family rose and fell several times. According to Osaimy, most historians divide Saudi states into three stages, the first one from 1745 to 1818, the second one form 1825 to 1891 (1999). The third one is the modern Saudi state that was founded by the late King Abdul Aziz Al-Saud (1876-1953), where he recaptured Riyadh in 1902, the country named as the Kingdom of Saudi Arabia in September 23, 1932 (Darweesh, 1983).

Saudi: Country and People

The Kingdom of Saudi Arabia is situated in the southwestern part of Asia. Extending from the Red Sea in the west to the Arabian Gulf in the east, it is bordered on the north by Jordan, Iraq and Kuwait, on the south, by Yemen and Oman, and on the east by the United Arab Emirates, Qatar and Bahrain. With an area of 1,960,582 million sq. km. (784,233 sq. mi.), Saudi Arabia comprises almost four-fifths of the Arabian Peninsula.

The capital city of Riyadh (population 3.7 million) is located in Najd, the heartland of the peninsula. At the north of the eastern part along the Arabian Gulf, there are oil-famous triple cities, Dammam, Khobar and Dhahran, which together have a population of 1.6 million. In the south of the Eastern Region there is the world’s largest sand deserts, the Rub Al-Khali (Empty Quarter). The Hijaz region along the Red Sea contains the holy cities of Makkah (population 1.6 million) and Madinah (population 819,000), the port city
of Jeddah (population 2.7 million) and the summer capital of Taif (population 634,000). In the southwest, mountain ranges of over 9,000 feet (Saudi Embassy, 2004).

As of the 2001 census, the Saudi population is 22.1 million, including about 5.6 million resident foreigners. In 2003 population is estimated to be about 24.3 million, including about 6 million foreigners. Arabic is the official language, and English is widely spoken, especially in business. Saudis have Arab ethnicity, with a minority of African and Asian ethnic. In Saudi Arabia, all citizens are Muslims.

Learning Places in Arabian Peninsula

There were many learning places in the Arabian Peninsula a long time before the establishment of Saudi Arabia. All these places do not teach science; however some may include science subjects in their curricula. Some of the main learning places related to science education are:

Kuttab

Kuttab is a style of small classrooms, open for all people from different levels in the society in equity. Aged people usually have separate kuttabs. In general it is free, but some parents may give something for the teacher (money or food), but the teacher will not ask for anything. In kuttab children memorize Qur’an and learn reading, writing, basic arithmetic and morals. Some advanced kuttabs add science in their subjects, especially health topics.

Home Schooling

Consists of special classes for some wealthy families who want special education for their children, and usually they choose good teachers to teach children advanced reading, writing and morals. In most cases, parents plan curriculum for their children
(Ameen, 1984, p.143). Based on parents’ interests, math and science are usually considered in home schooling subjects.

**Learning Journeys**

As it is known everywhere, some students leave their home to learn in a specific place or to study with a well-known scholar. Makkah, Madenah, Iraq and Syria were the popular destinations for learning (Alshwaier, 1992; Alsalman, 1999, p. 15). This kind of learning includes science, math, and other modern subjects besides Islamic studies, Arabic language, and humanities.

In general we can say about these places that they were helpful in the past and satisfied peoples’ needs in specific era, although there are limitations in their educational ways, especially in teaching science. In their review of Organization of Education Britannica Encyclopedia stated about these educational places that:

“Theyir curricula were limited; they could not always attract well-trained teachers; physical facilities were not always conducive to a congenial educational environment ... Most importantly, these schools could not meet the growing need for trained personnel or provide sufficient educational opportunities for those who wished to continue their studies” (Britannica on-line).

**Education Before the Establishment of Saudi Arabia**

There are two notable eras in Arabian Peninsula before establishing Saudi Arabia. Each era has a different style of education based on the interests of the powered authorities.

**First Era: Ottoman Empire, to 1916**

The Ottoman Empire took care of the western region of the Arabian Peninsula because of the importance of Makkahand and Maddinah in Islamic world, and ignored the rest of the peninsula except parts of the eastern region, which have oases in Al-Ahsa and
ports on Arabian Gulf. They established schools in the western region, but these schools became places to spread Turkish culture and to build supporters for them. And to achieve this dream they changed schools’ languages from Arabic to Turkish, even the teaching of Arabic language was in Turkish. “People didn’t accept these schools and didn’t engage in it, except few who have good relations with Turk leaders” (Sebai, 1979, 580). Ameen (1984) mentioned that “a Turkish school established in Al-Aahsa (Eastern Region) in 1908, but people did not get benefits from it because the use of Turkish language in all classes” (p. 140). At that time there were three schools in Hejas, some equal with high schools or above. Subjects of these schools include science, math, and foreign languages.

Despite the government efforts, there were private efforts to establish schools in Makkah, Jeddah, and Maddinah. In 1905 a wealthy man established Alfalah School, which exists today with a history of almost 100 years (Khayyat, 1999). Qazaz, 1991, considered that it is normal for Hejas Region to have more schools than other regions based on the importance of the two cities in Islamic world. Alzerekley (1984) emphasized that private education has favor on Saudi, because all those who work in government were students of this type of schooling before establishing the Kingdom (p. 172). These private schools started with limited subjects focusing on Islamic studies and Arabic Language, then they include science and math in their curricula.

**Second Era: Hashemy Era, 1916 – 1924**

Shareef Hussein Bin Ali led the Arab revolution against the Turk and Ottoman Empire and established a new state in Hejaz. He then stopped any kind of Turk influences, especially in education. He ordered all the schools closed and asked scholars to set a new educational system. Within one year “there was a great system starting from preparing school, then advanced elementary school and finally high secondary school” (Alfozan,
1981, 292). This educational system has science as well as other modern subjects. People were willing to be educated, so they engaged in schools from different ages, then they looked forward to continuing their education abroad. Some of the famous names in Saudi literature were students of these schools.

Ameen (1984) explains that Shareef Hussein discovered that education will lead people to be more knowledgeable in life, and they will not stop at a specific point. First they will find their identity, then they would engage in discussions about politics and other issues. He decided to kill his plan by himself to protect his position. First Hussein stopped any kinds of scholarship or studying abroad, then he started delaying and decreasing teachers monthly payments until they lost their ardor and looked for other jobs (Shalaby, 1987; Ameen, 1984). Sebai (1979) maintains “the most hateful subject for Shareef Hussein is teaching foreign languages, and he refused the suggestion from a wealthy American when he offered sponsoring scholarships to study in the U.S for some Arab youths” (p.235). All these acts stopped the development of science education in the area in early stage.

**Education Development in Saudi Arabia**

There are two major eras during the development of education in Saudi Arabia. Each era has different stages based on important changes in the Saudi educational system.

**Early Era: 1925 – 1954**

In 1902 King Abdulaziz recaptured Riyadh and continued adding other cities to his rule. In 1926 King Abdulaziz was known as the king of the Hejaz and Sultan Najd and Dependencies. The unification of Saudi was proclaimed on September 23, 1932.

Kuttab was the widespread style of education during that time. Kuttab curriculum focuses on Qur'an and reading and writing with basics of calculations, without teaching
science, with the exception of the western and eastern regions, which were still ruled by
the Ottoman Empire. According to Alsalloom, curriculum in Kuttab schools located in
these two provinces included, along with the Qur'an, foreign language, simple
mathematics, and Arabic reading (Alsalloom, 1995). Besides that some advanced kuttabs
were similar to elementary school in their curricula, where they teach science and other
subjects.

In 1925, a place called “the Directorate of Education”, which is a formally
organized educational center, was opened. Four months later, the official formal education
started with a total of 700 students engaging in twelve princely and private schools in
Riyadh and its dependencies (Hamzah, 1968, p. 227). Later the name of Princely Schools
changed to Public School. “The beginning was so hard, and everything needs to be
brought from outside the country, including teachers, textbooks, notebooks, pencils, and
even chalks and blackboards” (Assah, 1971, p. 781). By 1945, King Abdulaziz had
initiated an extensive program to establish schools in the Kingdom. Six years later, in
1951, the country had 226 schools with 29,887 students. Because of the demand, most
teachers were not qualified for teaching.

One of the important events during that time was the opening of a special school
named “Mission (Scholarship) Preparatory School” in 1935. This school has high school
features preparing students to study in Egypt and other countries’ universities. Alzerekley
(1984) reported, “the curriculum of this school was adopted from Egyptian curriculum”
(p. 171). This school was a solution for students’ lack of experimental sciences when they

In this era Egyptian curriculum and Syrian curriculum influenced Saudi education,
where most of general editors and supervisors were from Syria including the heads of the
Directorate of Education, and most teachers were from Egypt. At that time the Syrian curriculum was influenced by France’s curriculum. On the other hand Egyptian curriculum was shaped by England curriculum. In fact Egyptian curriculum had more effect on Saudi education, because of two main reasons. The first one is the great number of Egyptian teachers and educators brought to work in Saudi. The other reason is the fact that Saudi sent the first groups of students to study abroad to Egyptian universities. Hamzah (1968), in his book originally written in 1936, revealed that “the first group of students sent to study abroad, was 30 students sent to Egypt in 1930, followed by another group of 20 in 1936 to the same country” (pp.230-231). While Saint John Philby (Abdullah Philby), who spent over 35 years in Arabia, declared that “in 1925 there were 705 scholarships for students to study in Egypt, 259 in Syria and 46 in the U.S, England and other countries” (Philby,--, p.383), which gives a total of 1010 scholarships. Unfortunately, I did not find this fact in any other resource, and because Philby is a well-documented person, I believe that this number reflects varieties of scholarships, such as wealthy people grants, family and personal missions, and other kinds.

The main influence of Egyptian and Syrian curricula on science education in Saudi was using science textbooks as science curriculum, and forcing students to deal with science as facts. The only teaching method introduced to schools by the two curricula was lecturing, and the sole way to evaluate students’ achievements in science class was their abilities in memorizing scientific facts.

One of the exiting issues in education during this era, as described by the historian Algaser, is how some local rulers force Bedouin students to attend schools, and if they escaped to another place, the ruler sent after them to bring them back to school. Algaser gave an example of this situation in Yanbue (West) and how the tribe got benefits later
from this approach, where now there are members of the tribe working as professors in different scientific fields in Saudi.

Among the noteworthy dates in this era is the year 1928, when the first educational procedure was issued. Ten years later, Saudi delivered the first elementary education curriculum in 1938. Higher education started with the opening of Sharia’h (Islamic low) College in 1950 and the first teachers’ college in 1953 (Educational Documentation 46, 2002).

The educational census in 1953 showed that in the last year for the Directorate of Education there were 306 elementary schools with 39,920 students and 1,472 teachers, 10 secondary schools with 1,315 students and 133 teachers, one secondary institute with 335 students and 42 teachers, 35 students and 6 teachers in each of Teachers’ College and Sharia’h College, one industrial school with 37 students and 3 teachers, and finally three evening English language schools with a total of 302 students and 19 teachers (Educational Documentation 46, 2002, p. 7).

This early era ended in 1954, when the Ministry of Education was established, replacing the Directorate of Education, and headed by then Prince Fahd bin Abdulaziz (later King) as the first Minister of Education. During this era, when we say education, we mean male education, where there was not any kind of official female education, except girls’ kuttab schooling and some schools similar to kuttab system.

The previous historical review about the development of education in Saudi indicates that in all the previous eras, science education was not well established; and it is still strongly influenced by the old view, that science is a set of facts to be memorized. The last era, which is the beginning of establishing educational system in Saudi, was responsible of eliminating experimental methods in science and focusing on traditional
approaches in teaching. Among the negative influences on Science education from imported science curricula in this era that still exist in science education today in Saudi are:

- The phrase “science curriculum” is equal to “science textbook”
- The only scientific resources for students are school science textbook and science teacher.
- Focusing on quantity in science, by adding more scientific facts in student’s book.
- Memorization is the only way to evaluate students in science class.
- The educational system was built for traditional approaches in teaching science, using lecturing.
- Classes’ size, including room dimensions and number of students, do not support any kind of experimental approaches.

**New Era: 1955 to Current**

The first attempt to develop education in this era was the issuance of a temporary educational curriculum for elementary school in 1956, in order to give the curriculum committees enough time to build sustainable curricula. The new curricula was introduced in 1958/1959, along with a new testing timetable, the first form of educational supervision, which was named Educational Inspection, and the establishment of a new school to educate and qualify blind students in Riyadh (Almarefah 85, 2002).

In 1960, the government established the Presidency of Girls’ Schools, changed later to Presidency of Girls’ Education, as a separate and independent organization to control and supervise the education of girls at all three levels of education. This organization also controls female colleges of education and the number of junior-teacher
training colleges. “At the time when the presidency established in 1960, there were around 400 girls’ kuttabs, and 70 girls’ schools, with over 10,000 students and 600 teachers” (Bin Dohaish et. al., 2002, p.17). Early in 2003 the General Presidency for Girls’ Education was dissolved and its functions taken over by the Ministry of Education.

The remarkable events in this era, are the five-year development plans. Saudi Arabia decided to do development plans every five years, starting from 1970. The introduction of the First Development Plan in 1970 led to a dramatic quantitative growth of the educational system (Saudi Index, 1996; Wright, 1996). The Saudi Embassy portfolio describes that the number of students in the educational system increased six-fold between the 1970s and the 1990s, the number of full-time teachers grew more than nine-fold. Saudi’s ratio of 15 students to every teacher is one of the lowest ratios in the world (Embassy portfolio, 2004). “The sudden massive educational spread forced educational authorities to focus on quantity instead of quality” (Ibrahim & Ghanem, 1994, p.7) to cover all needy places.

Today, Saudi Arabia’s nationwide public educational system comprises 18 male teachers colleges, 87 female teachers colleges, and a large number of training institutions, more than 28,500 schools, over four hundred thousand teachers and assistants staff, and almost five million students (boys and girls) supervised by the Ministry of Education and other authorities (Ministry census, 2002; Presidency census, 2002). Schools are open to every citizen, as well as legal residents. The system provides students with free education, books and health services along with financial aid for needy students. Also there are monthly financial rewards for college and university students, specialized institutes and training centers.
Although there is a great process in education level in Saudi, there are signs of failure. Alrasheed, the current Minister of Education, offers evidence that there are weaknesses in student preparation especially in Arabic and English languages. Also the vast private schooling leads to the fact that parents may not trust the public education. He believes that the curricula do not provide students with the knowledge and job skills needed for their future employment. Furthermore, Alrasheed tells that in 1994, the percentage of government school buildings was less than 50% comparing with rental school buildings, which are ordinary homes (Alrasheed, 1997).

**The Structure of General Education in Saudi Arabia**

Educational system in Saudi imitates national curriculum and national textbooks. It is a central system taking a hierarchy structure, with high authorities in the Ministry and lower authorities in schools.

General education in Saudi Arabia, both for boys and girls, is divided into three levels: elementary, intermediate, and secondary. Also, there is an optional kindergarten level. These levels consist of six years of primary school and three years each of intermediate and high school. The Ministry of Education sets overall standards for the country’s educational system.

After elementary and intermediate education, students can attend either high schools offering programs in both arts and sciences, or vocational schools. Students’ progress through all study stages, except classes K1-3, is determined by comprehensive exams conducted twice a year. For the class 12 there is a national comprehensive exam at the end of school year prepared and supervised by the Ministry of Education.

The school year at all three levels consists of two semesters, which are fifteen weeks long. Classes per week vary from 28 to 36 hours per week; the length of each class
is 45 minutes. Passing the exam at the end of the school year is essential for moving either from grade-to-grade or from level-to-level. However, students who fail need to take another test in the subject that was failed. Before the new school year starts, if the student fails again, he needs to repeat the grade. In grades K 1-3 there is continuous evaluation instead of exams, where students get a report showing their progress three times during each semester. At the end of the year, if the student masters all subject criteria he or she gets a 1 or 2 grade meaning that he or she passes to the next level. If the grade is 3 or 4 the student may need to take the same level next year if the subject is among the fundamental classes, which is mainly reading and writing. This evaluation system was approved in 1998.

Boys’ secondary school structure and curriculum has been changed several times in Saudi, as curriculum planners and policymakers have realized that the curriculum did not meet individuals’ or national needs. In the past the name of high school was General Secondary School for boys and girls, but boys high education changed to Comprehensive Secondary School followed by Developed (Modern) Secondary School, then returned to the original one. (Alzaid, 1990; Alsenbl et. al., 1998)

The Comprehensive Secondary School initial program was limited to specific schools in Saudi. The first comprehensive secondary school was established in 1975, as an experimental school in Riyadh City. Then, in 1977 and 1978, three more schools in other cities were opened. The basic idea of this school was to allow students to select the courses and activities that they need, and to offer students access to an academic adviser to guide and help them during their studies, preparing them for the higher education system. Based on his abilities, a student could finish this stage in 2.5 years or less, and he may extend his length of study more than three years. Because of the need of additional
academic programs and areas of study, this program was replaced by another type of education.

The Developed (Modern) Secondary School program replaced the Comprehensive Secondary School in 1983. Alsalloom (1991) tells about this type of high school:

The modern (developed) secondary program offered broad choices of subjects and courses that permitted students to tailor programs to suit their future goals. The system encouraged students to take more responsibility and play an active role in shaping their education. After the first semester, students had a choice to pursue science curricula (chemistry, physics and mathematics) or literary curricula (general studies, commercial and religious studies). A total of 168 semester hours was required to graduate; 67 hours of general program core courses, 78 hours of division and department major courses, and 23 hours of electives (p.41).

In 1993 and after ten years of applying this program all around the country, the developed secondary school was phased out because of the negative social consequences for both students and the society, where students had the chance to be away from school when they do not have classes, out of the supervision of either school or home. In fact this problem was also in the comprehensive program. Some educators believe that the developed school plan was better than the current system, but the problem was in the practice, not in the structure or the curricula.

**Elementary School (K 1-6)**

Students start at the age of six (or up to three months less as an exception). Elementary education focuses mainly on Islamic religion and the Arabic language, mathematics, social studies, science, and physical education.
### Table 2-1
Subjects and Classes’ Loads in Boys’ Elementary School in Saudi

<table>
<thead>
<tr>
<th>Subjects</th>
<th>First Grade**</th>
<th>Second Grade</th>
<th>Third Grade</th>
<th>Fourth Grade</th>
<th>Fifth Grade</th>
<th>Sixth Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Islamic Studies</td>
<td>7 / 9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Arabic Studies</td>
<td>12 / 11</td>
<td>9</td>
<td>9</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Social Studies</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Science</td>
<td>0 / 1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics</td>
<td>2 / 4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Art Education</td>
<td>2 / 1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Moral and discipline</td>
<td>2 / 0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Physical Education</td>
<td>3 / 2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total Hours</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>31</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>Total subjects</td>
<td>6 / 8</td>
<td>9</td>
<td>12</td>
<td>17</td>
<td>18</td>
<td>18</td>
</tr>
</tbody>
</table>

(Ministry Study Plan in General Education, 1996)

* Each division represents from 1 to 7 subjects.

** First semester / second semester.

### Intermediate School (K 7-9)

Passing the sixth grade examinations is essential to enter the intermediate level.

The intermediate student is between 12 and 15 years old. Students in the intermediate level study, besides Islamic and Arabic language courses, more general education courses.

### Table 2-2
Subjects and Classes’ Loads in Boys’ Intermediate School in Saudi

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Hours Per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First Grade</td>
</tr>
<tr>
<td>Islamic Studies</td>
<td>8</td>
</tr>
<tr>
<td>Arabic Studies</td>
<td>6</td>
</tr>
<tr>
<td>Social Studies</td>
<td>5</td>
</tr>
<tr>
<td>English</td>
<td>4</td>
</tr>
<tr>
<td>Science</td>
<td>4</td>
</tr>
<tr>
<td>Mathematics</td>
<td>4</td>
</tr>
<tr>
<td>Art Education</td>
<td>2</td>
</tr>
<tr>
<td>Physical Education</td>
<td>1</td>
</tr>
<tr>
<td>Total Hours</td>
<td>34</td>
</tr>
<tr>
<td>Total subjects</td>
<td>15</td>
</tr>
</tbody>
</table>

(Study Plan in General Education, 1996) * Each division represents from 1 to 5 subjects.
Finally, with completion of the third year of the intermediate level and passing the examination, students can select one of these options: (1) general (regular) secondary school, which is the choice of the vast majority, (2) vocational education, (3) Qur'anic schools, (4) other institutes in different fields (military, public services, etc.).

**Secondary School (General) (K 10-12)**

Students in general high school follow a general curriculum in the first year. Then, each student specializes in either liberal arts or science for the next two years. Boys’ school has three branches named: Islamic & Arabic studies, Management & Social studies, and Natural Science studies. Besides the general secondary school there are other choices. The study of the Arab Union for Vocational Education on the present situation of vocational education in Arab countries showed that in Saudi there are eight fields of study after secondary school, four of which are vocational (the General Loyalty, 1988).

Table 2-3

**Subjects and Classes’ Loads in Boys’ Secondary School in Saudi**

<table>
<thead>
<tr>
<th>Subjects*</th>
<th>1st Grade</th>
<th>2nd Grade</th>
<th>3rd Grade</th>
<th>2nd Grade</th>
<th>3rd Grade</th>
<th>2nd Grade</th>
<th>3rd Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Islamic Studies</td>
<td>5</td>
<td>12</td>
<td>12</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Arabic Studies</td>
<td>6</td>
<td>9</td>
<td>9</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Social Studies</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Management Studies</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>7</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Science</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Mathematics</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>English Language</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Computer Science</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Library &amp; Research</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Physical Education</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Activities</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Total Hours</td>
<td>34</td>
<td>34</td>
<td>34</td>
<td>34</td>
<td>34</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Total subjects</td>
<td>21</td>
<td>19</td>
<td>19</td>
<td>22</td>
<td>21</td>
<td>17</td>
<td>17</td>
</tr>
</tbody>
</table>

* Each division represents from 1 to 5 subjects.  
(Study Plan in General Education, 1996)
Educational Authorities

The educational administration in Saudi Arabia consists of three agencies that have the authority to operate and run the educational system, which is originally planned by the Higher Committee for Education Policy as four agencies, the fourth one the General Presidency of Girls’ Education, which was nullified and its functions transferred to the Ministry of Education.

There are other authorities, which provide their affiliates and children with kindergarten, elementary, intermediate, secondary and adult education. Such authorities are the Ministry of Defense and Aviation, the Presidency of National Guard and the Ministry of Interior. Study plans and curricula enforced in the Ministry of Education. The main three agencies are:

The Ministry of Education

Was established in 1953. It is considered the largest centralized educational agency in Saudi. The Ministry of Education’s main objective is to provide general education for all male and female students. Therefore, the Ministry runs elementary, intermediate, and secondary schools. Moreover, the Ministry of Education is responsible for policy making and planning, curriculum, teacher and superintendent training, and special education. Recently other responsibilities, such as public libraries, museums and archeologic, were taken over by other ministries and agencies.

The General Organization for Technical Education and Vocational Training

Because of the oil revolution and its dynamic changes the government considered vocational education the main pillar in the Saudi future. According to Alsalloom (1995 & 1991) and the Ministry National Report (2001), two divisions of vocational and technical education were founded: one in the General Administration for Technical education, a
division of the Ministry of Education with three branches: Industrial, Commercial, and Agricultural; the second in the General Administration of Vocational Training, a division of the Ministry of Labor and Social Affairs. In 1980 these two administrations were integrated by a Royal Decree into the General Organization for Technical Education and Vocational Training. Now this organization is responsible for pre-vocational training centers, vocational and commercial secondary schools, and higher technical institutes.

**The Ministry of Higher Education**

Was established in 1975. Higher education was under the Ministry of Education, under the Supreme Council for Colleges, which was founded in 1962, and changed to Supreme Council for Universities in 1974. But due to the consequences of increasing numbers of schools and student enrollment causing rapid development in the higher education sector, the establishment of the Ministry of Higher Education was necessary. The Ministry of Higher Education is responsible for higher education policy and the kingdom’s eight universities and private colleges, and also coordinates post-secondary programs. It also supervises scholarships of Saudi students studying abroad.

**Education Policy in Saudi Arabia**

The Educational Policy document, issued in 1970 by the Supreme Committee for Educational Policy in the Kingdom of Saudi Arabia, is the basic reference book on the fundamentals, goals, and objectives of education. The objectives of Saudi educational policy are to ensure that education becomes more efficient, to meet the religious, economic and social needs of the country, and to eradicate illiteracy among Saudi adults (Ministry report, 1994).

The Policy described itself in the first article as:
The educational policy is the broad lines on which rests educational process in fulfilling the duty of acquainting the individual with his God and religion and adjusting his conduct in accordance with the teaching of religion, in fulfillment of the needs of society and in achievement of the nation’s objectives. It covers the various fields and stages of education, the programs and curricula, the means of education, the administrative system, the organs in charge of education and all other related subjects (p.5).

**General Principles of Education**

In the first part of the Saudi Educational Policy (1980) are the general principles of education. This section has 26 articles, some articles related to social and political aspects, while other articles are related to this study. Among these articles related to the fundamentals of education and science education, the policy stated that Saudi education should emphasize the following:

1. Strengthen faith in God and Islam, and in Mohammad (Peace be Upon Him) as Prophet and Messenger of God.

2. Foster a holistic, Islamic concept of the universe, man and life, such that the entire world is subjected to the laws of God in fulfilling its duty without any interruption or confusion.

3. Emphasize that life is a stage of work and production during which the Muslim invests his capacities with a full understanding of and faith in the eternal life in the other world. Today is work without judgment and tomorrow is judgment without work.

4. Instill the Islamic ideals of a humane, prudent and constructive civilization guided by the message of Mohammad (Peace be Upon Him) to realize glory on earth and happiness in the other world.
5. Engender faith in human dignity as decreed by the Holy Qur'an and that each Muslim is entrusted with the task of fulfilling God's wishes on earth.

6. Reinforce that it is the duty of each Muslim to seek education and the duty of the state to provide education in its various stages within the state's capacity and resources.

7. Integrate Islamic orientation in sciences and knowledge in all their forms, items, curricula, writing and teaching so that they would fall in harmony with sound Islamic thinking.

8. Stimulate the use of human knowledge in the light of Islam to raise the standard of living of our country and nation and to fulfill our role in world cultural progress.

9. Advocate social solidarity among the members of the Muslim community through cooperation, love, and fraternity and through placing public interest over private interest (pp. 6-9).

**Educational Aims in Saudi Arabia**

The broad aim of education is to satisfy the needs of the individual and the society. Alternately, the educational purpose of a group of people often reflects their habitat, cultural norms, and way of living. Additionally, the more developed a society, the more the needs of that same society become changeable and the more complex are the country's educational purposes. Therefore, the purposes and aims of education in any country represent the cultural values, beliefs and ideology of its members, besides observing environmental circumstance.

The main educational purposes of the Saudi education are based on the fundamentals of Islam. In fact the Kingdom of Saudi Arabia’s political, social and
economic rules is a continuation of its Islamic heritage. The most distinct objectives of Islam in attaining the purpose of education are stated in Part II in the Saudi Educational Policy. The second section of the document has 34 articles, some articles related to social and political aspect besides other subjects. These are the articles related to the study area:

1. The purpose of education is to have the student understand Islam in a correct comprehensive manner, to plant and spread the Islamic creed, to finish the student with the values, teachings and ideals of Islam, to equip him with the various skills and knowledge, to develop his conduct in constructive directions, to develop the society economically, socially and culturally, and to prepare the individual to become a useful member in the building of the community.

2. Demonstrating the full harmony between science and religion in the Islamic law, as Islam is a combination of religion and secularism, and Islamic thought meets all the human needs in their highest forms and in all ages.

3. Encouraging and promoting the spirit of scientific thinking and research, strengthening the faculties of observation and meditation, and enlightening the student about God's miracles in the world and God's wisdom in His creatures; thus enabling the individual to fulfill an active role in building a social life and in steering it toward the right direction.

4. Understanding the environment in all forms, broadening the horizons of students by introducing them to the different parts of the world and the natural resources and products that characterize each country, emphasizing the wealth and raw resources of our country, their geographical location, and economic position. Accepting a leadership role in safeguarding Islam, calling people to accept it, and working for the solidarity of the Islamic world.
5. Furnishing the students with at least one of the living languages, in addition to their original language, to enable them to acquire knowledge, arts and useful inventions, transmit our knowledge and sciences to other communities, and participate in the spreading of Islam and serving humanity.

6. Keeping pace with the characteristics of each phase of the psychological growth of young people, helping the individual to grow spiritually, mentally, emotionally, and socially in a well-rounded way, and emphasizing Islamic spirituality so that it will be the main guideline of private and public behavior for the individual and the society.

7. Studying individual differences among students so as to properly orient them and assist them to grow in-line with their abilities, capabilities and inclinations.

8. Caring for academically retarded students and eliminating as many of their handicaps as possible and setting up special permanent and provisional programs to fit their needs.

9. Training the necessary manpower and diversifying education with special attention to vocational training.

10. Planting the zeal of work in the hearts of students, commending it in all its forms, urging individuals to excel in their work and to emphasize its role in the construction of the nation. This is done by:

11. Forming scientific skills and attending to applied sciences in school to give the student the chance to practice handicraft activities, participate in production, and acquire experience in laboratories, construction work and farms.
12. Studying the scientific principles of various activities so that the level of mechanical production will attain progress and invention (Educational Policy, 1980, pp. 10-14).

**New Programs to Develop Curriculum in Saudi Arabia**

Among the notable current efforts to reform Saudi educational system the following projects:

**Work Priorities Policy**

In 1996/97 the Ministry sought the opinions of 1,500 educators and experts from different fields, about their views to develop education. The final results of the study were crystallized in Work Priorities Policy document covering 14 fields, among the important priorities was teachers training (National Report, 2001, p. 36).

**The Comprehensive Curriculum Development Project**

The project began in 1999; this project is an action for continuing what the Ministry of Education a few years ago in developing curricula started. In fact, it is a long-term plan to develop education, aimed to avoid poorly planned acts. This project has six phases; the Ministry of Education Century Report (2001) set these phases as:

1. Phase of studying the actual present facts and identifying the basics and criteria of development.
2. Phase of producing curricula document.
3. Phase of preparing educational materials.
4. Empirical phase, by testing textbooks on a sample of school.
5. Publicity phase, which contain the process of designing and producing textbooks.
Discovering and Sponsoring Gifted Students Project

The project aimed to discover talented students and provide them with the best opportunities to develop their talents in the framework of public education programs to help develop their society.

“The project includes students with extraordinary capabilities and distinguished performance in mental, intellectual or creative skills in one or more fields. 1 to 2% of public students are expected to make use of this project (National Report, 2001, p. 40).

The plan for this program started in 1991, and in next year the project started with a small program in science and another one in math and computer science. In 1992 I was chosen to teach in the program Pilot Study, as a teacher for science for the whole group of students, and in 1993 I participated in Experimental Program, as science teacher and evaluator. The Experimental Program had two groups in each field.

The progress of enhancing the program was low, but in 2000 the basic system was approved by a royal decree as the “King Abdulaziz & His Men Association” headed by HRHP Abdullah, the Crown Prince.

The Ministry of Education Ten Years Plan 2003-2013

The vision of this plan aimed to qualify students with Islamic morals, knowledge, skills and experiences to be able to react actively with new changes in science and technology, and to prepare them to be distinguished in international competitions in scientific and practices fields, by establishing an active educational system able to discover and support their abilities and perspectives. The plan also aimed to enhance students with a positive attitude toward work, in a motivating school environment.
The plan designed 15 goals, focusing on the preparation of students, teachers and school environment and comprised vocational education, handicapped and illiteracy sector for males and females.

The strategy of the plan is based on three aspects:

1. Using a scientific approach in plan stages: diagnosing, analyzing, determining fissures, setting goals, forming vision, planning programs and projects.
2. Applying wide contribution rule from all people getting benefits or dealing with the plan.

**Summary**

This chapter was about background of the study around Saudi Education. The chapter was divided into nine parts, Saudi: Country and people, learning places in Arabian Peninsula, education before the establishment of Saudi Arabia, education development in Saudi Arabia, the structure of general education in Saudi Arabia, educational authorities, education policy in Saudi Arabia, education aims in Saudi Arabia, and new programs to develop curriculum in Saudi Arabia.

The first part was a demographical view about Saudi Arabia and Saudi people. The view was supported with facts and census about the country and major cities. While the second part covered the learning places in early times in Arabian Peninsula that include Saudi. This part describes the following places: kuttab, home schooling, and learning journeys.

The third part related to the educational situation before the establishment of Saudi Arabia in two eras: the first era, Ottoman Empire (ending in 1916) and the second era,

Part five covered the structure of general education in Saudi Arabia. First, there were descriptions of the Comprehensive and Developed (Modern) secondary schools, elementary school (K 1-6), intermediate school (K 7-9) and current secondary school (general) (K 10-12). Educational authorities in Saudi were presented in part six. A brief review was given of the roles of educational authorities, which are Ministry of Education, the General Organization for Technical Education and Vocational Training, and the Ministry of Higher Education.

Parts seven and eight were about educational policy in Saudi Arabia and education aims in Saudi Arabia. The general principles of education and the Policy were mentioned with an examples of the aims and goals for education in Saudi.

Finally, in the last part, there were reviews of the new programs to develop curriculum in Saudi Arabia, including: Work Priorities Policy, the Comprehensive Curriculum Development Project, Discovering and Sponsoring Gifted Students Project, the Ministry of Education Ten Years Plan 2003-2013.
Chapter III: Literature Review

“The judgment on something is a part of the whole understanding of it” is one of the basics in Islamic Law. I presume that in order to understand how Saudi science teachers deal with learning, teaching, science, and nature, one needs to know about these issues in Arab and Islamic literature.

Saudi Culture

Ibn Khaldon (1331-1405), the founder of sociology from Arabs’ views (Abduldaim, 1984, p244), once said, “A man is the son of his environment.” It would be essential to join this statement with what John Dewey said about formal and informal education, asserting that:

“There is accordingly, a marked difference between the education which everyone gets from living with others, as long as he really lives instead of just continuing to subsist, and the deliberate educating of the young. In the former case the education is incidental. It is natural and important…” (Dewey, 1997, p.6)

Dewey’s comment may give us insight on the hidden curriculum in any society. Saudi Arabia is the country where Islam originated and all Saudi citizens are Muslims. Islam means submission to the will of God. This fact shaped the life of people now and in the past.

The Kingdom of Saudi Arabia is a young country. Until the 1950s, this country was without resources, people were living in mud houses without any kind of new technologies, and life was as simple as it was in the past centuries. After discovering and manufacturing oil this life changed suddenly within only few years. A massive improvement occurred everywhere in the country in social issues, health, education, transpiration and other fields (Abdelal, 1994). This sudden movement toward the future affects the lives of people in different ways, mainly those that are rushing to modernity
and those who have nostalgia to the past. The situation also creates new gaps between parents and new generations.

Most people prefer to live in big cities, especially the Capital Riyadh, leaving their small town. “Until the 1960s, most of the population was nomadic or seminomadic; due to rapid economic and urban growth, more than 95% of the population now is settled. Some cities and oases have densities of more than 1,000 people per square kilometer (2,600 per sq. mi)” (U.S Dep. of State, 2004).

Lifestyle and the people of Saudi Arabia have changed dramatically for many reasons, the following reasons are the most important:

1. After the establishment of Saudi Arabia, the founder of the new state, King Abdul Aziz, formed permanent settlements at developed water wells. In an attempt to add stability to the tribesmen by changing their nomadic method of life to agricultural and trade pursuits, he specified a settlement for each tribe. The government was paying generously on these settlements although country resources were limited at that time (Darweesh, 1983).

2. Discovering oil in 1938 and the advancement of the petroleum industry in the following years have brought several urban centers into the eastern region of Saudi Arabia. These cities and job opportunities attracted large numbers of tribesmen all over the country.

Tribal ties still exist strongly in Saudi Arabia even in big cities, but the social relations in Saudi Arabia are tied to family considerations, which is of an extended type. Until a few years ago, it was common to see up to three generations represented in the same home. This situation may strongly affect student field of study and future career.
Knowledge and Learning from Islamic View

Islamic culture interacted with other cultures and philosophies throughout history, but it has always had its own identity. “Islamic philosophy was selective in dealing with other temporary and ancient philosophies… and the far aim Islamic philosophy is Wisdom” (Naser I, 1983, p 40).

Islam has always encouraged knowledge, al-ilm in Arabic. The first word in Qur’an to Prophet Mohammed was “Read”:

[96:1-5] Read! In the name of your Lord who created - Created the human from something which clings. Read! And your Lord is Most Bountiful - He who taught (the use of) the Pen, Taught the human that which he knew not. AL-Alaq (The Clot)

There are many references to knowledge and the pursuit of knowledge in the Qur’an and Sunnah. These showing that the possessor of knowledge or wisdom has been given a very powerful gift, and that the pursuit of knowledge is something which should be done actively by everyone. For example from Qur’an:

[2:269] He [Allah] grants wisdom to whom He pleases; and he to whom wisdom is granted indeed receives a benefit overflowing. But none will grasp the Message except men of understanding.
[58:11] ...Allah will raise up to (suitable) ranks (and degrees) those of you who believe and who have been granted knowledge.

And from Sunnah:

“Upon a person whom Allah desires good, He bestows the knowledge of faith.” Authentic Hadith,
“A person who follows a path for acquiring knowledge, Allah will make easy the passage to Paradise for him.” Authentic Hadith.

Knowledge in Islam can be classified into two sorts, useful knowledge and nonuseful knowledge. Useful knowledge includes any field that humans get benefit from, and can be classified into two kinds. The first one is knowledge that everyone needs to know including general morality such as others’ rights (God, parents, neighbors, peers,
etc.) and personal cleanliness. These are obligatory knowledge. The other kind of knowledge is what humans are encouraged to learn, especially if the country needs specialists in these fields. On the other hand nonuseful knowledge like magic or harmful things that may affect humans or others should not be learned, except for the few who can learn it for specific reason.

Zakaria (1988) argues that in our Arab world today those who are proud and have high impressions about the Arab and Islamic culture in the Middle Ages are those who refuse scientific approach in our schools today (p. 11).

**Education from Islamic View**

Aims of education in Islam are seeking God’s satisfaction, which is obtained by being good humans, “earth construction” and fulfilling needs of the country. Goodness is centered in the ability to be good for yourself and for others (Kaylani, 1983). Others include all creatures around us such as people, animals, plants, etc. “Earth construction” means that humans should not do activities that may destroy the earth or the environment around him; at the same time he is encouraged to discover the world and life in balance. To fulfill country needs means that the country should have enough specialists in each field.

The first resource of education is the holy Qur’an (the word of God), then Sunnah (prophet Mohammed’s sayings and acts), and then knowledge of time. An example of educational aspects in Qur’an:

(But seek, with that wealth which Allah has bestowed on you, the home of hereafter, and forget not your portion of lawful enjoyment in this world; and do good as Allah has been good to you, and seek not mischief in the land. Verily, Allah likes not the Mufsidun (those who commit great crimes and sins), oppressors, tyrants, mischief-makers, corrupters) AL-Qasas 77 (The Narration).
Methods of teaching vary based on the field of study and ages of children. In early age, imitation and memorizing are common. Then in the second stage, learning from discussions and overthrowing previous knowledge on new situations will be employed more. In some fields such as philology, legislation and algebra problem solving are common.

Islamic scholars believe that there is a thorough view in education in Islam, “The difference between education in Islam and other education on earth, is that all nations are taking care of preparing ‘Good Citizen’, while Islam is seeking ‘Good Human’ (Qutb, 1986, p. 13). The idea of preparing a good citizen, who does not refuse to occupy other countries and kill their citizens in the sake of his own country, is not the aim of education in Islam, where education in Islam does not consider geographical borders, the aim is to be good human, for all Mankind (Albany, 1983, pp 66-68).

Science and Nature in Islamic Literature

As science is a human’s heritage (Zaitoon, 1986), it is fruitful and possible for one civilization to learn the science of another civilization; but to do that it must be able to abstract and make it its own. The prophet Mohammed said: “the Wisdom is the desire of Muslim, wherever he found it, he deserved it (his preference).” Because of that, in the past the Muslims did not just take over Greek science and translate it into Arabic and preserve its Greek character. It was totally transformed into the part and parcel of the Islamic intellectual citadel.

“It is not at all value free; nor is it a purely objective science of reality irrespective of the subject you study. It is based upon the imposition of certain categories upon the study of nature, with a remarkable success in the study of certain things, and also a remarkable lack of success [in others], depending on what you are looking at. Modern science is successful in telling you the weight and chemical structure of a red pine leaf, but it is totally irrelevant to what is the meaning of the turning of
this leaf to red. The “how” has been explained in modern science, the “why” is not its concern” (Nser, 2003).

The fundamental premises for establishing an Islamic science are based on the worldview which recognizes that the Word of God is relevant in each and every sphere of human activity, that God has created this universe with a purpose and he has made Man his vice-regent for an appointed term. The model and example to be followed is that of Prophet Muhammad. Nature is not to be exploited but should be understood and treated as a trust given to him by the Creator.

However, since science cannot exist in a vacuum or in total isolation of the historical and cultural conditions, then Islamization of knowledge, in a general sense, can be taken as including the Islamization of science as well.

In the discourse on Islamization of knowledge and science, Seyyed Hossein Nasr appears as the foremost academician who has advanced the notion of a “Sacred Science” as he calls it. Nasr’s view is based on a reconstruction of Islamic scientific thought on the basis of the revealed knowledge. His approach is similar to what Ismail Alfaruqi and Taha Alalwani brought in the International Institute of Islamic Thought (IIIT), created under the idea of “Islamization of knowledge” (Nasr, 2003; Alfaruqi, 1984; Alalwani, 1989).

Taha Alalwani is one of the scholars who spent aggrandized time to establish a vision of scientific Islamic theory, where he thought that Muslims should have what he and other scholars call “Islamization of knowledge.” Alalwani (1989) provides this view to scientific knowledge:

“The Islamic theory of scientific knowledge has two sources: Revelation and the tangible universe. Revelation is the source of absolute facts and truth about which there is no doubt whatsoever and not subjected to relativity. Revelation is contained in the Qura’n which is the word of Allah revealed to the Prophet (SAAS) [peace be upon him], Allah (SWT)
[almighty] has challenged mankind to produce a Surrah to match the shortest one of the Qura’n… the second source of Revelation is the legally binding elaborations of the Qura’n, contained in the Sunnah of the Prophet (SAAS), which consists of his authentic hadith and decisions i.e. all that he said, did, approved of, or condemned” (p.10).

**Teachers’ Rights and Duties in Islamic Literature**

The Islamic literatures stress the teachers’ role in education. For some people, the aim of education is getting new knowledge and new skills, but in Islamic education there is something more important, which is moral. We say in Arabic “Educating before teaching – or learning,” which is taken from the name of the ministry of education in most Arab countries that could be translated word-for-word as “the Ministry of Educating and Instruction.” By that is meant that taking care of a child’s morals and behaviors should occur before learning information or skills. Also we say in Arabic, “Whom his scholar is his book, his mistakes going to be more than his rights.” By that is meant that humans need guidance, which can be obtained from parents and teachers.

A teacher plays major roles in the educational system in Islam. He needs to be a good educator, who has strong knowledge. At the same time he needs to be well mannered and a good example in his behavior; the teacher needs to educate using his behavior more than his tongue. The Morals of Education Career Declaration announced by the Arab Gulf Countries Educational Bureau in 1985 addressed 15 out of 19 statements to teachers morals, all these statements start with the word “teacher.” The other four statements addressed the relation of the teacher with others (Alawa, 1985).

The teacher is a source of knowledge at the same time he is a guide for students to improve their abilities to discover new things and use it in their life. One of the teacher’s aims is making his students better than himself. In fact, seeing the teacher as a specialist in his field affects his teaching methods, where students are expecting to find the answer
from the teacher for each question. This situation led the teacher to prove his ability and knowledge by giving the answer directly instead of working with students to let them discover the answer using the scientific approach.

**Students’ Rights and Duties in Islamic Literature**

A student in his early ages (from six to ten) seems to be passive. During this stage he learns manners, such as respecting others (especially older people and teachers), and he learns conversation politeness. After ten, he becomes more active, starting to ask questions, then engaging in discussions with the teacher. Later, he will be able to teach younger students alphabet and simple arithmetic under supervision of his teacher; the age here is based on his ability and teachers’ need of help. Finally, the teacher assigns those who are able to be teachers.

Basically, girls are similar to boys, but they are less likely to teach other children, besides that, boys have a greater chance to learn. Unfortunately, this chance had been given to boys for social considerations only, while the encouragement to learn in Qur’an and Sunnah are addressed to all Mankind, males and females.

The studies of the National Comprehensive Plan for Science and Technology 2001–2020 (NCPST 2001-2020) represent that the previous situation for students still exists at all school levels in Saudi Arabia, where teaching is based on lecturing and memorization, instead of experimental methods. This is true in all subjects, including scientific fields.

**Curriculum Development**

In our world today, children are playing electronic games and watching television much more. Reading books is not as popular as before for children and for adults. Often both parents are working and do not have the time to read to their children or hear them
read. Schools also report that kids are less ready to sit and learn than they once were. At the secondary level, our students now resist lessons that require them to listen rather than to do. All these aspects are fundamental in the need to develop educational curriculum, but the problem comes when we see the old as something should be throw away entirely and replaced. “When new educational treatments come along we throw out the old and embrace the new, only to find that the new method has as many though different problems as the cure we rejected, to which, likely as not, we then return” (Karaolis, 1997). Change in education is also prompted by the philosophical dilemmas that exist at the core of education as a social enterprise, dilemmas to which there are no solutions, only responses. It is the lack of having a view about the circumstances related to the educational plan before implementing this plan in schools. In the process of implementing an educational plan we need to “know the difference and the role of the observation and the evaluation” (UNISCO V, 1992, p 19).

Brockmeyer (1993) argued that school systems have only limited latitude to carry out their development according to their own ideas. The course of development is much more determined by political, economic, social and cultural circumstances. Changes in schools may come about more often as a result of external circumstances than as a result of internal initiative. In some countries, improvements in education are often more dependent on political decisions and options than professionals think. This is an international phenomenon. “It is a characteristic of education in Australia that it is subject to fads. So-called reforms are introduced with great fanfare, only to be abandoned when the next educational or political trend comes along” (Karaolis, 1997). In fact this is notable more in educational systems with national-central structure, like ours in Saudi Arabia. It is typical of policy makers everywhere that they believe that change can be
achieved by changing structures, whereas in reality change can only be achieved by changing people. Most frustrating of all are the changes imposed from outside education according to agendas that reflect the interests of business, politics and the media more than the needs of learning and children. Such change has been characteristic since editors and politicians discovered that education could be made into a hot topic.

Reform concepts and development projects require the acceptance at least by that segment of those immediately affected who form opinions and tolerance from the majority. The success of reform measures in education is jeopardized if they are not developed through debate and clarified through participatory democratic processes. This also requires that concepts and guiding principles be examined to ensure their usefulness under differing development conditions (Alibrahim & Abdulrazaq, 1996). Developments in education do not lend themselves to linear design. "All or nothing" strategies are not permissible. Some researches suggest that developments in education have to expect the status quo to be recalcitrant and to use this constructively; various development avenues should be opened, and there should be no reliance on a single model (Brockmeyer, 1993).

Developing Curriculum in the U.S

There are two major educational approaches that emerged in the U.S during different eras and affect educational views not only in the U.S but also worldwide. The two approaches are:

Technical Scientific Approach

There are three major assumptions in this approach. The first one is that the major steps can be identified and managed, with a view that knowable components can be selected and organized such as Bobbitt & Charters Curriculum Activities and Tyler’s Four Basic Principles. The second assumption is that the curriculum development has a high
degree of objectivity and logic, with a view of the curriculum as a compendium of parts. Taba’s Grass-roots rationale is an example. The third assumption sees curriculum development involving key decision points, and it is rational. The view of the curriculum for this one is based on the view that the curriculum is the organization and delivery of contents and experiences, which is presented in Hunkins’ Decision-making model (Ornstein & Hunkins, 1998, p. 213).

**Nontechnical Approach**

There are also three major assumptions in this approach. First, curriculum development is subjective, personal, aesthetic, and transactional. It is the view of the curriculum as quality activities. Glatthorn’s Naturalistic Model is an example. The second one is based on the curriculum development as a “specialized talk,” viewing the curriculum as conversation, such as the Deliberation Model with the Conversational Approach. The third assumption is that the curriculum development is a dynamic process fraught with much uncertainty. The view of the curriculum is an emerging phenomenon with which humans interact; it is a dynamic and uncertain system, which can be seen in Post-positivist models (Ornstein & Hunkins, 1998, p. 213).

**New Projects in Science Education in the U.S.**

Project 2061 (Science for All Americans) is a far-reaching enterprise launched in 1985 by the American Association for the Advancement of Science to help bring about reform education in science, mathematics and technology (Project 2061 summary, 1995). The primary theme is that it is imperative for schools to teach more effectively in order to foster scientific literacy, rather than cover more content. In this project, science literacy is a national goal. Science for all Americans is based on the conviction that a scientifically literate person is one who is cognizant that science, mathematics, and technology are
human enterprises dependent upon one another. Primarily written by researchers, teachers, scientists, and leaders from business and industry, the report set goals that include, 1) defining scientific literacy, 2) establishing benchmarks for science education, and 3) creating a method to guide teacher education and material design (Ballone & Czerniak, 2001).

Another current science reform report, similar in effort and in themes to Project 2061, is the National Science Education Standards (The Standards). The Standards are guided by the following beliefs: 1) science is for all students, 2) science learning is an active process, 3) science teaching should reflect intellectual and cultural traditions of contemporary science and, 4) science education is part of systemic education reform (Ballone & Czerniak, 2001; NAS, 1996).

After all, some educators believe that there is still a problem in education development efforts in the U.S. “American schools know how to change. What they don’t know is how to improve” (Elmore, 2002).

**Teachers Role in Developing Curriculum**

The National Science Standards (1996) stated that “Teachers’ experiences with students make them indispensable participants in the design, development, and interpretation of assessment prepared beyond the classroom” (p. 90). Work with teachers not to tell them what to do, “change the way they think about themselves as teachers” (Miller, 1990, p. 53) and the way they see their students. “The effective teacher truly believes that all students can learn, it is not just a slogan. These teachers also believe that they must know their students, their subject, and themselves, while continuing to account for the fact that students learn differently” (Stronge, 2002, p.19) through differentiation of instruction.
Routman (2002) believes that “Even the best professional development may fail to create meaningful and lasting changes in teaching and learning, unless teachers engage in ongoing professional dialogue to develop a reflective school community” (p.32). I think the professional dialogue is essential for all those who have direct or indirect effects on education. Besides teachers, students, parents, policymakers and educational developers, dialogue should address the media and the private sector as well.

**Teachers’ Role in Developing Curriculum in Saudi Arabia**

Some educators agitate that in the Saudi educational system, as it is in the educational systems of all Arab countries, there was a feeling of lack of trust in teachers’ abilities and fidelity. For example, we will feel this sensation if we follow the history of educational supervision in Saudi Arabia.

The first kind of educational supervision in Saudi Arabia was established in 1959, under the name of “Inspection.” It was kind of general investigation on teachers’ work. In 1964 the name changed to “Professional Inspection,” the word professional added to represents the establishment of four departments: Arabic Language, Foreign Languages, Social Studies, and Math & Science. The processes are still the same. The name and the strategies of educational supervision changed in 1974, the new name was “Educational Directional” with decrease in investigating performances. Finally in 1996, “Educational Supervision” became the official name (Educational Supervision, 1999, pp. 23-30; Director’s Directory, 1988, pp.13-17). Honestly, in all these forms and stages of supervision, the main point is that checking a teacher’s papers works to prove that he is doing his job in a mannered way. This old view toward teachers delayed inviting teachers to work in developing curriculum in Saudi Arabia.
The other important point related to a teacher’s role in developing curriculum is the teacher’s background about recent efforts in developing curricula. Among the fundamental book resources for teachers’ educational programs in colleges and universities in Saudi Arabia are: Contemporary Curriculum, a book written by Damerdash Sarhan and first published in 1977; Contemporary Orientations in Science Curriculum & Instruction by Yagoub Nashwan (1984); and his second book, the New in Science Education, published in the same year. Also included is Planning & Developing Scholastic Curriculum, written by Fekrey Rayyan in 1981. For sure that at the time when these books were first published they were great books representing current educational views in the world, but now higher educational programs still using these books show that new theories in education are the works of: Kansan in 1958, Tyler in 1966, Neagly & Evans in 1957, Inlow in 1966, Johnson in 1967, Goodland in 1966, and John Michaelis in 1967. “Even though that the model recommended by Tyler in 1949 still provides the basic structure for preparing most curricula today” (Choate et. al., 1987), teachers in Saudi high educational programs do not know about the implementations of Tyler’s work in today’s curricula, and also they don’t study about new approaches in education.

The Educational Policy in Saudi Arabia mentioned various issues related to curricula and curriculum development, but it did not mention the engagement of teachers in planning curriculum. The Policy focused on teachers’ training and preparations to deal with new curriculum, in order to carry this new curriculum in schools. The articles 170,196, and 197 in Educational Policy (1980) stated that:

170: Teachers’ training is a continuous operation. A plan is set up to train and rehabilitate professionally disqualified ones, and another plan is set up to re-orient and improve the standards of qualified ones (p.31).
196: Concerned authorities give special attention to training, re-orientation and refreshing courses in order to strengthen experience and gain additional skills and knowledge (p.36).

197: Training covers all the aspects of the educational operation and its organs. Programs are set up to define the objectives of the session, its schedule and methods of execution, its values and the conditions required in those who will be in charge (p.36).

Now the Ministry of Education is trying to move from preparing teachers to carry curriculum in schools to engage teachers in planning and preparing curriculum. In the last few years, there were a number of teachers in National Committees (Families) in all subjects. Also, there were some teachers chosen for the writing and editing of textbooks.

**Features of Current Science Curriculum Reform Perspectives**

Expressing views or writing books and reports about the reform of education and reforming education are two very different activities. The former requires that a small group agrees on a set of ideas and expresses those ideas clearly and with adequate justification. The latter requires that millions of school personnel change. Changes in science curriculum in schools represent smaller instances of the latter. In order for changes to occur in science education, school personnel must change. Also, the most important factors influencing the possibility of changing school personnel are the programs and practices currently in place and supported by the school system.

McGee (2004) classified four historical perspectives on curriculum development based on four aspects. First is Learner, and in this approach the child is the focus of learning and curriculum. The primary objective is individual development, self-actualization, or self-sufficiency. The curriculum is fluid and changing. The second aspect is Subject Matter, where curriculum is organized by innate structure, principles, and processes of disciplinary knowledge. Mastery of content is the primary objective, and
curriculum is fixed and self-evident. The third aspect is the Society at Large, and here the learner functions primarily as a member of society rather than an individual. The primary objective is to prepare the learner for social roles. The curriculum reflects ideals, values and standards of the local and national community, and changes according to local values. The last aspect is Instruction. In this approach, learner information is not a requisite for curriculum development. There is no connection between the learner and the curriculum. The curriculum results in desired behavioral outcomes and the curriculum is fixed.

Researchers most often believe that “Today’s science reform efforts focus on the belief that all students are capable of learning science and therefore must be granted the necessary opportunities and conditions for optimal science learning” (Ballone & Czerniak, 2001). New themes emerged in science education recently along with reforming old concepts, and these themes include: cooperative learning, thematic approach, constructivism, and equity besides changing the view toward learning styles, assessment and evaluation, and classroom management (Gaff & Ratcliff, 1996).

Furthermore, in small districts or countries, the curriculum might reflect the limited experiences of only a few people. Even in large districts or developed countries, where there may be a deeper pool of experience, the curriculum may not necessarily be of the highest quality because it doesn’t get a critical review. The feeling in that case is, as McTighe suggests, that “We worked hard on it, it must be good” (Allen, 2002).

Reform of science education must be viewed as part of the general reform of education. Approaching the improvement of science education by changing textbooks, buying new computers, or adding a new course simply will not work. Science curriculum reform needs to be systemic and systematic. Systemic reform means that education will improve only if all the critical components are addressed in concert (Black & Atkins,
These critical components might include attainment targets, curriculum, student assessment, relevant in-service and pre-service teacher education, school administration, and supportive services (Tang, 2001).

**Features of Science Curriculum Reform Perspectives in the U.S**

According to Bybee (1995), from the perspective of science curriculum, significant differences exist between the 1960s and 1990s reforms in the U.S. The 1960s reform began at the secondary level and progressed to the elementary level. In the 1990s, reports have generally addressed all levels, K-12. In the 1980s and 1990s, there are fewer curriculum projects at the national level. Reform efforts are being initiated through state-level frameworks and many new science curricula are being completed through local development (Bybee, 1995; Gaff & Ratcliff, 1996).

Addressed by projects like Project 2061 was the development of answers to questions such as: What is the substance of science literacy? Who should be expected to acquire the requisite knowledge and skills? And how can science literacy be achieved nationwide? In fact, this is the central purpose of the project. But some countries are trying to reach something beyond this level by establishing a role for each member in the society, besides seeking the answers for the previous questions.

**Features of Science Curriculum Reform Perspectives in Saudi Arabia**

“Science for All” is a new wave of dealing with science curriculum asking to take care of the considerations of the society in order to have acceptance. By applying this view in science curriculum, the cultural, historical and environmental backgrounds of science should be considered in planning curriculum (Badran, 1991 p.66). Badran (1991) gives Canada as an example, where there are assurances to put science curriculum in
Canadian context taking care of the country’s scientific heritage and representing the historical roots for science and technology in Geology and Agriculture.

In this aspect, the engagement of all people in the society is expected, whether in planning curriculum or in implementing this curriculum. In light of this perspective, learning activities are connected with actual environments, habitats, structures, places and organizations. In this way, instead of bringing a ready curriculum to a country, the country should build its own one, based on the needs and abilities to carry this curriculum in real school (Alibrahim & Abdulrazaq, 1996).

This way of establishing curriculum is based on the current situation in the society, and for the needs of its members is the notable perspective in Saudi Arabia today. This view came to the Ministry’s work in developing curriculum after a long term of arguments from students, teachers, and parents that science in students’ textbooks is talking about different environments, other kinds of pollution, and examples of animals and plants that neither the student nor the teacher saw in his life.

**Requested Science Curriculum Reform Perspectives**

Studies on educational development asserted that imported educational plans or expertise, even from developing courtiers, to other countries, might be less qualified to work in these countries due to the lack of the whole understanding of the identity and cultural foundations for this country. The UNISCO Process of Educational Planning (1992) gives an example for this situation in Peru, where the country refused to view the “Sesame Street” program because they believe that there is hidden ideology in this program, aiming to implement the North American values in schools. This fact is also supported by some reformers’ approaches and philosophies. Paulo Freire (1921-1997) is a notable example.
Science curriculum reform needs to consider goals that students should achieve in science. These goals must be the fundamental perspectives for the reform. Among the critical goals are:

**Understanding Science**

Projects like Project 2061 aim to guide students to develop an awareness of what the scientific endeavor is and how it relates to their culture and their lives. According to Project 2061, students should appreciate how various natural and social sciences differ in subject matter and technique, yet share the assumption that objects and events have a constancy in pattern and structure that can be revealed through systematic study. And they should see that scientific knowledge is an open inquiry with a long history, motivated by a fundamental human desire to be curious, to probe the mysteries of the universe and life, and to gain some illumination of those mysteries in systematic study (Project 2061, 1995; NSE Standards, 1996; NCREL, 2004). To make interdisciplinary connections, teachers will require a deeper understanding of science and how this subject relates to the world outside of school (AAAS Blueprint, 1999, p.8).

**Developing Scientific Views of the World**

Comprehensive projects, such as Project 2061 and Science for All American, emphasized that students should be able to use their knowledge of science, mathematics, and technology to make their world more comprehensible and more interesting. Students must develop well-articulated views of the world based on scientific principles and concepts. In addition, students should be knowledgeable about the general features of the planet Earth, the living environment, human life and society, and technology (Project 2061, 1995; NSE Standards, 1996; NCREL, 2004).
Forming Perspectives on Science

The social and historical natures of science are an important part of a curriculum. Students should see how the powerful ideas of science emerged from particular historical, cultural, and intellectual contexts. Students should understand that scientific knowledge has a history (Project 2061, 1995).

Establishing Scientific Habits of Mind

Students should develop a positive attitude toward learning science, and if students are to be scientifically literate, they must possess certain scientific values, attitudes, and ways of thinking. Values include 1) a respect for the use of evidence, 2) an appreciation of logical reasoning in crafting scientific arguments, 3) honesty and curiosity in conducting scientific inquiry, 4) openness to ideas that challenge old ways of viewing and explaining the world, and 5) healthy skepticism about current scientific claims and arguments. Students should form balanced and well-reasoned beliefs about the social benefits of the scientific endeavor (NCREL, 2004).

Science Education in Saudi Arabia

I would generalize what Alhoaimel (1997) said about Arabic Language curriculum and textbooks, to cover science curriculum as well. He states, “There is an important failure in the structure of the curriculum, where the dividing and segregation lies between the lesson and the means of lesson” (p.68). In science textbooks, there are divisions between the facts of science and the implementations of these facts, and also there are barriers between science fields. In general, science is provided as separate subjects having nothing to do with each other, especially in secondary school and in intermediate school in lower level.
\begin{quote}
“It is today that Saudi Arabia of course has one of the best programs for the teaching of science and technology in the Islamic world. The centers at Dhahran and other places are really quite amazing but it is a very modern transformation … for example, in all Saudi universities, students are taught Islamic ethics with the hope that once they begin to learn science and engineering, they will take these and integrate them within this ethical system” (Naser, 2003).

Previous words are from a Harvard & Georgetown Universities’ professor who had the chance to visit Saudi scientific institutes. On the other side, there is a gloomy view represented in the NCPST 2001-2020, showing that although the annual budget for education in Saudi Arabia is more than $ 12,000,000,000, the percentage of students in scientific and technology fields in 1999 was 23%, compared with 45% for new industrial countries, 38% for industrial countries, and 34% for South Africa. In the same year, the percentage of graduates from the two fields to the population was 47 graduates for each 100,000 of population, comparing with 303 for the average of industrial countries, 69 for Latin America and South Africa, and 383 for South Korea (KACST, 2001).

In another issue related to science education in Saudi Arabia and Arab Gulf Countries, the interests are still in older educational theories, where the Directory of Teaching Science in General Education (Alghnaim, 1999) mentioned new theories and philosophies in education, such as: Piaget’s approach, Jerome Bruner’s Discovery Approach and, Historical Approach by both James B. Conant and Leopold E. Klofer (Arab Research Center, 1999, p.10). Meanwhile, the Directory did not mentioned new scientific approaches and projects similar to the Coordinated And Thematic Science (CATS) model and the 2061 Project.

Among the notable scientific educational efforts and projects in the Ministry of Education are:
**The Science National Committee (Family)**

The National Committees, or what the Ministry prefers to call “Family,” is a consultation board from different educational organizations in Saudi Arabia, including: policy makers, university professors, authors, educational supervisors, teachers and others. Each subject has its own unique committee with up to 15 members.

Among the national committees’ duties are evaluating school curriculum, developing educational plans, as well as consultations for new projects delivered by the Educational Development Agency in the Ministry. “The first national committee was Math National Committee, established in 1/1/1991, followed by Science National Committee in 1/28/1979” (Alrasheed, 1997, p. 34). There are now 14 national committees with subcommittees in some fields.

**American University (Beirut) Math & Science Curriculum (1975,1980)**

In the early 1970s, the Ministry of Education contracted with Educational Center for Math & Science in American University in Beirut, Lebanon to situate comprehensive plans to develop math and science for Saudi schools. The center produced the new curriculum and textbooks for secondary school in 1974/1975, and for intermediate school in 1979/1980. The process of this project followed these steps:

1. Analyzing academic achievement and perception levels for intermediate and secondary school students,
2. Determining desired subjects and units in each course,
3. Preparing teachers’ textbook guides,
4. Continuing evaluation of the work, with educators from Saudi universities,

The American University (Beirut, Lebanon) Math & Science Curriculum was used for about twenty years in Saudi schools, with minor modifications on textbooks. For more than ten years, science teachers were critiquing the old information in these books and the long length of subjects; besides that, science textbooks do not consider Saudi environmental problems and examples.

In 1999, Aldamegh and I, with some teachers, were assigned to develop science textbooks for intermediate school (K 7-9), with only a few months work period. The team decided to reform the old books, recommending that this change should be considered as a temporary development for science curriculum. The strategy of the work applied these aspects:

1. Rewriting the whole subjects using words and phrases from student daily use and local environment,

2. Using new exciting designs with new photos and drawings, caring of educational and technical aspects,

3. Replacing the old information with new facts, and adding new discoveries in science fields,

4. Decreasing the length of compulsory subjects, and adding new optional sections,

5. Replacing scientific experiments that required unavailable tools, by experiments with tools from local stores and homes,

6. Adopting some ideas from new science textbooks from the U.S, France, Austria, Germany, Singapore and other countries,

7. Focusing on problem solving, optional exciting independent activities, optional activities for talent students,
8. Requiring the use of new teaching methods, including problem solving, discussions, discovery, and small research projects. And in order to force teachers to use these methods, we eliminate answers for most activities,

From 1999 until now, intermediate schools have used these textbooks. In the beginning there was wide appreciation for these books, but as we expected, some teachers failed in using methods of teaching other than lecturing. The main critique was not providing teachers with a teacher’s guide showing results and answers to activities.


In light of the acceptance of intermediate science textbooks, the Ministry of Education delegated a team of nine educational supervisors, including me, to develop new science textbooks for elementary school (K 1-6). Putting authors in the same dilemma with time limitation.

The team finished the textbooks, following the same approach used in intermediate science textbooks, with consideration of elementary school level. The main point in this set of textbooks was the process of getting the information. What was summarized in the old textbooks in a few lines to memorize took several pages to explain using the discussion method and activities. For this reason, the team decided to reduce the amount of subjects in each year.

Besides the acceptance, teachers’ critiques for these books concentrate on the short length of the book because they are used to giving the information directly to the student, so it did not take so long to finish the book using the lecture method instead of the suggested method.
Science Share in School Curriculum

Some educators think that science education did not get the appropriate attention in Saudi education. Alsunbul et al. (1998), contended that science in elementary school is of secondary concern, since boys in first grade do not study science during the whole first semester of the school year. In the second semester they have only one hour per week, compared with math, for example, which has two hours per week in first semester and four in the second semester. The total hours for science in the elementary stage are only 11.5 per week, compared to 29 hours per week for math, while physical education has 15 hours per week.

In boys’ intermediate stage, math and science have an equal share, with four hours per semester each year, along with English language.

For girls, science has more hours, with a total of 14 hours per week for elementary stage, and 27 for math, besides 12 hours per week for each in intermediate school. In girls’ secondary school, first grade has six hours for science in all subjects and five for math, while in the second and third grades, in the scientific branch math has seven hours and the total for science subjects is 11 for each grade.

I do believe that the main reason behind decreasing science share in curriculum is the pressure from the media and society because of the practice of teaching science in traditional ways, demanding only lecturing and memorization.

In a study represented in Secondary Education Symposium in 1997, Alfuraih (1997) investigated the development of secondary education development since 1960, covering four development plans. I will adopt his comparison between the four plans for the first grade in secondary school:
Table 3-1

Subjects’ Percentage Comparison in Curriculum Development Plans for First Grade in Secondary School:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Islamic Studies</td>
<td>11 %</td>
<td>11 %</td>
<td>12 %</td>
<td>15 %</td>
</tr>
<tr>
<td>Arabic Studies</td>
<td>17 %</td>
<td>19 %</td>
<td>27 %</td>
<td>18 %</td>
</tr>
<tr>
<td>Social Studies</td>
<td>11 %</td>
<td>14 %</td>
<td>12 %</td>
<td>7 %</td>
</tr>
<tr>
<td>Mathematics</td>
<td>11 %</td>
<td>14 %</td>
<td>12 %</td>
<td>15 %</td>
</tr>
<tr>
<td>Science &amp; Technology</td>
<td>11 %</td>
<td>14 %</td>
<td>17 %</td>
<td>18 %</td>
</tr>
<tr>
<td>English</td>
<td>22 %</td>
<td>22 %</td>
<td>17 %</td>
<td>12 %</td>
</tr>
<tr>
<td>French</td>
<td>11 %</td>
<td>0 %</td>
<td>0 %</td>
<td>0 %</td>
</tr>
<tr>
<td>Computer Science</td>
<td>0 %</td>
<td>0 %</td>
<td>0 %</td>
<td>6 %</td>
</tr>
<tr>
<td>Library &amp; Research</td>
<td>0 %</td>
<td>0 %</td>
<td>0 %</td>
<td>3 %</td>
</tr>
<tr>
<td>Art Education</td>
<td>3 %</td>
<td>3 %</td>
<td>0 %</td>
<td>0 %</td>
</tr>
<tr>
<td>Physical Education</td>
<td>3 %</td>
<td>3 %</td>
<td>3 %</td>
<td>3 %</td>
</tr>
<tr>
<td>Activities</td>
<td>0 %</td>
<td>0 %</td>
<td>0 %</td>
<td>3 %</td>
</tr>
</tbody>
</table>

* Each division represents from 1 to 6 subjects.  
(Alfuraih, 1997, p. 6)

From this comparison and percentages, science share in secondary school is high. In fact, it is the highest along with Arabic language studies. The problem is mainly in the elementary level.

**Teacher’s Beliefs**

During the last decade, considerable time and effort has gone into developing and implementing suggested science education reforms. However, many of these reform reports have ignored beliefs of classroom teachers. Studies warn of the inherent problems associated with ignoring classroom teachers’ beliefs about reform. Research on beliefs indicates that teachers are crucial change agents leading the way to education reform and that teacher beliefs are precursors to change (Ajzen, 1985; Pajares, 1992; Ballone & Czerniak, 2001).
Recent studies have found that teachers’ beliefs about the nature of science can affect the way in which science is portrayed in the classroom (Brickhouse, 1991; Chen et. al., 1997; Lumpe et. al., 2000). According to (Ballone & Czerniak, 2001) studies of (Ajzen, 1985; Bandura, 1986; Pajares, 1992), assert that behavior is better predicted from an individual’s beliefs and that beliefs are believed to be the best indicators of the decisions individuals make throughout their lives. They also reveal that people regulate their level and distribution of effort in accordance with the effects they expect their actions to have. Clusters of beliefs around a particular situation form attitudes. These attitudes ultimately become causative agents; people act upon what they believe. Persons’ values that direct their life and determine their behavior are formed from connections among these clusters of beliefs.

Pajares (1992) offers a synthesis of findings on beliefs, which are as follows:

1. Beliefs are formed early and tend to be self-perpetuated. They tend to be preserved throughout time, experience, reason and schooling.
2. People develop a belief system that houses all the beliefs acquired through the process of cultural transmission.
3. Beliefs are prioritized according to their connections or relationship to other beliefs.
4. The earlier a belief is incorporated into the belief structure, the more difficult it is to change.
5. Belief alteration is relatively rare during adulthood.
7. The beliefs individuals possess strongly affect their behavior.
8. Beliefs about teaching are well established by the time a student attends college.
Beliefs play a key role in defining tasks and selecting the cognitive tools with which to interpret, plan, and make decisions regarding such tasks.

The Pajares review illustrates the notion that beliefs play a critical role in defining behavior and organizing knowledge and information. Therefore, the understanding of the belief structures of educators is essential to improving teaching practices, since they ultimately affect the behavior of the teacher in the classroom. However, beliefs are masked by attitudes, judgments, opinions, ideologies, values, theories, and perceptions (Ballone & Czerniak, 2001). It is imperative to take into account teachers’ beliefs regarding reform efforts. Failure to do so may result in the continual return of reform efforts.

Summary

This chapter emphasized the literature review. The chapter started with ideological and philosophical aspects of Saudi education. The researcher discussed Saudi culture, knowledge and learning from the Islamic view, education from the Islamic view, science and nature in Islamic literature, teachers’ rights and duties in Islamic literature, and students’ rights and duties in Islamic literature.

In the curriculum development part, there was a historical review of developing curriculum in the U.S, including technical scientific approach and non-technical approach. This part ended with representing new projects in science education in the U.S. such as Project 2061 (Science for All Americans) and National Science Education Standards.

Another part related to teachers’ role in developing curriculum focused on teachers’ roles in developing curriculum in Saudi Arabia. This part followed with discussion of science curriculum reform perspectives covering the features of science curriculum reform perspectives in the U.S and features of science curriculum reform
perspectives in Saudi Arabia, and ended with aimed curriculum reform perspectives. The aimed perspectives include: understanding science, developing scientific views of the world, forming perspectives on science, and establishing scientific habits of mind.

Under the title of science education in Saudi Arabia, a number of scientific educational efforts and projects in the Ministry of Education were discussed, including: the Science National Committee (Family), American University (Beirut) Math & Science Curriculum (1975, 1980), Intermediate School New Science Textbooks (1998/1999), and Elementary School New Science Textbooks (1999/2000). Then the researcher represented the share of science in school curriculum in Saudi Arabia.

The last part was about teacher’s beliefs, where the researcher considered it as a fundamental aspect in science educational reform.
Chapter IV: Research Methodology

Rationale

This study was designed to investigate the relationships between Saudi science teachers’ beliefs about science, nature and teaching and the way they teach science. The general literature review in Chapter I about curriculum development and the extensive review of the related literature in Chapter III about teachers role in reforming science education curriculum supported the need to investigate teachers’ abilities to engage in curriculum reform.

The first goal of this study is to document science teachers’ views about science, nature and teaching science. The second goal is to determine to what extent teachers could participate in science curriculum reform in Saudi. The final goal is to provide the Ministry of Education in Saudi with recommendations regarding science curriculum reform, based on the findings of the study.

The Study Setting

The study took place in Riyadh Region in Saudi Arabia. This central region has the Capital City Riyadh and ten counties. There is the General Educational Directory in Riyadh City, while in counties there are Educational Directories; all these directories refer to the General Educational Directory in Riyadh City. Under each Educational Directory there are Educational Centers. The number of educational centers depends on the size of the county and the number of schools. The smallest county has one center, while Riyadh City has seven educational centers.

Riyadh City, with around 20,000 male teachers in public schools, represents the Saudi population diversity. Also, teachers in this city have educational qualifications from universities and colleges around the country.
Besides the Capital Riyadh, five out of ten counties were chosen for the study based on several factors, including: distance from the capital city, the size of the county and number of schools, and the possibility of having a person who could take care of distributing and collecting questionnaires in an efficient way.

The five counties are: Dawadmi, Kharj, Qowaieiah, Afif, and Shaqra. The destinations from the capital and the school census for these counties along with other counties in Riyadh Region are represented in Table 4-1.

Table 4-1
Statistics of Riyadh Region Male Education

<table>
<thead>
<tr>
<th>Educational Directory</th>
<th>Elementary Schools</th>
<th>Intermediate Schools</th>
<th>Secondary Schools</th>
<th>Teachers’ Total</th>
<th>Science Teachers**</th>
<th>Distance from Capital Km ***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riyadh</td>
<td>462</td>
<td>257</td>
<td>107</td>
<td>18,223</td>
<td>2,186</td>
<td>0</td>
</tr>
<tr>
<td>Aflaj</td>
<td>40</td>
<td>16</td>
<td>8</td>
<td>666</td>
<td>80</td>
<td>330 S</td>
</tr>
<tr>
<td>Hotah &amp; Hariq</td>
<td>32</td>
<td>15</td>
<td>9</td>
<td>614</td>
<td>95</td>
<td>180 S</td>
</tr>
<tr>
<td>Kharj</td>
<td>73</td>
<td>41</td>
<td>22</td>
<td>2,289</td>
<td>274</td>
<td>80 S</td>
</tr>
<tr>
<td>Dawadmi</td>
<td>129</td>
<td>66</td>
<td>39</td>
<td>2,053</td>
<td>246</td>
<td>320 W</td>
</tr>
<tr>
<td>Zulfi</td>
<td>24</td>
<td>10</td>
<td>5</td>
<td>585</td>
<td>70</td>
<td>230 NW</td>
</tr>
<tr>
<td>Majmaah</td>
<td>64</td>
<td>34</td>
<td>19</td>
<td>1,238</td>
<td>148</td>
<td>200 NW</td>
</tr>
<tr>
<td>Qowaieiah</td>
<td>117</td>
<td>49</td>
<td>23</td>
<td>1,356</td>
<td>162</td>
<td>180 SW</td>
</tr>
<tr>
<td>Afif</td>
<td>56</td>
<td>30</td>
<td>17</td>
<td>970</td>
<td>116</td>
<td>500 W</td>
</tr>
<tr>
<td>Wadi Dawasser</td>
<td>58</td>
<td>31</td>
<td>14</td>
<td>1,074</td>
<td>128</td>
<td>500 S</td>
</tr>
<tr>
<td>Shaqra</td>
<td>25</td>
<td>14</td>
<td>10</td>
<td>573</td>
<td>68</td>
<td>200 W</td>
</tr>
<tr>
<td>Total</td>
<td>1,080</td>
<td>563</td>
<td>273</td>
<td>29,641</td>
<td>3,573</td>
<td>*</td>
</tr>
</tbody>
</table>

* (Ministry Census, 2002) – (without Special Education & Teachers’ Colleges).
** Approximate, based on unpublished census, direct questions to some directories & subjects/teachers percentages (science subjects = 6.7%of elementary load, 11.8%of intermediate, 18.18%of secondary) the average is about 12% of the total.
*** Approximate based on average of different ways (1Mile =1.6 Kilometer).
**** The General Educational Directory in Riyadh City supervises all schools in the eastern area of Riyadh Region.
Population and Sample Selection

The study targeted the population of all male science teachers in Riyadh Region (Riyadh City and counties), in all the Ministry of Education public school levels (elementary, intermediate and secondary). The population also includes science educational supervisors in Riyadh City, counties, and the main educational units in the Ministry of Education. Those supervisors are former teachers in public schools and have the same qualifications as science teachers.

At the time when the study launched, the female schools were under different authority other than the Ministry of Education. So female science teachers were not included in this study.

The approximate population is 3,673, consisting of 3,573 science teachers (see Table 4-1) and around 100 educational supervisors in the main units in the Ministry of education, Riyadh City and the ten counties. Due to the large number of science teachers in this area, a random sample was selected to represent the characteristics of the population. Involvement in the study was voluntary and anonymous (see letters in Appendix A).

Instrument

The instrument was a questionnaire with six sections (see Appendix B). The first one contains biographies and asks for the county name and also concerns personal characteristics of the participant, including: school level, qualifications, major, teaching topic, and years of experience. The second section concerns a teacher’s beliefs about science and nature, while the third section relates to a teacher’s views toward school science. The fourth section covers teacher – student relations in the classroom. The fifth concerns environmental factors affecting teaching science, with two sections, factors that
enable teacher’s work and the likelihood of occurring in school. The last section of the questionnaire has open-ended questions about the three major themes in the study: Science & Nature, Teaching Science and Reforming Science Curriculum.

Section 2 and section 3 were adopted with minor changes from “Development of a Questionnaire for Assessing Teachers’ Beliefs about Science and Science Teaching in Taiwan and Australia” a study prepared by Chung-Chi Chen, Peter Taylor, and Jill Aldridge in (1997). Section 5 was adopted from the study of Andrew T. Lumpe, Jodi J. Haney, and Charlene M. Czerniak named “Assessing Teachers’ Beliefs about Their Science Teaching Context” (2000), with some changes. Previous permissions to use the instruments were obtained from members in both teams. (See Appendix C).

Section 2, section 3, and section 4 of the questionnaire consist of 48 statements. These statements were divided into four domains: Nature of Science Inquiry, Status of Science Knowledge, Nature of School Science Inquiry, and Status of School Science Knowledge. Participants’ responses to each statement are recorded on a five-point Likert-type frequency response scale. In scoring, each response is allocated 1,2,3,4, or 5 points for each of the responses categories; Almost Never (AN), Seldom (S), Sometimes (ST), Often (O), and Almost Always (AA), respectively.

Section 5 has 27 statements (49-75), and each statement has two dimensions, Enable Belief and Likelihood Belief (Lumpe, 2000; Ford, 1992). The first item asked the participant to indicate his belief that the factor would enable him to be an effective teacher. The belief was indicated on a scale of strongly agree (scored 5) to strongly disagree (scored 1). The second item asked the participant to indicate the factor’s likelihood of occurrence. Teachers indicate their perceptions of possible occurrence on a scale of very likely (scored 5) to very unlikely to occur (scored 1).
Statements 1-75 arranged in groups under one theme or item, named Domain, and represent one of the six dimensions (Nature of Science Inquiry, Status of Science Knowledge, Nature of School Science Inquiry, Status of School Science Knowledge, Enable Belief and Likelihood Belief) related to general study questions. Each research question has from one to three domains.

**Translation of the Questionnaire**

The study took place in Saudi Arabia, where the language is Arabic, and since the original language of the questionnaire was English, translation was needed. Several factors were considered in the translation. First is the assurance of clear language in the translated version. Second, the corresponding meanings of the statements in both versions, and to ensure the use of the same themes used in similar studies even if it might not be common in teacher’s school daily uses, I decided to give these statements to the teacher:

“You may find some strange phrases or words in this questionnaire, I decided to use these phrases because it is common phrases in such topics all around the world”.

“I decided to use the phrase (scientific knowledge) instead of (scientific information or facts), because the first one is the common phrase. If you think that you didn't understand the question with (scientific knowledge) phrase, change the phrase to be (scientific information or facts) to answer the question.”

Third is the thematic and philosophical backgrounds of respondents. For this last factor, a statement was addressed to the teacher on the introductory page saying:

“The word (nature) in this questionnaire is used to refer to the world around us (creatures = live bodies + solid bodies), and it is not against the idea of creation or the existence of the creator.”

Finally to ensure teacher’s comfort with the translated questionnaire, I concluded my message to him with this statement: “Remember that it is not necessary to have only
one right answer for the same question. Everyone could justify his answer. I need your opinion.”

Based on the huge differences between Arabic Language and English Language sentence structure, additional words or phrases were added, modified or eliminated in each statement if needed. To ensure the accuracy and validity of the translation, the researcher conducted a comprehensive thematic review in related literature in Arabic studies, English studies, and translated studies.

To judge the translation of the questionnaire and to ensure the validity, I decided to do a pilot study using this translated questionnaire on a random sample of the population.

**Pilot Study**

One of the main goals for the pilot study was ensuring the validation of the translated questionnaire and to get broad judgments of the questionnaire’s Arabic language and the translation.

A random sample from the same population, science teachers and science supervisors in Riyadh Region and its counties, was selected for the pilot study, including Riyadh City and two of the largest counties (Dawadmi and Qowaieiah). From 80 questionnaires, I received 68 from Riyadh City and the two counties.

**Findings of the Pilot Study**

1. As I expected, teachers in counties are paying more attention than other teachers to respond to the questionnaire, by giving more comments to open-ended questions. Also there are some signs that teachers in counties were thinking about the question, not just making check marks in boxes. This was clear from the change of the answer for some questions.
2. In general, teachers in counties respond to all points, while in Riyadh City some teachers and supervisors ignored more points.

3. I got some oral comments and interests from teachers about the hope of implementing some points mentioned in my questionnaire into practice. These points are about giving teachers more responsibilities and more flexibility in dealing with the national curriculum.

4. From the open-ended questions, mainly No. 78, I found that 20 teachers think that: Science Curriculum = Science Textbook.

5. All teachers who responded to question No. 78 made clear statements showing their confusion between science curriculum and science textbook, except 2 teachers.

6. Only one teacher suggests that we should help teachers to understand the difference between the science curriculum and science textbooks.

7. On responding to question No. 76, three teachers made clear statements showing their confusion between the nature of science and the science curriculum.

8. From 30 questionnaires returned from Riyadh City, only 12 teachers responded to one or more of open-ended questions. And 18 questionnaires without answers, which gives 60% of them without answers for open-ended questions.

9. From 21 questionnaires returned from Qowaieiah County, 10 teachers responded to one or more of open-ended questions. And 11 questionnaires without answers, which gives 52% of them without answers for open-ended questions.

10. From 17 questionnaires returned from Dawadmi County, 12 teachers responded to one or more of open-ended questions. And 5 questionnaires without answers, which gives only 29% of them without answers for open-ended questions.
11. There were some written notes about the language of the questionnaire, besides other oral notes from some supervisors.

12. Minor changes have been made to the translation based on the pilot study. The most important point is changing question number 24: (In science classes, students should think “creatively”), to: In science classes, students should think “critically”.

**Data Collection**

In June 2003 the researcher finished the “Human Participant Protections Education for Research Teams” course, which covers aspects in educational research including: Roles and responsibilities of researchers and their key personnel, guiding ethical principles for research, federal regulations, informed consent, institutional review boards, ongoing protections throughout the course of the study, data and safety monitoring, reporting of adverse events, privacy and confidentiality, and historical events that have impacted policy and legislation. The researcher obtained the HPP certificate in June 3 2003. (See Appendix D).

In August 5, 2003 a request for exempt status for the dissertation study was submitted to the Associate Dean in College of Human Resources & Education at WVU, and the IRP approval received. (See Appendix E).

In April 2003, the researcher conducted the pilot study while he was in Saudi cooperating with educational supervisors, teachers and school principals in distributing and collecting questionnaires. Then he made the necessary changes on the questionnaire. At the same time the researcher obtained the approval to conduct the study from the Educational Development Center in Riyadh General Educational Directory. The approval includes distributing questionnaires in Riyadh City and other counties under the supervision of Riyadh General Educational Directory. Before leaving Saudi, the
researcher assigned a number of educational supervisors, teachers and school principals to distribute and collect questionnaires in Riyadh City and five counties. Their work was voluntary, based on personal relations with the researcher. The method of distributing and collecting questionnaires was hand-to-hand and personal visits to schools to save time and to ensure the precision in filling questionnaires.

From 500 questionnaires distributed in Riyadh City and five counties, the researcher received 378 questionnaires, giving a percentage of 75.6% of the total. The final number was 329 questionnaires after eliminating imperfect and inconsistent questionnaires.

Data Analysis

This study is descriptive in nature. The data were analyzed and reported using similar approaches in comparable studies like (Chen et. al, 1997; Lumpe et. al., 2000), where the data were analyzed and reported in percentages, means and frequencies. The SPSS (Statistical Package for the Social Studies) was used to analyze the data. Besides the approaches used in similar studies, comments and suggestions from educational measurement experts were considered.

The analyzing method for Nature of Science Inquiry, Status of Science Knowledge, Nature of School Science Inquiry, and Status of School Science Knowledge (statements 1-48) is comparable to the approach in a similar study (Chen et. al, 1997). Here a scale mean score is calculated by dividing the total scale score by the number of respondents and the number of scale items. Thus, the scale mean scores range between 1 (Almost Never) and 5 (Almost Always). A higher score indicates more inquiry view of the nature of school science and a lower score represents more traditional view.
A similar method was used to analyze Enable Belief and Likelihood Belief (statements 49-75) in calculating means. The addition is the comparisons between enable factors and likelihood of accruing in schools.

The responses to open-ended questions were categorized in subsets using coding method. The answers were classified based on the relationship with the six dimensions (Nature of Science Inquiry, Status of Science Knowledge, Nature of School Science Inquiry, Status of School Science Knowledge, Enable Belief and Likelihood Belief), besides considering the personal characteristics of the respondent, including the county name, school level, qualifications, major, teaching topic, and years of experience.

Summary

In this chapter the researcher reviews research methodology, starting with a rationale about the study that is about Saudi science teachers’ beliefs about science & nature and teaching science. The study setting represents the place of the study, which is Riyadh Region in Saudi Arabia. The population of the study was male science teachers in Riyadh Region, with a total of 3,673. In the sample selection, the researcher represented his method in selecting the sample from the population. The research instrument was a questionnaire consisting of 75 statements, and the translation of the questionnaire focused on the corresponding meanings, clear language and thematic uses in English and Arabic languages.

A pilot study conducted on the same population and the findings were reported. In collecting data, the researcher used hand-to-hand and personal visits to schools for more accuracy in filling out and returning questionnaires, cooperating with volunteers. Data were analyzed and reported in percentages, means and frequencies due to the nature of the study, which is descriptive.
In the next chapter, the researcher will discuss the results of the study, and answer the research questions.
Chapter V: Results

The main purpose of this study was to investigate Saudi science teachers’ beliefs about science and science teaching. Research data were collected through the completion of a questionnaire by 329 science teachers and science educational supervisors in Riyadh Region. The questionnaire determined each participant’s science curriculum perspectives and his view about science curriculum reform.

Since the study is descriptive in nature, the data analysis focused on representing participants’ responses using frequencies, means, and standard deviations. The questionnaire was constructed a group of from three to ten statements. The frequencies, mean, and standard deviations were represented for each statement, but the discussion will focus more on the average of the whole set. Each research question has from one to three domains.

This chapter includes the statistical analysis of the results of the study presented in three sections. The first section covers the demographical characteristics of the participants. The second section includes the answers for research questions one to nine and obtained by analyzing participants’ responses to the questionnaire statements, 1 to 75, related to: the nature of scientific inquiry, the status of scientific knowledge, the nature of school science inquiry, and the status of school science knowledge. The analysis focused on participants positions related to inquiry view and objective view in teaching science. In the third section are analyses of open-ended questions using the coding method.

Science teachers and educational supervisors have the same study qualifications. Each year, general educational directories nominate some good teachers to be supervisors, and they do not have a special preparation for supervision work. In participants’ responses, there were not any differences between science teachers and educational
supervisors except in open-ended questions, where supervisors had more thorough views. For these reasons, the analysis dealt with teachers and supervisors as one group.

**Section 1: Demographical Characteristics**

This section represents the personal characteristics of the participants, including their counties, level of teaching, kind of qualifications, science majors, science teaching subjects, and years of teaching experiences.

The sample is 329, consisting of 298 (90.6%) science teachers in all levels (elementary, intermediate, and secondary), 31 (9.4%) science educational supervisors. Teachers and supervisors have the same qualifications, so they are represented together. Regarding the distribution of respondents based on their teaching levels, there are 74 (24.8%) teachers teaching at the elementary level, 49 (16.5%) teaching at the intermediate level, and 175 (58.7%) teaching at the secondary level. There were not any significant differences between science teachers’ views in the three levels.

**Participants’ Areas and Teaching Levels**

Since Riyadh City is the largest city in Saudi. There were more participants from it than from other counties. Table 5-1 represents the numbers and percentages of teachers from each county. From Riyadh City there were 150 teachers from all levels consisting of 50.3% of the study sample; although 150 is only 6.9% of Riyadh City science teachers population. In other counties, the percentages of participants to the population are high. For example, from Afif there were 33, teachers giving 28.4% of the county science teachers’ population. The high number of teachers from secondary school, 175 (58.7%), is due to the four subjects (biology, chemistry, physics, and geology), while there are more elementary schools than intermediate schools, so they have more participants 74 (24.8%), compared to 49 (16.5%) in intermediate level.
### Table 5-1

Number of Participants Based on their Counties and Teaching Levels (N=329)

<table>
<thead>
<tr>
<th>Area Region / County</th>
<th>Elementary</th>
<th>Intermediate</th>
<th>Secondary</th>
<th>Total</th>
<th>Population in Country</th>
<th>Percentage to population</th>
<th>Supervisors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riyadh City</td>
<td>21</td>
<td>28</td>
<td>101</td>
<td>150</td>
<td>2,186</td>
<td>6.9 %</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50.3%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kharj</td>
<td>6</td>
<td>5</td>
<td>24</td>
<td>35</td>
<td>274</td>
<td>12.8 %</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11.7%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dawadmi</td>
<td>16</td>
<td>6</td>
<td>26</td>
<td>48</td>
<td>246</td>
<td>19.5 %</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qowaieiah</td>
<td>7</td>
<td>3</td>
<td>9</td>
<td>19</td>
<td>162</td>
<td>11.7 %</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.4%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Afif</td>
<td>13</td>
<td>6</td>
<td>14</td>
<td>33</td>
<td>116</td>
<td>28.4 %</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaqra</td>
<td>11</td>
<td>1</td>
<td>1</td>
<td>13</td>
<td>68</td>
<td>19.1 %</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.4%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>49</td>
<td>175</td>
<td>298</td>
<td>*</td>
<td>*</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>24.8 %</td>
<td>16.5 %</td>
<td>58.7 %</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Participants’ Qualifications**

As represented in Table 5-2, most science teachers have educational bachelor degrees in science (BEd), with a total of 208 (63.2 %). And the fewest are 5 (1.5 %) for Master in Science (MS), and 6 (1.8 %) for Master in Art (MA). There were 60 (18.2 %) with bachelor degrees in science (BSc), 39 (11.9 %) with bachelor degrees in science plus professional training (BSc&Ed), which is a diploma in education. The rest of the teachers of the sample have only diploma certificates (Dip.), with a total of 11 (3.4 %).

### Table 5-2

Number of Participants Based on Qualifications (N=329)

<table>
<thead>
<tr>
<th>Kind of Qualification</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor In Education (B Ed)</td>
<td>208</td>
<td>63.2 %</td>
</tr>
<tr>
<td>Bachelor In Science &amp; Educational Diploma (BSc&amp;Ed)</td>
<td>39</td>
<td>11.9 %</td>
</tr>
<tr>
<td>Bachelor In Science (BSc)</td>
<td>60</td>
<td>18.2 %</td>
</tr>
<tr>
<td>Master In Education (MA)</td>
<td>6</td>
<td>1.8 %</td>
</tr>
<tr>
<td>Master In Science (MS)</td>
<td>5</td>
<td>1.5 %</td>
</tr>
<tr>
<td>Diploma (Dip.) – equal high school or higher -</td>
<td>11</td>
<td>3.4 %</td>
</tr>
</tbody>
</table>
Participants’ Study Majors and Teaching Subjects

Table 5-3 represents study majors and teaching subjects. In study majors, general science, 71 (20.6 %), is the name of the bachelor degree obtained from teachers’ colleges. While in teaching subjects, the 129 (39.2 %) represents teachers in elementary and intermediate schools. In Table 5-1, the total of elementary and intermediate teachers was 122, the difference between the two numbers due to the fact that some teachers teach at more than one level. In Table 5-3, there are seven secondary school teachers teaching also at intermediate level.

Table 5-3

<table>
<thead>
<tr>
<th>Filed of Science</th>
<th>Study Major Number</th>
<th>Percentage</th>
<th>Teaching Subject Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Science</td>
<td>71</td>
<td>21.6 %</td>
<td>129</td>
<td>39.2 %</td>
</tr>
<tr>
<td>Biology</td>
<td>105</td>
<td>31.9 %</td>
<td>71</td>
<td>21.6 %</td>
</tr>
<tr>
<td>Chemistry</td>
<td>78</td>
<td>23.7 %</td>
<td>61</td>
<td>18.6 %</td>
</tr>
<tr>
<td>Physics</td>
<td>61</td>
<td>18.6 %</td>
<td>60</td>
<td>18.2 %</td>
</tr>
<tr>
<td>Geology</td>
<td>6</td>
<td>1.8 %</td>
<td>6</td>
<td>1.8 %</td>
</tr>
<tr>
<td>Other</td>
<td>8*</td>
<td>2.4 %</td>
<td>2**</td>
<td>0.6 %</td>
</tr>
</tbody>
</table>

* 3 Science & Math, 1 Zoology, 1 Biochemistry, 1 Microbiology, 1 Agriculture, and 1 Islamic Studies.
** 1 Classroom Teacher, and 1 Arabic Language Teacher.

Participants’ Years of Teaching Experience

The greatest number of participants, 109 (33.1%), has more than ten years of experiences, while the smallest number of participants, 55 (16.7%), has less than two years of experiences. In the middle, there are 79 (24.0%) participants having between two to five years of experience, and 86 (26.2%) having between five to ten years of experience.

Table 5-4

<table>
<thead>
<tr>
<th>Experience (Years)</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 2</td>
<td>55</td>
<td>16.7 %</td>
</tr>
<tr>
<td>2 – 5</td>
<td>79</td>
<td>24.0 %</td>
</tr>
<tr>
<td>5 – 10</td>
<td>86</td>
<td>26.2 %</td>
</tr>
<tr>
<td>More than 10</td>
<td>109</td>
<td>33.1 %</td>
</tr>
</tbody>
</table>
Section 2: Results of the Study Questions

There are nine questions addressed in the study. In this section, all these questions were separately answered in detail. Each research question has from one to three domains, each domain covered by group of statements in the questionnaire. The research questions were analyzed with a descriptive method, primarily with frequencies, percentages, and domains. Qualitative analysis was also used to study the responses to the three open-ended questions presented at the end of the questionnaire.

Question 1: How do science teachers in Saudi Arabia view science?

This question has two domains, the first one is the nature of scientific inquiry and the second is the status of scientific knowledge. Ten statements in the questionnaire covered each domain.

First Domain: Teachers’ View to the Nature of Scientific Inquiry

Statements from one to ten in the questionnaire covered this domain. These statements are presented in Table 5-5. Figure 1 shows teachers’ responses to each statement.

Table 5-5
Questionnaire Statements from One to Ten Related to the Nature of Scientific Inquiry

<table>
<thead>
<tr>
<th>#</th>
<th>Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Scientific observations depend on what scientists set out to find.</td>
</tr>
<tr>
<td>2</td>
<td>Scientific inquiry involves challenging other scientists’ ideas.</td>
</tr>
<tr>
<td>3</td>
<td>Scientific observations are affected by scientists’ values and beliefs.</td>
</tr>
<tr>
<td>4</td>
<td>Scientific inquiry involves thinking critically about one’s existing knowledge.</td>
</tr>
<tr>
<td>5</td>
<td>Intuition plays a role in scientific inquiry.</td>
</tr>
<tr>
<td>6*</td>
<td>When making observations, scientists eliminate their beliefs and values.</td>
</tr>
<tr>
<td>7</td>
<td>Scientific observations are guided by theories.</td>
</tr>
<tr>
<td>8*</td>
<td>Scientific inquiry starts with observations of nature.</td>
</tr>
<tr>
<td>9*</td>
<td>Scientific investigation follows the scientific method.</td>
</tr>
<tr>
<td>10</td>
<td>Scientific ideas come from both scientific and non-scientific sources.</td>
</tr>
</tbody>
</table>

Statements: 6, 8, and 9 reflect a more objectivist view and were therefore scored in reverse.
Figure 1:

The Frequencies of Teachers’ View to the Nature of Scientific Inquiry

Nature of Scientific Inquiry

Table 5-6 displays the raw scores made by the participants. A mean, standard deviation, frequencies, and percentage distribution was tabulated revealing the number of participants’ responses regarding their judgments to each statement in the nature of scientific inquiry domain. The questionnaire was prepared to show participants’ positions related to inquiry approach and objective approach in teaching science based on four domains: the nature of scientific inquiry, the status of scientific knowledge, the nature of school science inquiry, and the status of school science knowledge. The first two domains are discussed in Question 1, while the other domains are discussed in Question number 3.

The overall mean for the ten statements is (3.54). This mean gives a position moderately between the inquiry view and the objective view regarding the nature of scientific inquiry, with slight shift toward the inquiry view.
Table 5-6

Means, Standard Deviation, Frequencies and Percentages of Participants’ Responses Regarding their View of the Nature of Scientific Inquires Domain

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Almost Never (AN)</th>
<th>Seldom (S)</th>
<th>Sometimes (ST)</th>
<th>Often (O)</th>
<th>Almost Always (AA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.62</td>
<td>0.71</td>
<td>8</td>
<td>2.43</td>
<td>27</td>
<td>8.21</td>
<td>96</td>
</tr>
<tr>
<td>2</td>
<td>3.25</td>
<td>0.82</td>
<td>26</td>
<td>7.90</td>
<td>46</td>
<td>13.98</td>
<td>123</td>
</tr>
<tr>
<td>3</td>
<td>3.15</td>
<td>0.73</td>
<td>30</td>
<td>9.12</td>
<td>66</td>
<td>20.06</td>
<td>104</td>
</tr>
<tr>
<td>4</td>
<td>3.32</td>
<td>0.76</td>
<td>15</td>
<td>4.56</td>
<td>52</td>
<td>15.80</td>
<td>118</td>
</tr>
<tr>
<td>5</td>
<td>3.48</td>
<td>0.83</td>
<td>8</td>
<td>2.43</td>
<td>41</td>
<td>12.46</td>
<td>119</td>
</tr>
<tr>
<td>6*</td>
<td>3.35</td>
<td>1.13</td>
<td>47</td>
<td>14.92</td>
<td>73</td>
<td>22.19</td>
<td>91</td>
</tr>
<tr>
<td>7</td>
<td>3.72</td>
<td>0.97</td>
<td>9</td>
<td>2.74</td>
<td>28</td>
<td>8.51</td>
<td>82</td>
</tr>
<tr>
<td>8*</td>
<td>1.78</td>
<td>0.74</td>
<td>7</td>
<td>2.13</td>
<td>10</td>
<td>3.04</td>
<td>41</td>
</tr>
<tr>
<td>9*</td>
<td>1.90</td>
<td>0.92</td>
<td>6</td>
<td>1.82</td>
<td>12</td>
<td>3.65</td>
<td>53</td>
</tr>
<tr>
<td>10</td>
<td>3.59</td>
<td>1.17</td>
<td>12</td>
<td>3.65</td>
<td>36</td>
<td>10.94</td>
<td>104</td>
</tr>
</tbody>
</table>

Overall Mean = 3.17, Overall SD = 0.98, N= 329

* Statements: 6, 8, and 9 reflect a more objectivist view and were therefore scored in reverse.

** High mean reflects a more inquiry view.

Within the same context, Statement 3 “Scientific observations are affected by scientists’ values and beliefs” reverse the same meaning in Statement 6 “When making observations, scientists eliminate their beliefs and values”, which is more objective. Participants’ responses follow the same sequence in both statements, except the change in completely agree (AA) and completely disagree (AN) positions. In Statement 3, 30 (9.12 %), completely disagree (AN), and 48 (14.59 %) completely agree (AA). While for Statement 6, 47 (14.92 %), completely disagree (AN), and completely agree (AA) was 39 (11.85 %). The mean for Statement 3 is 3.15, while scores for Statement 6 reversed to calculate the mean, which is 3.35. The two means are close to each other, which show that participants were consistent in judging the two statements.
The notable majority of participants 155 (47.11 %), completely agreed (AA) with Statement 8 “Scientific inquiry starts with observations of nature”, which has more objective view, also 128 (38.91 %) completely agreed (AA) with Statement 9 “Scientific investigation follows the scientific method”, also this statement has more objective view, therefore both were scored in reverse. The responses in the two statements represented a more objective view toward scientific inquiry. Meanwhile, the frequencies for the position completely disagree (AN) in all the domain statements (other than the objective statements 6, 8, and 9) are low, which represent inquiry view toward scientific inquiry, but due to the high frequencies for the moderate position (SD) for Statements 1, 2, 3, 4, 5, and 10 and in Statement 7 with lower level, the overall mean was shifted to moderate level. Although participants seem consistent in their judgments in general, in fact they are not sure about their position.

In open-ended questions, participants argued that although they believe in using an inquiry approach in teaching science, they do not practice it in class due to external factors, such as: class size, textbook size (amount of information need to be covered), and supervision methods. Further discussion expanded in the analysis of open-ended questions.

Second Domain: Teachers’ View to the Status of Scientific Knowledge

Statements 11 to 20 in the questionnaire covered this domain. Table 5-7 represents these statements, while Figure 2 shows participants’ responses to each statement.
Table 5-7

Statements from Eleven to Twenty in the Questionnaire Related to the Status of Scientific Knowledge

<table>
<thead>
<tr>
<th>#</th>
<th>Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>11*</td>
<td>Scientific knowledge gives a true account of the natural world.</td>
</tr>
<tr>
<td>12</td>
<td>Scientific knowledge is tentative.</td>
</tr>
<tr>
<td>13</td>
<td>Scientific knowledge is relative to the social context in which it is generated.</td>
</tr>
<tr>
<td>14*</td>
<td>Scientific knowledge can be proven.</td>
</tr>
<tr>
<td>15</td>
<td>The evaluation of scientific knowledge varies with changes in situations.</td>
</tr>
<tr>
<td>16*</td>
<td>The accuracy of current scientific knowledge is beyond question.</td>
</tr>
<tr>
<td>17</td>
<td>Currently accepted scientific knowledge will be modified in the future.</td>
</tr>
<tr>
<td>18</td>
<td>Scientific knowledge is influenced by cultural and social attitudes.</td>
</tr>
<tr>
<td>19*</td>
<td>Scientific knowledge is free of human perspectives.</td>
</tr>
<tr>
<td>20</td>
<td>Scientific knowledge is influenced by myths.</td>
</tr>
</tbody>
</table>

* Statements: 11, 14, 16, and 19 reflect a more objectivist view and were therefore scored in reverse.

Figure 2:

The Frequencies of Teachers’ View to the Status of Scientific Knowledge

Status of Scientific Knowledge

AN= Almost Never, S= Seldom, ST= Sometimes, O= Often, AA= Almost Always
Table 5- 8

Means, Standard Deviation, Frequencies and Percentages of Participants’ Responses Regarding their View of the Status of Scientific Knowledge Domain

<table>
<thead>
<tr>
<th>#</th>
<th>Mean</th>
<th>SD</th>
<th>Almost Never (AA)</th>
<th>Seldom (S)</th>
<th>Sometimes (ST)</th>
<th>Often (O)</th>
<th>Almost Always (AA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
</tr>
<tr>
<td>11*</td>
<td>1.86</td>
<td>0.68</td>
<td>3</td>
<td>0.91</td>
<td>5</td>
<td>1.52</td>
<td>55</td>
</tr>
<tr>
<td>12</td>
<td>3.72</td>
<td>0.81</td>
<td>6</td>
<td>1.82</td>
<td>30</td>
<td>9.12</td>
<td>99</td>
</tr>
<tr>
<td>13</td>
<td>3.35</td>
<td>0.87</td>
<td>26</td>
<td>7.90</td>
<td>47</td>
<td>14.92</td>
<td>92</td>
</tr>
<tr>
<td>14*</td>
<td>1.89</td>
<td>0.74</td>
<td>2</td>
<td>0.61</td>
<td>8</td>
<td>2.43</td>
<td>50</td>
</tr>
<tr>
<td>15</td>
<td>3.13</td>
<td>0.89</td>
<td>25</td>
<td>7.60</td>
<td>72</td>
<td>21.88</td>
<td>106</td>
</tr>
<tr>
<td>16*</td>
<td>2.67</td>
<td>0.91</td>
<td>18</td>
<td>5.47</td>
<td>43</td>
<td>13.07</td>
<td>116</td>
</tr>
<tr>
<td>17</td>
<td>2.97</td>
<td>1.06</td>
<td>26</td>
<td>7.90</td>
<td>87</td>
<td>26.44</td>
<td>113</td>
</tr>
<tr>
<td>18</td>
<td>3.19</td>
<td>0.72</td>
<td>28</td>
<td>8.51</td>
<td>58</td>
<td>17.63</td>
<td>106</td>
</tr>
<tr>
<td>19*</td>
<td>2.69</td>
<td>0.84</td>
<td>34</td>
<td>10.33</td>
<td>43</td>
<td>13.07</td>
<td>94</td>
</tr>
<tr>
<td>20</td>
<td>2.14</td>
<td>1.18</td>
<td>103</td>
<td>31.31</td>
<td>120</td>
<td>36.47</td>
<td>72</td>
</tr>
</tbody>
</table>

Overall Mean = 2.67, Overall SD = 0.87, N= 329

* Statements: 11, 14, 16, and 19 reflect a more objectivist view and were therefore scored in reverse.
** High mean reflects a more inquiry view.

Participants’ majority, 266 (80.85%), completely agreed (AA) or moderately agreed (O) with Statement 11 “Scientific knowledge gives a true account of the natural world,” which present objective view. The mean for this statement is 1.86. That gives more objective view toward the status of scientific knowledge. For Statement 14 “Scientific knowledge can be proven,” which is also present objective view, 178 (54.10%) participants moderately agreed (O), and 91 (27.66%) completely agreed (AA), giving a total of 269 (81.76%). Conversely, only 10 (3.04%) participants completely disagree (AN) or moderately disagreed (S). That expressed more objective view toward the status of scientific knowledge, with a mean of 1.89.

The notable issue in this domain is the high number of responses representing moderate position (ST), which in fact shows that participants are uncertain about their
judgments. In Statement 12 “Scientific knowledge is tentative”, Statement 15 “The evaluation of scientific knowledge varies with changes in situations”, 16 “The accuracy of current scientific knowledge is beyond question” (objective), 17 Statement “Currently accepted scientific knowledge will be modified in the future”, and Statement 18 “Scientific knowledge is influenced by cultural and social attitudes” more than 30% responded for the moderate position (ST). Means for these statements are 3.72, 2.67, 3.33, 2.97, and 3.19, respectively. About 28% responded for the same position for Statement 13 “Scientific knowledge is relative to the social context in which it is generated”, and Statement 19 “Scientific knowledge is free of human perspectives” (objective).

The objective views in Statements 11, 14, 16, and 19, and the uncertainty of the majority judgments for the domain statements shifted the overall mean for this domain to be 2.67 with a moderate position between the inquiry view and the objective view toward the status of scientific knowledge, with a shift toward the objective view.

**Question 2: How do science teachers in Saudi view teaching and their roles as teachers?**

To answer this question, the researcher asked participants to judge two groups of statements. The first group is similar to statements in Question 1 in their ways of judgments and method of analysis. For the second group of statements, the researcher asked participants to judge the statements from two dimensions; first, the participant’s belief that this factor would enable him to be an effective teacher, and second, how likely is it that these factors will occur in his school. This approach is used to deal with questionnaire statements from 49 to 75, in a number of research questions. For these statements (49 to 75), low mean gives a strong agreement in the first domain, and more likely to occur in the second domain.
Thus, there are three domains in this question, the first domain is factors that should be considered in teaching science for students, the second domain is factors enabling teachers’ work (Enable) in relation to teaching and teachers’ role in science class, and the third domain is the likelihood for these factors of occurring in participant’s school (Likelihood).

Table 5- 9 presents the three questionnaire statements related to the factors that should be considered in teaching science for students, and Table 5-11 presents questionnaire statements related to factors enabling teachers’ work (Enable) in relation to teaching and teachers’ role in class.

**First Domain: Factors that should be considered in teaching science for students**

Figure 3 displays participants’ judgments regarding the three statements (30, 31, and 38) related to factors that should be considered in teaching science for students, while Table 5-10 presents means, standard deviation, frequencies and percentages of participants’ responses regarding factors that should be considered in teaching science for students.

Table 5 – 9

**Questionnaire Statements Related to Factors that Should be Considered in Teaching Science for Students**

<table>
<thead>
<tr>
<th>#</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>Students should be taught that there is a distinction between theory and observation.</td>
</tr>
<tr>
<td>31</td>
<td>In science classes, students should consider ethical issues related to scientific investigation.</td>
</tr>
<tr>
<td>38</td>
<td>In school science, students should be taught that accepted scientific knowledge will be modified in the future.</td>
</tr>
</tbody>
</table>
Figure 3:

The Frequencies of Teachers’ Views About Factors that Should be Considered in Teaching Science for Students

Table 5 – 10 reports that participants’ responses represent inquiry view related to teaching science and teacher’s role in science class. For Statement 30, “Students should be taught that there is a distinction between theory and observation”, the mean is 4.23, and the majority agreed with the statement. The highest responses were 165 (50.15 %) for strong agreement (AA), and 100 (30.40 %) for moderated agreement (O), giving a total of 265 (80.55 %) responses for the agreement. On the other hand, the objective view, which is presented in the moderate disagreement (S) and strong disagreement (AN) positions, has only 17 (5.78 %) responses. At the same time, participants showed responses with strong agreement (AA) of 190 (57.75.40 %), and moderate agreement of 83 (25.23 %), which gives a total of 273 (82.98 %) responses for agreement with Statement 31 “In science classes, students should consider ethical issues related to scientific investigation”. The mean for this statement is 4.32.
Statement 38 “In school science, students should be taught that accepted scientific knowledge will be modified in the future” has a mean of 3.33, due to 47 (14.92 %) moderate disagreement (S) responses and 32 (9.73 %) strong disagreement (AN) responses, which gives 79 (24.65 %) disagreement positions, against the agreement positions with a total of 155 (47.11 %). In open-ended questions, some participants critiqued this statement, because they do not want students to lose their trust in the current science textbook. The overall mean for this domain is 3.96, which reflects more inquiry view related to teaching science and teacher’s role in science class.

Table 5 - 10
Means, Standard Deviation, Frequencies and Percentages of Participants’ Responses Regarding Factors that Should be Considered in Teaching Science for Students

<table>
<thead>
<tr>
<th>#</th>
<th>Mean</th>
<th>SD</th>
<th>Almost Never (AN)</th>
<th>Seldom (S)</th>
<th>Sometimes (ST)</th>
<th>Often (O)</th>
<th>Almost Always (AA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
</tr>
<tr>
<td>30</td>
<td>4.23</td>
<td>1.68</td>
<td>7</td>
<td>2.13</td>
<td>12</td>
<td>3.65</td>
<td>45</td>
</tr>
<tr>
<td>31</td>
<td>4.32</td>
<td>1.38</td>
<td>5</td>
<td>1.52</td>
<td>17</td>
<td>5.17</td>
<td>34</td>
</tr>
<tr>
<td>38</td>
<td>3.33</td>
<td>0.87</td>
<td>32</td>
<td>9.73</td>
<td>47</td>
<td>14.92</td>
<td>95</td>
</tr>
</tbody>
</table>

* Overall Mean = 3.96, Overall SD = 1.31, N= 329
** High mean reflects a more inquiry view.

Second Domain: Factors Enabling Teachers’ Work (Enable) in Relation to Teaching and Teachers’ Role in Science Class

For the second and the third domain in this question, there are six statements in the questionnaire. Participants were asked to judge each statement twice, first if they think that this factor would enable their work, and second for the likelihood of occurring in their schools. Table 5 – 11 shows the six statements related to the two domains, factors enabling teachers’ work in relation to teaching and teachers’ role in science class, and the likelihood of occurring in their schools. Participants’ responses presented in Figure 4 (Enable), and Figure 5 (Likelihood).
Table 5 - 11

Questionnaire Statements Related to Factors Enabling Teachers’ Work in Relation to Teaching and Teachers’ Role in Science Class

<table>
<thead>
<tr>
<th>#</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td>Support from other teachers (coaching, advice, mentoring, modeling, informal discussions, etc.)</td>
</tr>
<tr>
<td>52</td>
<td>Team planning time with other teachers</td>
</tr>
<tr>
<td>69</td>
<td>A decrease in your course teaching load to give more time for planning</td>
</tr>
<tr>
<td>70</td>
<td>A reduction in the amount of content you are required to teach</td>
</tr>
<tr>
<td>74</td>
<td>Classroom assessment strategies</td>
</tr>
<tr>
<td>75</td>
<td>Teacher input and decision making</td>
</tr>
</tbody>
</table>

As presented in Figure 4 and in Table 5-12, participants showed high agreement on all domain statements, with overall mean of 1.69, which is close to the complete agreement (1.00). The notable frequency is 233 (70.82 %) for the strongly agree (SA), in Statement 69 “A decrease in your course teaching load to give more time for planning”,
supported by 65 (19.76 %) for agree (A), giving a total of 298 (90.58 %) for the agreement positions. Conversely, there were only 14 (4.26 %) responses for disagreement positions. On the same context, there were 289 (87.85 %) for the strongly agree (SA) and agree (A) positions in Statement 75 “Teacher input and decision making”. This reflects participants’ demands to the missing aspects related to teachers’ role in the traditional school with its hierarchy structure, where teachers are evaluated based on their abilities to carry educational authorities’ views into the classroom.

In another issue, the highest disagreement (D) response in this domain was 21 (6.38 %), supported by 10 (3.04 %) for strongly disagree (SD) in Statement 70 “A reduction in the amount of content you are required to teach” and also there were 30 (9.12%) undecided responses (U). Some participants in open-ended questions expressed their interests in increasing the amount of scientific facts in science textbooks.

Table 5-12

Means, Standard Deviation, Frequencies and Percentages of Participants’ Responses Regarding Factors Enabling Teachers’ Work in Relation to Teaching and Teachers’ Role in Science Class (Enable)

<table>
<thead>
<tr>
<th>#</th>
<th>Mean</th>
<th>SD</th>
<th>Strongly agree (SA)</th>
<th>Agree (A)</th>
<th>Undecided (U)</th>
<th>Disagree (D)</th>
<th>Strongly disagree (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
</tr>
<tr>
<td>51</td>
<td>1.59</td>
<td>0.75</td>
<td>169 51.37</td>
<td>135 41.03</td>
<td>18 5.47</td>
<td>6 1.82</td>
<td>1 0.30</td>
</tr>
<tr>
<td>52</td>
<td>1.85</td>
<td>0.81</td>
<td>140 42.55</td>
<td>123 37.39</td>
<td>43 13.07</td>
<td>20 6.08</td>
<td>3 0.91</td>
</tr>
<tr>
<td>69</td>
<td>1.41</td>
<td>0.72</td>
<td>233 70.82</td>
<td>65 19.76</td>
<td>17 5.17</td>
<td>10 3.04</td>
<td>4 1.22</td>
</tr>
<tr>
<td>70</td>
<td>1.84</td>
<td>0.86</td>
<td>175 53.19</td>
<td>93 28.27</td>
<td>30 9.12</td>
<td>21 6.38</td>
<td>10 3.04</td>
</tr>
<tr>
<td>74</td>
<td>1.82</td>
<td>0.89</td>
<td>121 36.78</td>
<td>155 47.11</td>
<td>46 13.98</td>
<td>5 1.52</td>
<td>2 0.61</td>
</tr>
<tr>
<td>75</td>
<td>1.64</td>
<td>0.78</td>
<td>171 51.98</td>
<td>118 35.87</td>
<td>30 9.12</td>
<td>7 2.13</td>
<td>3 0.91</td>
</tr>
</tbody>
</table>

* Overall Mean = 1.69, Overall SD = 0.81, N= 329
* Low mean gives strong agreement.
Third Domain: The likelihood for These Factors of Occurring in Participant’s School (Likelihood).

Figure 5:

The Frequencies of Teachers’ Judgments of the Occurring of Factors Enabling Teachers’ Work in Relation to Teaching and Teachers’ Role in Science Class

According to participants’ responses presented in Figure 5 and in Table 5-13, participants believe that it is likely for the mentioned factors, related to teaching and teachers’ role in science class, to occur in their schools. In Statement 51 “Support from other teachers, coaching, advice, mentoring, modeling, informal discussions, etc.”, there were 124 (37.69 %) responses for very likely (VL) and 128 (38.91 %) for somewhat likely (SL), which gives a total of 252 (76.60 %). The domain statements have a range from 13.07 % to 37.69 % for very likely (VL) positions, and a range from 20.97% to 38.91 % for the somewhat likely (SL) positions, which represents participants’ beliefs that these factors could occur in schools. On the opposite, there were 109 (33.13 %) for the disagreement positions, very unlikely (VU) and somewhat unlikely (SU), in Statement 69
“A decrease in your course teaching load to give more time for planning.” The range of percentages for very unlikely (VU) positions for the domain statements were from 4.56% to 20.06%, while the range of percentages for somewhat unlikely (SU) positions were from 1.52% to 15.80%. The overall mean for this domain (Likelihood) is 1.69, which is similar to the mean for the second domain (Enable).

Table 5-13
Means, Standard Deviation, Frequencies and Percentages of Participants’ Responses Regarding the Likelihood for These Factors of Occurring in Participant’s School (Likelihood)

<table>
<thead>
<tr>
<th>#</th>
<th>Mean</th>
<th>SD</th>
<th>Very likely (VL)</th>
<th>Somewhat likely (SL)</th>
<th>Neither (N)</th>
<th>Somewhat unlikely (SU)</th>
<th>Very unlikely (VU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td>1.59</td>
<td>0.75</td>
<td>124 37.69</td>
<td>128 38.91</td>
<td>39 11.85</td>
<td>23 6.99</td>
<td>15 4.56</td>
</tr>
<tr>
<td>52</td>
<td>1.85</td>
<td>0.81</td>
<td>79 24.01</td>
<td>118 35.87</td>
<td>59 17.93</td>
<td>52 15.80</td>
<td>21 6.38</td>
</tr>
<tr>
<td>69</td>
<td>1.41</td>
<td>0.72</td>
<td>98 29.79</td>
<td>69 20.97</td>
<td>53 16.11</td>
<td>43 13.07</td>
<td>66 20.06</td>
</tr>
<tr>
<td>70</td>
<td>1.84</td>
<td>0.86</td>
<td>71 21.58</td>
<td>80 24.32</td>
<td>71 21.58</td>
<td>5 1.52</td>
<td>56 17.02</td>
</tr>
<tr>
<td>74</td>
<td>1.82</td>
<td>0.89</td>
<td>43 13.07</td>
<td>114 34.65</td>
<td>108 32.83</td>
<td>40 12.16</td>
<td>24 7.29</td>
</tr>
<tr>
<td>75</td>
<td>1.64</td>
<td>0.78</td>
<td>82 24.92</td>
<td>114 34.65</td>
<td>60 18.24</td>
<td>41 12.46</td>
<td>32 9.73</td>
</tr>
</tbody>
</table>

* Overall Mean = 1.69, Overall SD = 0.80
* Low mean gives strong likelihood of occurring.

**Question 3**: How do science teachers in Saudi view learning?

This question has two domains, the first one is the nature of school science inquiry and the second one is the status of school science knowledge.

**First Domain: Nature of School Science Inquiry**

Nine statements in the questionnaire covered this domain. These statements represented in Table 5-14, followed by participants’ responses in Figure 5.
Table 5-14

Questionnaire Statements Related to the Nature of School Science Inquiry

<table>
<thead>
<tr>
<th>#</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>In science classes, investigations should enable students to explore their own ideas</td>
</tr>
<tr>
<td>22</td>
<td>In science classes, students should work collaboratively.</td>
</tr>
<tr>
<td>23</td>
<td>In science classes, students should discuss ideas with others.</td>
</tr>
<tr>
<td>24</td>
<td>In science classes, students should think critically.</td>
</tr>
<tr>
<td>25</td>
<td>In science classes, students should explore different methods of investigation.</td>
</tr>
<tr>
<td>26</td>
<td>Students should view science as a problem-solving exercise.</td>
</tr>
<tr>
<td>27*</td>
<td>In science classes, inquiry learning should start with observation.</td>
</tr>
<tr>
<td>28*</td>
<td>In science classes, students should apply the scientific method.</td>
</tr>
<tr>
<td>29</td>
<td>Students should enjoy themselves during science experiments.</td>
</tr>
</tbody>
</table>

Statements: 27, and 28 reflect a more objectivist view and were therefore scored in reverse.

Figure 6:

The Frequencies of Teachers’ View to the Nature of School Science Inquiry

![Bar chart showing frequencies of teachers' views]

AN= Almost Never, S= Seldom, ST= Sometimes, O= Often, AA= Almost Always

The overall mean for this domain is 3.54, which revealed a shift in participants’ positions toward the inquiry view to the nature of school science inquiry. The highest response is for complete agreement (AA) with Statement 22 “In science classes, students should work collaboratively”, where there are 144 (43.77 %). Conversely, only 2 (0.61%)
responses completely disagree (AN) with this statement. As presented in Table 5 - 15, participants’ responses with completely disagree (AN) is low in this domain. The lowest is 1 (0.30 %) for Statement 28 “In science classes, students should apply the scientific method” (objective), and the highest is 12 (3.65 %) for Statement 24 “In science classes, students should think critically”. On the other hand, the complete agreement (AA), and the moderate agreement (O) is high for the nine statements in this domain, where the percentages for participants’ positions is between 27.36 % for Statement 24, which has also the highest complete disagreement (AN), and 51.98 % for Statement 29 “Students should enjoy themselves during science experiments”. In the mean time the moderate agreement (O) is high for the whole domain statements, which 30.70 % to 41.03 % of participants’ responses in this position. The uncertainty in position sometimes (ST) ranged from 48 (14.59 %) for statement number 29, and 91 (27.66 %) for Statement 24.

Although participants showed a shift to the inquiry view toward the nature of school science inquiry, they argue that the practice is different. In participants’ responses in open-ended questions related to this domain, participants mentioned factors that prevented them from applying what they believe on their classes. A class’s size, field trips, science textbooks, and exams are the major factors based on participants’ views. A discussion of this effect presented in open-ended questions.
Table 5- 15

Means, Standard Deviation, Frequencies and Percentages of Participants’ Responses

Regarding their View of Nature of School Science Inquiry

<table>
<thead>
<tr>
<th>#</th>
<th>Mean</th>
<th>SD</th>
<th>Almost Never (AN)</th>
<th>Seldom (S)</th>
<th>Sometimes (ST)</th>
<th>Often (O)</th>
<th>Almost Always (AA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
</tr>
<tr>
<td>21</td>
<td>4.04</td>
<td>0.84</td>
<td>8</td>
<td>2.43</td>
<td>15</td>
<td>4.56</td>
<td>58</td>
</tr>
<tr>
<td>22</td>
<td>4.17</td>
<td>0.89</td>
<td>2</td>
<td>0.61</td>
<td>14</td>
<td>4.25</td>
<td>55</td>
</tr>
<tr>
<td>23</td>
<td>4.02</td>
<td>0.71</td>
<td>6</td>
<td>1.82</td>
<td>22</td>
<td>6.69</td>
<td>64</td>
</tr>
<tr>
<td>24</td>
<td>3.68</td>
<td>0.62</td>
<td>12</td>
<td>3.65</td>
<td>35</td>
<td>10.64</td>
<td>91</td>
</tr>
<tr>
<td>25</td>
<td>3.89</td>
<td>0.79</td>
<td>4</td>
<td>1.22</td>
<td>37</td>
<td>11.25</td>
<td>63</td>
</tr>
<tr>
<td>26</td>
<td>3.84</td>
<td>0.92</td>
<td>6</td>
<td>1.82</td>
<td>40</td>
<td>12.16</td>
<td>63</td>
</tr>
<tr>
<td>27</td>
<td>2.07</td>
<td>0.98</td>
<td>4</td>
<td>1.22</td>
<td>18</td>
<td>5.47</td>
<td>73</td>
</tr>
<tr>
<td>28</td>
<td>1.88</td>
<td>1.08</td>
<td>1</td>
<td>0.30</td>
<td>18</td>
<td>5.47</td>
<td>54</td>
</tr>
<tr>
<td>29</td>
<td>4.30</td>
<td>1.12</td>
<td>4</td>
<td>1.22</td>
<td>6</td>
<td>1.82</td>
<td>48</td>
</tr>
</tbody>
</table>

Overall Mean = 3.54, Overall SD = 1.15, N= 329

* Statements: 27, and 28 reflect a more objectivist view and were therefore scored in reverse.

** High mean reflects a more inquiry view.

Second Domain: Status of School Science Knowledge

Table 5- 16 shows the six statements covering this domain in the questionnaire.

The participants’ responses are displayed in Figure 7.

Table 5- 16

Questionnaire Statements Related to the Status of School Science Knowledge

<table>
<thead>
<tr>
<th>#</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>In school science, students should be critical of accepted theories.</td>
</tr>
<tr>
<td>33</td>
<td>In school science, students should view scientific knowledge as tentative.</td>
</tr>
<tr>
<td>34</td>
<td>In school science, student understanding should be influenced by their existing knowledge.</td>
</tr>
<tr>
<td>35</td>
<td>In school science, students should examine the history of accepted scientific knowledge.</td>
</tr>
<tr>
<td>36</td>
<td>In school science, students should learn that more than one theory can account for a given set of data.</td>
</tr>
<tr>
<td>37</td>
<td>In school science, students should learn about competing theories.</td>
</tr>
</tbody>
</table>
Participants’ responses revealed in Table 5-17 for this domain’s statements show that participants do not have united view or common agreement on these statements. The majority of participants’ responses for Statement 32 “In school science, students should be critical of accepted theories.”, Statement 35 “In school science, students should examine the history of accepted scientific knowledge.”, and 37 “In school science, students should learn about competing theories” shows uncertainty (ST) position, with 114 (34.65 %) for Statement 32 and Statement 35, and 100 (30.40 %) for Statement 37. Meanwhile, the high responses for Statement 33 “In school science, students should view scientific knowledge as tentative”, Statement 34 “In school science, student understanding should be influenced by their existing knowledge”, and Statement 36 “In school science, students should learn that more than one theory can account for a given set of data” reflected moderate agreements (O) with 100 (30.40 %), 121 (36.78 %), and 116 (35.26 %), respectively.
Table 5-17

Means, Standard Deviation, Frequencies and Percentages of Participants’ Responses Regarding their View of the Status of School Science Knowledge

<table>
<thead>
<tr>
<th>#</th>
<th>Mean</th>
<th>SD</th>
<th>Almost Never (AN)</th>
<th>Seldom (S)</th>
<th>Sometimes (ST)</th>
<th>Often (O)</th>
<th>Almost Always (AA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
</tr>
<tr>
<td>32</td>
<td>3.07</td>
<td>0.81</td>
<td>36</td>
<td>10.94</td>
<td>60</td>
<td>18.24</td>
<td>114</td>
</tr>
<tr>
<td>33</td>
<td>3.53</td>
<td>1.14</td>
<td>23</td>
<td>6.99</td>
<td>36</td>
<td>10.94</td>
<td>91</td>
</tr>
<tr>
<td>34</td>
<td>3.63</td>
<td>1.10</td>
<td>11</td>
<td>3.34</td>
<td>38</td>
<td>11.55</td>
<td>86</td>
</tr>
<tr>
<td>35</td>
<td>3.18</td>
<td>0.93</td>
<td>21</td>
<td>6.38</td>
<td>65</td>
<td>19.76</td>
<td>114</td>
</tr>
<tr>
<td>36</td>
<td>3.53</td>
<td>1.25</td>
<td>7</td>
<td>2.13</td>
<td>44</td>
<td>13.3</td>
<td>103</td>
</tr>
<tr>
<td>37</td>
<td>3.28</td>
<td>0.98</td>
<td>25</td>
<td>7.60</td>
<td>58</td>
<td>17.63</td>
<td>100</td>
</tr>
</tbody>
</table>

* Overall Mean = 3.37, Overall SD = 1.04, N= 329
** High mean reflects a more inquiry view.

Means for the status of school science knowledge domain’s statements is slightly above three for all statements. The lowest mean is 3.07 for Statement 32, and the highest mean is 3.63 for Statement 34. The overall mean for the domain is 3.37, which reflects a moderate position between the objective view and the inquiry view toward the status of school science knowledge, with a slight shift toward the inquiry view.

**Question 4:** What are the teachers' beliefs about the physical learning environment and laboratory activities?

To answer this question, the researcher asked participants to judge the statements from two dimensions: first, the participant’s belief that this factor would enable him to be an effective teacher, and second, how likely is it that these factors will occur in his school. This approach is used to deal with questionnaire statements numbered from 49 to 75.

Therefore, there are two domains in this question. The first domain is factors enabling teachers’ work (Enable) in relation to the physical learning environment and laboratory activities, and the second domain is the likelihood for these factors of accruing
in the participant’s school (Likelihood). Table 5-18, presents the questionnaire statements related to the physical learning environment and laboratory activities. The answer of this question is also supported by analyses of the open-ended questions.

Table 5-18
Questionnaire Statements Related to the Physical Learning Environment and Laboratory Activities

<table>
<thead>
<tr>
<th>#</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>53</td>
<td>Hands-on science kits (activities and equipment)</td>
</tr>
<tr>
<td>58</td>
<td>Permanent science equipment (microscopes, glassware, etc.)</td>
</tr>
<tr>
<td>59</td>
<td>Classroom physical environment (room size, proper furniture, sinks, etc.)</td>
</tr>
<tr>
<td>62</td>
<td>Expendable science supplies (paper, chemicals)</td>
</tr>
<tr>
<td>64</td>
<td>Science curriculum materials (textbooks, lab manuals, activity books, etc.)</td>
</tr>
<tr>
<td>65</td>
<td>Technology (computers, software, Internet)</td>
</tr>
</tbody>
</table>

First Domain: Physical Learning Environment and Laboratory Activities (Enable)

The analysis of this domain presented in Figure 8 in regard frequencies, and in Table 5-19 in regard means, standard deviation, frequencies and percentages of participants’ responses for each statement.

Figure 8:
The Frequencies of Teachers’ View to the Physical Learning Environment and Laboratory Activities (Enable)
Table 5-19

Means, Standard Deviation, Frequencies and Percentages of Participants’ Responses Regarding their View of the Physical Learning Environment and Laboratory Activities (Enable)

<table>
<thead>
<tr>
<th>#</th>
<th>Mean</th>
<th>SD</th>
<th>Strongly agree (SA)</th>
<th>Agree (A)</th>
<th>Undecided (U)</th>
<th>Disagree (D)</th>
<th>Strongly disagree (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
</tr>
<tr>
<td>53</td>
<td>1.47</td>
<td>1.31</td>
<td>210</td>
<td>63.83</td>
<td>89</td>
<td>27.05</td>
<td>25</td>
</tr>
<tr>
<td>58</td>
<td>1.35</td>
<td>1.46</td>
<td>244</td>
<td>74.16</td>
<td>63</td>
<td>19.15</td>
<td>14</td>
</tr>
<tr>
<td>59</td>
<td>1.40</td>
<td>1.10</td>
<td>236</td>
<td>71.73</td>
<td>66</td>
<td>20.06</td>
<td>18</td>
</tr>
<tr>
<td>62</td>
<td>1.68</td>
<td>0.97</td>
<td>169</td>
<td>51.37</td>
<td>112</td>
<td>34.04</td>
<td>37</td>
</tr>
<tr>
<td>64</td>
<td>1.44</td>
<td>1.53</td>
<td>218</td>
<td>66.26</td>
<td>82</td>
<td>24.92</td>
<td>25</td>
</tr>
<tr>
<td>65</td>
<td>1.41</td>
<td>1.04</td>
<td>231</td>
<td>70.21</td>
<td>72</td>
<td>21.88</td>
<td>19</td>
</tr>
</tbody>
</table>

* Overall Mean = 1.46, Overall SD = 1.24, N= 329
* Low mean gives strong agreement.

From the data in Table 5-19, the vast majority of participants believed that the physical learning environment and laboratory activities factors mentioned in this domain would enable them in teaching science. The overall mean for the domain statements is 1.46, and the lowest mean is 1.35, while the highest mean is 1.68. In this domain the low means indicates strong agreement. The highest strong agreement (SA) was 244 (74.16 %) in Statement 58 (“Permanent science equipment, microscopes, glassware, etc.” would enable teaching science). The agreement for the same statement was 63 (19.15 %); this gives a total agreement of 307 (93.31 %). In the meantime, there is more than 90 % of total agreement for Statement 53 “Hands-on science kits, activities and equipment”, Statement 59 “Classroom physical environment: room size, proper furniture, sinks, etc.”, Statement 64 “Science curriculum materials: textbooks, lab manuals, activity books, etc.”, and Statement 65 “Technology: computers, software, Internet”. And the lowest agreement
was for Statement 62 “Expendable science supplies: paper, chemicals” with a total of 85.41%.

On the contrary, the strong disagreement (SD) response in this domain was low, with 0% for Statement 64, and 5 (1.52%) for Statement 62. Meanwhile, the disagreement (D) response was 4 (1.22%) for three statements, and 5 (1.52%), 6 (1.82%), and 7 (2.13%) for the other three statements. Further discussion for participants’ responses expanded in open-ended questions.

Second Domain: Physical Learning Environment and Laboratory Activities (Likelihood)

As for the previous domain, the analysis of this domain is presented in Figure 9 in regard to frequencies, and in Table 5-20 in regard to means, standard deviation, frequencies and percentages of participants’ responses for each statement.

Table 5-20

<table>
<thead>
<tr>
<th>#</th>
<th>Mean</th>
<th>SD</th>
<th>Very likely (VL)</th>
<th>Somewhat likely (SL)</th>
<th>Neither (N)</th>
<th>Somewhat unlikely(SU)</th>
<th>Very unlikely(VU)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>53</td>
<td>2.53</td>
<td>0.73</td>
<td>78 23.71</td>
<td>111 33.74</td>
<td>60 18.24</td>
<td>47 14.92</td>
<td>33 10.03</td>
</tr>
<tr>
<td>58</td>
<td>2.11</td>
<td>0.91</td>
<td>124 37.69</td>
<td>112 34.04</td>
<td>44 13.3</td>
<td>31 9.42</td>
<td>18 5.47</td>
</tr>
<tr>
<td>59</td>
<td>2.59</td>
<td>0.83</td>
<td>92 27.96</td>
<td>88 26.75</td>
<td>51 15.50</td>
<td>57 17.33</td>
<td>41 12.46</td>
</tr>
<tr>
<td>62</td>
<td>2.36</td>
<td>0.94</td>
<td>82 24.92</td>
<td>126 38.30</td>
<td>59 17.93</td>
<td>43 13.07</td>
<td>19 5.78</td>
</tr>
<tr>
<td>64</td>
<td>2.18</td>
<td>0.84</td>
<td>104 31.61</td>
<td>117 35.56</td>
<td>67 20.36</td>
<td>28 8.51</td>
<td>13 3.95</td>
</tr>
<tr>
<td>65</td>
<td>2.59</td>
<td>0.87</td>
<td>90 27.36</td>
<td>87 26.44</td>
<td>57 17.33</td>
<td>56 17.02</td>
<td>39 11.85</td>
</tr>
</tbody>
</table>

* Overall Mean = 2.39, Overall SD = 0.85, N= 329
* Low mean gives strong likelihood of occurring.

The overall mean for participants’ responses regarding their view of the physical learning environment and laboratory activities regarding likelihood of occurring in their school is 2.39. This mean value shows that participants in general were uncertain in their
judgment. Although the responses with very likely (VL) and somewhat likely (SL) are more than 26 % for all statements, the uncertainty (N) reached 20.36 %, while the somewhat unlikely (SU) and very unlikely (VU) responses reached 17.33 %. The notable percentage is for very likely (VL) and somewhat likely (SL) in Statement 58, with a total of 236 (71.73 %), against 49 (14.89 %) for somewhat unlikely (SU) and very unlikely (VU). The uncertainty for this statement is close to the unlikely positions, where 44 (13.3 %) have neither judgment.

According to Table 5-20, the highest unlikely (SU) and very unlikely (VU) judgments was for Statement 59, where 98 (29.79 %) participants believe that it is unlikely for classroom physical environment (room size, proper furniture, sinks, etc) to improve. This was also shown in Statement 65, regarding improving technology (computers, software, Internet) in school, where the unlikely (SU) and very unlikely (VU) judgments were 95 (28.87 %). Participants’ responses and comments in open-ended questions explained the high percentages for the two statements.

Figure 9:
The Frequencies of Teachers’ View to the Physical Learning Environment and Laboratory Activities (Likelihood)

VL= Very likely, SL= Somewhat likely, N= Neither, SU= Somewhat unlikely, VU= Very unlikely
From participants’ responses, they agree that the factors mentioned would enable them in teaching science, with overall mean of 1.46, in the same time participants were uncertain of the occurrence of these factors in their schools, with overall mean of 2.39.

**Question 5: What are the teachers' beliefs about their students’ role in science class?**

This question has one domain, which is the nature of students’ role in science class. Statements 42 to 48 in the questionnaire cover this domain. Table 5-21 presents these statements.

Table 5-21

<table>
<thead>
<tr>
<th>#</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>It is OK for my student to ask me &quot;why do I have to learn this?&quot;</td>
</tr>
<tr>
<td>43</td>
<td>It is OK for my student to question the way he is being taught.</td>
</tr>
<tr>
<td>44</td>
<td>It is OK for my student to complain about activities that are confusing.</td>
</tr>
<tr>
<td>45</td>
<td>It is OK for my student to express their opinion.</td>
</tr>
<tr>
<td>46</td>
<td>It is OK for my student to speak up for their rights.</td>
</tr>
<tr>
<td>47</td>
<td>Student should help the teacher to plan what they are going to learn.</td>
</tr>
<tr>
<td>48</td>
<td>Student should help the teacher to decide which activities are best for them.</td>
</tr>
</tbody>
</table>

Figure 10 reveals participants’ responses to the domain’s statements, while Table 5-22 shows the means, standard deviation, frequencies and percentages of participants’ responses regarding their view of the nature of students’ role in science class.

Figure 10:

The Frequencies of Teachers’ View to Students’ Role in Science Class

AN= Almost Never, S= Seldom, ST= Sometimes, O= Often, AA= Almost Always
Table 5-22
Means, Standard Deviation, Frequencies and Percentages of Participants’ Responses Regarding their View of the Nature of students’ role in science Class

<table>
<thead>
<tr>
<th>#</th>
<th>Mean</th>
<th>SD</th>
<th>Almost Never (AN)</th>
<th>Seldom (S)</th>
<th>Sometimes (S)</th>
<th>Often (O)</th>
<th>Almost Always (AA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
</tr>
<tr>
<td>42</td>
<td>4.18</td>
<td>1.73</td>
<td>9</td>
<td>2.74</td>
<td>10</td>
<td>3.04</td>
<td>59</td>
</tr>
<tr>
<td>43</td>
<td>3.92</td>
<td>1.52</td>
<td>8</td>
<td>2.43</td>
<td>34</td>
<td>10.33</td>
<td>64</td>
</tr>
<tr>
<td>44</td>
<td>3.81</td>
<td>1.92</td>
<td>17</td>
<td>5.17</td>
<td>20</td>
<td>6.08</td>
<td>80</td>
</tr>
<tr>
<td>45</td>
<td>3.98</td>
<td>1.84</td>
<td>14</td>
<td>4.25</td>
<td>31</td>
<td>9.42</td>
<td>55</td>
</tr>
<tr>
<td>46</td>
<td>3.81</td>
<td>1.83</td>
<td>19</td>
<td>5.78</td>
<td>28</td>
<td>8.51</td>
<td>71</td>
</tr>
<tr>
<td>47</td>
<td>3.27</td>
<td>1.34</td>
<td>44</td>
<td>13.37</td>
<td>60</td>
<td>18.24</td>
<td>68</td>
</tr>
<tr>
<td>48</td>
<td>3.33</td>
<td>1.39</td>
<td>34</td>
<td>10.33</td>
<td>57</td>
<td>17.33</td>
<td>85</td>
</tr>
</tbody>
</table>

* Overall Mean = 3.76, Overall SD = 1.65, N= 329
* High mean gives strong agreement.

The highest mean for the statements of the domain is 4.18, which occurred for Statement 42 “It is OK for my student to ask me, why do I have to learn this?”. Also this statement has the highest complete agreement (AA) response, with 166 (50.46 %) of participants’ responses, and 85 (25.84 %) of moderate agreement (O), also it has the lowest complete disagreement (AN) response with 9 (2.74 %) and the lowest moderate disagreement (D) response with10 (3.04 %). This reveals an inquiry view toward the role of the student in science class.

Statement 43 “It is OK for my student to question the way he is being taught”, Statement 44 “It is OK for my student to complain about activities that are confusing”, and Statement 45 “It is OK for my student to express their opinion”, have high complete agreement (AA) and moderate agreement (O). For Statement 43 there are 223 (67.78 %) who completely agree (AA) or moderately agree (O), for Statement 44 there are 212 (64.43 %), and for Statement 45 there are 229 (69.60 %). These positions present a more inquiry views toward the role of the student in science class. The means for the three statements are 3.92, 3.81, and 3.98, correspondingly.
Conversely, there is more objective view expressed in response to Statement 47, “Student should help the teacher to plan what they are going to learn” where 44 (13.37 %) completely disagree (AN), and 60 (18.24 %) moderately disagree (S), giving a total of 104 (31.61 %). This was true also for Statement 48 “Student should help the teacher to decide which activities are best for them”, with a total of 91 (27.66 %) for the two positions. In fact Statements 47 and 48 have the lowest complete agreement (AA) of 80 (24.32 %) for Statement 47, and 81 (24.62 %) for Statement 48. They also have the lowest moderate agreement (O) response with 77 (23.40) and 72 (21.88 %), respectively. Consequently, the mean for both statements is the lowest in this domain, with 3.27 for Statement 47, and 3.33 for Statement 48. Since the mean is higher than three, participants’ judgments for the two statements reflect inquiry view, with low degree. The overall mean for the domain is 3.76, which represents an inquiry view toward the role of the student in science class, with a shift toward the moderate level between objective view and inquiry view.

The notable issue related to the nature of students’ roles in science class, presented in participants’ responses to open-ended questions, is the fact that participants believe in using an inquiry view in dealing with students, but they do not practice it in class. Participants blamed external factors. The main factor was related to the obligatory textbooks (amount and subjects), and current student evaluation system, which are mainly demands on testing students on the whole textbook. Tests might be prepared by the teacher, or by another teacher from outside the school.

**Question 6: How aware are the science teachers of the science education research literature on curriculum and teaching?**

In order to answer this question, the researcher asked participants to judge the statements from two dimensions, first, the participant’s belief that this factor would enable
him to be an effective teacher, and second, how likely is it that these factors will occur in his school. Therefore, there are two domains in this question. The first domain is the factors enabling teachers’ work (Enable) in relation to their awareness of research literature on science education, and the second domain is the likelihood of these factors accruing in the participant’s school (Likelihood). Table 5-23, presents the two questionnaire statements related to teachers’ awareness of research literature on science education. The answer of this question is also supported by analyses of the open-ended questions.

Table 5-23
Questionnaire Statements Related to Teachers’ Awareness of Research Literature on Science Education

<table>
<thead>
<tr>
<th>#</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>Professional staff development on teaching (workshops, conferences, etc.)</td>
</tr>
<tr>
<td>50</td>
<td>Regional and national guidelines for science education (standards and goals)</td>
</tr>
</tbody>
</table>

**First Domain: Factors Enabling Teachers’ Work (Enable)**

Figure 11 reveals participants’ judgments related to the importance of the two factors on their work in science class, to enable their work.

Figure 11:
The Frequencies of Teachers’ View Related to Teachers’ Awareness of Research Literature on Science Education (Enable)
As Table 5-24 represents, the vast majority, 307 (93.31 %), strongly agree (SA), or agree (A), with the statement (“Professional staff development on teaching, workshops, conferences, etc.” would enable their work). The statement has a mean of 1.52, which gives high agreement relating to the importance of the professional staff development on teachers’ work. However, in participants’ responses to the open-ended questions, they argue that this kind of professional staff development is absent in schools, and there are not enough educational associations in Saudi Arabia providing this kind of development.

Regarding the regional and national guidelines for science education (standards and goals) mentioned in Statement 50, 97 (29.48 %) strongly agree (SA), and 160 (48.63%) agree (A), giving a total of 257 (78.11 %) for strong agreement and agreement that this factor would enable teachers’ work. Due to the central structure of Saudi educational system, some participants think that this factor would not be helpful. Also 53 (16.11 %) have no judgments, by choosing undecided (U).

In open-ended question related to this point, educational supervisors presented more awareness of the new approaches in teaching science, while in some teachers’ responses there were confusions the different approaches in teaching science, related to the connections between the name of the approach and the description of this approach.

Table 5-24

<table>
<thead>
<tr>
<th>#</th>
<th>Mean</th>
<th>SD</th>
<th>Strongly agree (SA) Freq %</th>
<th>Agree (A) Freq %</th>
<th>Undecided (U) Freq %</th>
<th>Disagree (D) Freq %</th>
<th>Strongly disagree(SD) Freq %</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>1.52</td>
<td>1.12</td>
<td>187 56.84</td>
<td>120 36.47</td>
<td>17 5.17</td>
<td>3 0.91</td>
<td>2 0.61</td>
</tr>
<tr>
<td>50</td>
<td>2.00</td>
<td>1.05</td>
<td>97 29.48</td>
<td>160 48.63</td>
<td>53 16.11</td>
<td>14 4.25</td>
<td>5 1.52</td>
</tr>
</tbody>
</table>

* Overall Mean = 1.76, Overall SD = 1.09, N= 329
* Low mean gives strong agreement.
Second Domain: Factors Likelihood of Occurring in School (Likelihood)

Figure 12 shows participants’ judgments related to the likelihood of occurrence in their schools of the two factors related to teachers’ awareness of research literature on science education.

Figure 12:
The Frequencies of Teachers’ View Related to Teachers’ Awareness of Research Literature on Science Education (Likelihood)

Table 5-25 presents participants’ opinions regarding the likelihood of factors occurring in their schools. For the first factor, mentioned in Statement 49, regarding the professional staff development, most participants believe that this factor is likely to occur in their schools, with a total of 194 (58.97 %) for very likely (VL) and somewhat likely (SL) positions, against 84 (25.53 %) of somewhat unlikely (SU) and very unlikely (VU) positions. Due to the high responses of the uncertainty position, neither (N), which is 51 (15.50 %), the mean of the statement is 2.59, which could be considered as an uncertain position.

Meanwhile, for the factor related to regional and national guidelines for science education (standards and goals), mentioned in Statement 50, there were 195 (59.27 %)
responses showing very likely (VL) and somewhat likely (SL) positions, and there were 52 (15.81 %) for somewhat unlikely (SU), and very unlikely (VU) positions. In this statement, there were high responses of the uncertainty position, higher than Statement 49, with 82 (24.92 %) uncertain (U). For these reasons, the mean for this statement is 2.39, which reflects a shift toward unlikelihood of occurring.

Table 5- 25

Means, Standard Deviation, Frequencies and Percentages of Participants’ Responses Regarding their View of Factors Likelihood to Occur in their schools (Likelihood) Related to Teachers’ Awareness of Research Literature on Science Education

<table>
<thead>
<tr>
<th>#</th>
<th>Mean</th>
<th>SD</th>
<th>Very likely (VL)</th>
<th>Somewhat likely (SL)</th>
<th>Neither (N)</th>
<th>Somewhat unlikely(SU)</th>
<th>Very unlikely(VU)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
</tr>
<tr>
<td>49</td>
<td>2.59</td>
<td>1.03</td>
<td>68</td>
<td>20.67</td>
<td>126</td>
<td>38.30</td>
<td>51</td>
</tr>
<tr>
<td>50</td>
<td>2.39</td>
<td>0.76</td>
<td>82</td>
<td>24.92</td>
<td>113</td>
<td>34.35</td>
<td>82</td>
</tr>
</tbody>
</table>

* Overall Mean = 2.49, Overall SD = 0.90, N= 329
* Low mean gives strong likelihood of occurring.

**Question 7:** How are the science teachers' ideas changing with regard to the science curriculum and the teaching of science?

The main purpose of this question is to investigate participants’ views toward the change in science curriculum. The question has one domain covered by three statements in the questionnaire, and supported by one of the open-ended questions. Table 5-26 shows the three statements related to the question, and the participants’ judgments results reported in Figure 13. In order to answer this question, the researcher analyzed the data of the three statements using quantitative method, and applied the qualitative method on the data from the open-ended question.
Table 5-26

Questionnaire Statements from 39 to 41 Related to the Change in Teachers’ Ideas with Regard to the Science Curriculum and the Teaching of Science

<table>
<thead>
<tr>
<th>#</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>39</td>
<td>In school science, students should examine how society influences what counts as scientific knowledge.</td>
</tr>
<tr>
<td>40</td>
<td>In school science, students should consider social issues related to accepted scientific knowledge.</td>
</tr>
<tr>
<td>41*</td>
<td>In school science, students should be taught that scientific knowledge is objective and therefore free of human values.</td>
</tr>
</tbody>
</table>

* Statement 41 reflects a more objectivist view and was therefore scored in reverse.

Figure 13:
The Frequencies of the Change in Teachers’ Ideas with Regard to the Science Curriculum and the Teaching of Science

According to Table 5-27, most judgments were around moderate positions for Statement 39 “In school science, students should examine how society influences what counts as scientific knowledge”, where the notable majority of domain statements responses, 111 (33.74 %), showed moderate judgments (ST), and 96 (29.18 %) participants chose moderate agreement (O). Also in Statement 40, which is “In school science, students should consider social issues related to accepted scientific knowledge”, there are 99 (30.09 %) responses for moderate agreement (O) and 74 (22.49 %) responses for moderate judgments (ST).
In respect of participants’ judgments of Statement 41 “In school science, students should be taught that scientific knowledge is objective and therefore free of human values,” which presents objective view, Table 5-27 displayed that this statement has the highest complete agreement (AA) response in this domain, which is 99 (30.09 %), and also this statement has the highest complete disagreement (AN) response in domain statements, with a score of 26 (7.90 %) responses. Among the responses in open-ended questions related to this domain, participants expressed their dilemma with this statement. Here the majority accepts this statement with regard to the honesty and neutrality in science, where participants expressed the importance of freeing scientific work from scientists’ own beliefs. But participants also showed their hesitation in accepting this statement due to the fear of the use of science separately from human values and human rights. The overall mean for domain statements, which is 3.09, gives a moderate position between inquiry view and objective view in regard to the change in science curriculum and its relation to the society.

Table 5 - 27

Means, Standard Deviation, Frequencies and Percentages of Participants’ Responses Related to the Change in Teachers’ Ideas with Regard to the Science Curriculum and the

<table>
<thead>
<tr>
<th>Teaching of Science</th>
<th>#</th>
<th>Mean</th>
<th>SD</th>
<th>Almost never (AN)</th>
<th>Seldom (S)</th>
<th>Sometimes (ST)</th>
<th>Often (O)</th>
<th>Almost Always (AA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
</tr>
<tr>
<td>39</td>
<td>39</td>
<td>3.34</td>
<td>1.17</td>
<td>17</td>
<td>5.17</td>
<td>53</td>
<td>16.11</td>
<td>111</td>
</tr>
<tr>
<td>40</td>
<td>40</td>
<td>3.57</td>
<td>1.53</td>
<td>14</td>
<td>4.25</td>
<td>56</td>
<td>17.02</td>
<td>74</td>
</tr>
<tr>
<td>41</td>
<td>41</td>
<td>2.37</td>
<td>1.28</td>
<td>26</td>
<td>7.90</td>
<td>37</td>
<td>11.25</td>
<td>70</td>
</tr>
</tbody>
</table>

Overall Mean = 3.09, Overall SD = 1.33, N= 329
* Statement 41 reflects a more objectivist view and was therefore scored in reverse.
** High mean reflects a more inquiry view.
**Question 8:** What elements need to be changed in science curriculum?

There are two domains in this question. The first domain is the factors enabling teachers’ work (Enable) in relation to elements that need to be changed in science curriculum, and the second domain is the likelihood of these factors accruing in participant’s school (Likelihood). Table 5-28 shows questionnaire statements related to elements that need to be changed in science curriculum. The answer of this question is also supported by analyses of the three open-ended questions.

Table 5-28

<table>
<thead>
<tr>
<th>#</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>56</td>
<td>Extended class period length.</td>
</tr>
<tr>
<td>57</td>
<td>Increasing planning time for classes.</td>
</tr>
<tr>
<td>60</td>
<td>Adoption of an official school science curriculum for each region independently (goals, objectives, topics, etc.)</td>
</tr>
<tr>
<td>61</td>
<td>Adoption of science curriculum from developed country (goals, objectives, topics, etc.)</td>
</tr>
<tr>
<td>67</td>
<td>An increase in students’ academic abilities</td>
</tr>
<tr>
<td>71</td>
<td>Reduced class size (number of students)</td>
</tr>
</tbody>
</table>

**First Domain: Elements That Need to be Changed in Science Curriculum (Enable)**

Figure 14:

The Frequencies of Teachers’ View Related to Elements Need to be Changed in Science Curriculum (Enable)

SA= Strongly Agree, A= Agree, U= Undecided, D= Disagree, SD= Strongly Disagree
Participants’ judgments on the missing points of the science curriculum in Saudi that would enable them in teaching science are presented in Figure 14, and in Table 5-29.

Table 5-29

Means, Standard Deviation, Frequencies and Percentages of Participants’ Responses Regarding their View of the Elements Need to be Changed in Science Curriculum (Enable)

<table>
<thead>
<tr>
<th>#</th>
<th>Mean</th>
<th>SD</th>
<th>Strongly agree (SA)</th>
<th>Agree (A)</th>
<th>Undecided (U)</th>
<th>Disagree (D)</th>
<th>Strongly disagree(SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
</tr>
<tr>
<td>56</td>
<td>2.96</td>
<td>1.10</td>
<td>53</td>
<td>16.11</td>
<td>80</td>
<td>24.32</td>
<td>61</td>
</tr>
<tr>
<td>57</td>
<td>2.10</td>
<td>1.26</td>
<td>88</td>
<td>26.75</td>
<td>139</td>
<td>42.25</td>
<td>87</td>
</tr>
<tr>
<td>60</td>
<td>3.05</td>
<td>0.93</td>
<td>64</td>
<td>19.45</td>
<td>66</td>
<td>20.06</td>
<td>57</td>
</tr>
<tr>
<td>61</td>
<td>2.81</td>
<td>0.98</td>
<td>69</td>
<td>20.97</td>
<td>90</td>
<td>27.36</td>
<td>58</td>
</tr>
<tr>
<td>67</td>
<td>1.71</td>
<td>1.83</td>
<td>147</td>
<td>44.68</td>
<td>139</td>
<td>42.25</td>
<td>35</td>
</tr>
<tr>
<td>71</td>
<td>1.38</td>
<td>0.97</td>
<td>243</td>
<td>73.86</td>
<td>65</td>
<td>19.76</td>
<td>8</td>
</tr>
</tbody>
</table>

* Overall Mean = 2.34, Overall SD = 1.18, N= 329
* Low mean gives strong agreement.

The distinguished strong agreement and agreement was for Statement 76 related to an increase in students’ academic abilities, where 147 (44.68 %) strongly agreed (SA), and 139 (42.25 %) agreed (A), reaching a total agreement of 286 (86.93 %). The same statement also has the lowest strong disagreement (SD) of 1 (0.30 %), and the lowest disagreement (D) of 7 (2.13 %). Among the notable disagreements, the responses of Statement 56 (“Extended class period length” would enable teachers’ work), where 96 (29.18 %) disagreed (D) and 39 (11.85 %) strongly disagreed (SD). That gives a total of 135 (41.03 %) of disagreement.

For the debatable issue in Saudi education today, which is mentioned in Statement 60 “Adoption of an official school science curriculum for each region independently: goals, objectives, topics, etc.”, and Statement 61 “Adoption of science curriculum from developed country: goals, objectives, topics, etc.”, there were varying opinions. For adoption of an official school science curriculum for each region independently mentioned
in statement number 60, 130 (39.51 %) strongly agreed (SA) or agreed (A); conversely, 142 (43.16 %) strongly disagreed (SD) or disagreed (D), while 57 (17.33%) have not decided (U). On the other hand, for the adoption of science curriculum from a developed country, were 159 (48.33%) who strongly agreed (SA) or agreed (A), against 112 (34.05%) who strongly disagreed (SD) or disagreed (D). Meanwhile, the undecided (U) position is almost the same for both statements.

Participants’ dilemma of having a position in judging the first five statements in this domain, besides the varying opinions about Statements 56, 60, and 61, shifted the overall mean for this domain to be 2.34, which is a moderate position, showing participants’ uncertainty of the importance of these factors.

**Second Domain: Elements That Need to be Changed in Science Curriculum (Likelihood)**

Participants’ views regarding the likelihood for occurrence of the missing points of the science curriculum in Saudi are presented in Figure 15 as frequencies, and in Table 5-30 as means, standard deviation, frequencies and percentages.

**Figure 15:**
The Frequencies of Teachers’ View Related to Elements That Need to be Changed in Science Curriculum (Likelihood)

![Bar chart showing frequencies of responses to questionnaire statements](image)
Table 5- 30

Means, Standard Deviation, Frequencies and Percentages of Participants’ Responses Regarding their View of the Elements That Need to be Changed in Science Curriculum (Likelihood)

<table>
<thead>
<tr>
<th>#</th>
<th>Mean</th>
<th>SD</th>
<th>Very likely (VL)</th>
<th>Somewhat likely (SL)</th>
<th>Neither (N)</th>
<th>Somewhat unlikely(SU)</th>
<th>Very unlikely(VU)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
</tr>
<tr>
<td>56</td>
<td>3.57</td>
<td>1.39</td>
<td>24</td>
<td>7.29</td>
<td>57</td>
<td>17.33</td>
<td>71</td>
</tr>
<tr>
<td>57</td>
<td>2.49</td>
<td>0.99</td>
<td>54</td>
<td>16.41</td>
<td>130</td>
<td>39.51</td>
<td>98</td>
</tr>
<tr>
<td>60</td>
<td>3.77</td>
<td>1.42</td>
<td>19</td>
<td>5.78</td>
<td>48</td>
<td>14.59</td>
<td>61</td>
</tr>
<tr>
<td>61</td>
<td>3.35</td>
<td>1.29</td>
<td>39</td>
<td>11.85</td>
<td>72</td>
<td>21.88</td>
<td>62</td>
</tr>
<tr>
<td>67</td>
<td>2.63</td>
<td>0.86</td>
<td>59</td>
<td>17.93</td>
<td>108</td>
<td>32.83</td>
<td>84</td>
</tr>
<tr>
<td>71</td>
<td>2.69</td>
<td>0.73</td>
<td>100</td>
<td>30.40</td>
<td>77</td>
<td>23.40</td>
<td>42</td>
</tr>
</tbody>
</table>

* Overall Mean = 3.09, Overall SD = 1.11, N= 329
* Low mean gives strong likelihood of occurring.

As displayed in Table 5-30, the overall mean for this domain, which is 3.09, reveals that participants believe that the factors discussed in this domain is unlikely to occur in their schools. The majority thinks that it is very unlikely (VU) or somewhat unlikely (SU) for the extension of class period length. The total for the two positions was 177 (53.80 %). This number was similar to the strongly agree (SA) response and the agreement for Statement 71, related to reducing class size (number of students).

The highest very likely (VL) and somewhat likely (SL) judgment was for Statement 60, which related to the adoption of an official school science curriculum for each region independently, where 201 (61.09 %) think that it is unlikely to occur. Also in Statement 57 related to increasing planning time for classes, had 184 (55.92 %) responses for both positions. This statement also has the highest undecided position (U) with 98 (29.79 %) responses. Further discussion expanded in open-ended questions analyses.
**Question 9:** What are the missing points of the science curriculum in Saudi?

Like the previous question, this question has two domains, factors that would enable teachers (Enable), and the likelihood of occurring in school (Likelihood). The question is aimed to investigate the missing points of the science curriculum in Saudi. Questionnaire statements related to this question are presented in Table 5-31. The answer of this question is also supported by analyses of the three open-ended questions.

**Table 5-31**

Questionnaire Statements Related to Teachers’ Views to the Missing Points of the Science Curriculum in Saudi?

<table>
<thead>
<tr>
<th>#</th>
<th>Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
<td>Community involvement (civic, business, etc.)</td>
</tr>
<tr>
<td>55</td>
<td>Increased funding (from school and Ministry)</td>
</tr>
<tr>
<td>63</td>
<td>Support from administrators</td>
</tr>
<tr>
<td>66</td>
<td>Parental involvement</td>
</tr>
<tr>
<td>68</td>
<td>Active involvement of educational supervisors</td>
</tr>
<tr>
<td>72</td>
<td>Involvement of scientists</td>
</tr>
<tr>
<td>73</td>
<td>Involvement of university educator professors</td>
</tr>
</tbody>
</table>

**First Domain: The missing points of the science curriculum in Saudi that Would Enable Teachers’ Work (Enable)**

**Figure 16**

The Frequencies of Teachers’ Views Related to the Missing Points of the Science Curriculum in Saudi (Enable)

SA = strongly agree; A = agree; UN = undecided; D = disagree; SD = strongly disagree
Table 5- 32
Means, Standard Deviation, Frequencies and Percentages of Participants’ Responses Regarding their Views of the Missing Points of the Science Curriculum in Saudi (Enable)

<table>
<thead>
<tr>
<th>#</th>
<th>Mean</th>
<th>SD</th>
<th>Strongly agree (SA)</th>
<th>Agree (A)</th>
<th>Undecided (U)</th>
<th>Disagree (D)</th>
<th>Strongly disagree(SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
</tr>
<tr>
<td>54</td>
<td>2.20</td>
<td>0.91</td>
<td>99</td>
<td>30.09</td>
<td>110</td>
<td>33.43</td>
<td>80</td>
</tr>
<tr>
<td>55</td>
<td>1.40</td>
<td>1.27</td>
<td>227</td>
<td>69.00</td>
<td>81</td>
<td>24.62</td>
<td>14</td>
</tr>
<tr>
<td>63</td>
<td>1.50</td>
<td>0.96</td>
<td>201</td>
<td>61.09</td>
<td>97</td>
<td>29.48</td>
<td>25</td>
</tr>
<tr>
<td>66</td>
<td>2.18</td>
<td>0.73</td>
<td>102</td>
<td>31.00</td>
<td>114</td>
<td>34.65</td>
<td>77</td>
</tr>
<tr>
<td>68</td>
<td>1.78</td>
<td>0.89</td>
<td>145</td>
<td>44.07</td>
<td>136</td>
<td>41.34</td>
<td>29</td>
</tr>
<tr>
<td>72</td>
<td>1.57</td>
<td>1.51</td>
<td>194</td>
<td>58.97</td>
<td>92</td>
<td>27.96</td>
<td>35</td>
</tr>
<tr>
<td>73</td>
<td>1.55</td>
<td>1.61</td>
<td>191</td>
<td>58.05</td>
<td>102</td>
<td>31.00</td>
<td>30</td>
</tr>
</tbody>
</table>

* Overall Mean = 1.74, Overall SD = 1.13, N= 329
* Low mean gives strong agreement.

In this domain, the strong agreement (SA) and the agreement (A) responses were high for all domain statements, with a range from 308 (93.62 %) in Statement 55, related to increasing funding, to 209 (63.52 %) in Statement 54 that suggested community involvement. This statement also has the highest moderate position, with 80 (24.32 %) for undecided (U) judgments. On the contrary, the same statement had the highest strong disagreement (DS) and disagreement (D) responses, with a total of 40 (12.16%) responses. In the same context, Statement 66 related to parental involvement, had the highest strong disagreement (SD) response, 11 (3.34 %), and the second highest disagreement (D) response, 25 (7.60 %), which gives a total of 36 (10.94 %).

The lowest strong disagreement (SD), response of 1 (0.30 %), occurred for each of Statement 55 “Increased funding: from school and Ministry”, Statement 63 “Support from administrators”, and Statement 72 “Involvement of scientists”. For Statement 73 “Involvement of university educator professors”, strong disagreement (SD) had 2 (0.61 %) responses only.
The overall mean for this domain was 1.74, which could be considered between agreement (A) (2.00) and strongly agreement (SA) (1.00), that the missing points of the science curriculum in Saudi mentioned in this domain would enable science teachers’ work.

**Second Domain: The Likelihood of Occurring for the Missing Points of the Science Curriculum in Saudi (Likelihood)**

As displayed in Figure 17, and in Table 5-33, the participants’ responses centered on the moderate judgments. The position neither (N), has the highest frequencies for Statements 54, 66, 78, and 89. Also, neither (N) judgment was high for the other three statements in this domain. The range for neither (N) judgment frequencies and percentages was from 55 (16.72%) in Statement 63, to 98 (29.79%) in Statement 66.

**Figure 17**

The Frequencies of Teachers’ Views Related to the Missing Points of the Science Curriculum in Saudi (Likelihood)

VL = very likely; SL = somewhat likely; N = neither; SU = somewhat unlikely; VU = very unlikely
Table 5- 33

Means, Standard Deviation, Frequencies and Percentages of Participants’ Responses Regarding their View of the Missing Points of the Science Curriculum in Saudi (Likelihood)

<table>
<thead>
<tr>
<th>#</th>
<th>Mean</th>
<th>SD</th>
<th>Very likely (VL)</th>
<th>Somewhat likely (SL)</th>
<th>Neither (N)</th>
<th>Somewhat unlikely(SU)</th>
<th>Very unlikely(VU)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
</tr>
<tr>
<td>54</td>
<td>3.17</td>
<td>0.97</td>
<td>41</td>
<td>12.46</td>
<td>71</td>
<td>21.58</td>
<td>84</td>
</tr>
<tr>
<td>55</td>
<td>2.64</td>
<td>0.91</td>
<td>93</td>
<td>28.27</td>
<td>72</td>
<td>21.88</td>
<td>71</td>
</tr>
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<td>63</td>
<td>2.01</td>
<td>0.72</td>
<td>129</td>
<td>39.21</td>
<td>111</td>
<td>33.74</td>
<td>55</td>
</tr>
<tr>
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<td>3.16</td>
<td>1.01</td>
<td>29</td>
<td>8.81</td>
<td>76</td>
<td>23.10</td>
<td>98</td>
</tr>
<tr>
<td>68</td>
<td>2.36</td>
<td>0.76</td>
<td>82</td>
<td>24.92</td>
<td>126</td>
<td>38.30</td>
<td>69</td>
</tr>
<tr>
<td>72</td>
<td>2.96</td>
<td>0.94</td>
<td>59</td>
<td>17.93</td>
<td>76</td>
<td>23.10</td>
<td>78</td>
</tr>
<tr>
<td>73</td>
<td>2.92</td>
<td>0.89</td>
<td>61</td>
<td>18.54</td>
<td>72</td>
<td>21.88</td>
<td>89</td>
</tr>
</tbody>
</table>

* Overall Mean = 2.74, Overall SD = 0.89, N= 329
* Low mean gives strong likelihood of occurring.

Participants think that it is very likely (VL), 129 (39.21 %), or somewhat likely (SL), 111 (33.74 %), for Statement 63 to occur. In fact, this statement has the lowest very unlikely (VU) judgment, 9 (2.74 %), and the lowest somewhat unlikely (SU) judgment, 25 (7.60 %), with a total of 34 (10.34 %). Meanwhile, the highest unlikelihood judgment was for Statement 54, where the total of very unlikely (VU) and somewhat unlikely (SU) positions were 133 (40.43 %). The overall mean for this domain, which is 2.74, has a moderate position with a slight shift toward the likelihood of occurring.

**Section 3: Analysis and Discussion of Open-Ended Questions**

The analysis of open-ended questions followed a qualitative method, using a key words and terms approach. For the necessity of the analysis, the discussion is implied on each point in this chapter. The three open-ended questions are:

76) Would you like to add any comments, notes, or suggestions about the nature of science?

77) Would you like to add any comments, notes, or suggestions about science teaching?
Would you like to add any comments, notes, or suggestions about developing or reforming science curriculum?

Following are the main points in participants’ responses to the three questions.

**Classes’ Size**

Class’s size means the capacity of the class, comparing the number of students with the area of the room. The official dimensions of the classroom in Saudi schools buildings is 5 X 8 m (around 15 X 24 feet), while the rental schools buildings and old schools have 4 X 6 m (around 12 X 18 feet) rooms or less. Another important point relating to class’ size is the limit of “big” and the limit of “small.” Needless to say, that the country population, people’s density in specific areas, and the strategy of school distribution in urban areas affect the class size. In Saudi Arabia, the Ministry of Education planned to assign at least one elementary school in each square (approximately from 2 – 4 sq. km). In fact this plan actually holds with minor exceptions. Therefore, the problem is not in the distribution of schools; rather it is the number of classes in each school, due to the lack of more classrooms in school building. So the large number of students is distributed in a few classes.

The Ministry of Education census in 1999 shows that the statistic for students’ density is 22.2 students per class for the whole K 1-12 levels (Almarefah 43, p. 52). This official census does not represent the facts that the majority of rural schools have a small number of students, normally between 1–10 students only in small towns and villages. Besides, those 22 students in a 4 X 6 sq. m room (in rental building) is too much.

Teachers were asked to give the average number of students in their current classes, and to give their preferred number of students in science class. For city teachers, the average range was between 30 and 45 students (average: 37.5) in government school
buildings, and between 22 and 31 students (average: 26.5) in rental and older school buildings. For rural school teachers, the average range was between 8 and 24 students (average: 16). (This average does not consider three schools with students from 1 to 5 in class.) The average of the preferred number of students in science class for city teachers was from 20 to 25 students, and from 15 to 20 for rural school teachers. In general, city teachers asked for decreasing student numbers, while rural teachers asked for increasing in student numbers.

How does classes’ size affect teaching science? One teacher describes the situation: “… small classes and so crowded with students, neither teacher nor student can move easily … awful in hot summer with poor quality air conditioner.” Another teacher said:

“It is impossible for all students in class to use lap equipment, we don’t have enough for them, just few, so students have to watch the teacher doing the work, and sometimes students at the end of the class cannot see well.”

From teachers’ responses to open-ended questions, the main effects are:

1. In big classes it is impossible for all students to engage in discussions. The class time is not enough for them to do so. It is important for students to engage in discussions to share ideas and make clear their positions. Also it is important for students to be able to prove their opinions and build it on a strong base; this will be available only in small classes, while it is difficult in big classes and impossible in huge ones.

2. It is difficult for teachers to follow students’ improvements. Even if he can take general comment about the class improvement, but he cannot focus on each student in the class.
3. If we have big classes we cannot use lap equipment easily; usually schools have limited numbers of expensive equipment such as microscopes and computers. We want the student to be able to deal with these equipments instead of watching it only.

4. Teamwork is important in each level of education. It will be difficult or impossible to have this way of learning in huge classes.

5. In huge classes lecture is the only effective way of teaching. Even if lectures might be useful in some topics, but it is recommended in public lectures, not in schools, especially in science.

6. It is impossible for teachers to take care of students’ papers and projects in big classes, because they have no time to do this kind of tasks. If teachers try to do these tasks, they will be overwhelmed and their comments will not be helpful for students.

7. Although teachers know that students can learn from the real field more than the classroom, there is no way to take outdoors activities such as field trips, the huge class makes it impossible to do that because of the need of more cars to carry students (boys’ public schools do not have school buses), and more teachers to supervise students during the trip.

8. The only way to evaluate students in big classes is exams. A lot of educators think that exams are not fair to evaluate students or measure students’ improvements. The exam phobia is something we cannot take away from students, so even if they are doing well in the class they might have bad grades in exams.
Field Trips

Field trips are related to class’s size, and teachers mentioned the two points in the same time, but some teachers mentioned other problems. Teachers argue that they are facing problems from schools principals if they want to do this kind of activity. “The official documents for intermediate science curriculum did not implied scientific and filed trips as a part of the curriculum” (Aldamegh, 1998, p. 39), so teachers have problems in getting permissions from school principals to do field trips. Besides that, time is hardly enough to explain context in science textbook orally.

Effective Teaching Methods

Is there only one effective teaching method? In teaching we cannot use the same skills or methods all the time, we need to take care of other circumstances in each situation. Therefore, for the same teacher with the same class, and teaching the same lesson, there will be more than one good way to teach, based on other factors such as weather conditions and psychological factors. On the other hand, some teachers might be able to use a specific teaching approach better than other methods. Some teachers asked for detailed lessons’ plans for each subject. Those teachers are a minority in my sample. The majority asked for more freedom of using teaching methods in order to be creative in teaching science.

In other words, teachers’ comments are the opposite of the recommendations of a study made by the Educational National Committee – King Abdulaziz City for Science & Technology in 1997 prepared by Abdullah Alrasheed and others about teaching science in elementary and intermediate schools in Saudi, critiquing the previous science textbooks in intermediate stage, which is similar to the current books in this issue, for giving the
teacher the opportunity of choosing teaching methods rather than recommending specific methods.

The main concern here, based on teachers’ comments, is the fear of teachers’ evaluation and supervision methods right now in Saudi. If we change these suggestions from its theoretical shape to be in practical way, teachers may find themselves enforced by administrators and supervisors to follow the same suggested methods or be severed in evaluation.

**Science Textbooks and External Textbooks**

Teachers’ comments about science textbooks have three dimensions. The first dimension is the amount of information in science textbook that must be finished before the end of the semester. There are real problems in teaching methods in schools anywhere and most of these problems occur because teachers need to end the textbooks before the end of the year. In the current science textbooks in Saudi there are treasures of knowledge, the huge amount of information make it resources or references. Also the science textbooks prepared by the Arab Educational Bureau for Arab Gulf Countries, and suggested to replace the current science textbooks, have twice as much information, but it is not the right way to learn or teach science based on teachers comments, which is supported by new educational approach in science education, like Project 2061 and Coordinated And Thematic Science (CATS) models.

Teachers are arguing that with this amount of information, it is the teacher’s own job, and students have nothing to do in the classroom other than listening to and observing the teacher. “We are in rush to end these books before the end of the year,” said one teacher. Also the majority of teachers cannot or would not deal with students as partners in the learning process due to the lack of experience and they find excuse in the amount of
subjects to be covered. Again it is an external factor, textbooks that led teachers to choose specific ways of teaching.

The second dimension in teachers’ comments regarding science textbooks is the shape or design of the textbook. Most teachers are calling for reshaping science textbooks. The Ministry Annual Report 2001-2002 represents that among the difficulties for the Ministry to prepare exiting educational textbooks are the lack of professional experts in designing lessons, and poor resources in Ministry libraries besides not having photos and images library (pp.46-47).

All over the world, there are numbers of great educational science textbooks, following different teaching approaches. Some of these books provide lesson plans and teaching strategies, others take care of activating students in the classroom. Some educators think that these books would be helpful for their schools, so they translate it to be used in their countries, or at least suggested adopting these books for their country. From teachers’ comments about this kind of books, there are groups of teachers who argue that these books were made for other countries, environments and for other students, using materials common in publishing place, but never heard of in other places. On the other hand, some teachers think that since we cannot prepare high-quality science textbooks, we should translate one of the famous series. In the middle, the majority believes that we should adopt external textbooks and reshape them to fit in our environmental and cultural situations.

The third dimension related to science textbooks is the confusion about the two themes “science textbook” and “science curriculum,” where most teachers’ comments represent that they do not distinguish the two themes. This is clear when the teachers use the two phrases in the same sentence. In responses to the open-ended questions, most
teachers who talked about science curriculum or science textbook used the term “science
textbook” as “science curriculum.”

**Adopting External Experiences (Science Curriculum including textbooks)**

This point is a part of the previous one, but it is more general because some
participants (mainly supervisors) discussed science curriculum in general, not only
textbooks. One of the main points in open-ended questions, is the argument that
curriculum planners and policy makers need to be connected with the real field, so they
can build work and decisions based on a society’s actual situation and needs. In some
cases countries adopt or imitate theories or curriculum from other places, or accept some
philosophies from foreign philosophers. For example the concepts in education in general
that came from Germany, France to the U.S. and the opposite from the U.S to other
countries. In this case we cannot say that the concepts can be applied to the situation (the
society) unless these new views are reshaped to suit this society.

Right now in Saudi, where we are having varied efforts to develop our educational
system, some think that the country should build its own curriculum without adopting
other systems, including textbooks. A teacher said: “Every nation builds its own school
textbooks based on the uniqueness of the nation.” While others think we should take ready
notable models specifically from developing countries. Which is translated in teachers’
suggestion: “Why should we start from the beginning? We can start from where others
stopped.” Finally, there are those who thought that we need external experiences, but not
to be ready made. It needs more work to reshape this new expert to fit in our society. This
position has agreements more than the two previous positions.
For sure that decision-makers can order to set any change, but in my opinion society’s refusal or teachers’ neglects will tear down these efforts, since it is not representing their desires.

**Summary**

In this chapter, the researcher presented the results of the study. This chapter is divided into three sections: the demographical characteristics of the participants, answers of research questions, and analysis of open-ended questions.

The first section covered the biographical and demographical characteristics of the 329 science teachers and educational supervisors who participated in this study, based on: participants’ areas and teaching levels, participants’ qualifications, participants’ study majors and teaching subjects, and participants’ years of teaching experience.

The second section includes the answers of research questions from one to nine. The questions were separately answered in detail, based on teachers’ views to: the nature of scientific inquiry, the status of scientific knowledge, the nature of school science inquiry, and the status of school science knowledge, enabling factor in teaching science, and the likelihood of occurring.

In the third section, there were analysis and discussion of the three open-ended questions using qualitative method and applying words and themes coding approach. The main points in the analysis were: class size, field trips, effective teaching methods, science textbooks and external science textbooks, and adopting external experiences.

The next chapter contains summary of the study, summary of the findings, discussion, conclusion, and recommendations related to reforming science curriculum in Saudi Arabia.
Chapter VI: Summary, Discussion, Conclusion, and Recommendations

The study was conducted to investigate Saudi science teachers’ beliefs about science and science teaching in order to implement suggestions for science curriculum reform in Saudi. To accomplish the purpose of the study, the researcher presented the statement of the problem, the rationale, the methodology, and the data analysis in the previous chapters. In this chapter, the researcher summarizes the study findings and provides conclusion, discussion and recommendation for improving science curriculum reform in Saudi and for conducting future studies.

Summary

Summary of the Study

The main purpose of this study was to investigate Saudi science teachers’ beliefs about science and science teaching based on: their views of science and science teaching; the learning and learning environment; their roles as teachers; their students’ role in science class; changing ideas with regard to the science curriculum; and their views of reforming science curriculum in Saudi. The sample of the study consisted of male science teachers in Riyadh Region (Riyadh City and counties), who taught in all the Ministry of Education public school levels (elementary, intermediate and secondary), besides science educational supervisors in the same region. The data were randomly collected from 329 participants (teachers and supervisors) by utilizing a questionnaire as an instrument of the study.

The questionnaire had six sections. The first one concerns personal characteristics of the participant, including: school level, qualifications, major, teaching topic, and years of experience. Sections two, three and four addressed teacher’s beliefs about science and nature, about school science, and about teacher – student relations in the classroom. The
fifth section concerned environmental factors affecting teaching science. Finally, the objective of the sixth section was to draw teacher’s belief about the three major themes in the study: Science & Nature, Teaching Science, and Reforming Science Curriculum, using their own words in three open-ended questions.

In sections two, three and four were a total of 48 statements. Participants were asked to evaluate each statement based on the following responses: Almost Never (AN), Seldom (S), Sometimes (ST), Often (O), and Almost Always (AA), respectively. In scoring, each response is allocated 1, 2, 3, 4, or 5 points for each of the responses, respectively. Almost Always (AA) considered as complete agreement while Almost Never (AN) counted as complete disagreement. A higher score indicates a more inquiry view of the nature of school science and a lower score represents a more objective view. Statements: 6, 8, 9, 11, 14, 16, 19, 27, 28, and 41 reflect a more objectivist view and were therefore scored in reverse.

For statements (49-75) in Section 6, participants were asked to evaluate each statement based on two dimensions, Enable Belief and Likelihood Belief. First, the participant was asked to indicate his belief that the factor would enable him to be an effective teacher on a scale of strongly agree (SA) (scored 5) to strongly disagree (SD) (scored 1). Second, the participant indicated his perception of possible occurrence on a scale of very likely (scored 5) to very unlikely to occur (scored 1).

The data were analyzed using SPSS (Statistical Package for the Social Studies). Since this study is descriptive in nature, the analyses were comparable to the approach in similar studies (Chen et al., 1997; Lumpe et al., 2000), where the data are analyzed and reported in percentages, means, standard deviations, and frequencies. A scale mean score
is calculated by dividing the total scale score by the number of respondents and the number of scale items.

The responses to open-ended questions were analyzed using the quantitative method. The responses categorized in subsets using coding method based on the relationship with the study’s six dimensions: nature of science inquiry, status of science knowledge, nature of school science inquiry, status of school science knowledge, enable belief, and likelihood belief.

**Summary of the Findings**

**Section 1: Demographical Characteristics**

Participants’ characteristics analyzed in this section showed the followings:

1. The sample total was 329, consisting of 298 (90.6 %) science teachers in all levels (elementary, intermediate, and secondary), and 31 (9.4 %) science educational supervisors.

2. There were not significant differences between science teachers’ responses and science educational supervisors’ responses except in open-ended questions.

3. Although it was not a goal of this study to investigate the differences in teachers views based on qualifications, teaching levels, study majors, years of experiences, and counties, the researcher did not find a significant difference between participants’ responses based on these factors.

4. The number of participants from each county ranged from 13 (4.4 %) from Shaqra County to 150 (50.3 %) from Riyadh City.

5. Regarding the distribution of teachers based on their teaching levels, there are 74 (24.8 %) teachers teaching in elementary level, 49 (16.5 %) teaching in intermediate level, and 175 (58.7%) teaching in secondary level.
6. The distribution of participants based on qualifications showed that most science teachers have Educational Bachelor degrees in science (BEd), 208 (63.2 %), and the lowest are 5 (1.5 %) for Master in Science (MS). Other qualifications include: Master in Art (MA), 6 (1.8 %); Bachelor degrees in science (BSc), 60 (18.2 %); bachelor degrees in science plus professional training (BSc&Ed), 39 (11.9 %); and diploma in education (Dip.), 11 (3.4 %).

7. Participants’ Study majors consist of: General Science, 71(21.6 %); Biology, 105 (31.9 %); Chemistry, 78 (23.7 %); Physics, 61 (18.6 %); Geology, 6 (1.8 %); other study subjects include 8 (2.4 %) of the total.

8. Based on teaching science subjects, the highest was General Science teachers, 129 (39.2 %); the lowest was 6, (1.8 %) for Geology; while 2 (0.6 %) taught other subjects.

9. Finally, the years of experiences of the sample ranged from less than two years to more than ten years. The majority, 109 (33.1 %) had more than ten years, whereas the lowest number of participants, 55 (16.7 %), had less than two years.

Section 2: Results of the Study Questions

In this section, the results were summarized according to the study questions. Each question had from one to three domains:

Question 1: How do science teachers in Saudi Arabia view science?

The results of the first domain (teachers’ view to the nature of scientific inquiry) had an overall mean of (3.17), indicated that participants had a moderate position between inquiry view (5) and objective view (1) toward the nature of scientific inquiry, with a slight shift toward the inquiry view. Meanwhile, in the second domain (teachers’ view to the status of scientific knowledge), the notable issue was the high response representing
moderate position (ST). The objective views in Statements 11, 14, 16, and 19, and the uncertainty of the majority judgments shifted the overall mean for this domain to be 2.67 with a moderate position between the inquiry view and the objective view toward the status of scientific knowledge, with a shift toward the objective view.

Question 2: How do science teachers in Saudi view teaching and their roles as teachers?

In the first domain (factors that should be considered in teaching science for students), the overall mean was 3.96, which reflects inquiry view related to teaching science and teacher’s role in science class.

In the second domain (factors enabling teachers’ work (Enable) in relation to teaching and teachers’ role in science class), participants showed high agreements on all domain statements, with an overall mean of 1.69, which is close to the complete agreement (1.00). Whereas in the third domain (the likelihood for these factors of accruing in participant’s school), participants belief that it is likely for the mentioned factors, related to teaching and teachers’ role in science class, to occur in their schools, was measured with an overall mean of 1.69 for this domain.

Question 3: How do science teachers in Saudi view learning?

The overall mean for First Domain, the Nature of School Science Inquiry, is 3.54, which revealed shifted in participants’ positions towards inquiry view to the nature of school science inquiry. Although participants showed shift to the inquiry view toward the nature of school science inquiry, they argue in open-ended questions that the practice is different.

Participants of Second Domain, the Status of School Science Knowledge, do not have a united view or common agreement. The overall mean for the domain is 3.37, which
reflects a moderate position between the objective view and the inquiry view toward the status of school science knowledge, with a slight shift toward the inquiry view.

Question 4: What are the teachers' beliefs about the physical learning environment and laboratory activities?

Regarding the results of the First Domain: Factors related to physical learning environment and laboratory activities (Enable), the majority of participants believe that the physical learning environment and laboratory activities factors mentioned in this domain would enable them in teaching science. The overall mean for the domain statements is 1.46, and the lowest mean is 1.35, while the highest mean is 1.68. In this Enable domains the low means gives strong agreement.

For the Second Domain, which related to the likelihood for these factors to occur in schools, the overall mean for participants was 2.39. This mean value is close to the uncertainty of occurring (2.5).

Question 5: What are the teachers' beliefs about their students' role in science class?

This question had one domain, which is the nature of students' role in science class. The overall mean for the domain is 3.76, which represents a inquiry view toward the role of the student in science class, with a shift toward the moderate level between objective view and inquiry view.

Question 6: How aware are the science teachers of the science education research literature on curriculum and teaching?

For (Enable) Domain, the vast majority, 307 (93.31 %), strongly agrees (SA), or agree (A), with the statement, which said that professional staff development on teaching, workshops, conferences, etc. would enable their work. The statement has a mean of 1.52, which gives high agreement. Regarding the regional and national guidelines for science
education (standards and goals), 97 (29.48 %) responses strongly agreed (SA), and 160 (48.63 %) agreed (A), giving a total of 257 (78.11 %) for strong agreement and agreement that this factor would enable teachers’ work.

In relation to the Likelihood Domain, 194 (58.97 %) believed that professional staff development is likely to occur in their schools, but due to the high responses of the uncertainty position, neither (N), which is 51 (15.50 %), the mean of the statement is 2.59, which could be considered as an uncertain position. While for national guidelines for science education the mean was 2.39, which reflected a shift toward unlikelihood of occurring.

Question 7: How are the science teachers' ideas changing with regard to the science curriculum and the teaching of science?

The notable majority of domain statements’ responses showed moderate judgments (ST) (uncertainty), and moderate agreement. The overall mean for domain statements, which is 3.09, gives a moderate position between inquiry and objective views in regard to the change in science curriculum and its relation to the society.

Question 8: What elements need to be changed in science curriculum?

In the First Domain, which asked whether elements need to be changed in science curriculum to enable teachers to effectively teach science, the distinguished strong agreement and agreement was related to an increase in students’ academic abilities, 286 (86.93 %), and the statement also had the lowest strong disagreement (SD), 1 (0.30 %), and the lowest disagreement (D), 7 (2.13 %). The notable disagreement related to (Extended class period length) where 135 (41.03 %) disagreed or strongly disagreed. Participants’ dilemma of having a position in judging most domain statements shifted the overall mean for this domain to be 2.34, which is moderate position.
For the Second Domain, the likelihood of occurring, the overall mean for this domain, which is 3.09, reveals that participants’ believe that the factors discussed in this domain are unlikely to occur in their schools.

**Question 9: What are the missing points of the science curriculum in Saudi?**

For the First Domain “The missing points of the science curriculum in Saudi that Would Enable Teachers’ Work”, the strong agreement (SA) and the agreement (A) positions were high for all domain statements. The overall mean for this domain was 1.74, which could be considered as agreement (A) (2.00) to strong agreement (SA) (1.00), that the missing points of the science curriculum in Saudi mentioned in this domain would enable science teachers’ work.

For the Second Domain “The Likelihood of Occurring for the Missing Points of the Science Curriculum in Saudi”, the overall mean for this domain, which is 2.74, has a moderate position with a slight shift toward the likelihood of occurring. The uncertainty (neither) was notable in all domain statements.

**Section 3: Analysis and Discussion of Open-Ended Questions**

The three open-ended questions are:

- Would you like to add any comments, notes, or suggestions about the nature of science?
- Would you like to add any comments, notes, or suggestions about science teaching?
- Would you like to add any comments, notes, or suggestions about developing or reforming science curriculum?

The main points in participants’ responses to the three questions were:

**Class Size**

In Saudi schools, large numbers of students are distributed in few classes due to the lack of more classrooms in school buildings. The Ministry of Education’s official
percentage for students’ density, which is 22.2 students per class for the whole K 1-12 levels, do not represent the fact that some rural schools have from 1–10 students, while some city schools have 38-45 students in a 5 X 8 m (around 15 X 24 feet) room. In cities’ schools the average of students’ number in class is 37.5 students, while for rural schools, the average is 26.5 students. The preferred number of students was from 20 to 25 in cities’ schools, and from 15 to 20 for rural schools.

The main effects of large classes on teaching science are:

1. It is impossible for all students to engage in discussions to share ideas and make clear positions in science topics.

2. It is difficult for teachers to follow students’ improvements (assessment).

3. Students’ cannot use lab equipment easily due to the limited numbers of expensive equipment.

4. It will be difficult or impossible to have teamwork as a way of learning in huge classes (cooperative learning).

5. In huge classes, lecture is the only effective way of teaching.

6. It is impossible for teachers to take care of students’ papers and projects in big classes.

7. There is no way to take outdoors activities such as field trips because of the need of more cars to carry students.

8. The only way to evaluate students in big classes is exams.

Field Trips

Field trips are related to a class’s size, and teachers mentioned the two points in the same time. Besides that teachers argue that they are facing problems from schools
principals if they want to do this kind of activities because official documents for science curriculum did not imply scientific and filed trips as a part of the curriculum.

Effective Teaching Methods

A minority of teachers asked for detailed lesson plans for each subject, while the majority asked for more freedom of using teaching methods in order to be creative in teaching science. Teachers’ refusal of adding lesson plans to textbooks is based on their fear of the evaluation and supervision methods right now in Saudi. They expected to be enforced by administrators and supervisors to follow the same suggested methods or be severed in evaluation.

Science Textbooks and External Science Textbooks

Regarding science textbooks, participants’ comments had three dimensions: the huge amount of information in science textbook that must be finished before the end of the semester, the unexciting shape or design of the textbook, and the confusion about the two themes “science textbook” and “science curriculum,” where most teachers’ comments represent that they do not distinguish the two themes.

In relation to adopting external science textbooks for Saudi schools, there were three positions: some teachers argue that these books were made for other countries, environments and for other students and shouldn’t be adopted; others thought that since we cannot prepare high quality science textbooks, we should translate one of the famous series; and the majority believed that we should adopt external textbooks and reshape it to fit in our environmental and cultural situations.

Adopting External Experiences (Science Curriculum including textbooks)

Some participants discussed the science curriculum in general, not only textbooks. There were three positions. Some participants think that the country should
build its own curriculum without adopting other systems, including textbooks. Others think we should take ready notable models specifically from developing countries. Finally, there are those who thought that we need external experiences, but not to be ready-made. It needs more work to reshape this new expert to fit in our society.

**Discussion**

One of the major aims of this study, as presented in the subtitle of the study, is investigating science education reform perspectives. The dilemma of establishing curriculum theory is finding criteria that have agreement from the society, which can be used as basics of the curriculum theory (Beauchamp, 1981). As we know, it is not easy to find these criteria in multi-cultural societies. In other words, if we compare the situation in multi-cultural countries (such as the U.S, Canada, and Australia), or multi-lingual countries (such as Switzerland and Canada), or complex countries (such as India), if we compare it with countries that lack this diversity, (such as Saudi Arabia) which have the same ethnic and the same backgrounds such as language, history, religion, and spiritual aspects, it would be easier for countries like Saudi to establish curriculum theory, at least from the theoretical hypothesis. In my opinion, the curriculum problem in Saudi is not establishing curriculum theory or setting aims, since the Educational Policy in Saudi has established it. In this case if I apply Newman’s (1982) concerns regarding “utility in education” and his views of aims, I would pass the question: What is the aim of education? To ask: In Saudi Arabia, since we don’t have a problem of the agreement of the kind of the aim itself, how can we reach this aim? And: How can we move the answer from papers to be real strategy in real life and real school?

As mentioned in Chapter II about the circumstances related to the establishment of the educational system in Saudi, the effect of old views and approaches in education
adopted from Egyptian and Syrian curricula still exist in Saudi education today. One of the major features of that era was the adoption of only one definition for educational and scientific terms and considering the rest as false, if it is not the official term or does not match what stated is in school textbook.

In Saudi education today, one of the main problems is reaching agreement on definitions. Participants argued about the problems of not having specific definitions for educational terms, such as: goals, aims, reform, development, and other terms. Generally speaking, in education we have a dilemma in reaching agreement on definitions. Educators to describe specific approaches in education use development, transformation, reforming, shaping, reshaping, and other concepts. The problem accrues when people use the same definition to describe different things. In Saudi educators are making more effort to prove their position in other issues like: The misconceptions regarding goals classification. It might be agreement in English to use “aim” to describe the broad goal and “goal” to mention the general goals, and finally using “objectives” for subject goals. But in Arabic the word “ghaiyah” means “aim” in English and “hadaf” means “goal,” and since the Educational Policy in Saudi set one Aim for education, so educators are dealing with goals, which is the other word. We used to deal with it as “General goals,” “long term goals or far goals,” and “short term goals or close goals.” The problem comes when we try to establish limits for general, short, and long. Is general for the whole K 1-12 or is it for a stage or even for class? Does long mean at the end of the year or the end of the unit? This confusion led some educators to establish levels within generality, long, and short. Salem (1997) suggests the use of five levels of aims and goals: Aims, General Educational Goals, General Instructional Objectives, Special Instructional Objectives, More Specific Instructional Objectives (pp. 18-29). For this reason, the Curriculum
Document (1999) prepared by the Curriculum Documents Arbitration Committee in the Ministry of Education spent the five page documents specifying and classifying goals in education.

More to add, there is a problem in accepting or refusing scientific information from resources other than student textbooks, which is also an effect of the factors mentioned in Chapter II about the establishment of Saudi educational system, and in Chapter III about science and knowledge from the Islamic view.

From teachers’ comments and from my previous experiences in the Ministry of Education and teachers’ preparation programs, this kind of discussion leads to spending more time on reaching agreements more than establishing the whole vision of the project that needs to be developed.

The other important issue related to reforming science education in Saudi is how people view the necessity of the change in education, and what they think about the rush changes in Saudi educational system. Among the upset arguments in participants’ responses in open-ended questions, were the critiques of rush changes and projects in Saudi education. The process of educational reforms today still works in the same way as it did in the eras mentioned in Chapter II. Ample critiques had been made about the haste in curriculum development projects, and the rush in quieting or nationalizing a project before evaluating the results. This critique is visible in studies like: Educational System in the Kingdom of Saudi Arabia by Alssenbl et al. (1987), Education in Saudi Arabia: A model with difference, by Alzaid (1990), Alsalloom’s book “History of Educational Movement in the Kingdom of Saudi Arabia” (1991), “Education and Development: Evaluating the Accomplishments and Challenges’ Facing in Arab Gulf Countries 1985 – 1995” a study prepared by Aljallal (1995), and even a paper from the General Directory
for Preparing & Developing Curriculum in the Ministry of Education named Curriculum & Instruction in the Kingdom of Saudi Arabia: Historical Critical Study, presented in the first Educational Meeting about secondary education in Saudi in 1998, and other studies. From a logical point of view, we knew that if the incomes were poor, the outcomes would be poor too. We need to review our thoughts about curriculum development process, keeping in mind science teachers’ abilities to involve in this act. That has meant the necessity of reviewing science teachers’ educational programs in universities and teachers’ colleges for future teachers, besides the professional staff development for current teachers (Bin Salamah, 2001; Musharraf, 2000).

In regarding training sessions, the article 198 in Educational Policy (1980) stated that:

“After setting up a certain program, an information session is called to elaborate the program’s principles and landmarks, project its objectives and define the means of its execution. Persons who prepared the program shall participate in this session together with inspectors, outstanding teachers, and writers of textbooks and teachers’ book.” (p.36)

But for financial reasons the Ministry does not do these types of training, rather they may prepare one training session in Riyadh City only and ask local educational directories to do similar sessions. In the last case teachers and most educational supervisors do not have the chance to meet authors. Again, it is the effect of the era where the Ministry of Education needs any kind of teachers with any kind of qualifications and abilities. Recently, the Teachers’ Basic Competence Assessment “Test” was introduced to the Saudi educational system. The Minister of Education approved the first study in 1998 (Almarefah 95, 2003, p. 39). The outlines of this assessment are similar to teachers’ assessments in the U.S. Although the project aims to apply this evaluation procedure on
all teachers, the Ministry decided to start with new teachers only in 2005. Hopefully this project would help in assessing teachers as well as reducing the use of students’ tests to evaluate teachers, “Ministries of education in the Arab world stick with exams because they see it as the valid mean to observe teachers’ work” (Alnabelsy, 1988, p. 102).

As presented in Chapter III about curriculum reform in Saudi, there was not a thorough view of the reform, or a comprehensive view of reform projects. Previous curriculum reform in Saudi was mainly focusing on textbooks and study plans, except the reform in secondary school, which also was not a stable reform. Participants of the study, except individuals, do not see the change as a whole project, rather they still see it as introducing new textbooks.

From the answers of question number 78, it is clear that teachers are looking for the change, with some of them absolutely refusing any kind of changes. Among this minority an intermediate school science teacher suggested that “we have good science textbooks, so why we need to talk about changing it”; another one from the same stage argued that “our previous books were more than good, return the old books…education should be stable without making more changes.” On the opposite side, an elementary school teacher assumed that “we need new ‘curriculum’ every two years,” another elementary teacher asked for “doing like other countries…changing curriculum is continuing issue.” Also, there was a neutral position asking for the change if it is required based on “scientific and society changes”.

It is human habit, but not for all people. From ancient cultures until now, most people have been frightened of changing their life’s habits. The fear barred people to think about changing their life. The fear of unknown, the fear of going to the worst, the fear of being in an inappropriate situation, even the fear of thinking of the change itself, all of
these kinds of fears make people keep their life as it was yesterday. The problem comes when people’s fears forced on others ignored their dignity and essential rights, especially if they are children. On the other hand, in any culture and at any time there are few people looking for something different, some kind of change. The change only for the sake of change may be the reason for some of them because they are bored by the repetition of life, while others are looking for improving their current situation by trying other ways and solutions. Saudi science teachers’ responses, as presented in the analysis of the study, are divided in three groups regarding the change: complete refusal of the change, fully acceptance of a change, and moderate change. Most teachers with the fully acceptance, see change in education as a trial-and-error procedure.

Regarding teachers’ abilities to carry the change, some teachers were willing to make theoretical change, comparing the current school situation with the hope, without paying attention to the ability to get this hope or not, like the lovely game for candidates before elections. Indeed teachers need to be ideologically and practically mature enough to imagine and engage in a curriculum development process. The misconceptions may appear as imagining that the change is too easy, so any one can do it; on the other hand some teachers think that it is impossible to make the change, or at least it is impossible for them to engage in changing the process, only a few supervisors suggested the need for guidelines of the educational reform (similar to Benchmarks).

As described in Chapter III about nature, science and knowledge from the Islamic view, Saudi science teachers strongly believe in this view of science and knowledge. In their views of changing science textbooks, some teachers want school science books similar to Maurice Bucaille’s book (2002). This French non-Muslim physician has interest in correlating certain scientific “facts” with the Qur’anic verses. He learned Arabic and
studied the Qur’an in its original language. Since the publication of the English translation of his book, *La Bible, le Coran et la Science* (1976) as *The Bible, the Qur’an and Science* (1978), Bucaille has, however, become the pioneer of an unfortunate trend in modern times and several studies have been devoted to “prove” the divine origin of the Qur’an on the basis that the Qur’an contains certain scientific facts which were unknown to humanity at the time of its revelation. This book and similar studies were the pillars of some teachers’ views about science curriculum. The Islamization of knowledge is now very popular, and is being discussed in educational conferences throughout the Islamic world. Some teachers in Saudi are calling for Islamization of science textbooks.

Some teachers respond to the three open-ended questions (76, 77, 78 in the questionnaire) emphasizing the necessity of “cleaning” our intermediate science textbooks from “what is against the prophet’s sayings” without giving any examples. Another response asked for “providing versus from Qur’an and the prophet’s sayings in each lesson”. Islamic scholars do not deal with Qur’an as a “book of science,” rather they see it as a “book of signs” but also they do not believe that there is any conflict between the two statements (Abd-Allah, 2004). Science teachers are under the fear of ideology similar to Bertrand Russell, the famous British philosopher, who said in a lecture that “modern science has nothing to do with the discovery of the nature of reality” (Naser, 2003), so when they ask for implementing more ties with Islamic view of science, they want to make sure that science is coming with Islamic view.

Most of the problems and confusions in this issue have arisen from the misuse of objective terminology through a kind of corruption between secular and secularization of language. For example, Jamal-uddin Afghani’s (d. 1897) response to Renan’s polemic against Islam was based on the claim that Islam and science is incompatible (Stenberg,
1996). Because modern Western scientific worldview, which has created an illusion of reality apart from Reality, grew out of the Age of Enlightenment, Reformation and the Scientific Revolution of the 17th century showing science without spiritual aspects, modern science has created a belief system in which there is no room for the Divine. This belief system comes with its own values and ethics in competition with the religious worldview.

“...this discourse is not merely a philosophical leisure for some Muslim scholars is clear from the fact that the thrust of modern science is not restricted to the technologically imposed images and sounds brought to millions of Muslim homes but its myriad forms go much deeper and penetrate the very fabric of the belief system on which Islam is based: Modern science not only claims to provide answers to the physical phenomena it is also claiming to provide ‘answers’ to such fundamental doctrines as the origin and destiny of the universe and human life” (Iqbal, 1997).

For many religious observers, modern society is virtually immoral. Under the rubric of libertarianism, utilitarianism, and capitalism, people have been encouraged to follow their own desires and pursue their own selfish goals to life in light of the self-referential and contradictory nature of the statement: “All truth is relative,” and the absolute system, built on certainty and determinable facts. On the other hand, many religions, especially Islam, encourage people to control their desires, in order to be God-fearing and pious, and to accept Islam as the true absolute system and dealing with universal, natural, value aspects, and reject all other ideologies (Banaei & Haque, 1995).

The previous view of Banaei and Haque represents some people’s concern toward using ideological and scientific approach in schools in the Islamic world. Fancy (2004) argues that since Muslims accept Islam as one, true, absolute system, the science conducted under that system would also necessarily retain some of that flavor, but we
should not be attached with the foundational problem proving the validity of Islam from ground zero, and instead, move towards pursuing scientific inquiries within an Islamic moral and spiritual framework. Most study participants lack this view. Some participants explained that they refuse the adoption of external experiences due to the “secularism of the experience origin.”

Conclusion

1. Before establishing the educational development, we need to keep in mind that “the fast change could erupt some people in the society; this situation may lead to chaos” (UNISCO I, 1991, p. 24). Teachers argued that they do not understand the aims of educational development projects in Saudi.

2. The findings of the study imply that such an educational reform in science education must simultaneously address all the components of an educational system and the concept of systemic reform.

3. Teachers’ capacity to guide students towards the new aims in any reform must be supported by the amendment of teachers’ training programs, the provision of resource materials (e.g., teaching materials, textbooks, research findings, etc.), the introduction of appropriate assessment projects, and new administrative arrangements.

4. Although Saudi science teachers presented inquiry views about science, nature, and teaching science, they do not practice these views in science class.

5. The chaos in educational reform projects in the Ministry of Education, and the confusions in study participants’ views about science and teaching, and belief and practice present the need for a standards-based learning system and establishing Benchmarks for science in Saudi education.
6. One of the major problems in Saudi education is the lack of conceptual framework (Alghanem, 1999). The Ministry of Education needs to apply basic concepts on educational reform such as what the Project 2061 stated “the universe is a unified system and knowledge gained from studying one part of it can often be applied to other part” (Benchmarks, 1993, p. 5).

7. The findings primarily infer there is a need for science educational reform to develop an evidence-based policy and practice mode. Thus, attainment targets should be addressed, including: understanding science & technology and the nature of science, the process skills, thinking skills, scientific attitudes, design & manufacture of science textbooks, technological development, and the application of science.

8. Educators must keep in mind that understanding the curriculum is the first step to develop a curriculum (Pinar et. al., 2000). For Saudi science teachers, there is confusion in understanding the curriculum.

Recommendations

Implications of the study findings for practice

First of all, I would like to remind all those who have something to do with educating children, including teachers, parents, curriculum developers, and policy makers with this statement:

“When people fail to teach a child how to read and write they doom that child to difficulty in finding a job, in understanding vital information, the child will become a liability rather than an asset to society. In the same way, when people fail to teach a child the kind of preparation and skills needed for technological and scientific development, they are not using school to their fullest capacity” (Ozmon & Craver, 1999, p.77).
I. General Comments to the Ministry of Education and teachers

I would encourage the Ministry of Education and science teachers to keep in mind these aspects all the time during the reform of education and during the teaching of science:

1. Dealing with students’ intellectual and physical abilities in a fair way; this means not ignoring disabled students, students with learning disorders, students with low ability in memorization, or letting them feel that the lesson is for someone else. Either in preparing the subject in textbooks or in classroom, by addressing science for all students not only for gifted student or a student who has good ability in memorization. In other words, keeping in mind that students do not learn in the same way.

2. As the uniqueness of the individual appears in phenomenology, we should pay more efforts to help the student to get his own voice, view, and feeling or in short term to find his identity.

II. Recommendations to the Ministry of Education

I would encourage the Ministry of Education in Saudi to apply these methods to activate curriculum development, by reshaping the role of educational partners: students, teachers, supervisors, and parents:

1. Curriculum development in the Ministry of Education needs to set Benchmarks. “Benchmarks (are) different from a curriculum, a curriculum framework, a curriculum design, or a plan for a curriculum” (Benchmarks summary, p. 3). Benchmarks help to avoid language and terms confusions besides showing the path for the work for all people.

2. Using meetings and interviews with teachers, parents and students, the Ministry of Education should examine the current structure of school curriculum today in order to
examine the values of the people involved, and how those people see their current role and what they want their role to be, besides what the Ministry wants from them.

3. In order to establish broad goals for the curriculum development plan and how curriculum should look when completed, all participants should feel that these are their own goals and plan, not as something coming from anywhere or anyone else. There is no problem to spend more time on this issue since we can come to agreement from all people engage in our educational path.

4. In order to provide students and teachers with a mechanism for self-evaluation I would suggest that everyone should evaluate his process by comparing his situation with his previous goals. Written reflections and peer-evaluation are useful to do that. Also, we may use parents and community evaluation.

5. To determine teachers’ and students’ perspectives on justice and whether they feel that they are being treated equally and given equal opportunities I encourage everyone to discover his own abilities and set his own view of his role including duties and rights. This view needs to be valid, meaning we need to help people to examine their real position, not the position that others suggested for them, nor hypothetical selfish view.

6. In evaluating our work, I would ask to follow students throughout school into adulthood to see what differences occur and if they are being offered equal opportunities regardless of class, status, and/or wealth. Also, I want students to evaluate themselves by comparing their previous goals and their followed carriers.

7. One of the greatest challenges in students’ school life is exam. Whatever we do to make it acceptable by students, it instills hard feelings for them, chaos situation of challenge, fear, and depression. We need to apply new evaluation methods to measure all aspects of students’ learning process, including (and not limited to) work projects,
group participation, student’s applied of scientific approaches and means in his home and community. It would be a pioneer idea if we enhance community evaluation for students based on their participation in their living areas. This would help teachers as well to spend more time on creating creative teaching methods more than preparing students for exams.

8. The administration of the educational system should change, establishing a teaching materials database, Inspiring a broader range of content in textbooks, developing multiple forms of assessments, and organizing the comprehensive evaluation of the achievement of all these changes.

9. From teachers’ comments on open-ended questions, I would like the Ministry to activate and reshape the role of educational supervisors by applying a more-Freirian approach in their work to allow the change to come from the four partners, supervisors, teachers, students and parents. This is in order to achieve some kind of Newman’s unity frame of work in education. Keeping in mind that each of the following steps has two ways, giving and receiving, teachers want:

- Supervisors to understand teachers first, not to be coming to change them, or telling them what to do.

- Supervisors and teachers to work together to understand students.

- Parents to understand their children and teachers.

- The four educational pillars “supervisors, teachers, students and parents” to work together as a horizontal net not as a hierarchy structure.
III. Recommendations to science teachers and schools

1. In discussing educational problems, I would encourage teachers, students and parents to deal with it as a group concern, not as individual issues or the Ministry’s own work. Therefore, everyone is expecting to work to solve problems, not blaming others.

2. Teachers should see their roles to be curriculum designers and classroom facilitators, working collaboratively with each other, instead of just being content transmitters working alone.

3. Students should see themselves as active participants in the educational process, not just as passive accepters.

4. The pedagogy of teacher training programs should change, building their capacity to evaluate classroom events, encouraging them to do action research.

5. Each school should provide ongoing workshops for teachers, so they can explore alternative teaching methods and student evaluation procedures. These workshops need to be accurate and based on teachers’ needs. It would be more effective if a group of three to six schools work together as a team.

6. Before making educational workshops for teachers, they must be evaluated in order to know the need for every one. Then they should be arranged in groups based on their needs and backgrounds (The workshop for any group must consider the group needs) (Hamdan, 1992, p 115).

7. Responding to teachers’ views about their lack of chances to be creative in teaching methods, I would ask school principals to allow teachers to have more freedom of using new teaching methods.
Implications of future studies related to the study’s field

Due to the lack of supporting studies available in Saudi Arabia relates to this study, further research would have to be done to provide conclusive vision of the science education reform. The following studies are suggested,

- Science education in urban schools vs. rural schools: Case studies of teacher beliefs and classroom practices.
- Teachers' beliefs about using educational technology in the science classroom.
- Systemic reform in science education: Constructing scientific knowledge in the classroom.
- Teacher beliefs regarding the implementation of constructivism in science class.
- Teacher personal practical theories and their influence upon teacher curricular and instructional actions.
- Using qualitative research to develop causal explanations for transforming ideas for teaching and learning science in Saudi.
- Developing classroom process data for the improvement of teaching science.
- From intentions to actions: Relationship between teacher beliefs and science education reform.
- A teacher professional development framework guided by reform policies, teachers' needs, and research.
- Teachers' beliefs about accommodating students' learning styles in science classes.
- Conducting benchmarks for science literacy in Saudi: national framework.
- Evaluation of the preparation of teachers in science: Assessment of preservice teachers' attitudes and beliefs.
• Research on instructional strategies for teaching science
• Relationship between science knowledge levels and beliefs toward science instruction.
• The enhancement function of staff development and a teacher’s efficiency.
• Teachers' beliefs about science, technology, and society reforms.
• Study of preservice and inservice teachers' beliefs about effective teaching.
• Teachers' beliefs about thematic units in science.
• Teachers' beliefs and intentions regarding the implementation of science education reform.
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(Arabic text)

Appendixes A

Letters to Participants
Cover Letter:

Dear science teacher/ science educational supervisor:

This questionnaire is an instrument for doctoral thesis in curriculum & instruction titled:

Investigating Science Teachers’ Beliefs about Science and Science Teaching:
Struggles in Implementing Science Education Reform in Saudi

This questionnaire was developed to find out how teachers think about science and science teaching. It is not meant to evaluate you as a teacher, I need only your opinions about science.

Please remember that:

- Your participation is entirely voluntary.
- Your refusal to participate will not be revealed by the procedures of the study.
- You may refuse to respond to any question in the questionnaire.
- Your responses or lack thereof, will be kept confidential.
- Your questionnaire and transcripts of your questionnaire will not be labeled with your name or your school (please don’t write your name or the name of your school).
- Only the researcher of the study and his academic advisor – and his committee if needed - will have access to your questionnaire.
- Participation will not affect academic or career status.
- Questionnaire should take between 20 minutes and 40 minutes to conduct.
- You have the right to quit at any time.
- All aspects of the data collection and analysis will be kept anonymous.
- This information will only be used for research purposes.
- You may request a copy of your questionnaire, if you want.

If you have any concern or comments or questions, you may contact my academic supervisor at Educational Theory & Practice Department, WVU:

Dr. Patricia A. Obenauf
Postal Address: 604P Allen Hall
P.O. Box 6122
Morgantown, WV, 26506
Phone: 304-293-3442x1325
Email: pobenauf@wvu.edu

Thanks in advance for your cooperation.

Yours,
Saleh AL-Abdulkareem
Dear science teacher/science educational supervisor:

This questionnaire was developed to find out how teachers think about science and science teaching. It is not meant to evaluate you as a teacher, I need only your opinions about science.

With this questionnaire I would like to find out two things from you as a teacher/supervisor:
1. What your believes about science and science teaching is about;
2. How we use these views to construct suggestions for science curriculum reform in Saudi.

This questionnaire is an instrument for doctoral thesis in curriculum & instruction titled:
Investigating Science Teachers Beliefs about Science and Science Teaching: Struggles in Implementing Science Education Reform in Saudi

General and important notes:

1) You may find some strange phrases or words in this questionnaire; I decided to use these phrases because it is common phrases in such topics all around the world.
2) The word (nature) in this questionnaire is used to refer to the world around us (creatures = live bodies + solid bodies), and it is not against the idea of creation or the existence of the creator.
3) I decided to use the phrase (scientific knowledge) instead of (scientific information or facts), because the first one is the common phrase. If you think that you didn't understand the question with (scientific knowledge) phrase, change the phrase to be (scientific information or facts) to answer the question.
4) Remember that it is not necessary to have only one right answer for the same question. Every one could justify his answer. I need your opinion.

This information will only be used for research purposes and will be kept confidence. Thanks in advance for your cooperation.

Yours,
Saleh AL-Abdulkareem
Appendixes B

Research Questionnaire
Questionnaire

Investigating Saudi Science Teachers' Beliefs about Science and Science Teaching

This questionnaire is an instrument for doctoral thesis titled:

Investigating Science Teachers’ Beliefs about Science and Science Teaching:
Struggles in Implementing Science Education Reform in Saudi Arabia

Submitted as partial fulfillment of the requirements
for the degree of Doctorate in Education

By:
Saleh AL-Abdulkareem
B.A King Saud University, 1991
M.A West Virginia University, 2001
College of Human Resources & Education
Department of Educational Theory and Practice
West Virginia University, 2003
I would appreciate it if you would provide me with some personal information first.

**First: Personal characteristics**

*(For supervisors: the information describes the last year in teaching)*

- What is the name of your district? (…………………………………………)
- What is the level of your school? (Circle one or more)
  - Elementary
  - Intermediate
  - Secondary (High)
- What kind of qualifications do you have? (Check one)
  - BEd (Bachelor of Education)
  - BSc + professional training (Bachelor of Education and Education Diploma)
  - BSc (Bachelor of Science)
  - MA (Master of Education)
  - MS (Master of Science)
  - Other, namely (…………………………………………)
- What Science major do you have? (Check one)
  - General science
  - Biology
  - Chemistry
  - Geology
  - Physics
  - Other, namely (…………………………………………)
- What Science topic do you teach? (Check one)
  - General science
  - Biology
  - Chemistry
  - Geology
  - Physics
  - Other, namely (…………………………………………)
- How many years of teaching experience do you have? (Check one)
  - Less than 2 years
  - 2 to 5 years
  - 5 to 10 years
  - More than 10 years
- Are you a supervisor / previous supervisor in science teaching / science curriculum fields:
  - Current supervisor (Specify your work)
  - Previous supervisor (Specify your previous work in supervision)
### The questionnaire

**Second:**

#### Your Views about What Occurs in Science

Please indicate how often, in your opinion, each practice occurs in science. (Your views about the nature of science) (Check the appropriate box)

<table>
<thead>
<tr>
<th>#</th>
<th>Process of Scientific Inquiry</th>
<th>Almost Never</th>
<th>Seldom</th>
<th>Sometimes</th>
<th>Often</th>
<th>Almost Always</th>
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<tbody>
<tr>
<td>1</td>
<td>Scientific observations depend on what scientists set out to find.</td>
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<td>2</td>
<td>Scientific inquiry involves challenging other scientists’ ideas.</td>
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<td>3</td>
<td>Scientific observations are affected by scientists’ values and beliefs.</td>
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<td>4</td>
<td>Scientific inquiry involves thinking critically about one’s existing knowledge.</td>
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<td>5</td>
<td>Intuition plays a role in scientific inquiry.</td>
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<td>6</td>
<td>When making observations, scientists eliminate their beliefs and values.</td>
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<td>7</td>
<td>Scientific observations are guided by theories.</td>
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<td>8</td>
<td>Scientific inquiry starts with observations of nature.</td>
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<td>9</td>
<td>Scientific investigation follows the scientific method.</td>
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<td>10</td>
<td>Scientific ideas come from both scientific and non-scientific sources.</td>
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<table>
<thead>
<tr>
<th>#</th>
<th>Certainty of Scientific Knowledge</th>
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<tr>
<td>11</td>
<td>Scientific knowledge gives a true account of the natural world.</td>
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<td>12</td>
<td>Scientific knowledge is tentative.</td>
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<td>13</td>
<td>Scientific knowledge is relative to the social context in which it is generated.</td>
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<td>14</td>
<td>Scientific knowledge can be proven.</td>
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<td>15</td>
<td>The evaluation of scientific knowledge varies with changes in situations.</td>
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<td>16</td>
<td>The accuracy of current scientific knowledge is beyond question.</td>
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<td>17</td>
<td>Currently accepted scientific knowledge will be modified in the future.</td>
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<td>18</td>
<td>Scientific knowledge is influenced by cultural and social attitudes.</td>
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<td>19</td>
<td>Scientific knowledge is free of human perspectives.</td>
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<td>20</td>
<td>Scientific knowledge is influenced by myths.</td>
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</table>
Third:

Your Views about What Should Occur In School Science

Please indicate how often, in your opinion, each practice should occur in school science.
(Check the appropriate box)

<table>
<thead>
<tr>
<th>#</th>
<th>Process of School Science Inquiry</th>
<th>Almost Never</th>
<th>Seldom</th>
<th>Sometimes</th>
<th>Often</th>
<th>Almost Always</th>
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<tbody>
<tr>
<td>21</td>
<td>In science classes, investigations should enable students to explore their own ideas.</td>
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<td>22</td>
<td>In science classes, students should work collaboratively.</td>
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<td>In science classes, students should discuss ideas with others.</td>
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<td>24</td>
<td>In science classes, students should think critically.</td>
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<td>25</td>
<td>In science classes, students should explore different methods of investigation.</td>
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<td>26</td>
<td>Students should view science as a problem-solving exercise.</td>
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<td>27</td>
<td>In science classes, inquiry learning should start with observation.</td>
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<td>28</td>
<td>In science classes, students should apply the scientific method.</td>
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<td>29</td>
<td>Students should enjoy themselves during science experiments.</td>
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<td>30</td>
<td>Students should be taught that there is a distinction between theory and observation.</td>
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<td>31</td>
<td>In science classes, students should consider ethical issues related to scientific investigation.</td>
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<table>
<thead>
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<th>#</th>
<th>Certainty of School Science Knowledge</th>
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<th>Seldom</th>
<th>Sometimes</th>
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<th>Almost Always</th>
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<tbody>
<tr>
<td>32</td>
<td>In school science, students should be critical of accepted theories.</td>
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<tr>
<td>33</td>
<td>In school science, students should view scientific knowledge as tentative.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>34</td>
<td>In school science, student understanding should be influenced by their existing knowledge.</td>
<td></td>
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</tr>
<tr>
<td>35</td>
<td>In school science, students should examine the history of accepted scientific knowledge.</td>
<td></td>
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</tr>
<tr>
<td>36</td>
<td>In school science, students should learn that more than one theory can account for a given set of data.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>In school science, students should learn about competing theories.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>38</td>
<td>In school science, students should be taught that accepted scientific knowledge will be modified in the future.</td>
<td></td>
<td></td>
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<tr>
<td>39</td>
<td>In school science, students should examine how society influences what counts as scientific knowledge.</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
### Certainty of School Science Knowledge

<table>
<thead>
<tr>
<th>#</th>
<th>Process of Students Role in Science Class</th>
<th>Almost</th>
<th>Seldom</th>
<th>Sometimes</th>
<th>Often</th>
<th>Almost</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>In school science, students should consider social issues related to accepted scientific knowledge.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>41</td>
<td>In school science, students should be taught that scientific knowledge is objective and therefore free of human values.</td>
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</tr>
</tbody>
</table>

### Forth:

**Your Views about Students Role in Science Class**

Please indicate how often, in your opinion, each practice should occur in science class. (Check the appropriate box)

<table>
<thead>
<tr>
<th>#</th>
<th>Process of Students Role in Science Class</th>
<th>Almost</th>
<th>Seldom</th>
<th>Sometimes</th>
<th>Often</th>
<th>Almost</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>It is OK for my student to ask me &quot;why do I have to learn this?&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>It is OK for my student to question the way he is being taught.</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>44</td>
<td>It is OK for my student to complain about activities that are confusing.</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>45</td>
<td>It is OK for my student to express their opinion.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>46</td>
<td>It is OK for my student to speak up for their rights.</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>47</td>
<td>Student should help the teacher to plan what they are going to learn.</td>
<td></td>
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</tr>
<tr>
<td>48</td>
<td>Student should help the teacher to decide which activities are best for them.</td>
<td></td>
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</tr>
</tbody>
</table>

### Fifth:

**Environmental Factors Effecting Teaching Science**

(Circle the appropriate number in each column)

<table>
<thead>
<tr>
<th>#</th>
<th>Environmental Factor</th>
<th>Column 1</th>
<th>Column 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>Professional staff development on teaching (workshops, conferences, etc.)</td>
<td>SA A UN D SD</td>
<td>VL SL N SU VU</td>
</tr>
<tr>
<td>50</td>
<td>Regional and national guidelines for science education (standards and goals)</td>
<td>SA A UN D SD</td>
<td>VL SL N SU VU</td>
</tr>
<tr>
<td>51</td>
<td>Support from other teachers (coaching, advice, mentoring, modeling, informal discussions, etc.)</td>
<td>SA A UN D SD</td>
<td>VL SL N SU VU</td>
</tr>
<tr>
<td>#</td>
<td>Environmental Factor</td>
<td>Column 1</td>
<td>Column 2</td>
</tr>
<tr>
<td>----</td>
<td>--------------------------------------------------------------------------------------</td>
<td>----------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>52</td>
<td>Team planning time with other teachers</td>
<td>SA A UN D SD</td>
<td>How likely is it that these factors will occur in your school? (VL = very likely; SL = somewhat likely; N = neither; SU = somewhat unlikely; VU = very unlikely)</td>
</tr>
<tr>
<td>53</td>
<td>Hands-on science kits (activities and equipment)</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>Community involvement (civic, business, etc.)</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>Increased funding (from school and Ministry)</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>Extended class period length</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>Increasing planning time for classes</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>Permanent science equipment (microscopes, glassware, etc.)</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>Classroom physical environment (room size, proper furniture, sinks, etc.)</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Adoption of an official school science curriculum for each region independently (goals, objectives, topics, etc.)</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>Adoption of science curriculum from developed country (goals, objectives, topics, etc.)</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>Expendable science supplies (paper, chemicals)</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>Support from administrators</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>Science curriculum materials (textbooks, lab manuals, activity books, etc.)</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>Technology (computers, software, Internet)</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>Parental involvement</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>An increase in students’ academic abilities</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>Active involvement of educational supervisors</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>A decrease in your course teaching load to give more time for planning</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>A reduction in the amount of content you are required to teach</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>Reduced class size (number of students)</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>Involvement of scientists</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>73</td>
<td>Involvement of university educator professors</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>74</td>
<td>Classroom assessment strategies</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>Teacher input and decision making</td>
<td>SA A UN D SD</td>
<td></td>
</tr>
</tbody>
</table>
Cont. No 71:
What is the students' average in your classes (          ),
the suitable number in your opinion is (          ).

76) Would you like to add any comments, notes, or suggestions about the nature of science?
……………………………………………………………………………………………..
……………………………………………………………………………………………..
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77) Would you like to add any comments, notes, or suggestions about science teaching?
……………………………………………………………………………………………..
……………………………………………………………………………………………..
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78) Would you like to add any comments, notes, or suggestions about developing or reforming science curriculum?
……………………………………………………………………………………………..
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Again, thank you for your cooperation and for spending time to fill this questionnaire.

Saleh
Appendixes C

Permissions to use the instruments (e-mails):
From: Lumpe et. al. (2000), by Andrew T. Lumpe
From: Chen et. al. (1997), by Peter Taylor
To: "Saleh AL-Abdulkareem" <dawerd@yahoo.com>

CC: jhaney@bgnet.bgsu.edu, charlene.czerniak@utoledo.edu, paobenauf@mail.wvu.edu

Subject: Re: Requesting your permission to use your questionnaire in my study

From: alumpe@uttyler.edu

Date: Thu, 8 May 2003 12:03:01 -0500

Dear Saleh AL-Abdulkareem,

Your study sounds very interesting. Of course, please feel free to use the instrument. The journal holds the copyright so just make sure to cite the work.

A suggestion for your study...since the science teaching context in Saudi Arabia may be very different than in the U.S., you may wish to interview a set of teachers to generate an appropriate set of contextual factors which may lead to a different set of instrument items.

Let me know if you have any other questions. I wish you well with your research.

Andrew Lumpe

Andrew T. Lumpe, Ph.D.
Celia and Sam Roosth Endowed Chair of Education and Professor
University of Texas at Tyler
3900 University Blvd.
Tyler, TX 75799
alumpe@uttyler.edu

Saleh AL-Abdulkareem <dawerd@yahoo.com>
05/07/03 12:11 AM

To: alumpe@siu.edu, jhaney@bgnet.bgsu.edu, charlene.czerniak@utoledo.edu, cczerni@uoft02.utoledo.edu

cc: patricia.obenauf@mail.wvu.edu, paobenauf@mail.wvu.edu

Subject: Requesting your permission to use your questionnaire in my study

Dear Drs. Andrew T. Lumpe, Jodi J. Haney, Charlene M.Czerniak,

I am a graduate student in Curriculum and Instruction Department "majoring in Science Education" at West Virginia University (Morgantown, WV), and right now I am working on my doctoral dissertation, which is a study about the relationship between science teachers' beliefs and science education reform in Saudi Arabia. (The title might be: Investigating Science Teachers Beliefs about Science and Science Teaching: Struggles in Implementing Science Education Reform in Saudi). And during my search for resources and similar studies, I found your great study "Assessing Teachers’ Beliefs about Their Science Teaching Context", and because some of my points and questions are similar to yours in your study, I am writing to you asking for your permission to use your questionnaire in my study.

I'll mention the resource of the questionnaire in my proposal and in my research. I may add or eliminate some points in your questionnaire. And I am not using exactly the same questionnaire, I am working with my advisor to set a new one combining your points with other points related to my study. But I believe that I should take your permission to use phrases or questions from your questionnaire.

Waiting to hear from you.

Best regards,
Saleh AL-Abdulkareem
Ok I understand now...well good luck with the development of your questionnaire...I would be interested in seeing the final product.

Cheers
Peter
Appendixes D

HPP certificate
(Via e-mail)
Human Participant Protections Education for Research Teams

Saleh A. Al-Abdulkareem has completed this course at West Virginia University.

Date of completion: 06/03/03

Specific topics addressed include:
- Roles and responsibilities of researchers and their key personnel
- Guiding ethical principles for research
- Federal regulations
- Informed consent
- Institutional review boards
- Ongoing protections throughout the course of the study
- Data and safety monitoring
- Reporting of adverse events
- Privacy and confidentiality
- Historical events that have impacted policy and legislation

Research Compliance Office
West Virginia University