A Dissertation entitled

Saudi Science Teachers' Perceptions of the Effectiveness of the Saudi Arabian Ministry of Education's Professional Development Program

by

Alaa Alsubhi

Submitted to the Graduate Faculty as partial fulfillment of the requirements for the Doctor of Philosophy Degree in

Curriculum and Instruction

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An Abstract of

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Alaa Mesfer Alsubhi

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During the 2007-2008 academic year, the Saudi Ministry of Education (MoE) introduced a new science curriculum in all public schools across all grades in an effort to modernize its public education curriculum (Almuntasheri, Gilles, Wright, 2016; Mansour & Al-Shamrani, 2015). This new curriculum, based on an Arabic translated version of the McGraw-Hill science series curriculum, emphasizes student-centered and inquiry-based learning within a constructivist framework (Almuntasheri et al., 2016; Mansour & Al-Shamrani, 2015). In order for this new curriculum to be effectively implemented given its substantial difference from previous curricula, the MoE began instituting professional development (PD) programs for Saudi science teachers throughout the country, with separate programs for male and female science teachers; however, the effectiveness of these PD programs has not been systematically investigated. To address this gap, the study conducted in this dissertation involved a survey of 68 male secondary school science teachers in the South District of Makkah, Saudi Arabia regarding the effectiveness of PD programs they participated in that aimed at implementing the new science curriculum. The survey questionnaire was based on a translated version (English

to Arabic) of an instrument developed and previously used by Williams (2014), Lowden (2003), and Liguori (2000), which were adapted from Guskey's (2000, 2002) PD evaluation model. The results were analyzed using descriptive statistics, which are reported and discussed in the present dissertation. Major findings include the reported lack of qualified trainers and lack of support for PD.

Keywords: Saudi science teachers, professional development, science curriculum

I dedicate this dissertation to the memory of my beloved father's soul, Mesfer Alsubhi, and to my mother, Saleha Alsubhi, who sacrificed their comfort for creating a comfortable life for my sisters, my brothers, and me.

I also dedicate this dissertation to my wife, Norah Aldujayn. Your love, support, help, and encouragement during the doctoral program has been tremendous and kept me motivated to finish. I appreciate our discussions as I was forming and completing my study. And to my three amazing children, Khalid, Jana, and Mohammed, for your wonderful understanding, love, and support of me during the doctoral program. I hope that one day they can read this research and find inspiration in it for their own educational pursuits. I love you all very much, thank you!

Lastly, I dedicate this dissertation to the rest of my family, especially to all my brothers and sisters for their prayers and supports that they accorded me without ceasing and for their understanding when I had be a recluse in order to get my master's and Ph.D. degrees done. Special thanks to my brother, Meqabel; the love and support you have given me throughout my life and career has always been an amazing inspiration. I love all of you.

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Chapter One

Introduction

In 2016, the Kingdom of Saudi Arabia's (KSA) Crown Prince Mohammad bin Salman declared a new developmental plan known as *Vision 2030* (Saudi Arabia, 2016; Mosaad, 2016). Prince Mohammad (2016) asserted that *Vision 2030* "is the first step on our journey toward a better, brighter future for our country and our citizens" in significantly developing the science educational process of Saudi students from an early age (Saudi Arabia, 2016, p. 13). The *Vision 2030* program addressed several economic, social, and educational goals. Such as science education, *Vision 2030* focused on developing science curricula, creating teacher preparation and development programs, fostering creativity and innovation in the educational environment, developing students' skills and knowledge (Saudi Arabia, 2016).

The KSA is a country with a history of rapid development, and there is an almost universal agreement about the importance of the education system for achieving economic development and accommodating social change. Education has an especially important role in the development process of countries like the KSA because it is secondary education from which all further education follows, and it is the state of the secondary education system that ultimately determines a developing nation's degree of dependence on foreign countries.

Many educational researchers conclude that there is a link between professional development (PD), student achievement, and educational change (Cole, 2012; French, 1997; Guskey, 1994; Sparks & Hirsh, 1997). In addition, high-quality PD is important to

increasing teachers' knowledge, skills, attitudes, and beliefs so that teachers may better enable their students to succeed academically (Cohen & Hill, 2000; Dana & Yendol-Hoppey, 2008).

With the increased recognition of the importance of PD, and its potential impact on student achievement, there are questions being raised about its effectiveness along with demands for demonstrating and justifying the results of PD efforts (Guskey, 1994). PD can no longer be seen as a program that can be delivered once by one person at one time. Learning opportunities need to go beyond just talking about new ideas or simply reading about new pedagogy (Darling-Hammond, 1998; Renyi, 1998). PD cannot be separated from teachers' daily practice and immediate classroom environments, it must be built into the professional job of teaching (Darling-Hammond, 1998; Renyi, 1998). Fullan (1999), in fact, described successful schools as those who collaboratively work together with the purpose of improving student learning. In successful schools, teachers use student performance data to determine the effectiveness of instructional change and engage in PD to refine their teaching. The other purpose of PD is to keep teachers updated with current and relevant instruction techniques that can lead to more successful learning outcomes for their students (Timperley, Wilson, Barrar & Fung, 2007; Yoon, Duncan, Lee, & Shapley, 2008; Behlol & Anwar, 2011).

During the 2007-2008 academic year, to modernize its public education curriculum, the Saudi Ministry of Education (MoE) introduced a new science curriculum based on an Arabic translated version of the McGraw-Hill science series curriculum in all public schools across all grades (Almuntasheri, S., Gilles, R. M., Wright, T., 2016; Mansour & Al-Shamrani, 2015). The curriculum was ultimately implemented in all

science courses by 2013 (Ghoneim Sywelem & Witte, 2013). The new curriculum places heavy emphasis on student-centered learning and understanding concepts instead of memorizing them and attempts to make meaningful connections to students' lives and experiences (Mansour & Al-Shamrani, 2015). This new science curriculum adopts a teaching approach based on the constructivist theory of learning with an emphasis on critical thinking and problem solving (Mansour & Al-Shamrani, 2015).

Because the science teachers in the KSA have been primarily educated under a completely different and more traditional teacher- and subject-centered curriculum that required more memorization than meaningful connections, they must overcome a learning curve. Noting this need, the MoE simultaneously implemented a PD program to help prepare and train Saudi science teachers to teach this new curriculum (Mansour & Al-Shamrani, 2015). This MoE resolution requires science teachers to participate in PD programs to prepare them to effectively implement the new science curriculum.

Studying the effects of PD is a high priority for both teachers and administrators. Fullan (2007) wrote that teacher development is widely used in schools to foster deeper thinking and higher levels of learning. Moreover, a supportive, knowledgeable, and skillful teaching staff could have a positive impact on the teaching and the learning experience (Heller, Daehler, Wong, Shinohara, & Miratrix, 2012). Thus, PD can meet teachers' needs in the area of teaching practices and teaching efficacy (Briggs & Coleman, 2007), but more research is needed in this area, particularly in the KSA.

Problem Statement

Teaching is a profession that requires teachers to be highly qualified professionals

through teacher preparation. Additionally, through PD activities and programs, teachers can become lifelong learners. Yet whenever students do not meet the standards, the teacher is often the first to be blamed. As a result, the demand to improve teacher education programs persists in order to enhance teaching and learning, the ultimate goal of educational development. For instance, many of the studies reviewed by Horowitz et al. (2005) found that there was a strong relationship between the quality of teachers and the achievement of their students. Likewise, O'Clair (2005), Johnson (2005), Hill (2003), Kirkpatrick (2002), Thomas (2001), and Basta (1998) reported a positive relationship between student achievement and their teachers' qualifications (as cited in Heller et al., 2012). Moreover, some research has attributed student performance to a combination of the experience of the teacher in his or her field of teaching (Hill, 2003) and the extent to which he or she had acquired content knowledge and pedagogical content knowledge (Darling-Hammond, 2000). Heller et al. (2012) found that even a moderate amount of PD can improve student learning outcomes with a strong and persistent effect. Thus, both a high standard of preparation and an opportunity to maximize teaching experience are required in good teacher education programs.

One of the most important topics in the field of education in the KSA is related to PD of science teachers. This topic has become particularly important since the introduction of the new science curriculum by the MoE in response to the rapid development of technology, industry, and science. To be able to teach the new curriculum, science teachers must participate in PD that is effective. However, the perceived effectiveness of the existing PD programs has only recently been investigated, and, even then, only to a limited extent (e.g., Almazroa, & Al-Shamrani, 2015; Aseeri,

2015). Very little research has been conducted to determine the effectiveness, perceived or actual, of science teachers' PD programs in the KSA (Almazroa, & Al-Shamrani, 2015).

Significance of the Problem

Studies suggest that high-quality teaching can make a significant difference in student learning outcomes (Gess-Newsome, 2003; Loucks-EIorsley, Hewson, Love & Stiles, 1998). Moreover, teachers are facing changing standards and curricula, must meet increasing expectations, and need to maintain and even deepen their content knowledge and learn new methods of teaching. To meet challenges of preparing students for the 21st century, PD opportunities for teachers are important components (Eisner, 2003).

In the KSA in particular, curriculum reforms in science have placed additional pressure on teacher preparation and training. While some PD opportunities have been provided by the MoE, there has been a lack evaluation of the effectiveness of these PD programs (Omair, 2013). Understanding how Saudi science teachers perceive the effectiveness of the PD that is currently available to them might be the first step in fostering PD that would prepare them for teaching science according to the official curriculum based on the McGraw Hill Education series as well as for meeting student needs. Moreover, knowing what science teachers see as challenges and obstacles to PD could help the MoE and school administrators address these challenges and obstacles.

The study in this dissertation was designed to add to the field's existing knowledge base and understanding of effective PD. The results of this evaluation study were significant to science education with regard to addressing teacher PD in an effective way to improve science teaching. The findings of this study were shared with the MoE.

In this research. The researcher helped improving this situation as it is targeted toward collecting the different perspectives of science teachers working today in SA. The findings were also help the researcher provide some pedagogical suggestions to improve current PD programs in SA and offer some advice to help overcome barriers currently confronting it. Finally, the study can help determine what modifications may be needed to successfully implement PD to work within the unique context of Saudi education.

Purpose Statement & Research Questions

To address the lack of research on the effectiveness of PD programs for Saudi science teachers, the purpose of this research is to examine Saudi male science teachers' perceptions of the effectiveness of PD for improving their ability to teach the new Saudi Arabian science curriculum. In keeping with the purpose of the research, this study addressed the following two major research questions and 10 minor research questions:

1. Is there fidelity between the MoE's goals, format, and content for PD and the teachers' perceptions of that PD?

   PD programs in this research question are further divided into the following specific characteristics:

   a. What are the goals of the PD programs in which participants have participated?
   b. What are the PD program format in which participants have participated?
   c. How is the content for PD decided in programs in which participants have participated?

2. What is the level of perceived effectiveness of PD among Saudi male science teachers?

   Effectiveness in this research question is further divided into the following specific levels:

   a. What is the participants' satisfaction to their PD experiences?
   b. To what extent do the participants report the learning new knowledge and skills from their PD experiences?
   c. What is the participants' level of perceived organizational support for PD?
   d. To what extent do participants report using new knowledge and skills gained from their PD experiences?
   e. What is the participants' level of perceived impact that their PD has had on student learning outcomes?
   f. To what extent do participants report changes in their attitudes towards teaching and learning in science as a result of their PD experiences?

Scope of the Dissertation

This dissertation delimited to male teachers teaching the new science curriculum at secondary schools that apply the Credits' System. It is also focused on the PD programs and evaluation models that are currently used in Saudi Arabia, namely the Guskey Model, so it does not include a comprehensive review or discussion of all programs and evaluation models. Additionally, it is limited to the male gender because males and females teach in separate schools in the KSA. Moreover, this dissertation focuses on one geographic location only (Makkah) because the researcher has access to a

database of teachers in this region. The findings should be somewhat generalizable to all Saudi male science teachers in the country who apply a new curriculum because of the social homogeneity of the KSA. However, the findings may not be generalizable to Saudi female science teachers, non-Saudi science teachers, and Saudi male science teachers who do not teach the new science curriculum.

Conceptual Framework

The model for evaluating PD in this dissertation is based on the work of Guskey (2000, 2002). In his book, *Evaluating Professional Development*, Guskey (2000) stated that PD evaluation should focus on measuring knowledge, skills, attitudes and beliefs of teacher participants because, to have an impact on students, PD must first have an impact on the teachers. Guskey (2000, 2002) who places changes in students learning at the center of effective teacher development. In this way, student change is a crucial factor for teacher change as illustrated by figure 1. Furthermore, Guskey (2000) suggested a model of teacher change in which teachers are more likely to change their attitudes and beliefs once they see evidence of positive student outcomes. Teachers become committed to a new instructional approach or innovation once they have seen it work in their classrooms (Guskey, 2000). Thus, evaluations must assess the perceived impact of PD on student learning. In keeping with his model of teacher change and student learning outcomes, Guskey's (2000) model for evaluating PD includes five levels of gathering information about PD plus one level of teacher change arranged from simple to complex as listed below:

1. Participants' satisfaction
2. Participants' learning

3. Organization support and change
4. Participants' use of new knowledge and skills
5. Student learning outcomes
6. Participants' change in attitudes and beliefs

Guskey's model for evaluating PD divides the types of evaluation into three types: planning (before implementation), formative (during implantation), and summative (after implementation). Because this dissertation addresses Saudi male science teachers' prior experiences with PD, it focuses on summative evaluation. To conduct a summative evaluation of a PD program, Guskey (2000) recommended addressing five evaluation levels: participants' satisfaction, participants' learning, organization support and change, participants' use of new knowledge and skills, and student learning outcomes. Guskey (2002) added an additional level of evaluation (Level 6) that addresses changes in participants' attitudes and beliefs.

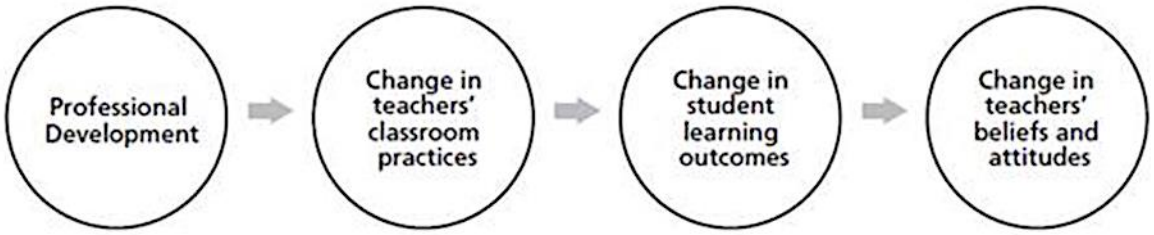

Figure 1. Guskey's model of teacher change. Adapted from "Professional Development and Teacher Change" by T. R. Guskey, 2002, *Teachers and Teaching,* 8, p. 383. Vol. 8, No. 3/4, Copyright 2002 by Francis Ltd DOI: 10.1080/13540600210000051 2.

Definition of Terms

1. *Staff development/professional development*: The terms "professional development" (or "PD") and "staff development" are used interchangeably throughout this dissertation as "...those processes that improve the job-related

knowledge, skills, or attitudes of school employees..." (Sparks & Loucks-Horsley, 1990, p.5-6). The definition of PD in this dissertation also draws from the KSA MoE's (1998) staff development and supervision guideline book, which defined PD as programs designed to make a positive changing of individual's vocational and functional skills, which enables them to acquire knowledge and expertise for improvement.

2. *Effective professional development*_ Used to describe when PD aligns with district goals, school improvement, and changes in teachers' beliefs, attitudes, knowledge, and skills (Darling Hammond, 1998; Lowden, 2003, Cole, 2012).
3. *Evaluation*: "A continual and systematic process of assessing the value or potential value of an extension program to guide decision-making for the program's future" (Suvedi, Heinze, & Ruonavaa, 1999, p. l).
4. *Professional development process* – the overall design of the school district's program for PD and its links to district goals and teacher evaluation (Guskey, 2000, 2002).
5. *Professional development format* - when and how the teachers are participating in specific PD opportunities (Guskey, 2000, 2002).
6. *Professional development content* - the topics of PD offered to teachers in each of the school districts (Guskey, 2000, 2002).
7. *Teacher's perception of professional development* – Divided into the following six levels based on the work of Guskey (2000, 2002):
    a. Participant satisfaction - the level of satisfaction the participants felt about their PD experiences in the school district in general

b. Participant learning - the level at which the participants acquired the intended knowledge and skills through PD offered by the district.
c. Organizational support and resources - the level at which the school district shows support for PD by allocating resources and incentives for teachers
d. Implementation of new knowledge, skills and instructional pedagogy - the extent to which the participants applied their new knowledge and skills in their classroom teaching.
e. Perception of student learning - participants' perception of how their learning through PD affected student performance or achievement of the students in their classrooms
f. Change in attitudes and beliefs - the ideas, judgments and values teachers have about teaching and education in general. These beliefs and attitudes impact their behavior in the classroom.

Organization of the Study

This dissertation is organized in five chapters. Chapter 1 introduces the topic and research focus, the statement of problem, the significance of the study, the statement of purpose, the research questions, the scope of the dissertation, the theoretical framework, and the definition of terms. The following chapter, Chapter 2, reviews the literature related to evaluating PD, background of the KSA's education system and PD history. Chapter 3 describes the methods of the research, including the design, situation, population, and sample. Additinally, the third chapter incudes a description of the questionnaire instrument, an explanation of the statistical techniques used for data

analysis, and record keeping. Next, the findings of the study are reported in Chapter 4. Finally, Chapter 5 consists of the discussion, implications, recommendations, and conclusions.

Chapter Two

Literature Review

This chapter includes a review of the literature. It begins with a brief history of the Kingdom Saudi Arabia (KSA) in general, the history of the Saudi education system, and the history of Saudi professional development (PD). Following the overview of the Saudi historical context, the review addresses research on PD in general, including the definition and importance of PD. Next, the literature review covers research on teachers' views of PD, specifically Saudi teachers' views. Finally, the literature review ends with research on the Guskey model of evaluating of the effectiveness of PD.

Saudi Arabia Professional Development History

History of the KSA in general. The history of the Arabian Peninsula, where the modern state of Saudi Arabia is now situated, reaches back millennia to a time where the region was home to various nomadic tribes and settlements mostly along trading routes between East and West (Bowen, 2015). The birth of the Prophet Mohammed in 570 ACE and his ascendency as the Prophet of Islam carrying the Message of Allah in the form of the Holy Quran around the year 610 ACE put the region on the map and united the many Arab tribes and nomads that populated the peninsula (Bowen, 2015). In the following hundreds of years, various empires and dynasties controlled the region, particularly the part containing the Holy Cities of Makkah and Medinah, which is called the Hijaz.

The present nation of Saudi Arabia, which is officially called the Kingdom of Saudi Arabia, gets its name from the al-Saud Royal Family, who have had varying degrees of control over the region since 1720 when the First Saudi State was established, and in 1744, a pact was made between Muhammad bin Saud and Imam Muhammad bin

Abdul Wahhab in which Muhammad bin Saud would provide military power and governance while Imam Muhammad would provide religious guidance (Bowen, 2015). In 1824, the Saudis occupied Riyadh and began the Second Saudi State under the rule of Turki ibn Abdullah ibn Muhammad ibn Saud (Bowen, 2015). However, these first two Saudi States were limited in power and regional governance, as power struggles shifted the control of the Arab Peninsula between the Ottomans, Egyptians, Saudis, and others (Bowen, 2015).

In 1902, Abd al Aziz ibn Saud retook Riyadh and established the Third Saudi State, which would become modern Saudi Arabia. Between 1902 and 1932, the Saudis took control of more and more of the Arab Peninsula under the leadership of Abd al Aziz (Bowen, 2015). In the meantime, the United Kingdom recognized the Saudi state in 1927, and American engineer Karl Twitchell discovered initial signs of oil in the region during a geological survey (Bowen, 2015). These events culminated in the declaration of the founding of the KSA in 1932 by its first king, King Abd al Aziz (Bowen, 2015). All six of the Saudi kings since have been the sons of King Abd al Aziz (Sa'ud, Faisal, Khalid, Fahad, Abdullah, and Salman).

As this brief review of the history behind the establishment of the KSA shows, the roles of Islam, Arab identity, and oil wealth are important to understand the social and economic dimensions of the country and its support of education. Indeed, the official and only legally recognized religion in the KSA is Islam (Aljabreen & Lash, 2016; Bowen, 2015), and it influences the social, political, and cultural practices and policies of the country, including educational policy, most notably the gender segregated aspect of the

education system (Bowen, 2015). Moreover, the citizens of the KSA self-identify their nationality as Arab and are "fairly homogenous" (Bowen, 2015, p. 8).

Ever since oil was first discovered in 1931, the KSA has emerged as one of the world's largest producers and exporters of oil. It possesses "25% of the world's known oil supplies," and the quality of oil is such that it needs far less refinement than most other oil sources around the world (Bowen, 2015, p. 6). The amount and quality of oil and its importance in the modern world has allowed the KSA to achieve an economic position that bestows significant power on the world stage. The country also has the capital to invest in many social and humanitarian programs to improve the lives of its citizens, with the education field having a high priority on this list (Bowen, 2015). As a wealthy but developing nation, the KSA has invested a substantial amount of resources into education in general and teacher preparation in particular. In fact, as of the 2018 budget, the education received 1.9 billion SR ($900 million USD), second only to the military (Ministry of Finance, 2018).

History of the Saudi education system. Prior to the emergence of the modern KSA, education was handled locally, with three forms of education available: Quranic and traditional education taught by local imams, public schools provided by the Ottoman Empire, and private schools organized by parents (Almalki, 2011). In 1924, the Third Saudi State created the Department of Education, which was narrow in scope and only supervised four schools (Alhageel, 1993). In 1952, the Ministry of Knowledge was established and was tasked with developing and managing the education system. The need for the creation of the Ministry of Knowledge was clear given the fact that the number of public schools had tripled in the 10 years prior to 1952 (Snyder, 1963).

Through various reforms, the Ministry of Knowledge began to standardize the education system and curriculum, including the preparation, training, and certification of teachers.

By 1970, it became clear that the KSA needed a more focused direction and strategic plan for its growth and development, so the King began establishing five-year development plans, the first of which covered the period of 1970–1975 and the most recent of which is the ninth development plan covering the period of 2015–2020. In each of these development plans, education figures prominently. As an outcome of the first development plan, in 1975 the Ministry of Higher Education (MoHE) was formed, which also corresponded with the emergency of junior colleges/teacher colleges created in part as institutes for the education of teachers (Ministry of Economy and Planning, 2018).

Starting under Crown Prince Abdallah, who served as Crown Prince from 1995 to 2005 and would later rule as King from 2005 to 2016, a number of influential reforms were made. In 1997, a continuing education and PD program for in-service teacher was established by the Ministry of Knowledge. Subsequently the Ministry of Knowledge delegated the planning, implementation, operation, and evaluation of the PD programs to the 45 school districts around the country. In 2003, the Ministry of Knowledge was changed to the Ministry of Education (MoE), and in 2015, the MoE and MoHE merged ("Establishment of the Ministry," 2018). In this same period, King Abdallah promoted education through various scholarship programs, including a study abroad scholarship program that since it began has sent over a million Saudi students to attend institutions of higher education around the world, particularly in the US. The impact of this program and the influence of returning students on the development of the education system. One of the major changes under the King Abdallah's project for public education (Tatweer

Project) of 2006 was the reform of the science and math curriculum based on adapted and translated versions of the McGraw-Hill science and math textbooks (Almazroa & Al-Shamrani, 2015).

The structure of the educational systems in Saudi Arabia. Saudi education is organized into three stages: elementary, intermediate and secondary education (see Figure 2). Each stage is also divided into a certain number of grades following a 6-3-3 system, which is six years' elementary education, three years intermediate, and three years for secondary education (Alromi and Alswaidani, 2013). This style of organizing the educational ladder is widespread in the Arab world.

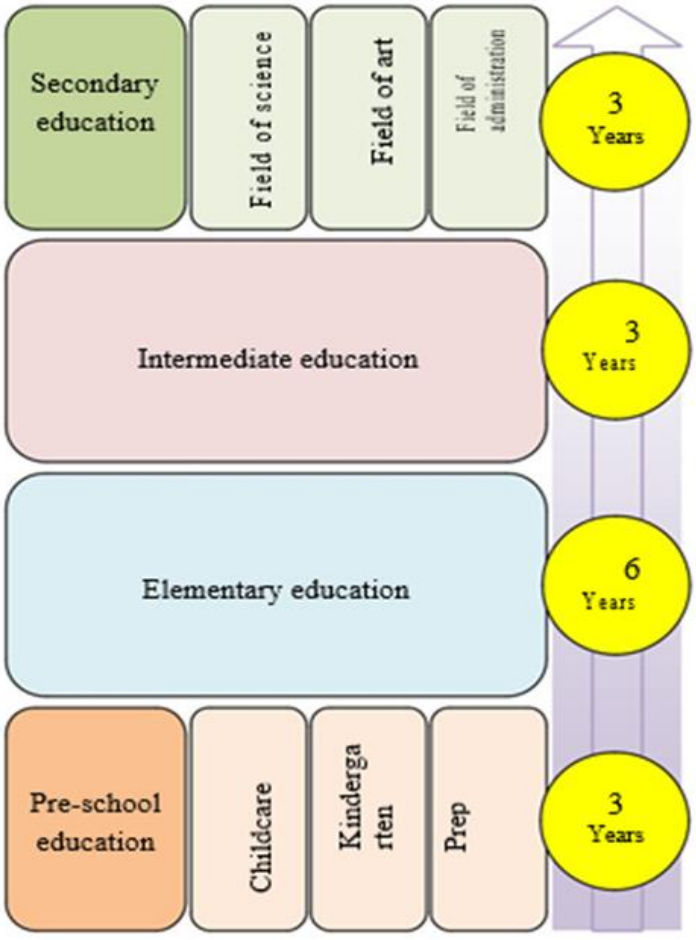

Figure 2. Adapted from "The structure of the educational systems in Saudi Arabia" by Ministry of Education, 2014. Copyright 2014 by the Saudi Arabia Ministry of Education.

As Figure 2 shows, in addition to the three main stages of education (elementary, intermediate, and secondary), the organizational structure in Saudi Arabia also includes three years for pre-school education. This pre-school stage is a mixed gender system that is under the supervision of girls' schools. The pre-school stage can last up to three years and consists of three levels: childcare, prep, and kindergarten.

The number of schools, students and teachers has increased every year from the academic year 1924 up to now. Table 1 displays a summary of statistics on both male and female education by stage and type of education for the academic year 2014.

Table 1

Summary of Ministry of Education 2014 Statistics on General Education in Saudi Arabia

Stage	***Gender***	***Schools***	***Students***
Pre-school	Male	-	71,906
	Female	-	110,650
	Total	2,559	182,556
Elementary	Male	6,872	1,304,068
	Female	6,929	1,266,266
	Total	13,801	2,570,334
Intermediate	Male	4,373	639,933
	Female	3,952	590,644
	Total	8,325	1,230,577
Secondary	Male	2,954	670,198
	Female	2,771	543,886
	Total	5,725	1,214,084
Adult Ed.	Male	821	14,563
	Female	1,688	37,340
	Total	2,509	51,903
Special Ed.	Male	1,269	15,395
	Female	596	9,356
	Total	1,865	24,751
Total	Male	16,289	2,644,157
	Female	18,495	2,630,048
	Total	34,784	5,274,205

Adapted from "Statistics on General Education in Saudi Arabia" by Ministry of Education, 2014. Copyright 2014 by Saudi Arabia Ministry of Education.

History of Saudi Arabian PD. The now renamed Ministry of Knowledge began offering PD programs for teachers in 1954, and from that point until 1973, the Ministry of Knowledge was directly responsible for designing and implementing them. During this timeframe, the PD programs were limited to certain highly populated regions, were often offered over summer vacations, and were long-term programs that could take anywhere from six months to three years to complete. They also included courses in various subject areas in addition to psychology and pedagogy. In this sense, the programs resembled full undergraduate degree programs rather than what is often considered PD today because other than such programs, the teachers had very little to know prior training or education to become teachers (General Directorate of Training and Scholarships, 2002).

In 1974, the Ministry of Knowledge established the position of General Directorate of Training and Scholarships with the task of achieving continuous PD of teachers, to rehabilitate the national centers for PD, and to reach international standards of teacher training and development. In 1975, with the establishment of teacher colleges designed to provide comprehensive degree-bearing programs for teachers, PD finally started to resemble the typical concept of supplemental training opportunities rather than the primary form of teacher training (General Directorate of Training and Scholarships, 2002–2011).

During the period of 1997–1998, the General Administration for Educational Training and Scholarships was established and 45 Educational Training Centers (ETCs) were opened throughout the 13 regions of the KSA to help the General Directorate administer, implement, and evaluate PD for teachers. These ETCs were necessary because the growing number of teachers in all areas of the KSA became difficult for the

General Directorate to oversee alone (Ministry of Education, 2010). Additionally, in 2006, King Abdallah announced a project to develop public education (*Tatweer Project*), which, in addition to reforming the curricula and standards of public education also included programs to improve teacher training and PD.

In this history of PD for teachers in the KSA, three distinct eras emerged. In the first era, from approximately 1954 to 1975, PD was programs were the only education and training teachers received. From 1975 to 2006, teacher colleges were established, so PD programs became supplementary programs but did not serve everyone equally. Since 2006, the PD system can be characterized as becoming more accessible, equitable, and accountable. According to Tatweer (2010), the new teacher PD project is based on the following seven pillars:

1. Equal opportunity: All teachers and administrators have access to PD according to his/her needs.
2. Continuity: PD is designed to keep educators informed of developments in the education system and trends in teaching.
3. Inclusiveness: PD is a comprehensive system that encompasses all educators from various educational categories and school districts.
4. Effectiveness: PD must keep up with developments in the fields of science and education.
5. Participatory: PD builds on input from all educational stakeholders.
6. Linked with Curricula: PD is designed to achieve the aims of the curricula and the needs of educational institutions and students.

7. Continuous Assessment: PD must undergo ongoing evaluation of training processes and outcomes to ensure the objective criteria are met.

As this list of the seven pillars of the Tatweer Project make clear, the evaluation of PD programs for teacher development is extremely important.

Models and goals of Saudi teacher PD. Most PD in the KSA is of two types: a formal type of PD planned and coordinated by the MoE that focuses on implementation of the curriculum in general and a less formal type that is developed and provided by supervisors of the schools themselves that focuses on specific needs of teachers such as training for the use of technology in the classroom (Almazroa & Al-Shamrani, 2015; Sabah, Mansour, & Al-Shamrani, 2014). According to Almazroa and Al-Shamrani (2015), the most common type of PD is training workshops, and they further claim that the term "training" is the most prevalent term used to describe Saudi PD (p. 10). The Saudi guidebook for training provided for science and mathematics teachers includes the following resources: basic teaching kit, differentiated instruction, active learning, conceptual understanding, and planning for understanding (Tabouk Educational Administration, 2014). However, more details about the exact types of PD models used by the MoE are difficult to come by because, as Almazroa and Al-Shamrani stated, there is "limited official documentations about professional development" (p. 11).

The goals of Saudi Teacher PD have been fairly consistent over the past couple decades, although some changes can be observed. In 2002, the General Directorate of Training and Scholarship (2002) listed the following specific learning objectives for Saudi PD:

- To inform teachers of their duties

- To improve teachers' performance and capabilities
- To develop positive attitudes towards their work
- To promote positive interpersonal relationships between teachers
- To expose teachers to the latest educational research and theories.
- To provide the opportunity to implement ideas, opinions, and solutions
- To bridge the gap between theory and practice
- To minimize errors and conserve time, effort, and money
- To develop their independent learning skills.

Later, according to the Tatweer Project (2014), the goals of science teacher PD in the KSA included the following outcomes:

- Improving the general education outcomes
- Developing basic teaching skills
- Improving learning capacity for both teachers and supervisors
- Improving teachers' classroom management and leadership.
- Providing support to teachers as they implement the new science curriculum
- Introducing teachers to the inquiry-based learning approaches and constructivist theories upon which the new science curriculum is based (as cited in Almazroa & Al-Shamrani, 2015, p. 11)

In general, the goals over the years have not changed, although the policies and curricula have. Yet it is important to mention that previous research has found that, while the Saudi PD goals looks good on paper, in practice there have been many gaps, limitations, and problems in their implementation (Sabah et al., 2014). Sabah et al.'s (2014) study of teacher's reported experiences after participating in the Saudi PD programs found that

teachers do not participate in the planning process, do not choose the goals or intended outcomes, and received the training delivered in a top-down process starting from project expert to a central trainer to a supervisor.

Research on PD in General

Definition of PD. In the field of education, PD is the process for improvement in job-related knowledge, skills, and attitudes of school employees (Sparks & Loucks-Horsley, 1989). School employees can include school board members, office administrators, principals, and non-certified staff, but the primary focus of most educational PD is on teachers (Sparks & Loucks-Horsley, 1989). PD has also gone by other names, such as staff development (Sparks & Loucks-Horsley, 1989), teacher development, school improvement (Loucks-Horsley, Harding, Arbuckle, Murray, Dubea, & Williams, 1987), and professional learning experiences (Loucks-Horsley, Stiles, & Hewson, 1996), all of which tend to be used interchangeably without any major distinction.

Regardless of the exact term used, there are certain common components of PD. Guskey (2000) structured his PD framework around three major categories – process, content, and context. Similarly, Lowden (2003) emphasized the components of process (the design) and content (the topics), but differed from Guskey by highlighting format (when and how teachers participate) rather than context. Guskey (2000) described PD as an intentional, ongoing, and systemic process. Almazroa and Al-Shamrani (2014) noted that Guskey's description of PD as ongoing and systemic marks a shift in the concept of PD from a fairly narrow view as something that occurs a few days every year to a broader view of something that is integrated throughout the year into multiple aspects of the

teaching profession and involving the wider the entire educational community. So, for the purposes of this paper, science teacher PD is the process, content, science teacher's perception of PD, and format of improving teacher-related knowledge, skills, and attitudes as well as student learning outcomes in an intentional, ongoing, and systemic way.

Importance of PD. Gordon (1999) identified five critical areas of school improvement that necessitate some degree of PD: shared governance, transformational leadership, student-centered teaching, teacher collegiality, and cultural change. Similarly, Almazroa and Al-Shamrani (2014) noted that pre-service education is neither long nor intense enough to create expert teachers, making PD important to continue the process of making great teachers. They mentioned four purposes of teacher PD, which include helping teachers recognize the special expertise in relation to their work, master the knowledge and skills needed, help teachers grow and develop, and improve teaching quality (Almazroa & Al-Shamrani, 2015).

Major change in particular can benefit from PD; Green and Etheridge (2001) noted that school restructuring calls for PD that fosters a collaborative professional culture, improve teachers' problem-solving skills, and ultimately increase student achievement. Moreover, by providing teachers with the tools needed to identify and critically examine the school's culture, PD can lead to subsequent changes in curriculum, instruction, and assessment. Because change is constant and resistance to change is common, the need for an effective PD process is ongoing.

To improve teachers' knowledge, skills, and motivation, it is important to expose them to quality PD in its design and implementation (Yoon, Duncan, Lee, & Shapley,

2008). PD is needed to help teachers better understand how students learn, engage in critical analysis of their teaching, and make their teaching more student-centered and meaningful (Gordon, 2004). PD can provide teachers with teaching techniques to enable students to become active participants, critical thinkers, and lifelong learners, and even a minimal amount of PD can have long-lasting effects on both teacher and student knowledge, skills, and abilities (Heller, Daehler, Wong, Shinohara, & Miratrix, 2012). However, the extent of the impact of PD depends on its effectiveness.

Effective PD. The literature is nearly unanimous in the belief that ultimately PD effectiveness is defined by improvements to the growth, development, and achievements of students (see, for example, Park, 2013; Gordon, 2004; Guskey, 2000; Loucks-Horsley et al., 1998). Loucks-Horsley et al. (1987) provided a description of what a strong PD program looks like, which has been influential to subsequent research on PD effectiveness. According to Loucks-Horsley et al., a strong PD program is characterized by a diversity of opinions, ideas, people, and practices at the same time as it focuses on a limited number of common district goals. Combining diverse perspectives with common goals then leads to the emergence of needs or issues unique to individual staff that can then be addressed in each school (Loucks-Horsley et al., 1987). In addition, the goal of such effective programs should be to provide teachers with learning experiences that relate to the actual classroom setting to make the PD experience more meaningful and useful (Park, 2013). To achieve relevant PD experiences, Loucks-Horsley et al. (1987) recommend that the structure of a strong PD design must involve the following strategies: including multiple school decision makers, facilitating collaboration, planning, finding time, implementing the plan, providing follow-up support, ensuring maintenance and

continuity, and providing leadership and support (Loucks-Horsley et al., 1987). Subsequent research by Loucks-Horsley et al. (1998) led to the further development of this structure, in which they claim that effective PD experiences:

- are driven by a well-defined image of effective classroom learning and teaching,
- provide opportunities for teachers to build knowledge and skills,
- model strategies with teachers that they will use with their students,
- build a learning community,
- support teachers to serve as leaders,
- provide links to other parts of the education system, and
- continuously assess themselves and make improvements to improve teacher effectiveness, student learning, leadership, and the community (p. 36–37).

Within this structure, certain more specific characteristics must be present in effective PD as well.

To this end, in her review of the literature on PD, Lowden (2003) synthesized the research to develop a list of 12 qualities of effective PD common among multiple notable researchers in the field (e.g., Darling-Hammond, 1998; Miller, 1998; Sparks & Loucks-Horsely, 1989; Sparks & Hirsh, 2000; Guskey, 1994; Hawley &Valli, 1999; Ferraro, 2000; Little, 1993; Abdal-Haqq, 1996,Cole, 2012, Park, 2013). According to Lowden's review, effective PD should be:

1. experiential;
2. grounded in inquiry and research;
3. collaborative;
4. connected to and derived from teachers' work;

5. sustained and intensive;
6. provided on-site;
7. connected to other aspects of school change and organizational improvement;
8. reflective;
9. data-driven;
10. focused on meeting teachers' needs;
11. aligned with initiatives to develop further expertise in subject content use of technology, and teaching strategies in teaching to high standards; and
12. evaluated based on its impact on teacher effectiveness and student learning. (pp. 3–4).

As noted in most of the research, this last point about the impact on student learning is particularly important and must serve as the ultimate measure of PD effectiveness. As Park (2013) emphasized, effective PD should ultimately aim at improving students' achievement, which can only be achieved by improving the ability of teachers to provide high-quality education (Park, 2013).

Gordon (2004) defined successful PD as a combination of experiences that empowers educators, educational teams, and educational organizations in their pursuit of excellence to enhance the capacity, culture, and continuity of the student's educational support system. Additionally, effective PD focuses on improving curriculum, instruction, and student assessment (Gordon, 2004). Gordon (2004) also viewed professional staff development as a major function of leadership to improve the performance of all school personnel. He asserted that PD is the only known and reliable way of improving practice for all professionals in schools to enhance student learning, explaining, "In order for

effective PD to be successful, it must become a vehicle for school improvement, a means to the ultimate goal of student growth and development" (Gordon, 2004, p. xiii).

Glenn's (2005) research identified five hallmarks of high-quality PD programs, asserting that they are:

- connected to and derived from teachers' work with their students;
- sustained, ongoing, intensive, and supported by peers and school leaders;
- organized around collective problem solving for specific problems of practice;
- integrated into the framework of teacher career regulations and incentives; and
- responsive to social and educational priorities at national, state, and local levels.

Glenn's (2005) hallmarks of PD adhere to the guidelines set forth by the National Staff Development Council (NSDC, 2001) and have been partially interwoven into educational growth and reforms as policies are created to increase student achievement (as cited in Williams, 2014).

Darling-Hammond & Richardson (2009) not only developed a list of characteristics of effective research supported by the research but also highlighted what the research does not support. According to them, the research *does not support* PD that

- relies on the one-shot workshop model,
- focuses only on training teachers on new techniques and behaviors,
- is not related to teachers' specific contexts and curriculums,
- is episodic and fragmented,
- expects teachers to make changes in isolation and without support, and
- does not provide sustained teacher learning opportunities over multiple days and weeks (p. 51).

More recently, Almazroa (2013) synthesized the research on PD effectiveness and surveyed a sample of Saudi science teachers to develop resulting in a list with 20 characteristics of effective science teachers categorized by five dimensions: goals, content, support, approaches, and evaluation. For example, one goal of effective science PD should be to share a common vision of teaching and learning, the content should be based on teachers' needs, the support needs to include adequate resources, the approaches should take a variety of forms and include a follow-up with teachers, and the evaluation must involve continuous reviews and assessments (Almazroa, 2013; Almazroa & Al-Shamrani, 2015).

Noting that there are tradeoffs in terms of time, funding, staffing, and expertise when it comes to implementing effective PD programs and that there is no one-size-fits-all approach to PD, Guskey (1994) posited the concept of an "Optimal Mix" that PD programs should strive to meet. Guskey offered guidelines towards achieving this Optimal Mix:

- Recognize that change is both individual and organizational.
- Think big but start small (planning and implementation).
- Work in teams to maintain support.
- Include procedures for feedback on results.
- Provide continued follow-up, support, and pressure.
- Integrate programs.

All of these lists of characteristics and qualities of PD share a lot in common, particularly the emphasis on experiential learning, collaborative environments, reflection, administrative follow-up and support (feedback, resources, time, and budget), and data-

driven evaluation. In fact, lists and criteria of effective PD mean nothing without the evaluating them. Before evaluating the model, however, it is important to first identify what type of PD model is being implemented.

PD models. Sparks and Loucks-Horsley (1989) group numerous PD approaches into five main models: (a) individually guided PD, (b) observation/assessment, (c) involvement in a development/improvement process, (d) training, and (e) inquiry. These five models are discussed in greater depth along with various specific PD approaches that fit within each overall model. Assumptions, design, and strengths and weaknesses of each are also discussed.

In an individually guided PD model, teachers choose their own PD activities they believe will promote their learning and practice (Sparks & Loucks-Horsley, 1989). While teachers do a great deal of learning on their own in an informal and unstructured way, this PD model involves actively promoting and monitoring such individual activities in a school system (Sparks & Loucks-Horsley, 1989). This model assumes that individual teachers know best what their learning needs are and that they are capable of self-direction (Sparks & Loucks-Horsley, 1989). Research on adult learning theory, andragogy, and adult development provides a strong framework for the ideas of the individually guided model, particularly the concepts of self-diagnosis, self-directed learning, and readiness to learn in ways that are relevant to real-life tasks and problems (Knowles, 1984). This model of PD can take many forms, from unstructured to highly structured, and can include grants, projects, webinars, and simply reading published research on a topic of interest. Individually guided activities can include personal

histories, journal writing, portfolios, and role-playing (Langer & Colton, 1994; Dietz, 1995).

The observation/assessment model involves other staff, faculty, and administrators providing feedback to teachers in regard to their classroom performance (Park, 2013; Sparks & Loucks-Horsley, 1989). This model assumes that the feedback gained from observations and assessments can stimulate reflection in the teacher (Sparks & Loucks-Horsley, 1989). Teaching is usually an isolated profession, so usually teachers are not able to see what works and does not work well from an outside perspective. This model provides "another set of eyes" to give teachers a different view of their practice (Sparks & Loucks-Horsley, 1989). The observation/assessment model also assumes that peers and supervisors have knowledge that differs from and is more experienced than the teacher under observation in order for the model to improve practice. Research shows that the keys to the effectiveness of this model are the inclusion of a reflection component and effective coaching (Williams, 2014). Under the observation/assessment model, one can include various approaches such as clinical supervision and peer coaching (Sparks & Loucks-Horsley, 1989).

In the development/improvement process model, teachers are involved in developing curricula, designing programs, or participating in school-improvement processes to address general or specific issues (Sparks & Loucks-Horsley, 1989). One of the assumptions of this model is that adults learn best when they have a need to address or a problem to solve (Knowles, 1984). Another assumption is that those who work closest to the job understand how to best improve the job performance (Sparks & Loucks-Horsley, 1989). Finally, the development/improvement process model is that teachers can

acquire useful skills and knowledge through the process of addressing a specific need or problem in the school (Sparks & Loucks-Horsley, 1989). Some of the particular approaches within this model are curriculum reviews, program design, strategic planning, and solving a particular need or problem.

The training model guides teachers in the acquisition of new knowledge or skills through directive instruction on an individual or group basis (Sparks & Loucks-Horsley, 1989). While it may seem similar to the observation/assessment model, the main difference is that it is more directive and the trainer is more actively involved rather than passively observing. According to Sparks and Loucks-Horsley (1989), for many educational professionals, training is synonymous with PD, but it is just one model that could be used. Because of how widespread training is as a PD model, there is much more published research on training compared to the other models. Typically, training involves an expert trainer who leads lessons, workshops, or demonstrations with direct instructions and clear learning outcomes, and is similar to traditional and directive teaching models in this sense (Sparks & Loucks-Horsley, 1989). The training model has four main components: (a) theory or rationale for the new behaviors to be learned, (b) demonstration or modeling of the target behaviors, (c) practice in the training setting, and (d) guided classroom practice with feedback on performance (Loucks-Horsley et al., 1990). Because of its similarities with the observation/assessment model and the fact that the last step of effective training usually includes some kind of feedback, Sparks and Loucks-Horsley (1989) suggest that they can work well together to improve outcomes. This model assumes there are behaviors worthy of replication and that teachers can change their behaviors based on replicating behaviors of others (Sparks & Loucks-

Hoursley, 1989). Some approaches considered part of the training approach include workshops, demonstrations, simulations, courses, and role-playing (Williams, 2014).

Finally, the inquiry model requires teachers to identify an area of interest, collect data, and make adjustments based on the interpretation of the data (Sparks & Loucks-Horsley, 1989). Because it is based on the idea that teachers can develop their own understanding of classroom phenomena through in-depth research, inquiry, and reflection, this model is rooted in the constructivist perspective and is based on research by Schon (1983) and Sparks and Simmons (1989) (as cited in Loucks-Horsley et al., 1990). The inquiry model is based on the assumption that teachers are able to formulate valid questions about their practice and investigate objective answers to those questions through careful analysis (Guskey, 2000; Sparks & Loucks-Horsley, 1989). Practices within the inquiry model include action research and reflective inquiry (Loucks-Horsley et al., 1990). Although this model can take many forms, they all tend to share the following four steps in the process: (a) identify the problem, (b) formulate a research question based on the problem and a method to address the question, (c) carry out the research design, and (d) take action based on the results of the research, such as an intervention to be implemented in the school (Sparks & Loucks-Hoursley, 1989).

Strengths and weaknesses of PD models. Individually guided PD model can suffer from its unstructured and variable nature. This makes it difficult to measure and monitor progress in order to evaluate effectiveness. The lack of incentives and accountability for individually guided approaches can lead to lower levels of participation and follow through. Despite its apparent weaknesses, some studies have found individuals are more motivated to learn in individually guided PD. Other advantages of

individually guided PD include its flexibility, opportunity for choice, and individualization (Guskey, 2000).

One of the benefits of the observation/assessment model is the fact that both the observer and the teacher being observed can gain new perspectives from which they can develop their own practice (Sparks & Loucks-Horsley, 1989). Unfortunately, a great deal of the effectiveness of this model depends on how good of a coach the observer is (Williams, 2014). If the evaluations of the supervisor or peer has too much power over the observed teacher's career and is not very supportive, then it is possible to use this model in a punitive way to bully or intimidate the observed teacher.

The major benefit of the development/improvement model is that it simultaneously develops the teachers' skills, knowledge, and abilities as well as improves the school by addressing existing needs, problems, or issues face by the school. According to Guskey and Peterson (1996), involvement in development/improvement processes allows participants to increase their specific knowledge and skills as well as to improve their ability to work together in shared decision-making systems. One potential weakness of this approach is that the effectiveness of this model depends on reliable information and appropriate levels of expertise in order to make informed decisions (Williams, 2014). Without appropriate information and expertise, the teachers could acquire beliefs and learn habits that are detrimental to their practice and lead to worsening of the school's needs and problems.

Training can benefit from cost-efficiency because large numbers of teachers can learn from single demonstrations followed by feedback (Loucks-Horsley et al., 1990). However, training greatly depends on the expertise, ability, and credibility of the trainer

who is leading the session (Pancucci, 2007). Moreover, schools must provide adequate time for the training to take effect. Pancucci (2007) claimed that a major limitation of this model is that in most cases it does not provide enough time for the teachers to assimilate the knowledge and change their behaviors. This weakness led Pancucci to conclude that while it may seem efficient, it may not be effective.

One of the major strengths of the inquiry model is that it shifts the focus of teaching from simply teaching students to finding out what students know, how they learn, and what approaches can help them learn better (Loucks-Horsley et al., 1987). As a result, researcher-teachers report being more self-assured and willing to change, finding student behavior as more interesting, and listening to the concerns of students more (Loucks-Horsley et al., 1987). However, the inquiry can be intimidating to teachers and can seem like a waste of time and money to administrators (Loucks-Horsley et al., 1987).

Teachers' Views on PD

Science teachers' views. The definition of PD, qualities of effective PD, and models of PD have been well discussed, but what remains unclear is how science teachers themselves view PD experiences and how they affect their practice. Loucks-Horsley et al. (1998) summarized previous findings that show teachers want PD designed and delivered by professional developers who can teach in ways consistent with state and national standards, who understand the nature of the science discipline, and who are aware of the unique needs of the particular schools and teachers involved.

PD can also have a strong effect on teacher practices. In a rare national view of science teachers' PD, Supovitz and Turner (2000) surveyed 3464 science teachers and 666 principals in 24 communities around the US. They found that science teachers who

had less than 20 hours of PD were significantly more likely to use traditional teaching methods and less likely to use inquiry-based methods compared to teachers with over 20 hours (Supovitz & Turner, 2000). Additionally, science teachers with more positive attitudes towards reform were more likely to use inquiry based practices (Supovitz & Turner, 2000). The authors concluded that their research shows a strong and significant relationship between PD and teachers' practices and culture (Supovitz & Turner, 2000).

The effects of PD can be long-lasting even with a short PD course. Heller, Daehler, Wong, Shinohara, and Miratrix (2012) conducted a randomized experiment with over 270 elementary teachers and 7,000 students in six states in which they compared in three related but systematically varied teacher 24-hour PD courses: Teaching Cases, Looking at Student Work, and Metacognitive Analysis. Along with the three different PD groups, the study included a control group that received no treatment (Heller et al., 2012). All PD approaches had the same content but delivered in different manners (Heller et al., 2012). The results showed improved teacher pedagogical and content knowledge as well as student test scores for all PD interventions compared to control, and the effects persisted even at a one-year follow-up (Heller et al., 2012). The Teaching Cases and Looking at Student Work PD approaches were particularly impactful, supporting the idea that teachers must learn how to do instruction, not just hear and talk about it (Heller et al., 2012).

Saudi science teachers' views. Since 2013, PD for Saudi science teachers has been a major topic of interest because of the implementation of a new science curriculum for the entire country (Ghoneim Sywelem & Witte, 2013). As a result, research on Saudi science teachers' perspectives on PD has started to emerge in the literature. Ghoneim

Sywelem and Witte (2013) were among the first Saudi researchers to publish research in this area. In their study, they surveyed 295 science teachers in 20 elementary schools in the KSA. They found that many of the participants did not recognize the importance and usefulness of PD activities. Only half of the teachers believe PD activities help them in acquiring knowledge and skills, solving classroom difficulties, and discovering new ideas and strategies for classroom management, while the other half disagreed. One of the main issues identified by this research was that many teachers cited a lack of peer mentoring in their PD experiences, in which they indicated that they never received formal or informal evaluations from their peers. Additionally, the teachers reported that they did not have the opportunity to work together, observe each other, and provide constructive feedback (Ghoneim Sywelem & Witte, 2013). As clearly evident in the literature on PD effectiveness, the very things that the Saudi teachers reported not receiving are the most important components of strong PD experiences.

Mansour, Alshamrani, Aldahmash, and Alqudah (2013) also identified and explored science teachers' perceived PD needs in terms of their knowledge and skills both pedagogy and content. In their study, Mansour et al. (2013) surveyed 499 Saudi science teachers and 61 science teacher supervisors. Their main finding was that while Saudi science teachers and science teacher supervisors share many of the same perceived needs, there was a mismatch between the two in terms of certain pedagogical needs unique to individual teachers depending on their teaching interests, for example in teaching special needs students and using problem-solving teaching strategies in science (Mansour et al., 2013). As they concluded,

> That difference reinforces the necessity for those who direct science teacher in-service programmes to attend to the primary axiom of in-service education: the needs of every science teacher who will participate in an in-service programme must be assessed prior to planning and instituting the activities. (Mansour et al., 2013, p. 41)

This finding is similar to what Loucks-Horsley et al. (1998) found in relation to the perspective of teachers in general.

More recent research has generated more positive results in terms of Saudi science teachers' perspectives towards PD, perhaps reflecting improvements in the PD process. Qablan, Mansour, Alshamrani, Aldahmash, and Sabbah (2015) surveyed 609 Saudi science teachers and found that the teachers found the PD generally helpful. However, some of the barriers revolved around the heavy emphasis on lecturing instead of involving teachers, the lack of time, trainer preparedness, and unavailable resources (Qablan et al., 2015). Although most of the surveyed teachers support the idea of more PD opportunities, many of them reported not being able to integrate what they learned in PD into their classrooms because of the noted barriers and obstacles (Qablan et al., 2015).

In a correlational analysis, Almuntasheri, Gillies, and Wright (2016) compared the effect of guided inquiry-based versus teacher-directed approaches on the learning outcomes of students. They grouped six teachers and their students into inquiry-based, and teacher-directed groups, with three teachers in each group and a total of 107 students in six 6^{th} grade classes. Following an ANOVA analysis of the pre- and post-tests of the students' understanding of the concept of density in each group, Almuntasheri et al. found that students of teachers who participated in the guided-inquiry PD workshops

showed a better conceptual understanding of the topic as indicated by both multiple-choice and open-question tasks. These findings support the need to provide PD guidance to teachers who implement inquiry-based teaching methods and that effective PD can result in improving student learning outcomes (Almuntasheri et al., 2016). One of the influential PD model evaluations is Guskey model.

The Guskey Model

The PD evaluation model used in this dissertation is based on the work of Guskey (1991, 2000, 2002). Guskey (2000) stated that PD evaluation should focus on measuring knowledge, skills, attitudes and beliefs of teachers because PD must first have an impact on the teachers before it can impact student learning. Guskey (2000) traces the history of evaluating PD to three foundational models: Ralph Tyler's Evaluation Model, Metfessel and Michael's Evaluation Model, and Kirkpatrick's Evaluation Model. The work of Ralph Tyler throughout the 1930s and '40s established the belief that the first step towards evaluating any program is to start with the goals and objective of the program (as cited in Guskey, 2000), which is often referred to as backward design. Twenty years after Tyler, Metfessel and Michael (1967) made two important contributions to evaluation models: one, the inclusion of multiple constituencies in the process and, two, advancements in data collection and analysis (as cited in Guskey, 2000). The work of Kirkpatrick (1959, 1977, 1978), which was designed for business and industry but has applications for education as well, contributed the concepts of reaction evaluation, learning evaluation, behavior evaluation, and results evaluation (as cited in Guskey, 2000).

Additionally, Hanover Research (2015) highlighted three PD evaluation models that have gained popularity since the 1980s: the Kirkpatrick, Guskey, and Clarke-Hollingsworth models. Each of these ways of evaluating PD differ in their conceptualization of teacher change, which the Hanover Research (2015) report categorizes as linear (Kirkpatrick and Guskey models) and distributed (Clarke-Hollingsworth model). Guskey based his model on Kirkpatrick's model, but applied it explicitly to the teaching profession instead of PD in business and industry.

Guskey (1991) found that while most scholars who study PD agree that one of the best measures of effectiveness is improvements in student outcomes, very few studies actually include student achievements in their evaluations of PD effectiveness. Instead, most research focus on participants' satisfaction, which says very little about effectiveness (Guskey, 1991). Guskey's (2000) model of PD evaluation started with five levels: (1) participants' satisfaction, (2) participants' learning, (3) organizational support and change, (4), participants' use of new knowledge and skills, and (5) student learning outcomes. For each of these five levels, Guskey describes what questions the level addresses, how information can be gathered, what is measured, and how the information gathered can be used. From these five levels, a sixth was added by later researchers based on a subsequent article published by Guskey (2002) in which he described a teacher change model.

In 2002, Guskey introduced his model for teacher change states that teachers are more likely to change their attitudes and beliefs once they see evidence of positive student outcomes. In other words, teachers become committed to a new approach or innovation in their teaching once see work in action in their classrooms (Guskey, 2002).

Furthermore, Guskey's theory of teacher change contains four elements: staff development, change in teacher's practice, change in student learning outcomes, and change in teacher's attitudes and beliefs. This model suggests that PD evaluations should also assess how teachers perceive that impact of PD on their teaching methods and on student learning.

Noting this relationship between Guskey's (2002) the theory of teacher change and Guskey's (2000) PD evaluation model, two dissertations, one by Lowden (2003) and a subsequent one authored by Williams (2014), combined both of Guskey's theories and focused on teacher outcomes while excluding the organizational and student outcomes (Lowden, 2003; Williams, 2014). This teacher-oriented synthesis of both of Guskey's models results in six elements: (1) teachers' satisfaction, (2) teachers' learning, (3) teachers' perceptions of organizational support and change, (4) teachers' use of new knowledge and skills, (5) teachers' perspectives of student learning, and (6) change in teachers' attitudes and beliefs. The goal of evaluating PD should be to continuously improve the PD process and, ultimately, to have a positive impact on student learning outcomes.

The current dissertation is based on this combined and modified version of the Guskey Model. The six levels of gathering information about PD in this version are shown in *Table 2*, arranged from simple (Level 1) to complex (Level 6). The organization of the table is based on Guskey's (2000) descriptions of each level of evaluation criteria, with the columns representing the questions addressed, the how the information can be gathered, what the level is measuring, and how it can be used.

Table 2

Guskey's Five Levels of PD Evaluation Plus Teacher Change Model

Evaluation level	Questions addressed?	Information gathering	Measures	Usefulness
1. Participants' satisfaction	Did they like it? Was their time well spent? Did the material make sense? Will it be useful? Was the leader knowledgeable and helpful? Was the environment comfortable?	Questionnaires post-session Focus groups Interviews Personal learning logs	Initial satisfaction with the experience	To improve program design and delivery
2. Participants' learning	Did participants acquire the intended knowledge?	Paper-and-pencil tests Simulations & demos Reflections/ Questionnaires Participants' portfolios Case study analyses	New knowledge and skills of participants	To improve program content, format, and organization
3. Organization support and change	What was the impact on the organization? Did it affect organizational climate? Was implementation advocated, facilitated, and supported? Was support public and overt? Were problems addressed efficiently? Were sufficient resources made available? Were successes recognized and shared?	School records Meeting minutes\ Questionnaires Focus groups Structured interviews Participant portfolios	The organization's advocacy, support, accommodation, facilitation, and recognition	To document & improve organization support To inform future changes
4. Participants' use of new knowledge and skills	Did participants effectively apply the new knowledge and skills?	Questionnaires Structured interviews Participant reflections Participant portfolios Observations	Degree and quality of implementation	To document & improve implementation of program content
5. Student learning outcomes	What was the impact on students? Did it affect student performance or achievement? Did it influence students' physical or emotional well-being? Are students more confident as learners? Is student attendance improving? Are dropouts decreasing? Did the new learning have a positive impact on students' behavior?	Student records School records Questionnaires Structured interviews with stakeholders Participants' portfolios	Students learning outcomes: -Cognitive -Affective -Psychomotor	To improve program design implementation, and follow-up To demonstrate the overall impact of professional development
6. Participants' change in attitudes and beliefs	Did participants find the experience meaningful? Did participants feel they learned practical instructional strategies? Did participants believe their teaching became more effective? Did the participants feel they can better meet the various needs of all the students? Do the participant believe efforts are recognized? Do participants believe PD connects to district needs and overall school improvement?	Paper-and-pencil instruments Simulations and demonstrations Participant reflections (oral and /or written)/Questionnaires Participants' portfolios Case study analyses	Participants' change in attitudes and beliefs concerning teaching and learning	To improve program content, format, and organization. To inform future change efforts.

Adapted from "*Evaluating professional development*, Does it make a difference? Evaluating professional development. *Educational Leadership, and Teachers' perceptions of professional development experiences* " by Guskey and Williams , (2000,2002, and 2014), *Educational Leadership, 59(6),* p.45-5,1*and (Doctoral Dissertation).University of Nevada, Reno,*p.126-127.Copyright 2000,2002, and 2014 by London: Corwin Press, Thousand Oaks, CA: Corwin Press & ProQuest LLC.

Conclusion

As the literature shows, the exchange of ideas and experiences, feedback from peers, and reflective inquiry are all essential components of effective PD. Moreover, the advice from Sparks and Hirsh (2000) about improving PD offers strong recommendations at various levels. At the national level, the MoE can fund research into PD approaches, establish evidence-based standards, and set policies to guide schools; at the regional level, the ETCs can provide high-quality PD to support PD in schools; and at the local level, school systems can provide more time for PD and encourage a collaborative environment in order to foster a rich and receptive environment for PD (Sparks & Hirsh, 2000). In KSA, research is needed to focus on evaluating PD regarding its effectiveness in helping Saudi science teachers implement the new Saudi science curriculum. To this end, the research questions of interest are,

3. Is there fidelity between the MoE's goals, format, and content for PD and the teachers' perceptions of that PD?
4. What is the level of perceived effectiveness of PD among Saudi male science teachers?

While questions like these have just started to be answered in the KSA, there are a lot of areas of science teacher PD to still explore in the KSA. The descriptive study proposed in this dissertation proposal can provide a good idea of the current state of PD.

Chapter Three

Methodology

This chapter describes and explains the methodology used in this dissertation. The study in this dissertation was a cross-sectional, descriptive survey of Saudi male science teachers and their perspectives on the effectiveness of their PD experiences regarding the new science curriculum based on translated McGraw-Hill science textbook series. To this end, the two research questions of addressed in this study are as follows:

1. Is there fidelity between the MoE's goals, format, and content for PD and the teachers' perceptions of that PD?
2. What is the level of perceived effectiveness of PD among Saudi male science teachers?

The research design, sample, instrumentation, data collection, and data analysis procedures to answer these questions are explained in this chapter.

Research Tradition and Design

In order to answer the research questions and address the purpose of this study, a quantitative research tradition was followed. Within this tradition, this study used a non-experimental, descriptive approach with a survey design that focused on the opinions of Saudi male science teachers. According to Creswell (2012), "survey research designs are procedures in quantitative research in which investigators administer a survey to a sample or to the entire population of people to describe the attitudes, opinions, behaviors, or characteristics of the population" (p. 376). As stated in the purpose and the research questions of this current study, the researcher examined science teachers' perceived effectiveness of PD on teaching the new Saudi Arabian science curriculum. As such,

descriptive data based on Saudi male science teachers' perceptions was collected and no causality was sought.

Additionally, the type of non-experimental design can also be considered a cross-sectional, descriptive design in terms of the timeframe and purpose of the research (Johnson, 2001). According to Johnson (2001), "in cross-sectional research the data are collected from research participants at a single point in time" (p. 9). Moreover, a cross-sectional study design is useful for examining *current* attitudes, beliefs, opinions, or practices (Creswell, 2012). Because the major research objective in this study is to describe science teachers' perceived effectiveness of PD for teaching the new Saudi science curriculum, and because the data was collected at a single point in time, this study is considered a cross-sectional, descriptive design.

Situation, Population, and Sample

The situation in this study focused on the current perceptions of Saudi male secondary school science teachers in Makkah, Saudi Arabia towards the effectiveness of PD programs aimed at implementing the new science curriculum. To this end, the target population included male science teachers working in secondary schools who apply the new science curriculum and are located in the South District of Makkah, Saudi Arabia. Male teachers were exclusively addressed in this study rather than only female or both male and female science teachers because the education system in the KSA is gender segregated and, as a Saudi male researcher, I have more access to the population of male science teachers in the KSA. According to the Makkah Statistical Cards website covering the period ranging from 2017-2018, the General Administration of Education for Training and Scholarship identified 38 such schools. Of these, 29 are public and 9 are

private. If every secondary school has approximately two-three male science teachers (which is typically the case), the target population would be around 111 teachers.

Two inclusion criteria was used. First, all members of the target population were males. Second, each member should be teaching in a secondary school that uses the Credits' System School and is located within South District of Makkah.

The researcher employed a non-probability sampling method referred to as comprehensive sampling (also known as census). This method has been chosen because the target population is finite and rather small. According to Creswell (2012), non-probability sampling is considered when it is easy to locate the members of the target population because of their convenience, and when they share the characteristic of interest in the study. Assuming a typical 33% response rate among the 111 total teachers that were included in the comprehensive sampling method resulted in a target sample of approximately 68 participants in the end.

Variable and Instrumentation

There is one major variable in this study—the perceived level of effectiveness of PD. This major variable is further divided into six categories that was measured by the survey: perceived satisfaction, reported learning, perceived organizational support, reported use of knowledge and skills gained, perceived impact on student learning outcomes, and reported changes in participants' attitudes. Average scores based on teacher responses to a series of survey questions were calculated for each of the six categories of effectiveness as well as each individual survey question. There are no independent variables in this study because it is a descriptive study. The researcher's intent is to describe the level of effectiveness of PD as perceived by Saudi male science

teachers. Further, there are no control, mediating, and moderating variables because the study does not intend to establish correlation or causation.

Regarding instrumentation, the researcher used an existing survey developed and previously used by Williams (2014), Lowden (2003) and Liguori (2000), all of which are based on the Guskey (2000, 2002) evaluation model of PD. The original survey is in English, so the researcher translated the survey into Arabic, and checked the translation with bilingual English–Arabic experts. All the questions were be on a 4-point Likert scale (strongly agree, agree, disagree, strongly disagree). The questions as a set were used to measure the Saudi male science teachers' perceived effectiveness of PD for teaching the new science curriculum.

The survey consisted of two sections of 51 closed-ended items. Section 1 included 9 items total. Seven items gathered demographic information about participants, such as age, marital status, the type of the school in which they work, their educational background and experience in teaching. These questions helped the researcher to have a deeper understanding of the respondents. Section 1 also contained nine items to collect information on the process; goals, format, and how the content is decided in the PD programs the participants have experience. As such, Section 1 helped address major research question 1 and its associated sub-questions.

Section 2 included 42 items that gather information about teachers' perceived effectiveness of Saudi PD program for science teachers, divided into six sections: (a) satisfaction, (b) reported learning, (c) perceived organizational support, (d) reported use of knowledge and skills gained, (e) perceived impact on student learning outcomes, and (f) reported changes in their attitudes. As such, Section 2 helped address major research

question 2 and its associated sub-questions. The following is an example of the items included in Section 2: “Professional development activities which I have attended are very useful in solving the difficulties that I had in the classroom” (Liguori,2000, Lowden, 2003 & Williams, 2014).

The validity and reliability of the survey instrument developed by Liguori (2000) and modified by Williams (2014) was previously assessed by a panel of experts who reviewed the questions and made suggestions and Williams (2014) reported the Cronbach Alpha coefficient of $\alpha=0.80$, suggesting that the questionnaire was sufficiently reliable.

However, since the population being surveyed in this study is very different and the instrument was translated from English into Arabic, new evidence of reliability and validity needed to be established. In terms of reliability, I conducted a pilot study that involved administering the questionnaire to 33 Saudi male science teachers and calculated the Cronbach’s Alpha coefficient of the translated survey. The results of the pilot study showed the instrument is very reliable ($\alpha=0.96$). Additionally, to assess the construct validity of the translation, I consulted with a panel of three bilingual English–Arabic experts. The expert reviewers suggested a few changes in the wording of the translation for increased accuracy and understandability. The pilot questionnaire also included an open-ended section for the participants to provide feedback and suggestions about understandability and accuracy. Minor adjustments were made based on both sources of feedback.

Data Collection Procedures

This study collected data on the Saudi male teachers’ perceived effectiveness of PD towards teaching the new science curriculum. A free online questionnaire software

program (e.g., Qualtrics.com) was used. During the beginning of the Saudi school year, a link to the survey was emailed to the study participants who were asked to complete it within two weeks. The local MoE offices provided the researcher the email addresses of the study participants.

Prior to collecting the data, University of Toledo (UT) Institutional Review Board (IRB) approval was obtained. Seeking approval of research from the IRB is necessary to protect human subjects. Since this study involves human subjects (Saudi male science teachers) who provided information that is not available through public sources or commercial providers (UT IRB Guidance Form, 2008; NHS Determination Form, 2015), IRB approval was needed. In addition, the researcher sought permission from the director of the Science Department of the General Administration of Education in Makkah, who is the gatekeeper to the participants. According to Homan (2001), "Gatekeepers are those who give access to a research field. Their role may be in allowing investigators into a given physical space, or it may go further in granting permission for research to be conducted in a particular way" (p.329).

Record Keeping and Data Analysis

Efforts were made to conduct this study in accordance with the ethical principles of research. One of them is protection from harm, including physical, social, legal, and psychological harms. The researcher ensured that human privacy, dignity, and autonomy are respected by getting informed consent, maintaining confidentiality, and protecting anonymity. In general, it is the researcher's intent to maximize benefits and minimize harms (Resnik, 2011). The level of risk in the current study was relatively low. The decision to take part in the study was voluntary for each prospective participant.

Prior to completing the questionnaire, each participating teacher in this study was provided with an online informed consent form. The principle of informed consent is integral in protecting human subjects seeking to participate in a research study (Homan, 2001). As part of obtaining informed consent, the researcher provided participants with sufficient information about the study for them to determine whether to take part in the study. The contents of the informed consent form included the title and purpose of the study, potential risks involved, potential benefits, confidentially information as well as the researcher's contact details (Creswell, 2012; UT SBE Adult Consent Template, 2011). In addition, there was a statement indicating that participating in the study is voluntary and one is free to withdraw from the study at any time without giving any reason.

Confidentiality and anonymity of the participants were ensured. Any participants' identifying information that the researcher has collected was protected to ensure others cannot identify the participants when reading the research report. To ensure confidentiality and anonymity, the researcher stored any participants' identifying information in a password-protected computer that was accessible by the researcher only. In addition, the researcher ensured that no identifying information appears in the research report.

To answer the research question, descriptive statistics was used. Once collected, the data was entered into the Statistical Packages for the Social Sciences (SPSS) software program (IBM, Version 25). Using SPSS, frequencies, means, standard deviations, ranges, and percentages were calculated to describe the level of perceived effectiveness of PD among Saudi male science teachers. The results were analyzed and presented in

tabular and graphical forms. These descriptive statistics provided insight into how useful and effective Saudi male science teachers perceive the PD programs to be for them and their efforts to teach the new science curriculum.

Conclusion

Based on the prior research on PD, particularly among science teachers, along with the needs of Saudi teachers working to implement the new national science curriculum, the following research question was identified: What is the level of perceived effectiveness of PD among Saudi male science teachers? This research question provided a guide for the further research in the chosen field science teacher PD. Once the methods outlined in this paper are followed, it is expected that the results showed the majority of Saudi male science teachers perceive PD as not being very effective. The findings can then provide a foundation for future research addressing the concerns of Saudi science teacher PD and ultimately potential lead to improvements to the PD programs offered in the KSA.

Chapter Four

Results

The purpose of this study is to examine Saudi male science teachers' perceptions of the effectiveness of PD for improving their ability to teach the new Saudi Arabian science curriculum. This chapter presents the results and analyses for the following two major research questions with demographics which contain 10 minor research questions. The first research question was as follows:

1. Is there fidelity between the MoE's goals, format, and content for PD and the teachers' perceptions of that PD?

Moreover, PD programs in this research question are further divided into the following specific characteristics:

a. What are the *goals* of the PD programs in which participants have participated?
b. What are the PD program *format* in which participants have participated?
c. How is the *content* for PD decided in programs in which participants have participated?

The second research question was as follows:

2. What is the level of perceived effectiveness of PD among Saudi male science teachers?

Effectiveness in this research question is further divided into the following specific levels:

a. What is the participants' satisfaction to their PD experiences?

b. To what extent do the participants report the learning new knowledge and skills from their PD experiences?
c. What is the participants' level of perceived organizational support for PD?
d. To what extent do participants report using new knowledge and skills gained from their PD experiences?
e. What is the participants' level of perceived impact that their PD has had on student learning outcomes?
f. To what extent do participants report changes in their attitudes towards teaching and learning in science as a result of their PD experiences?

The first part of this chapter presents the descriptive findings from the data in Section One of the questionnaire. This includes demographic information, the findings of process and content PD categories. The second part provides the summary result of this study. These six sub-questions are based on the data from Section Two of the questionnaire, which focused on the level of perceived effectiveness of PD context that comprised of the six levels of evaluating PD. Overall, the two primary questions of this study are presented, accompanied by their analyses, findings, and a chapter summary.

Demographics

The dataset was examined to obtain descriptive statistics and to provide a general summary of the overall questionnaire responses. Out of 111 male Saudi secondary school science teachers from Makkah contacted via email, there were 68 teachers who responded to the questionnaire, for a response rate of 61.3%.

Age and marital status. The largest number of participants were between the ages of 36 and 40, which included 21 participants (30.9%). The next highest age range

was 31 to 35 years, with 18 participants (26.5%). Fifteen participants (22.1%) were over 45 years old and 9 (13.2 %) were between the ages of 41 and 45. Finally, the lowest age range among the sample was the 25-30 year-old-range, with only 5 participants (7.4% of the sample). In terms of the participants' marital status, 65 (95.6%) were married, while only 3 (4.4%) were single at the time of the survey. Also, because the focus of the study is on male science teachers, the gender of all of the participants was male.

Table 3

Participants' Age

Age	N	%
25 – 30	5	7.4
31 – 35	18	26.5
36 – 40	21	30.9
41 – 45	9	13.2
Over 45	15	22.1
Total	68	100

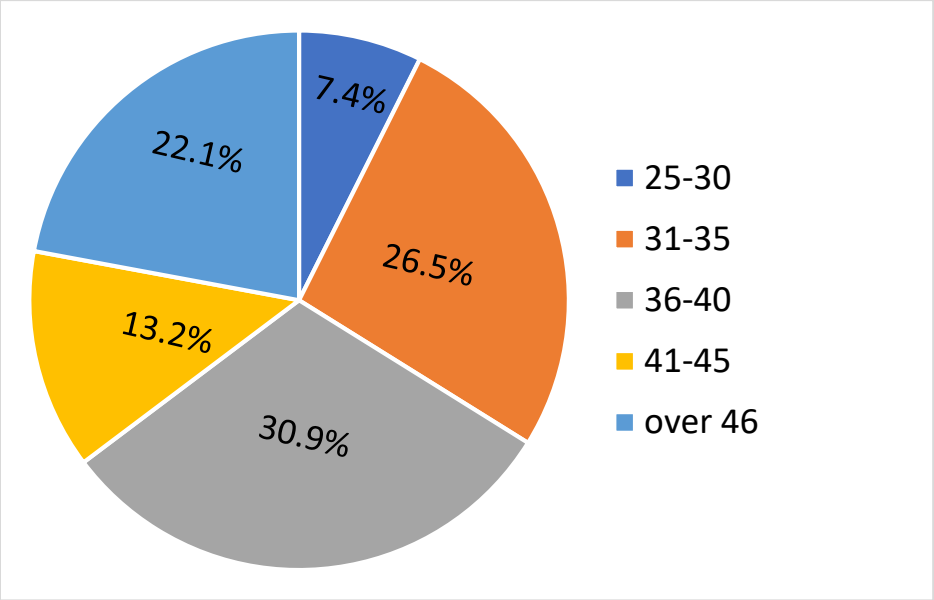

Figure 3. Pie chart of participants' age.

Table 4

ParticipantsMarrital Status

Marital Status	N	%
Married	65	87.3
Single	3	10.9
Total	68	100.0

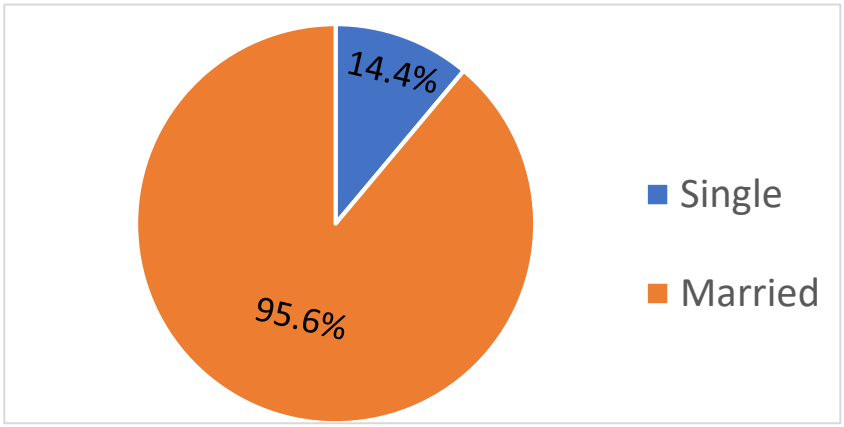

Figure 4. Pie chart of marital status.

Teaching experience. Among the teachers in this study, most (69.1%, N = 47) reported having more than 20 years of total teaching experience. In contrast, only 21 of the teachers (30.9%) had between 1 and 19 years of total teaching experience. That means that the sample in this study skews towards older teachers with more years of total teaching experience.

Table 5

Participants' Total Years of Teaching Experience

Total Years of Teaching Experience	N	%
1–19	21	30.9
20–40	47	69.1
Total	68	100

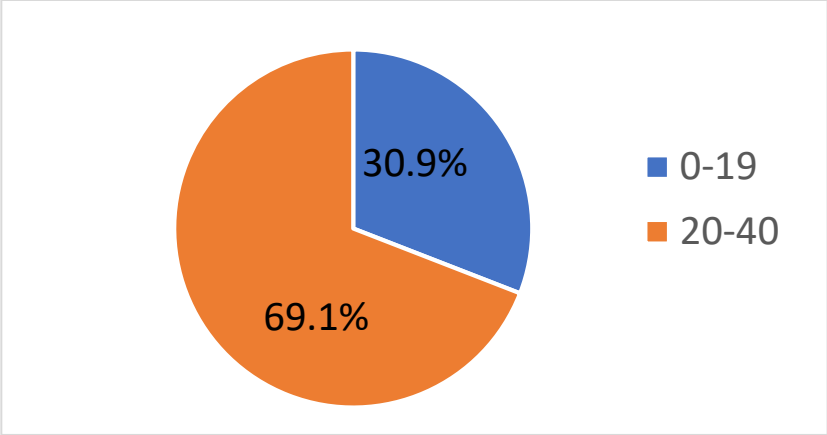

Figure 5. Pie chart of total years of teaching experience.

In addition to total years of teaching experience, the survey also asked about the years of teaching experience the teachers had in their current district at the time of the survey. Almost two thirds of the particpants (64.7%, N = 44) had more than 10 years of teaching at their current school. The most frequent responses, also known as the mode, were for both 4-9 years and 10-14 years, with 20 responses (29.%) each. Thus, together more than half of the participants (40 out of 68, or 58.8%) had been teaching in their current school district from 4 to 14 years at the time of the survey. Sixteen teachers reported teaching in the district between 15 and 24 years (23.5%). Finally, both extremes of 1-3 years and over 25 years each had eight teachers (11.8%).

Table 6

Participants' Teaching Years of Experience in Current District

Years of Teaching Experience in Current District	N	%
1 – 3	8	11.8
4 – 9	20	29.4
10 – 14	20	29.4
15 – 19	9	13.2
20 – 24	7	10.3
Over 25	8	11.8
Total	68	100

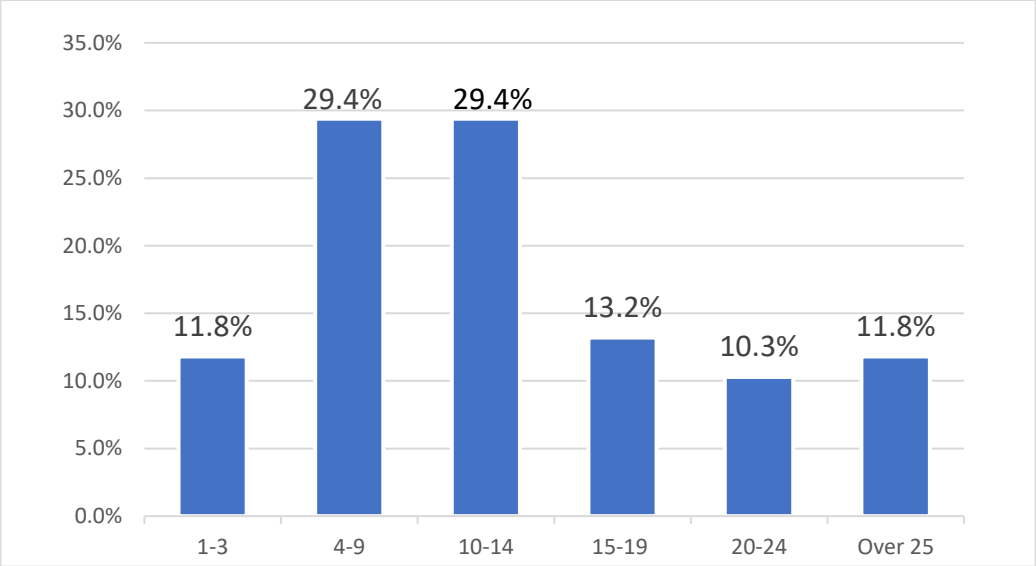

Figure 6. Bar graph of years of teaching experience in current district

Grade level. The teachers' grade levels of teaching also varied. The fewest group of respondents taught at the 11th grade level with 10 teachers (14.7%), followed by respondents who taught at the 12th grade with 25 science teachers (36.8%). The highest number of respondents taught at the 10th grade level, with 33 science teachers (48.5%).

Table 7

Participants' Grade Level Taught

Grade level taught	N	%
10th Grade	33	48.5
11th Grade	10	14.7
12th Grade	25	36.8
Total	68	100

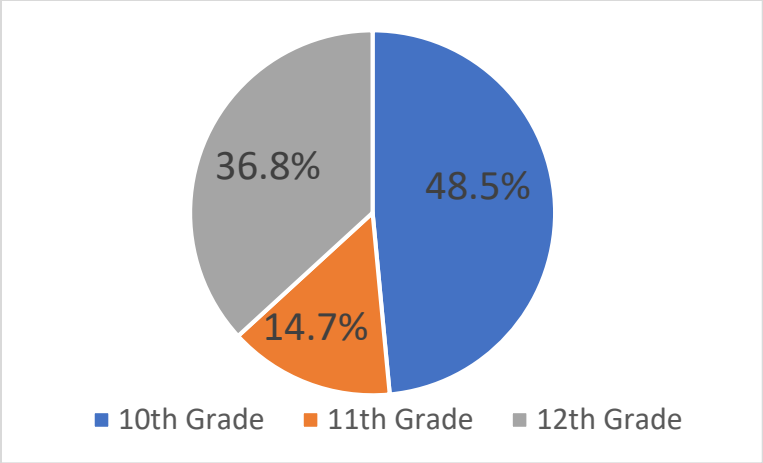

Figure 7. Pie chart of grade taught

Research Question 1

The first research question asked, "Is there fidelity between the MoE's goals, format, and content for PD and the teachers' perceptions of that PD?" That question was answered by the first main section of the questionnaire after the demographics. The results of this first section and how it answers Research Question 1 are reported below.

The goals of Saudi science teachers' PD. Table 8 shows the frequency and percentage of each of the four questions. Respondents indicated on question one of the survey whether or not they were aware of the goals of their district's PD. Question two asked whether or not their district's PD is linked to school improvement and increased student outcomes. Question three asked whether or not their district's PD plan is related to the teacher evaluation process. Finally, question four asked whether or not their district's PD plan is related introduce teachers to the inquiry-based learning approaches and constructivist theories upon which the new science curriculum and vision 2030 is based.

Table 8 indicates that the “Yes” responses with the highest percentages 75% (51 out of 68) of the teachers reporting that they were aware of the goals of their district's PD, while 25% (17 out of 68) were not. Sixty nine percent (47 out of 68) of the respondents indicated that their district's PD plan is linked to the overall improvement of the school district and to increasing student outcomes. Fourteen percent (10 out of 68) were not sure and 16% (11 out of 68) responded “No” to this question. Teachers indicated whether or not their district's PD plan is related to the teacher evaluation process. While 51.5% of the respondents indicated that the PD is linked to the teacher evaluation process, 30.9% were not aligned and 17.6% indicated that it was unsure. Half (50%), or 34 out of 68, teachers indicated that their district's PD plan is related introduce teachers to the inquiry-based learning approaches and constructivist theories upon which the new science curriculum and vision 2030 is based, while the other half either reported they were unsure or indicated that it was not aligned, with 30.9% (N = 21) and 19.1% (N = 13) of the responses, respectively.

Table 8

PD Goals

Statement	**Response**	***N***	**%**
Aware of the goals	Yes	51	75
	No	17	25
Linked to school improvement and student outcomes	Yes	47	69.1
	No	11	16
	Not Sure	10	14.7
Related to teacher evaluation process	Yes	35	51.5
	No	21	30.9
	Not Sure	12	17.6
Related to the inquiry-based learning and constructivist theories of the new science curriculum	Yes	34	50
	No	13	19.1
	Not Sure	21	30.9

The format of Saudi science teachers' PD. Table 9 shows the responses to Question 5 of the survey, which was about what time PD is offered in their school. An overwhelming majority number of respondents showed that they participated in PD during the school time (80.9%) (n=55). A fairly high percent of respondents indicated that they participated in the beginning of school years (30.9%) (n=21). Teachers also indicated that they were given PD opportunities end of the school year (19.1%) (n=13). The lowest percentage of respondents indicated they participated in PD in the evening (14.7%) (n=10).

Table 9

PD Format

PD in my district is offered	**N**	**%**
During the school time	55	80.9
In the beginning of the school year	21	30.9
In the evening	10	14.7
End of the school year	13	19.1

Question 6 concertated on PD process/format where respondents indicated that they participated in a variety of PD activities that incorporated different types of presentation strategies. Respondents could make more than one type of activity they participated in. The most frequently response was in the category of "Training," with all of the participants (68 out of 68) reporting they participated in some kind of PD training at some point in their careers. The "Training" category included the following specific options, with the percentage of participants who reported being involved in such

activities indicated in parentheses: workshops or seminars (61.8%), presentations or demonstrations (58.8%), expert lectures (22.1%), and conferences (17.6%,).

The second format of PD most frequently utilized was the "Individually Guided Staff Development" category. The Individually Guided Staff Development category consisted of the creation of individual PD plans where learning is designed by the teacher through goal setting (60.7%), reflection (50.8%), guided practice (47.5%), and individual professional improvement plans where teachers exercise an improvement plan in an identified area of weakness (24.6%).

The third format of PD most frequently participated in by respondents was "Observation and Assessment." This category consisted of classroom observation by administrators (67.9%), formal mentoring program with a trained mentor (35.7%), and classroom observation by a peer (28.6%).

Involvement in a "Development/Improvement Process" in a district was the fourth most frequently used format in this study. This category included curriculum development (75.9%) and participating on a school improvement committee (35.2%).

Finally, the least frequently used PD format in this study is "Inquiry." Inquiry included peer study groups where teachers meet to discuss current research (83%) and action research where teachers formulate questions, gather, and analyze data and use their findings to inform instruction (30.2%). For all the results for PD formats in which respondents participated, see Table 10.

Table 10

PD Activities

Type of PD Activities	N*	%
Training	*68*	*100.0*
Workshops or seminars	42	61.8
Presentations or demonstrations	40	58.8
Expert lectures or motivational speeches	15	22.1
Conferences	12	17.6
Individually guided staff development	*61*	*89.7*
Individual PD plan	37	60.7
Guided practice	31	50.8
Reflection	29	47.5
Individual professional improvement plan	15	24.6
Observation/assessment	*56*	*82.3*
Classroom observation and assessment by administrators	38	67.9
Mentoring	20	35.7
Classroom observation bya fellow teacher	16	28.6
Involvement in a development/improvement process	*54*	*79.4*
Curriculum development days	41	75.9
School improvement committees	19	35.2
Inquiry	*53*	*77.9*
Peer study groups	44	83.0
Inquiry/action research	16	30.2

*Note: Numbers of responses for each subcategory can exceed the total number of participants because the survey allowed more than one response per question

Content decision-making of Saudi science teachers' PD. In analyzing Question 7, Table 11 shows the frequency and percentage of teacher responses related to PD content for the decision-making process. Many teachers responded that either the "General Administration for Educational Training and Scholarships" (42.6%; n=29) or the "Ministry of Education" (41%; n=28) were making decisions about what PD content would be offered to teachers. The General Administration for Educational Training and Scholarship is under the MoE at the national level, which means that 83.6% (n=57) of the participants reported that their PD is directed and provided at the national level. Some

respondents indicated that other people in the PD Committee were part of this decision making process (33.8%; n=23). District level Administrators received a low percentage (14.7%; n=10), indicating less involvement in the content decision-making for PD in the district.

Table 11

PD Content Providers

PD in my district is provided by	**N**	**%**
General Administration for Educational Training and Scholarships	29	42.6
Ministry of Education	28	41
PD Committee	23	33.8
District level Administrators	10	14.7

Survey respondents were asked in question 8 of the list topics of the last three topics for teaching and learning have your PD experiences offered in which they participated. The results are shown in Table 12. Of the 68 respondents, 46 indicated that they participated in PD related to classroom management (67.6%), 28 teachers participated in Assessment of learning outcomes (41.2%), 26 teachers participated in lesson plan design (38.2%), 26 in Differentiation of skill levels and learning styles (38.2%), 22 teachers participated in a laboratory materials and approaches opportunity (32.4%). The fact that classroom management received the highest number of responses suggests that most of the training they are receiving or the information they are paying the most attention to is related to basic educational practices rather than the more advanced pedagogically oriented topics that are the stated goals of the new science curriculum.

Table 12

PD Content Topics

PD topics:	**N**	**%**
Classroom management	46	67.6
Assessment of learning outcomes	28	41.2
Lesson plan design	26	38.2
Differentiation of skill levels and learning styles	26	38.2
Laboratory materials and approaches	22	32.4

Survey respondents were asked in Question Nine of the survey to list the training in teaching of the following specific subjects in science of the PD opportunities offered by the school district in which they participated. The results are shown in Table 13. Of the 68 respondents, 27 teachers indicated that they participated in PD related to chemistry (39.7%), 25 participated in physics (36.8%), 22 in biology (32.4 %), and 3 in geology (4.4%).

Table 13

PD Content Subject Areas

PD in my district training in teaching any of the specific subjects in science have provided	**N**	**%**
Chemistry	27	39.7
Physics	25	36.8
Biology	22	32.4
Geology	3	4.4

Summary of Research Question 1. The responses were examined in Section One of the questionnaire to obtain descriptive statistics and gain a general understanding of the data. It was identified that the teachers' years of teaching experience ranged from 20-40 years from various educational levels. Three fourths of the teachers indicated that they were aware of the district's PD plan and only slightly more than two thirds believed that the plan was linked to overall school improvement and increased student outcomes. Moreover, only half of the participants

believed the district PD plan was related to the teacher evaluation process. Only half of teachers believed the district PD plan was related to the inquiry-based learning approaches and constructivist theories upon which the new science curriculum and the Saudi Vision 2030 strategic plan is based.

In regard to when PD occurred, the majority indicated that they received PD during the school day. Also, all of the participants indicated that the PD format they have experienced was training, with workshops or seminars sub-type of training being the most common at around two-thirds. About four out of every five participants indicated they had experienced the individually guided staff development category of PD, with teacher-designed individual PD plan being the most common sub-type of this format at around two thirds of participants. However, less than half of teachers who responded indicated that they had input on the content that was offered through Ministry of Education. Most of them indicated that General Administration for Educational Training and Scholarships were the ones who made the decisions on the content they would receive. When listing the topics for teaching and learning content of PD, two thirds of the teachers listed the most common specific topic was Classroom management.

In terms of the fidelity between the MoE's purpose and goals for science teacher PD and the results of Section One of this survey, it appears that there is a lack of fidelity. A quarter of the participants reported they are unaware of the goals, one third either did not believe or did not know if the PD training benefitted student outcomes, half reported that their PD is either not tied to their evaluation or they were unsure, and half indicated that their PD is not related to inquiry-based learning or construvist theory of the new science curriculum.

While this section made it clear that the fidelity between the MoE's stated plans and the science teachers' actual experiences in terms of the goals, format, and content is not high, it did not show how effective the teachers perceive their PD experiences to be. To better understand these perspectives, the following section reports on Saudi science teachers's level of perceived effectiveness of their PD experiences.

Research Question 2

The second research question asked, "What is the level of perceived effectiveness of PD among Saudi male science teachers?" This question was further divided into the participants' satisfaction, the extent to which they report the learning new knowledge and skills, their level of perceived organizational support and change, their reported use of their new knowledge and skills gained, the level of the perceived impact on student learning outcomes, and the extent to which they report changes in their attitudes towards teaching and learning in science.

This research question and subquestions were addressed in the second section of the questionnaire. Questions 10–51 in Section Two of the questionnaire evaluated teachers' PD experiences. Teachers indicated their perceptions to various statements using a 4-point Likert scale. The scale was coded as follows: 1 = strongly agree; 2 = agree; 3 = disagree; 4 = strongly disagree. Therefore, higher the percentage of teachers who gave a rating of 1, the more they agreed with the statement, and the higher the percentage who responded with a rating of 4, the less they disagreed with the statement. Moreover, there were six subsections of Section 2 of the survey that correspond with Guskey's six levels of PD evaluation, which are (1) teachers' satisfaction, (2) teachers' learning, (3) teachers' perceptions of organizational support and change, (4) teachers' use

of new knowledge and skills, (5) teachers' perspectives of student learning, and (6) change in teachers' attitudes and beliefs. According to Guskey, the lower levels are more basic while the higher levels are more advanced. Thus, a high level of agreement on Guskey's Level 1: Teacher Satsifaction is considered a bare minimum for an effective PD program, while high agreement on Level 6: Change in Teachers' Attitudes and Beliefs is considered a highly effective PD program. Tables 14–19 report the percentage and number of responses for each question on the survey, based on each of the four levels of agreement. The results for each section/level are reported below.

Participants' satisfaction. Table 14 shows responses in regard to teacher's satisfaction of PD in their district (Guskey Level 1). There were five statements and a majority (64.7%) of teachers reported they strongly agree or agree that their PD "is generally a positive experience." More than half of the survey participants (58.8%) agreed that it "Meets my needs" and "Is time well spent." However, the lowest agreement was in regard to PD being "Is offered by instructors who are knowledgeable and effective" (48.6%).

Table 14

Participants' Satisfaction

PD in my school district:	Strongly Agree	Agree	Disagree	Strongly Disagree
10. Meets my needs.	10.3% (7)	48.5% (33)	35.3% (24)	5.9% (4)
11. Is offered at a time that is convenient	13.2% (9)	47.1% (32)	35.3% (24)	4.4% (3)
12. Is time well spent	14.7% (10)	44.1% (30)	33.8% (23)	7.4% (5)
13. Is offered by instructors who are knowledgeable and effective	11.8% (8)	36.8% (25)	38.2% (26)	13.2% (9)
14. Is generally a positive experience	16.2% (11)	48.5% (33)	23.5% (16)	8% (11.8)

Participants' learning. The next subsection of the questionnaire aimed to identify if learning from the PD has occurred (Guskey Level 2). As presented in Table

15, results indicated that the highest percentage of strongly agree and agree (73.6%) was that teachers learned "new knowledge and skills" because of PD. The lowest percentage of agreement with only about two thirds (67.6%) agreeing or strongly agreeing was for teachers who indicated they learned the "new concepts connected to prior knowledge" because of PD.

Table 15

Participants' Learning

PD in my school district provided:	Strongly Agree	Agree	Disagree	Strongly Disagree
15. Practical instructional strategies	17.6% (12)	55.9 % (38)	22.1% (15)	4.4% (3)
16. New knowledge and skills	16.2% (11)	57.4% (39)	23.5% (16)	2.9% (2)
17. The theory behind the practice	17.6% (12)	51.5% (35)	26.5% (18)	4.4% (3)
18. New concepts connected to prior knowledge	17.6% (12)	50% (34)	26.5% (18)	5.9% (4)

Participants' organizational support and change. The results of the next section, reported in Table16, are reflective of teacher responses related organization support and change (Guskey Level 3). Most teachers responded that PD was recognized as "often conducted during the school day" (86.8%), "Has a positive impact on the organization as whole" (69.1%), "Has a positive impact on the culture and climate in my school" (67.6%), and "Is recognized as being extremely important by Myself" (64.7%). These were the areas with the highest percentages of partcipants who strongly agreed or agreed. Notably, almost two thirds (63.2%) of participants disagreed (35.3%) or strongly disagreed (27.9%) that their PD leads "to in-service credit or a stipend," which was the highest amount of disagreement for any item in this section, indicating a lack of recognition or financial reward for participation in PD.

Table 16

Participants' Organizational Support and Change

PD in my school district:	Strongly Agree	Agree	Disagree	Strongly Disagree
19. Has a positive impact on the organization as whole	20.6% (14)	48.5 % (33)	26.5% (18)	4.4% (3)
20. Has a positive impact on the culture and climate in my school	19.1% (13)	48.5% (33)	27.9% (19)	4.4% (3)
21. Is often conducted during the school day	32.4% (22)	54.4% (37)	8.8% (6)	4.4% (3)
22. Leads to in-service credit or a stipend	11.8% (8)	25.0% (17)	35.3% (24)	27.9% (19)
23 (a). Is recognized as being extremely important by Ministry of Education	19.1% (13)	35.5% (24)	38.2% (26)	7.4% (5)
23 (b). Is recognized as being extremely important by District Administrators	10.3% (7)	42.6% (29)	39.7% (27)	7.4% (5)
23 (c). Is recognized as being extremely important by Building Administrators	11.8% (8)	35.3% (24)	38.2% (26)	14.7% (10)
23 (d) Is recognized as being extremely important by My Colleagues	10.3% (7)	39.7% (27)	35.3% (24)	14.7% (10)
23 (e) Is recognized as being extremely important by Myself	23.5% (16)	41.2% (22)	29.4% (20)	5.9% (4)
23 (f) Is recognized as being extremely important by Parents	11.8% (8)	32.4% (22)	38.2% (26)	17.6% (12)

Participants' use of new knowledge and skills. Table 17 presents the results for the fourth effectiveness subsection of the questionnaire teacher responses, which was related the usefulness of the new knowledge obtained at the training (Guskey Level 4). This included statements related to "going back to the classroom and experimenting with the new instructional strategies taught" (76.5% agreement), "implementing or applying new instructional practices" (76.5% agreement), and "note positive changes in my teaching" (75% agreement), which were the responses with the highest percentages of strongly agree or agree. However, many disagreed (32.3%) that they "become committed

to new teaching strategies," suggesting that they try new strategies, but do not necessarily become committed to them.

Table 17

Participants' Use of New Knowledge and Skills

After I have participated in a PD experience, I usually:	Strongly Agree	Agree	Disagree	Strongly Disagree
24. Go back and experiment/ practice with new instructional strategies	26.5% (18)	50.0% (34)	19.1% (13)	4.4% (3)
25. Implement/apply new instructional practice	22.1% (15)	54.4% (37)	17.6% (12)	5.9% (4)
26. Become committed to new teaching strategies	22.1% (15)	45.6% (31)	27.9% (19)	4.4% (3)
27. Note positive changes in my teaching	20.6% (14)	54.4% (37)	22.1% (15)	2.9% (2)
28. Make long lasting changes in my teaching	22.1% (15)	48.5% (33)	25.0% (17)	4.4% (3)

Participants' student learning outcomes. The purpose of the fifth subsection of the questionnaire was to categorize teachers' perceptions concerning the impact on student learning (Guskey Level 5). Teachers responded to statements about PD having a positive impact on student learning and increase in student engagement. Most of the participants either agreed or strongly agreed with all of these statements, with about one third of participants strongly agreeing with most statements and about half agreeing with most statements. Only around one fifth to one quarter of participants disagreed or strongly disagreed with most statements. The highest level of agreement, with 83.8% either agreeing or strongly agreeing was for the statement that PD "makes a positive impact on my students' learning." However, the lowest level of agreement with 69.1% either strongly agreeing or agreeing was found in the statement "Student achievement has risen on MoE or district assessments." Therefore, the overwhelming majority of teachers

believe PD improves student learning, but far fewer believe that it is measured in standard assessments at the national or district levels.

Table 18

Participants' Student Learning Outcomes

Generally, my PD impacts my students in the following ways:	Strongly Agree	Agree	Disagree	Strongly Disagree
29. It makes a positive impact on my students' learning.	35.3% (24)	48.5% (33)	14.7% (10)	1.5% (1)
30. Student achievement increases	35.3% (24)	44.1% (30)	19.1% (13)	1.5% (1)
31. Students are more engaged in learning	30.9% (21)	45.6% (31)	22.1% (15)	1.5% (1)
32. Students are involved in their own learning	30.9% (21)	42.6% (29)	22.1% (15)	4.4% (3)
33. Classroom management has improved	33.8% (23)	44.1% (30)	20.6% (14)	1.5% (1)
34. Student achievement has risen on MoE or district assessments	26.5% (18)	42.6% (29)	27.9% (19)	2.9% (2)
35. Student achievement has risen on teacher or classroom assess	27.9% (19)	47.1% (32)	22.1% (15)	2.9% (2)
36. Students' confidence as learners has improved	29.4% (20)	52.9% (36)	16.2% (11)	1.5% (1)

Participants' teacher change in attitudes and beliefs. The final subsection of the questionnaire addressed the degree to which participants believed that their participation in PD changed their attitudes and beliefs (Guskey Level 6). Most of the participants agreed or strongly agreed with all the statements in this section, with responses hovering around 80% agreement, ranging from 79% to 89.7% agreeing or strongly agreeing. The highest level of agreement, at 89.7%, was for the statement that PD "connects to district needs and overall school improvement." In contrast, the lowest level of agreement at 79.4% was for the statement "I have enjoyed the experience." Even though most participants reported that PD changed their perspectives and beliefs in some way, the

level of enjoyment was not as high as the rest. Overall, the findings from this section are positive.

Table 19

Participants' Change in Attitudes and Beliefs

PD in my school district:	Strongly Agree	Agree	Disagree	Strongly Disagree
37. The experience was meaningful to me	35.3% (24)	45.6% (31)	13.2% (9)	5.9% (4)
38. I learned practical instructional strategies	29.4% (20)	51.5% (35)	13.2% (9)	5.9% (4)
39. My teaching becomes more effective	30.9% (21)	52.9% (36)	13.2% (9)	2.9% (2)
40. I am more efficient or productive as a teacher	27.9% (19)	52.9% (36)	13.2% (9)	5.9% (4)
41. I have enjoyed the experience	30.9% (21)	48.5% (33)	16.2% (11)	4.4% (3)
42. I become empowered in new ways	30.9% (21)	52.9 % (36)	11.8% (8)	4.4% (3)
43. I have learned to meet the various needs of all of my students	26.5% (18)	55.9% (38)	14.7% (10)	2.9% (2)
44. It has a positive impact on student behavior	27.9% (19)	54.4% (37)	14.7% (10)	2.9% (2)
45. My students become more actively engaged in learning	33.8% (23)	48.5% (33)	14.7% (10)	2.9% (2)
46. I can see a positive impact on student achievement	33.8% (23)	52.9% (36)	10.3% (7)	2.9% (2)
47. It impacts my annual performance evaluations positively	36.8% (25)	50% (34)	8.8% (6)	4.4% (3)
48. I receive positive feedback from my supervisor	38.2% (26)	47.1% (32)	10.3% (7)	4.4% (3)
49. My efforts are recognized	42.6% (29)	45.6% (31)	8.8% (6)	2.9% (2)
50. I feel proud of my accomplishments	42.6% (29)	44.1% (30)	10.3% (7)	2.9% (2)
51. It connects to district needs and overall school improvement	33.8% (23)	55.9% (38)	5.9% (4)	4.4% (3)

Summary of Research Question 2. In Questions 10–51, teachers' perceptions of their PD experiences were examined. The results of the descriptive analysis of these questions were reported. Regarding teacher's PD satisfaction in their district (Guskey Level 1), a majority of teachers reported they strongly agree or agree that their PD "is

generally a positive experience." More than half of the survey participants agreed that it "Meets my needs" and "Is time well spent." However, the lowest agreement was in regard to PD being "Is offered by instructors who are knowledgeable and effective."

From Guskey Level 2, the highest agreement was that their PD experience tauth them new knowledge and skills. However, one third disagreed that in their PD, they learned how "new concepts connected to prior knowledge." Thus, while they may have learned new knowledge and skills, it was not clearly tied to their previous knowledge for many participants.

In regards to Guskey Level 3, almost two thirds of participants did not think that their PD leads "to in-service credit or a stipend," which was the highest amount of disagreement for any item in this section, indicating a lack of recognition or financial reward for participation in PD.

Moreover, in Guskey Level 4, which was related the usefulness of the new knowledge obtained at the training, a higher percentage of teachers reported that they tried "new instructional practices" than those who reported they had "become committed to new teaching strategies." This finding suggests that some of the teachers have tried new strategies as a result of their PD experience, but they did not always become committed to the new strategies.

Guskey Level 5 categorized teachers' perceptions concerning the impact on student learning. Teachers responded to statements about PD having a positive impact on student learning and increase in student engagement. Therefore, the overwhelming majority of teachers believe PD improves student learning, but far fewer believe that this improvement is measured in standard assessments at the national or district levels.

Lastly, in terms of Guskey Level 6, the participants believed that their participation in PD changed their attitudes and beliefs. Most of the participants agreed or strongly agreed with all the statements in this section, which means the findings from this level are positive. What is interesting is that most of the participants reported that their PD experiences changed their attitudes and beliefs even though they reported some problems at the lower levels, such as instructors who were not knowledgeable, a lack of connection to prior knowledge, a lack of a stipend or credit for participation, a lack of commitment to new teaching strategies, and lack of measurable improvement in students' standardized tests as a result of their PD participation.

Conclusion

In this chapter, data collected from the PD survey was presented in tables depicting the descriptive and statistical analyses. The final chapter offered a summary of the major findings of this research with discussion the findings, implications, and recommendations.

Chapter Five

Discussion, Recommendations, and Implications

The final chapter of this dissertation restates the research problem, research questions, and reviews the major methodology used in the study. The major sections of this chapter summarize the results and discuss their implications.

In this chapter, the researcher described and discussed the study results and findings in light of the previous studies with the purpose of this study was to determine the impact or effective of PD using Guskey's (2000, 2002) models of teacher change and evaluating PD in the schools within selected school district based on the following two research questions fidelity between the MoE's goals, format, and content for PD and the teachers' perceptions of that PD six criteria: 1. participant satisfaction; 2. participant learning; 3. the organization's support and change; 4. change in teacher knowledge, skills, and instructional pedagogy; 5. teacher perception of student learning; and 6. changes in attitudes and beliefs of teachers.

Discussion

The sample of male Saudi science teachers in this study tended to be older and more experienced, with most reporting they had more than 20 years of teaching experience. Moreover, they also tended to be at their school district between 4 and 14 years with a small number having been in their current district for more than 20 years, suggesting that those with more than 20 years of experience had taught at least two districts.

Research Question 1. The first research question asked, "Is there fidelity between the MoE's goals, format, and content for PD and the teachers' perceptions of

that PD?**"** A higher number of participants than expected answered "no" or "unsure" when asked about their awareness of the PD plan and whether they believe it was related to school improvement, increased student outomes, teacher evaluation, and inquiry based learning and constructist approaches. It would be expected that all or almost all of the participants would at least be aware of the PD plan, but one quarter reported not even being aware of it, which shows that more needs to be done to communicate the MoE's PD plan with teachers. Even more participants reported that they did not think the PD had an effect on certain outcomes, with a third answering in the negative or uncertainty about whether it was linked to overall school improvement and increased student outcomes, and only half of the participants stated that it was related to their teacher evaluation process or inquiry-based learning approaches and constructivist theories.

Even though a majority of the responses to the above items were answered in the affirmitive ("yes"), the amount who answered such was lower than would be expected in a successful PD plan. Killion (2002) has argued that student achievement and evaluation should be clearly linked to a district's PD plans. Likewise, many educational researchers have demonstrated the link between effective PD and outcomes such as student achievement and educational change (Cole, 2012; French, 1997; Guskey, 1994; Sparks & Hirsh, 1997). The present study did not measure the *actual effect* of PD on these outcomes, but it did measure the *perceived fidelity*. What the findings of this section of the questionnaire shows is that a non-negligible number of teachers are not aware of the PD plan and do not think it is clearly affecting the outcomes above. So, either the PD really does not have a noticeable impact or it is perceived as such; either way, more needs to be done (1) to measure the effect of PD on outcomes such as student learning, school

change, and teacher evaluation and then (2) to clearly report those connections back to the teachers so they can see the improvements. More discussion about this suggested implication can be found in the recommendations section below.

Based on the results of Section One of this questionnaire, there was a lack of fidelity between what the MoE has stated are the goals and outcomes of their PD program for science teachers and what a sample of those science teachers perceive. Most importantly, one quarter of the teachers reported being unaware of the goals of the PD. Moreover, one third were unsure or did not agree that the PD training had a positive effect on student outcomes, and half reported being unsure or not agreeing that their PD is tied to their evaluation as teachers. Finally, half did not believe that their PD was tied to inquiry-based learning or constructivist theories, which are supposed to be the teaching theories underlying the adopted McGraw-Hill science curriculum (Mansour & Al-Shamrani, 2015).

Moreover, these findings do not align with the stated goals of the MoE, which include the following:

- Improving the general education outcomes
- Developing basic teaching skills
- Improving learning capacity for both teachers and supervisors
- Improving teachers' classroom management and leadership.
- Providing support to teachers as they implement the new science curriculum
- Introducing teachers to the inquiry-based learning approaches and constructivist theories upon which the new science curriculum is based (as cited in Almazroa & Al-Shamrani, 2015, p. 11)

The Ministry of Education (2006) has also stated that goals of the new science curriculum focus on developing the following: learner-centered teaching, excitement-based multimedia, multi-modal learning, collaborative work, active inquiry-based learning, critical thinking skills, decision-making skills, student-intiated learning, and real life context-based learning (as cited in Binjumah, 2017).

Despite the fact that, by using the McGraw-Hill science curriculum, the MoE has emphasized inquiry-based, learner-centered, and context-based learening within a constructivist framework, a full two-thirds of the participants stated that their PD experiences focused on classroom management while only slightly more than a third of the participants reported that their PD experiences focused on either designing lessons or implementing differentiated instruction to align with the goals above. While classroom management is important, it should not be the primary focus of PD, especially when trying to introduce a new curriculum to an experienced group of teachers. These experienced teachers probably have a good grasp on classroom management, but are more likely to need help implementing a new curriculum that involves using inquiry, collaboration, problem solving, critical thinking, and so on. As noted by Park (2013), the goal of such effective programs should be to provide teachers with learning experiences that relate to the actual classroom setting to make the PD experience more meaningful and useful.

When asked about the types of PD they received, the participants reported a variety of designs. The most common type of PD was the standard training style, with all participants reporting having participated in that type of PD at some point. The variety of designs experienced by the participants, including individually guided approaches, is a

promising sign as it aligns with what the literature recommends and shows that the MoE is not only relying on one type of traditional, lecture/presentation type of PD (Heller et al., 2012).

However, the question about who makes decisions regarding the design of the PD is less promising, as almost all of the paritcipants stated either the MoE or the General Administration for Educational Training and Scholarship provides the content for their training, with little to no input from district-level committees or administrators. This practice goes against the recommendation in the literature, which supports the use of shared decision-making in the PD development process. According to Loucks-Horsley et al. (1987), a strong PD program is characterized by a diversity of opinions, ideas, people, and practices. Including diverse perspectives with common goals can bring to the surface local needs or issues that can be addressed in the PD of each district (Loucks-Horsley et al., 1987). Moreover, multiple decision makers and collaboration in the planning, implementation, follow-up, maintenance, leadership, and support can help ensure that the PD can be effectively tied to relevant experiences based on local contexts, even if the main goals and primary content is standardized across the country. According to Guskey and Peterson (1996), involvement in development/improvement processes allows participants to increase their specific knowledge and skills as well as to improve their ability to work together in shared decision-making systems.

Research Question 2. The second research question asked, "What is the level of perceived effectiveness of PD among Saudi male science teachers?" While many of the responses from the participants about the various types of perceived effectiveness were positive, one of the most negative findings was about the experience of the PD instructors.

Almost half of the participants reported that the instructors who provided their PD were not "knowledgeable and effective." Thus, a large number of participants did not believe their PD instructors were qualified to lead the PD. Combined with the finding that most of the PD experienced by the participants was of the traditional training design type, the perceived lack of experience is worrying. According to Loucks-Horsely et al. (1990), training style PD is often used because it is cost effective since large numbers of teachers can learn from one PD instructor or facilitator; however, the effectiveness of training-style PD greatly relies on the percieved expertise, ability, and credibility of the trainer leading the session (Pancucci, 2007). Loucks-Horsley et al. (1998) also reported that teachers want PD designed and delivered by experts who meet three criteria: (1) they can provide instruction consistent with national standards, (2) they understand the nature of the science discipline, and (3) they have some awareness of the localized and unique needs of the schools and teachers in the district. As multiple studies have shown, high-quality PD is essential for improving teachers' knowledge, skills, attitudes, and beliefs so that teachers may enable their students to succeed academically (Cohen & Hill, 2000; Dana & Yendol-Hoppey, 2008; McLaughlin & Talbert, 1993). However, research on the potential weaknesses of the instructors who deliver the PD content in Saudi Arabia is needed.

In terms of learning new teaching strateges, the results of this study suggest that there may be a short-term benefit that does not necessarily translate into long-term adoption of new teaching approaches. More teachers reported having tried new teaching practices as a result of their PD experience than those who reported having "become committed" to such practices. This lack of commitment suggests that teachers may try out new teaching strategies because of what they learned in their PD experience, but that

does not necessarily mean they will continue to use such strategies. In educational literature, these short-term gains that do not persist characterize a phenomenon called the fadeout effect, which is a very common occurrence when new educational interventions are applied (Wolf & Peele, 2019). However, most research on fadeout has been conducted on students' learning and not teachers' PD (Wolf & Peele, 2019), so more can be done to explore this phenomenon as it relates to PD.

It was also found in this dissertation that PD for Saudi male science teachers is not clearly tied to rewards or incentives. Almost two thirds reported that their PD did not result in in-service credit or a stipend, and slightly less than half indicated that their PD was not linked to the teacher evaluation process**.** What is the benefit/motivation for these teachers? Of course, there are PD requirements that push teachers to participate, and hopefully teachers also are intrinsically motivated by the desire to learn and improve their teaching; however, extrinsic motivations such as financial incentives and social benefits like recognition or awards help as well. Guskey (2002) argued that in order for PD to lead to change, it must recieve both support and pressure from administrators. Support means participants feel they are able to take a risk to try new things because there are certain rewards, recognition, or other incentives, while pressure helps initiate change when self-motivation for change is low. Without tying PD to some kind of support or pressure, it is less likely to result in change. As a recent study from Appova and Arbaugh (2018) found, a lack of stipends or other resources to support teacher involvement in PD demotivated teachers' learning because it made them feel skeptical about whether their district actually valued PD.

Another major finding about the effectiveness of the PD experiences of male Saudi science teachers was the inconsistency regarding how the PD affects student learning. While most of the teachers reported that they believe PD improves student learning in general, not nearly as many believed that PD improves results on standard assessments at the national or district levels. If the teachers think PD improves their students' learning, why don't they think it improves standardized test results? In contrast to the teachers' perceptions, a recent review of effective teacher PD by Darling-Hammond, Hyler, and Gardner (2017) found most studies show an improvement on students' standardized test scores whose teachers participated in PD versus those whose teachers did not. Thus, the evidence shows PD can improve the results those measurements for students. Still, about half of the teachers in this sample did not perceive such results in their experience. Perhaps more needs to be done in Saudi Arabia to report the impact of PD, so that teachers can readily perceive any improvements.

The most positive results were for the sixth level in Guskey's model, which was about teachers' changes in attitudes and believs. According to the results of the questionnaire, most participants believed that their participation in PD changed their attitudes and beliefs. Notably, even though most participants reported changes their attitudes and beliefs, there were also many negative responses at the lower levels measured in the questionnaire, such as a lack of knowledgeable PD instructors, a lack of connection to prior knowledge, a lack of a stipend or credit for participation, a lack of commitment to new teaching strategies, and lack of notiecable improvement in students' standardized tests as a result of their PD participation. With all these important components of effective PD lacking in the Saudi male science teachers' experiences, it is

remarkable that they saw positive change in their own attitudes and beliefs after participating. One might assume that positive change in teachers' attitudes would depend on having very positive experiences with PD, but that does not entirely seem to be the case in this study. This suggests that Guskey's models for teacher change and evaluating PD are not simple hierarchical models where the bottom levels need to be met before the higher levels can be met.

Limitations and Delimitations

Because of the scope of this study, there are certain limitations to how the results can be used and generalized. Because all participants were Saudi male science teachers who taught in a secondary school using the new science curriculum in South District of Makkah, the results cannot easily be applied to other demographics. These results are mostly limited to this specific population, although there is some generalizability to Saudi male science teachers using the new curriculum in other districts since the curriculum and PD are largely standardized at the national level. In other words, what male science teachers in the South District of Makkah experience is very similar to what male science teachers experience in other districts.

These findings are also limited by the descriptive method used in the analysis of the questionnaire, which only allows for drawing conclusions about *what* Saudi male science teachers perceive about their PD experience rather than *how* or *why* they believe what the believe or even *how such beliefs are related* to other factors. In other words, no correlational or causal relationships can be drawn from this data.

Finally, the self-report nature of the questionnaire can only measure what the teachers are willing to report, which can be affected by a few research biases. For

example, the social desirability bias may lead participants to give slightly more positive responses to the questionnaire items to meet what they might expect the researcher or society in general wants to hear rather than how they really feel.

In addition to the limitations of the study, the study had certain delimitations that deliberately narrowed the scope. The first delimitations of this study was that this study exclusivel addressed male teachers rather than only female or both male and female science teachers. The study was delimited to this group because the education system in Saudi Arabia is gender segregated and, as a Saudi male researcher, I have more access to the population of male science teachers in Saudi Arabia. The same cannot be said for female science teachers, however, because there may be some differences in the education and training process for male and female teachers, including a different centers for the General Administration for Training and Scholarship for men and women. Second, each participant needed to be teaching in a secondary school that has applied the new science curriculum. Lastly, the study was delimited to teachers located within South District of Makkah.

Implications and Recommendations

Based on the findings and limitations of this study in relation to the literature on the topic of PD in general, there are some recommendations that can be made to improve future PD research and practices.

Research recommendations. First, for future research, one area of study that may be useful includes research on the potential weaknesses of the instructors who deliver the PD content in Saudi Arabia is needed. Since a substantial number of participants reported that PD instructors were not knowledgeable, more research should

be conducted to find out why that is and what the characteristics, qualifications, and abilities of PD instructors in Saudi Arabia are. Sabah et al. (2014) have also recommended placing focus on the PD instructor with emphasis on how these trainers are prepared and equipped these trainers with the required skills and competencies.

It is strongly recommended based on the findings of this research that administrators provide ample support to teachers as they try to improve their teaching skills. Along those lines, teachers must feel empowered by their administrators. When administrators require teachers to attend PD programs, they should feel that they are supported in those opportunities, are empowered to have input on topics, and are provided enough time for collaboration to implement what they learn. The responses from the teachers in this study showed there is room for improvement in this regard.

Another area of future research would be to determine how the fadeout effect of PD might impact the effectiveness of PD. Many studies measure the effect of PD in the short term, but what are the long-term differences and changes that might occur as a result of participating or not participating in PD? Such a longitudinal study would help measure the effect of PD on Guskey's teacher change model. Research on the fadeout of PD for teachers is needed because most research in this area is about students' learning rather than teachers' PD (Wolf & Peele, 2019).

As noted in the literature review, research studies examining PD and student achievement are rare. Furthermore, educational research focusing on the link between PD and student achievement is needed, particularly in response to current reform efforts and new expectations for student learning. Moreover, another recommendation which is a comparative research study on the perceptions of principals and science teachers in the

district should be conducted to gain insight into similarities and differences between different types of educators at various levels of administration. Also, a qualitative reasearch study for future research should also be conducted to explore in depth how the PD can be effectively delivered to impact student outcomes. Lastly, a qualitative research study to define Saudi science teacher perception on items for example what time means, what support looks like, and how they define appropriate feedback.

Policy and practices. In addition to research, there are also some important recommencations for future PD policies and practices in Saudi Arabia. First, more needs to be done to measure the impact of PD on certain outcomes such as student learning and teacher change. Second, once those measures are gathered and analyzed more systematically, the results of the impact of PD should be reported back to the teachers. As defined by Guskey (2000), evaluation is the "systematic investigation of merit or worth" and includes the "collection and analysis of appropriate and pertinent information" collected by "appropriate methods and techniques" (p. 41–42). Following Guskey's recommendation, the evaluation of Saudis science teacher PD must be systematic and use appropriate methods and techniques in order to determine the effecitiveness of PD and how it can improve performance and outcomes.

The responses from the Saudi male science teachers in this study indicate that they have not been involved in PD programs that have consistent training elements congruent with "best practices" based on the research literature. PD programs must designed using evidence-based practices based on research, including the benefits of demonstration, modeling, supervised practice, and specific feedback to participants.

Moreover, systematic procedures for follow up and support are critical to sustaining a change in classroom practice.

Another recommendation related to policy and practices is to offer more forms of PD opportunities with input from local stakeholders at the school and district levels. As Sabah et al. (2014) noted, PD opportunities can come in a variety of models and types, but in this dissertation, it was found that most PD experiences followed traditional training-type models. Mentorship is one area of PD that is not commonly used in Saudi Arabia but could help improve PD experiences and facilitate long-term changes that a single training session or a small number of sessions cannot change. It is very important that these different PD opportunities include some freedom for districts to decide what style of PD might work best for their population and to allow them to adopt different activities such as classroom observation, reflection, professional dialogue, and individually guided models.

Based on the findings of this study, it is evident that PD opportunities for Saudi male science teachers need to include procedures for teachers to collaborate. It would be beneficial to develop a PD platform that would allow the teachers to collaborate with colleagues in their subject area and grade level as well as with administrators in order to provide ongoing support and a way to discuss lesson plans and activities. Based on the research on PD programs, it seems that professional learning communities, particularly with an online component, may best meet the needs of the teachers in this regard. In order to continuously support teachers at all levels, teachers should be regularly surveyed to identify needs at their level. PD should then be tailored to meet the needs of teachers at the middle school as well as high and elementary school.

Finally, it is recommended that the MoE find ways to more explicitly reward or recognize participation in PD through financial incentives, promotions, and/or awards. These incentives show teachers the the MoE values PD, and it provides additional motivation for participation. As Guskey (2002) noted, both support, such as those incentives mentioned above, and pressure, such as follow-up evaluations and accountability, are essential to ensure that PD experiences result in teacher change and improved student learning outcomes.

Conclusion

This dissertation adds to our understanding of the effectiveness of science teacher PD in Saudi Arabia, which is an area of study that has only just begun to occur. Moreover, the findings from this study also shed some additional light on how the Guskey models of PD evaluation and teacher change fit within the context of Saudi Arabia. Based on the findings from the study included in this dissertation, it is clear that there is some lack of fidelity between the PD goals, format, and content as stated by the Saudi MoE and as perceived by male Saudi science teachers. This lack of fidelity suggests that the MoE needs to do more to be more explicit in its PD goals, to follow-up with PD evaluations, to clearly tie PD to certain teacher and student outcomes, and to report the results of such outcomes back to the teachers so they can see the impact of PD on their classroom practices and student learning. This study also showed that PD for Saudi male science teachers is generally satisfactory, but it has some weaknesses and gaps that need to be addressed, such as a lack of knowledgeable PD instructors, a lack of connection of PD content to teachers' prior knowledge, a lack of a stipend or credit for participation, a lack of commitment to new teaching strategies, and lack of percievable

improvement in standardized test scores. Based on these findings, it is recommended that the Saudi MoE revisit its PD for science teachers, especially moving forward. The next time that the Saudi MoE decides to revamp the science curriculum, it is of the utmost importance that planners and implementers deliberately and comprehensively consider the PD component of the curriculum implementation because even the best desiged curriculum completely depends on teachers knowing how to put it into practice.

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Appendix A

IRB Approval Letter

The University of Toledo
Human Research Protection Program
Social, Behavioral and Educational IRB
Center for Creative Education – Suite 2102
3000 Arlington Avenue, Toledo, Ohio 43614
Phone: 419-383-6796 Fax: 419-383-3248
(FWA00010686)

IRB Exemption Granted Notification

To: Mark A Templin

Curriculum and Instruction, Department of

From: Social, Behavioral and Educational IRB

IRB Number: 300366

Title: Saudi Science Teachers' Perceptions of the Effectiveness of the Saudi Arabian Ministry of Education's Professional Development Program

Event Review Type:

The above named project was reviewed and determined to meet criteria for exempt research under the following category or categories:

Category 2

by the designee of the University's Social, Behavioral and Educational IRB. Exemption has been granted as of . The full board will acknowledge this at its next convened meeting.

You are free to conduct your study without further reporting to the Social, Behavioral and Educational IRB unless major revisions make your research no longer eligible for the exemption approval or unless you need to make personnel changes. If you are unsure of whether any proposed changes would require IRB approval, please contact the IRB office. Upon completion of your study, you are required to submit a final report form to the Social, Behavioral and Educational IRB office.

Documents reviewed and approved as part of this protocol application submission:

- Alaa Alsubhi RSP103[2].pdf (Conflict of Interest Disclosure)
- RSP103. Alaa Alsubhi IRB.pdf (Conflict of Interest Disclosure)
- 10-21 SBE_Waiver of Written Consent for Exempt Research (Arabic) .pdf (Consent - Informed Consent Form)
- 10-21 SBE_Waiver of Written Consent for Exempt Research (English).pdf (Consent - Informed Consent Form)
- 10-21 Ministry of Education Letter (English).pdf (Misc/Other)
- Salem, Nada Mounif Letter.pdf (Misc/Other)
- 10-21 Email script (English) .pdf (Recruitment Materials)
- 10-21 Email-Script (Arabic).pdf (Recruitment Materials)
- 10-21 Questionnaire (Arabic).pdf (Surveys/Questionnaires/Interview Script)
- 10-21 Questionnaire (English).pdf (Surveys/Questionnaires/Interview Script)

Appendix B

Curriculum and Instruction
The University of Toledo
Main Campus
Gillham Hall, 2th floor
MS 914
Toledo, OH 43606--3390
Phone # 419-530-2495
Fax # 419.530.8447

ADULT RESEARCH SUBJECT - INFORMED CONSENT FORM
Saudi Science Teachers' Perceptions of the Effectiveness of the Saudi Arabian Ministry of Education's Professional Development Program

Principal Investigator Dr.Mark Templin: 419-530-8458

Other Investigators: Alaa Alsubhi (Doctoral Candidate-- Curriculum and Instruction in the University of Toledo) 419--902--6665

Purpose: You are invited to participate in the research project entitled *"Saudi Science Teachers' Perceptions of the Effectiveness of the Saudi Arabian Ministry of Education's Professional Development Program"* which is being conducted at the University of Toledo under the direction of *Dr. Mark Templin.* The purpose of this study is *to examine Saudi male science teachers' perceptions of the effectiveness of PD for improving their ability to teach the new Saudi Arabian science curriculum.*

Description of Procedures: This research study will take place *online. The questionnaire link will be distributed to you through E--mail. The questionnaire contains 51 questions and should take approximately 10-20 minutes to complete. You will be asked to complete it within two weeks.*

Potential Risks: *There are minimal risks to participate in this study, namely the risk of potential breach of confidentiality.*

Potential Benefits: *As a participant in this research study, there will be no direct benefit for you; however, information from this study may benefit other people now or in the future. For instance, Science Department may benefit by learning about the results of this research.*

Confidentiality: *The researchers will not collect your identifying information. All data collected will be anonymous and protected to ensure others cannot identify you when reading the research report. Data will initially be collected in Google Forms, which is protected by the researcher's account name and password. The researchers will not gather IP addresses. Upon completion of the data collection phase, the researcher will download a spreadsheet of the responses from Google Forms and store the data in a password protected computer that will be accessible by the researcher only. Once downloaded, the Google Form and all associated data will be deleted from Google. In addition, no identifying information will be collected, and no identifying information will appear in the research report.*

Voluntary Participation: The anonymous data collected from you in this research may be used for future research purpose. As a reminder, your participation in this research is voluntary. *Your refusal to participate in this study will involve no penalty or loss of benefits to which you are otherwise entitled and*

will not affect your relationship with the Saudi Arabian Ministry of Education. You may skip any questions that you may be uncomfortable answering. In addition, you may discontinue participation at any time without any penalty or loss of benefits.

Contact Information: *Before you decide to accept this invitation to take part in this study, you may ask any questions that you might have. If you have any questions at any time before, during or after your participation you should contact a member of the research team Alaa Alsubhi: Email: Alaa.Alsubhi@rockets.utoledo.edu*
Phone: 419-902-6665
Or the principal investigator Dr. Mark Templin: 419--530--8458

If you have questions beyond those answered by the research team or your rights as a research subject or research-related injuries, the Chairperson of the SBE Institutional Review Board may be contacted through the Human Research Protection Program on the main campus at (419) 530-6167.

CONSENT SECTION – Please read carefully

You are making a decision whether or not to participate in this research study. By *continuing and completing this survey you indicate that you have read the information provided above,* you have had all your questions answered, and you have decided to take part in this research. You may take as much time as necessary to think it over.

By participating in this research, you confirm that you are at least 18 years old.

Appendix C

Approval from the General Administration of Public Education in Makkah

12382

To whom it may concern

I am writing to you on behalf of Mr Alaa Alsubhi. Mr. Alsubhi has requested that I submit a letter to clarify that the Ministry of Education accepted Alaa's research and gave him the permission to conduct his survey. The Ministry will be able to give Alaa all information that he needs to collect his data.

Best regards,

Director of Planning and Information Department

Mstoor Mohammed AL-Thaqafi

مكة المكرمة – العزيزية – هاتف: ٠١٢ ٥٥٨٠٢٢٨ – فاكس: ٠١٢ ٥٥٧٥٢٦