



CONTINUING PROFESSIONAL DEVELOPMENT (CPD) PROVISION FOR SCIENCE AND MATHEMATICS TEACHERS IN SAUDI ARABIA: PERCEPTIONS AND EXPERIENCES OF CPD PROVIDERS

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Introduction

High quality teaching demands qualified, knowledgeable and skilful teachers throughout their career (Day & Sachs, 2004). According to Kennedy (2005), promoting quality education in schools requires paying more attention to the Continuing Professional Development (CPD) of teachers which is considered an essential component for creating a positive impact on their pedagogy and teaching practices. The term CPD is used to "describe all the activities in which teachers engage during the course of a career which are designed to enhance their work" (Day & Sachs, 2004, p.3). CPD activities may include professional development meetings, attending internal and external courses and conferences, coaching and mentoring, joining PD networks, participating in reflective discussions, and conducting action research and investigations (The Training and Development Agency TDA, 2007, p. 4). Guskey (2002) describes three aspects for the aspired change as major goals for professional development programs. These are: change in teachers' classroom practices, change in their attitudes and change in their students' learning outcomes.

In recent years, there has been a call for a substantive change in Professional Development (PD) forms, models and practices in

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Abstract. *This study examines the perspectives of science and mathematics Continuing Professional Development (CPD) providers regarding the nature and status of CPD provision in Saudi Arabia. It was carried out during a time when current government reforms in Saudi Arabia have placed the teaching and learning of math and science in the schools at the core of its agenda. To achieve the study results, an open-ended questionnaire was developed and used in the data collection process. Twenty science and mathematics CPD providers completed the questionnaire. Data were analyzed inductively using thematic analysis. Three themes were elicited from the study analysis: CPD planning and delivery, assessing the impact of CPD, and views of effective CPD. The article concludes that the dominant model of CPD in Saudi Arabia is based on traditional notions that are focused on a single shot design (such as training courses and workshops). The study suggests increasing the scope of CPD efforts in Saudi Arabia to allow for other forms of CPD opportunities and that science and mathematics Saudi CPD providers require support and fine tune training in order to assure the success of the CPD efforts.*

Keywords: *continuing professional development, providers' perception, Saudi Arabia, science and mathematics education.*

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order to attain a change in pedagogy and development of teaching practices (NRC, 1996; TDA, 2007). More emphasis has been placed on alternative models that engage teachers in a life-long professional development process (Day & Sachs, 2004; NRC, 1996). Kennedy (2005) proposed nine categories of CPD models: (1) training; (2) award-bearing; (3) deficit; (4) Cascade; (5) standard-based; (6) coaching/mentoring; (7) community of practice; (8) action research; and (9) transformative model. Kennedy also organized these nine models into three categories based on the professional autonomy they provide for teachers. The first three models were categorized under the transmission category where teachers have low control over their learning. The other three models, the standard-based, the coaching / mentoring, and the community of practice models, are transitional models where teachers have professional autonomy. The third category, transformative, involves the action research model and offer even more professional autonomy for teachers. According to Kennedy (2005), moving from transmission through transition to transformative would increase the capacity for professional autonomy of the teachers.

The delivery and diversity of CPD models are affected by the nature of the educational system (i.e., whether they are centralized or non-centralized systems) (Stadler, 2010). As to Stadler, in the non-centralized systems (e.g., Denmark), schools are responsible for organizing the CPD activities that meet the needs of teachers at a particular context. On the other hand, in centralized educational systems (e.g., Turkey, and Saudi Arabia), the CPD activities are usually organized by the ministries of education (Stadler, 2010). Yet what is important is not the professional development *per se*, but the successful implementation of these efforts and a clear evidence of their effectiveness. The Training and Development Agency TDA document *Impact evaluation of CPD* (TDA, 2007) identified key components which may lead to effective CPD. Some of these components are: identifying intended outcomes, taking into account the previous knowledge of participants and providing them with relevant CPD activities, modeling effective teaching practices and models, and including impact evaluation as part of the CPD activities.

Impact evaluation of professional development programs is very important to determine whether the investment in professional development yields 'tangible payoffs' as the budget is being more limited (Guskey, 2002). In addition, evaluation is necessary to determine whether the PD programs achieve their objectives or planned purposes. According to Lowden (2003), evaluation is a crucial component of all PD activities for providing high quality PD programs that improve teachers' knowledge and instructional skills. Evaluation should be sophisticated to include the impact of CPD at different levels such as teacher, school, and student (Kennedy, 2005). There is an urgent need for evaluation that focuses on the outcomes of CPD (Bolam & McMahon, 2004).

Guskey introduced five levels of evaluation to improve professional development programs where success at one level is a prerequisite for the success at the higher levels. These levels are level 1: participants' reaction, level 2: participants' learning, level 3: organizational support and change, level 4: participants' use of new knowledge and skills, and level 5: students' learning outcomes (Guskey, 2002). Harris et al., (2006), however, found that the impact of CPD on students is usually and significantly under evaluated especially at the higher levels. To evaluate the impact of PD at higher levels (e.g., level 4: participants' use of new knowledge and skills), evaluators should allow enough time for participants to adapt the new skills and practices before starting the evaluation process at this level. Having into account the complexity of the evaluation process at higher levels, one would understand why CPD providers focus on evaluation at lower levels. Also, the evaluation process at the higher levels requires more evaluation tools and methodologies. For example, the evaluation process at level 1 may be completed by simply administering questionnaires at the end of a certain PD session, while the evaluation process at level 5 may require more tools such as students' records, school records, questionnaires, structured interviews, and portfolios. Guskey's model of CPD impact evaluation is considered comprehensive and has been utilized by different researchers (e.g., Goodall et al., 2005). Hence, this study is utilizing Guskey's five-level evaluation framework as a benchmark to examine at what levels CPD providers in Saudi Arabia evaluate the impact of CPD.

Literature has focused more on evaluating of CPD in recent years (e.g., Rivera, Manning, & Krupp, 2013). However, earlier studies (e.g., Harris et al., 2006) indicated that the impact of CPD is rarely comprehensive enough to cover the five levels of Guskey's evaluation model. Impact of CPD is also rarely assessed based on outcomes or at the long term (Opfer & Pedder, 2011; Rose & Reynolds, 2008). To



evaluate the impact of CPD effectively, there is a need for developing general evaluative models which consider the most important aspects of effective CPD and following systematic approaches that consider the complexity of educational systems (Stadler, 2010). Moreover, because the providers of CPD are primarily responsible for evaluating the effectiveness of CPD activities (Mullins, Lepicki, & Glandon, 2010), they need high quality preparation to do their evaluation duties effectively and professionally (Harries et al., 2006; Sadler, 2010).

Few studies investigated the provision (planning, organizing, evaluating) of CPD (Bolam & McMahon, 2004); this is particularly true in countries such as Saudi Arabia where interest in the professional development of teachers is relatively recent. Therefore this study intends to explore the nature and status of CPD provision for science and mathematics teachers from Saudi providers' perspectives. More specifically, this research intends to answer the following research questions:

1. How do science and mathematics CPD providers plan for and implement teachers' CPD in Saudi Arabia?
2. How do science and mathematics CPD providers assess the impact of CPD in Saudi Arabia?
3. What are the CPD providers' views of effective CPD?

Significance of the Study

It is widely recognized that providers' knowledge, skills, perceptions and approach are decisive in the success of any CPD experience. Hence, this research attempts to explore and understand how CPD providers plan for, implement, and assess their CPD programs and activities. Knowledge of how providers, particularly in Saudi Arabia, perceive their CPD efforts within their contextual experiences may shed light on how CPD is affected by the nature of the educational system in a particular context. Findings therefore, may help direct and plan future CPD trajectories and Policy- amenable effectiveness features.

The findings of the current research may also help educational policymakers better plan for and organize CPD activities for science and mathematics teachers in the Kingdom of the Saudi Arabia (KSA) and other countries. It will also provide policymakers with recommendations related to providers' preparation to do their job effectively, and introduce suggestions for improving the evaluation of CPD. Furthermore, the findings of this study will add to the limited accumulative knowledge and research on CPD in KSA and abroad.

Context of the Study

To better understand the scope of this research, it is imperative to explain the professional development route for teachers in Saudi Arabia; specifically mathematics and science teachers. Pre-service teachers in Saudi Arabia are usually prepared through two types of institutes. The first type is the colleges of education, which prepare teachers for the middle and secondary schools; these colleges concentrate on preparing science teachers to teach mainly specific subjects, such as physics, chemistry, or biology; and mathematics teachers to teach mathematical content. The second type of institutes is the teacher colleges which prepare teachers for the elementary schools; these colleges provide pre-service teachers with general courses in science and mathematics.

While the job of preparing pre-service teachers is left to the universities and teachers colleges, Saudi Ministry of Education is considered the sole authority responsible for teachers' in-service programs (Alharbi, 2011). Interest in the professional development of teachers in Saudi Arabia has increased (Obikan for Research and Development, 2010) and the Saudi Ministry of Education is putting more efforts toward increasing the professional development of teachers. Yet, literature indicates that these efforts are not yet mature or effective enough to create the needed change in teachers' attitudes or pedagogy.



Methodology of Research

Research Approach

The general design of this study was led by an interpretive qualitative approach. The qualitative approach helps researchers gather rich and in-depth information from participants and involves the interpretation or the examination of what they think or how they behave with respect to certain phenomena or contextual experiences.

Study Participants

Only twenty participants volunteered to participate in this study and completed the written questionnaires which were mailed to them. All the collected questionnaires qualified for analysis. Participants covered four geographical educational directorates in Saudi Arabia.

Fourteen participants were males, while six were females. In addition, 10 participants were science CPD providers, and 10 were mathematics CPD providers. Participants also varied in the number of their years of training experience. (i.e., four had 1-3 years; 11 had 4-10 years, and five had more than 10 years of training experience). With regard to educational degrees, 4 participants had MA; one had a PhD, while the rest had a bachelor degree. It is worth noting that names utilized in this study are pseudonyms.

Data Collection

An open-ended questionnaire (see Appendix 1) was developed by the research team to gather information from CPD providers in Saudi Arabia. The choice of collecting data using open-ended questionnaire was made after taking into account different considerations.

First, the open-ended questions have an inviting quality and encourage participants to react and qualify their responses. Second, they help researchers invest time with others, and allow for greater geographical coverage (Phellas, Bloch & Seale, 2012). In addition, the open-ended questionnaire was preferred over interviews because interviewing is relatively a recently recognized method of data collection in Saudi Arabia and, hence, may require effort and caution from the part of the researchers to sensitive issues that are particular to the Saudi Arabian culture.

The open-ended questions were developed after reviewing an extensive literature review related to CPD (e.g., Goodall et al., 2005; Guskey, 2002) and were clustered around the research questions set for this study. Attention was paid to keep the questions clear, specific and short to provide meaningful and interpretable data. Also several prompts for each question were developed and added to the questionnaire to help researchers collect richer data. The open-ended questionnaires were reviewed by faculty members and experts in Science Education and professional development to check the appropriateness of the questions and their prompts. The questionnaire was developed and piloted in the Arabic Language as it the native language for the participants. The emerging themes and some selected excerpts were translated into English for the purpose of publication and the translation was checked by two bilingual (Arabic-English) specialists.

The final version of the questionnaire consisted of two parts. The first part requires participants to complete a demographic sheet to provide information about their level of education, major, and years of training experience. The second part contained 14 open-ended questions that covered four main dimensions of professional development: planning, implementation, evaluation, and effectiveness. The review of related literature helped us select and design questions that best represent each dimension of PD. The dimension of evaluation, for example, consisted of questions such as: What are the areas you evaluate (e.g., participants' satisfaction, changes in participants' knowledge, skills, and behaviors, students' outcomes, etc); which area, you believe, is the most important for measuring the impact of PD; Clarify how do you evaluate the CPD activities you organize; and how you benefit from the collected data and evidences?



Data Analysis

The researchers followed certain procedural steps during the analysis of data. First, all questionnaires were read several times individually to ensure that they are of sufficient value that warrant coding. The passages that represent participants' answers to a single question were then compiled in one file. Second, data were analyzed thematically following Braun and Clarke (2006) procedures: familiarizing self with the data through reading and re-reading and noting down initial ideas, generating initial codes in a systematic fashion, collating codes into potential themes, reviewing themes and generating a thematic map for the entire analysis, defining and naming themes, producing the report and selecting vivid extract examples.

It is worth noting that the coding process was conducted independently by two of the research team who generated, refined, and compared the initial codes. Researchers' agreement on this step determined the final codes that determined the potential themes. This was done to establish trustworthiness in data analysis and ensure replicability of codes. Furthermore, the coding process was conducted in Arabic. Only the emerging themes and some selected excerpts were translated into English by the research team who were fluent in Arabic and English. An external reader helped in warranting the translation and back translation process.

Results of Research

Three major themes that correspond to the research questions appeared through data analysis of the open-ended questionnaires. These themes are: CPD planning and delivery, assessing the impact of CPD, and views of effective CPD. In what proceeds, we present and discuss the emerged themes.

CPD Planning and Delivery

This study aimed at uncovering the CPD models and types that are provided for science and mathematics teachers in Saudi Arabia and learn about how CPD providers plan for and implement teachers' CPD. Analysis of the collected data indicate that participants in general refer to two approaches of CPD: one relates to the formal CPD programs that are usually coordinated by the Ministry of Education and another is a less formal type of CPD that is usually performed by the providers themselves through the schools. Khaled who has a bachelor degree in Mathematics Education and has been a supervisor for 4 years reported:

There are two types of programs for CPD that we provide for teachers. The first type of these programs is coordinated by the ministry and our role here is to execute the training plans prepared by the training management center in the ministry. The second type is prepared by us [supervisors] based on teachers' needs like how to deal with the computer programs and other programs.

Fathi also refers clearly to these two types of CPD programs when he reported:

The Ministry determines the CPD programs that science teachers are in need and their intended outcomes. Our role here is to execute these programs and train teachers on them and achieve the program outcomes. As for the integrated CPD plans for science teachers, besides the training programs, we have a plan usually prepared by the department or the supervisors themselves that usually includes diverse strategies implemented throughout the year according to the set plan.

When providers were asked about how they plan for teachers' CPD, all of them have directly referred to the formal type of training programs coordinated by the Ministry of Education and clearly indicated that they do not participate in planning the intended objectives for these training programs. Exemplary responses from the participants were as follows:



Rami: my role is restricted on just training teachers on pre-planned training kits.

Shaher: we have ready kits from the Ministry. It is planned, designed and chosen by the experts.

Mused: I have no role in the planning for CPD.

Nuha: the CPD planning is done by project experts.

Suleiman: the planners are the CPD team in the ministry, we are the central trainers. We don't set plans, we just execute them.

The excerpts taken from participants' written reports assure that they don't participate in the planning process for the formal type of CPD nor they choose the goals and the intended outcomes of these programs. Participants have also noted that the delivery of the training kits for teachers is a top-down training process starting from a project expert to a central trainer to a supervisor and finally delivered to teachers. According to Shaher who has a bachelor degree in Science Education and has three years of supervisory experience, "training is conducted by a team of experts. When the central trainers finish the training course, they start training their colleagues." Similar to all participants, Rami also referred to the same training process when asked how trainers are being prepared to provide training. He responded: "through a training course in which I am a trainee and then I become a trainer."

This top-down approach, however, was criticized by participants and was described as having a theoretically-oriented nature. The following excerpt taken from Khaled's response is rather lengthy, but clarifies this thought very well. According to him:

As for the Ministry programs, [trainers are being trained] through attending the programs in the ministry and often the programs have a theoretical nature because the expert trainers in the Ministry don't have a practical experience in the field which they train on. They just collect theoretical materials from different references and internet sites. Some of these references are in Arabic while most are in English. That is why when we ask about the practical side, there are always unrealistic and confusing responses.

Faisal also criticized how providers are being trained on the formal CPD. He reported:

Trainers are not well qualified. They just attend a training program by another trainer who was trained on the program by other supervisors and then the supervisor is given the job of training teachers without good preparation.

Participants noted that they don't even participate in choosing the type of the training program nor its content. According to Fathi, who has a non-educational science degree and has been a science CPD provider for 4 years:

The ministry decides and chooses the programs that we train teachers on. The ministry also designs the training kits. Our role is to attend a training course on these kits and then train teachers on them

With the exception of Sameera who reported that even the material of the kits are unchangeable, participants have noted that their role in the formal CPD was restricted to modifying and slightly changing the ready training kits. For example, Samer reported, "training kits are prepared and planned by the ministry, we just modify them based on certain needs... the kits are prepared by the experts, we add the design and final production."

The training model of CPD which was mentioned by most participants, albeit universally common, has been described by Kennedy (2005) as, "often subject to criticism about its lack of connection to the current classroom context in which participants work." This criticism echoes what have been reported by the participants in this study.

From a different angle, when participants were asked to mention all the CPD models or types they implement, analysis of their written reports showed that their CPD efforts were limited to certain types. In addition to the formal training programs which all participants referred to, participants reported that they implement workshops mentioned by 14 participants, selected readings that guide teachers



mentioned by 5, educational bulletin mentioned by 6, individual and group meetings with the supervisor mentioned by 8, and practical lessons mentioned by 4. Extremely, Mused who has a PhD in Science Education and has been providing CPD to teachers for 6 years, and Sameera who has a bachelor degree in Mathematics Education and has been providing CPD to teachers for 11 years reported that the only CPD model they implement was the formal training of CPD. The Direct teaching model of CPD including courses and workshops which was described by Lieberman (1996) was the dominant model of CPD which Saudi providers relied on.

The other models and types of CPD mentioned by Lieberman (i.e., school enacted CPD such as peer coaching, critical friendships, mentoring, action research, task-related planning teams, and the community of practice model); and out of school learning (such as joining professional development networks, school-university partnerships, conferences etc.) were all absent from the general models that CPD providers in Saudi Arabia use. These forms have been perceived by Kennedy as allowing for transformative practice and professional autonomy compared to all the forms mentioned by participants that were perceived as embodying a traditional transmission view of CPD. Exceptionally, Nuha and Salwa- who have bachelor degrees in Mathematics Education and have worked as CPD providers for 4 years- mentioned that they implement the models of peer coaching and mentoring in their provision of CPD above and beyond workshops, meetings and seminars and educational projects. Peer coaching and mentoring, however as Kennedy explained, can support either a transmission or a transformative view of CPD based on the underlying philosophy behind its use. In recent years more educators (e.g., Knight, 2002) call for increasing the scope of CPD efforts to allow for more informal CPD opportunities that are based on professional dialogue about teaching and learning. These reflective forms of CPD were described by Warwick (2004) as the most valuable in enhancing the teachers' instructional practices.

In an attempt to understand what CPD providers have already delivered to teachers, participants were asked about the content of their delivered CPD. All participants referred to common content and core activities. Teaching strategies, classroom management, project based learning, differentiated learning, active learning, inquiry, and constructivism were general to 19 of the participants. Only Nuha- who has a non-educational mathematics degree- reported training teachers on subject matter knowledge including conceptual understanding of mathematical concepts such as measurement, geometry, algebra, numbers and operations and so on.

The emphasis on delivering pedagogical knowledge over subject matter knowledge can be explained in light of the participants' educational backgrounds. All the 19 participants had educational Science and Mathematics degrees; therefore pedagogy was part of their specialty.

Assessing the Impact of CPD

In addition to clarifying the intended outcomes and identifying effective teaching and learning strategies, impact evaluation is seen as an important element to determine the effectiveness of a CPD program (TDA, 2007). According to Guskey (2002), evaluation is a multifaceted process that requires analysis and assessment of five succeeding levels of information. These levels are: participants' reaction, participants' learning, organization support and change, participants' use of new knowledge and skills, and students' learning outcomes. Guskey's framework of CPD evaluation is considered a comprehensive framework that brings about the multilayered complex nature of CPD assessment (Bolam & McMahon, 2004).

In this research question, we aimed at understanding how Saudi CPD providers assess the impact of CPD. We attempted to understand their perceived practices of CPD assessment in reference to Guskey's model of CPD evaluation. We asked participants to identify the aspects of evaluation that they use. Three participants have pointed out that they don't have a specific mechanism for evaluation and that their evaluation of the impact of CPD is thought of and implemented on the spot. According to Rami who has a master degree in Science Education and has been training teachers for three years, "I have never assessed CPD based on a scientific method. I just ask teachers and principals general questions and I use the classroom observation to discover the CPD impact." Similarly, Majed and Suleiman- although reported using classroom visits- have also indicated that they don't have a particular mechanism for



evaluation. Other participants, on the other hand, have referred to some ways and methods that they use to assess CPD. The following excerpts exemplify participants' responses when asked about the fields of assessment that they implement.

Turky: I observe how teachers interact with each others. I observe the enthusiasm they show while participating in the activities.

Nuha: I implement classroom visits and study the impact of the training on teachers' learning through the worksheet they have to finish during the training workshop.

Ahmed: I assess the trainees at the end of the program, and assess their classroom application of the new skills and knowledge. I also ask trainees about their opinions about the CPD program through a questionnaire.

Mused: during the program, first I assess change in teachers' attitudes through their participation in the activities, and the discussion, second, during field visits for the teachers' classrooms and observing their performance competency and teaching strategies.

Sameera: I conduct classroom visits for the teachers and observe their teaching practices. I also assess participants' satisfaction about the program.

As revealed through the analysis of participants' reports, we find that most participants (13 participants) have referred to level 4 of Guskey's model of CPD evaluation. According to Guskey, level 4 assesses participants' use of new knowledge and skills which may involve questionnaires, interviews and direct observation of the teachers. Many participants have clearly indicated that observing participants' use of new knowledge and skills in the classroom is very important and that they feel it is the most important aspect of CPD evaluation.

Two key points, however, are relevant when discussing this level of evaluation as pointed out by Guskey. The first point relates to the necessity of specifying indicators about the degree and quality of implementation. The second point rests in allowing sufficient time to pass after the completion of a PD session. Although the 13 participants have generally referred to level 4 of Guskey's model, none of them indicated setting indicators for the classroom implementation or assuring that sufficient time pass to allow teachers adapt the new acquired knowledge and skills.

Another level of evaluation that was mentioned by most participants in reference to Guskey's model was level 1. In this level, information are gathered about participants' reaction to the experience of the PD since it is considered a prerequisite to higher-level evaluation results. Furthermore, information for this level are usually gathered through questionnaires that are general enough to be used in many PD activities. Level 1 of Guskey's evaluation model was also mentioned by participants as very important aspect of their CPD evaluation. For example Shaher who has a bachelor degree in science education and has three years of training experience reported when asked about the CPD aspects that he assesses, "[I use] questionnaires to assess teachers' opinions and satisfaction about the trainer, the training material, the place of training, and if trainees have additional suggestions." In total, 9 participants reported assessing this level of evaluation.

From a different angle, only few participants referred to level 2 of Guskey's model. The focus in this level is to assess the knowledge and skills that participants have acquired from attending the CPD session. Yet, evaluation information at this level requires that some indicators of successful learning to be outlined prior to a certain professional development experience. Information are usually gathered in this level through pre-post assessment. The five participants, who referred to this level, however, used different information gathering techniques. Basemah who has a bachelor in science education and 15 years of training experience described her practices at this level, "I evaluate teachers' performance before the start of the CPD activities. I assess their performance during the CPD experience through observing group work, and I evaluate at the completion of the CPD experience through conduction projects that require teachers to translate what they have learned." Salwa also pointed out that she measures the training effect on teachers' knowledge and skills through some written worksheets that participants have to finish during the experience.

It is worth mentioning that most participants either referred to one level or at maximum to two



levels of Guskey's evaluation model. Only Hissah (who has a bachelor of science and 7 years of training experience) and Faisal (a math education supervisor and a trainer for 17 years) reported evaluating their CPD activities at three levels. Hissah indicated:

To determine the effectiveness of the CPD activities and experiences I provide, I have to assess the training effect on participants' knowledge and skills and determine to what extent the program goals have been achieved according to the criteria we are interested in. I also assess the trainees' reaction after the completion of the training immediately through the questionnaires. I assess what participants have learned from the program through some activities they have to finish. I assess teachers' use of the new knowledge and skills in the classroom. I also assess how teachers benefit their colleagues through the exchange visits between them and implementing some lessons.

It becomes clear from the above excerpt that Hissa implements three levels of evaluation. These levels in reference to Guskey's model of CPD evaluation are: participants' reaction (level 1), participants' learning (level 2), and participants' use of new knowledge and skills. Faisal also described a three-level evaluation approach of CPD. He described his assessment practice as follows:

I visit the teacher after the completion of the CPD experience and observing the improvement in his performance. I examine students' academic achievement before and after the teacher enrollment in the CPD program. I also communicate with the school administration to know about and assess the students' performance after the program.

In addition to levels 2 and 4, Faisal describes some of his assessment practices that fall within level 5. In this level, the focus of evaluation is on students' learning outcomes (i.e., what was the impact of the program on students' learning?) information are usually gathered for this level from students and school records and usually the purpose of this level evaluation is to document the program's overall impact. It note worthy that Faisal was the only participant who implement evaluation practices from level 5 of Guskey's model in addition to practices in levels 2 and 4. The impact of CPD on students' learning has been found to be under-evaluated in other studies as well (e.g., Harris et al., 2006).

Views of Effective CPD

This study aimed at understanding the perspectives of science and mathematics CPD providers about the features of effective and less effective CPD. Analysis of data showed that participants have some views about the factors that make a CPD program successful. To ease the presentation of these factors, we have combined the factors reported by participants under three aspects: factors that relate to the nature of the training program itself, factors that relate to the trainer and factors that relate to the teachers (i.e., the trainee).

One of the factors about the nature of the training programs that was repeatedly mentioned by the participants relates to the applicability of the CPD programs provided for teachers. Most participants have emphasized the importance of the relevance of the CPD content to classroom applications.

Most participants have also called for tracking the effectiveness of a CPD effort in relation to whether it meets the overall needs of the teachers or not. Nuha expressed this idea well when she reported, "the factors that make a CPD program less effective is when it is not applicable and doesn't meet the needs of the teachers or when it is not related to the implemented curriculum." This finding indicates that participants in this study recognize the importance of identifying teachers' professional needs as a starting point for planning for CPD.

Different other factors that participants felt is important in determining the effectiveness of a certain CPD program were: the design of the CPD program is not based on a single one shot design, its content is not repeated or over copied by other CPD programs, it includes activities that are rich in content and creative in nature, fun, their implementation is simple and require short time, and the place of their implementation is convenient, organized, clean, and includes the needed materials and resources.



From a different angle, participants reported factors that relate to the CPD providers themselves such as being skilled, competent, and specialized. Few participants have also referred to the personal and moral characteristics of the trainers. The personal and moral characteristics of the trainers are important specifically in countries like Saudi Arabia where Islamic and moral teaching is central and critical to the KSA culture. Two participants have also referred to the work load and the combined job of the trainers as being both supervisors and CPD trainers as factors that make the CPD programs less effective. Suleiman, for example, have called for "separating the duties of the supervision from the duties of CPD provision."

With regards to teachers, participants reported features that make the CPD more effective such as teachers' desire and willingness to change. Other participants referred to teachers' convictions and the discrepancy between those of the teachers and those set for the programs to achieve. Providers also see that providing teachers with incentives upon finishing and achieving the goals of CPD and holding them accountable for their PD may make the CPD efforts more effective and successful. When asked if they have ever developed creative aspects in the CPD they provide, surprisingly six participants reported that they have never developed creative aspects or activities in their CPD provision. Suleiman, for example reported: "as I mentioned before, the CPD team in the Ministry is responsible for planning and developing these programs. We are the central trainers; we just implement them." Rawan elaborated: "I just follow what is in the training kits."

The other participants, on the other hand, reported some aspects that they developed and considered creative. A repeatedly mentioned aspect (i.e., mentioned by 7 participants) is translating theoretical concepts into practice and providing teachers with the opportunity to implement what they have learned. From a different aspect, three participants reported that they give teachers active role in their learning and follow a learner-centered approach in their training. Other participants reported providing teachers with videos from YouTube, experiments, and how to deal with technological tools like Quiz Creator while some participants reported paying attention to how the material is presented, the slides design, and using different strategies to convince teachers to implement what they are learning.

Discussion

The purpose of this study was to understand the status and nature of CPD provision in Saudi Arabia from the perspectives and experiences of science and mathematics CPD providers. Planning for CPD, implementing its activities and the evaluation of its impact are all integral parts of teachers' CPD in any given country (TDA, 2007). The knowledge, skills and approach of the CPD provider could influence, positively or negatively, the success of any CPD experience.

A central finding in this study indicates that the dominant model of CPD in Saudi Arabia is the training model which usually depends on a training plan established to meet the educational priorities of a central authority (e.g., Ministry of education) in terms of identifying the needed skills and competences of the teachers. Saudi CPD providers' role in these plans is kept on minimal and many CPD providers expressed negative feelings toward their preparation as trainers. Most providers have also indicated providing traditional notions of CPD that are based on a single shot design (such as courses and workshops). As for the activities that CPD providers implement, most can be seen as features of a top-down delivery approach and rarely recognize teachers as a source for critical and reflective practice that leads to their professional development.

As for the CPD strategies and activities, participants reported activities such as lecture style, group learning, exploration and inquiry, direct application on the teachers' guides, advanced organizers, concept maps, case study and discussion. At this point, it is valid to point out the distinction made in literatures between direct teaching or training versus the horizontal approach that considers teachers themselves as a resource for critical and reflective practice that leads to their professional development. All the activities mentioned by the participants are recognized as features of a top-down delivery model in contrast to activities such as classroom observation and reflection; encouraging and extending professional dialogue which are considered as features of successful CPD efforts (Kazemi & Franke, 2004; Rose & Reynolds, 2008).



Although participants in this study reported that they do not plan for the formal CPD activities and programs, some of them have shown a practical knowledge about how to plan for CPD and most seemed aware of the importance of collecting information about teachers' needs in the planning process. When teachers were asked about how they collect information about teachers' needs, participants balanced between the necessity of meeting teachers' individual needs and meeting national needs. Common answers related to self-identification of the teachers to their individual needs through teachers' surveys and meetings with the supervisors, and identifying national or country priorities and needs through supervisors' classroom visits and observations, principals' surveys, and meetings on the Ministry level to identify national needs. Literature indicates that CPD efforts in general may tend to prioritize national needs over teachers individual needs. According to Cordingley, Bell, Rundell, and Evans (2003), involving teachers in planning and conducting need analysis to ensure that the new practices and strategies are well aligned with what individual teachers value has been recognized as an important component of successful CPD efforts.

Furthermore, study findings indicate that while most participants held general views about how to assess the impact of CPD, some admittedly reported not adopting systematic procedures for evaluation. Analysis of data showed that none of the participants implement a comprehensive evaluation of their CPD, despite the fact they implement different aspects of evaluation. Guskey's describes each level of evaluation in his model as important by its own and that in order to have a range of perspectives about the impact of the CPD; evaluators have to track the efficiency and effectiveness of the program at each level. From a different angle, level 3 of Guskey's model was not mentioned by any of the participants in this study. At level 3 of Guskey's evaluation model, the focus is on the school or the organizational policies that are compatible with the implementation efforts. Evaluators at this level usually assess the organizational attributes necessary for success of the CPD programs and efforts. This level, however, has been described by Guskey as the most complicated level which requires specialized and varied procedures of data collection, which may explains why none of the participants reported implementing it.

From a different angle, providers identified some factors that they think enhance the effectiveness of a CPD effort. Among these is the applicability of the CPD content and its relevance to classroom application. According to Scherz, Bialer, and Eylon (2010, p: 2), in order to make a CPD program effective we need to "base part of it on records of practice, which we call 'evidence.'" Similar to Saudi CPD providers, Hustler et al. (2003) found in a study that examined teachers' perceptions of CPD that teachers perceived the relevance and applicability of the CPD as key features of worthwhile CPD experiences.

Another factor that participants referred to is the necessity of meeting teachers' needs. Bekiroğlu (2007) emphasized the importance of continuously assessing the emerging needs of teachers to improve the designs of CPD. Although recent literature call not only for ensuring that teachers' needs are met but also allowing teachers to identify their own learning needs and jointly plan for and assess the impact of CPD (Cordingley, Bell, Rundell & Evans, 2003), we see that providers perspectives in this regard are positive and may form a base to help shifting to more collaborative forms of CPD, which according to Cordingley et al. (2003, p.3), help the CPD become, "a joint mission, flexible enough to ensure that it was fit for purpose rather than a 'one size fits all' package of imposed change."

With regard to the aspect that relates to CPD providers, participants mentioned that providers should be skilled, competent, and specialized. Research (e.g., Goodall et al., 2005; Harries et al., 2006) started to study providers' skills and knowledge upon recognizing that the status, knowledge, and approach of the CPD providers have a critical role in influencing teachers' attitudes towards and understandings of CPD. Participants also realize that teachers and their motivational aspects such as their desires and expectations are also important factors to enhance the effectiveness of any CPD effort and suggest providing teachers with certain forms of incentives for participating in the CPD program. Understanding motivational aspects of the teachers and what influence their motivation to participate in CPD is critical to assume the success of any CPD efforts (Thomson & Kaufmann, 2013). Furthermore, Kelchtermans (2004) explains that PD should not be conceived only in terms of technical issues. There should be recognition that it is also based on internal and moral dimension from the part of the teachers.



Implications

Based on the findings of this study, the following recommendations are offered:

- Increasing the scope of CPD efforts in Saudi Arabia to allow for other forms of CPD opportunities. CPD opportunities can vary in models and types. Examples may include school enacted CPD such as (peer coaching, critical friendships, mentoring, action research, task-related planning teams, and the community of practice model); and out of school learning (such as joining PD networks, school-university partnerships, conferences etc.). More attention, however, should be paid to assure the sustainability of these efforts and document change in teachers' (improvement) over time (Singh, Yager, Yutakom, Yager, & Ali, 2012).
- The CPD providers' role is very important in assuring the success of the any CPD effort. Hence, emphasis should be place on how to prepare and equip these trainers with the required skills and competencies. Providers' training should be expanded to allow them adopt different activities as classroom observation and reflection; and encouraging and extending professional dialogue which are considered as valuable for critical and reflective practice.
- CPD providers in Saudi Arabia also need to have sufficient support and training about the modes of evaluation available for use and their evaluation should be comprehensive enough to allow tracking the effects of CPD at the five levels of Guskey' model.
- Efforts should be paid to focus on how best to provide PD activities and models for science and mathematics teachers. These efforts should recognize the factors or features of more effective CPD programs which would ensure attaining positive outcomes on the levels of teachers, students, and schools.
- Future research should consider the following points. First, it is necessary to conduct detailed research that captures the CPD experiences through observing the interaction between the provider and teachers and among teachers themselves. Moreover, it is important to investigate policy makers' views of what is considered effective CPD and their vision for PD in Saudi Arabia to measure future trends and directions.

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Appendix 1**Open Ended Questionnaire: Perceptions and Experiences of CPD Providers****Continuing Professional Development (CPD) Provision for Science and Mathematics Teachers in
Saudi Arabia: Perceptions and Experiences of CPD Providers****Dimension 1: Planning for CPD :**

- How do you plan for CPD? What are the factors that you take into consideration when you plan for CPD?
- How CPD programs are being selected? Who participates in selecting and designing CPD programs?
- How is information being gathered about teachers' needs for CPD? Explain how this information is being utilized to identify the goals and priorities of CPD

Dimension 2: CPD Delivery:

- What are the CPD models that you organize?
- Give examples about the content of some of the CPD programs you provide
- What are the strategies and tools that are used in the delivery of CPD?

Dimension 3: Assessment of CPD

- What are the aspects that you assess to evaluate the effectiveness of CPD programs / activities?
- Explain the procedures for assessing the activities of CPD
- Explain how do you benefit from the evaluation of CPD

Dimension 4: Effectiveness of CPD:

- How do you see your role and the teachers' role in CPD?
- In your opinion, what are the aspects that make CPD activities more/less effective?
- Do you develop creative forms of CPD?

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