Ensuring Effective Impact of Continuing Professional Development: Saudi Science Teachers' Perspective

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Many researchers critique that continuing professional development programs in Saudi Arabia are neither well organized nor are systematic. This study came to assess the impact of CPD opportunities in the country to better suit the professional needs of Saudi science teachers and support them in implementing the reformed instructional practices. Both quantitative and qualitative data were collected from 609 Saudi science teachers by means of closed and open ended questionnaire and later interviews with 9 teachers. Findings indicated that several Saudi science teachers have benefited from participating in the CPD programs but have also faced several challenges. Further analysis of the data resulted into five major themes; perspectives of participating in CPD, features of distinguished CPD programs, perceptions of ways to improve the impact of CPD, the impact of CPD on classroom practices, and barriers face classroom implementation.

Keywords: Saudi Arabia, professional development, science teachers.

BACKGROUND AND THEORETICAL FRAMEWORK

It is widely accepted that the quality of teaching cannot be improved without improving the quality of teachers (Borko, 2004, Seferoglu, 2001; Loucks-Horsley, Harding, Arbuckle, Murray, Dubea, & Williams, 1987). A teacher who has opportunities to learn can provide more opportunities for his students. Therefore, providing teachers with continuous professional development experiences is essential to improve the quality of their teaching (Lindberg, 2011). Matseliso, and Jita (2010) define CPD programs as systematic efforts to bring about change in teachers' classroom practices, in their attitudes and beliefs, and in the learning outcomes of students.

Despite the general consensus on the significance of CPD to the improvement of classroom teaching and learning, several researches pointed to the ineffectiveness of most programs (Guskey, 2000; Luft, 2001; Rhoton, Madrazo, Motz, & Walton, 1999; Wee, Shepardson, Fast, & Harbor, 2007). The characteristics of these CPD programs are well documented in the

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State of the literature

- Continuous professional development experiences help teachers change and reconstruct their teaching role.
- Professional development experiences should be demand driven and not supply driven.
- In addition to receiving CCPD experiences, teachers need to be provided with continuous field support to help them internalize and implement the new practices inside their classrooms.

Contribution of this paper to the literature

- This study offers several suggestions on how to make CPD experiences more meaningful to teachers in order to effectively impact their classroom practices.
- It provides insights to teacher educators and professional development providers into how teachers view their professional roles in order to better design and tailor CPD experiences.
- It offers solutions to maximize the impact of CPD experiences inside the schools through creating professional learning communities that consist of teachers, school principals, and education supervisors.

Continuing Professional Development (CPD) in Saudi Arabia:

The Kingdom of Saudi Arabia (KSA) started to provide Saudi teacher with CPD program in early 1975 (El. Deghaday, Mansour, & Alshamrani. (2014). Since that time, the MoE in the country established an independent department for teacher training called the General Administration for Educational Training and Scholarships in 1998, which is in charge of providing two types of professional development program: teacher training and internal and external scholarships for teachers (Almazroa & Al-shamrani, in press). The CPD policy is highly centralized and geared around delivering CPD through a direct supervision of the general training departments in the Ministry of Education (MoE), and through specialized centers in each educational governorate.

The necessity of providing Saudi science teachers with CPD has received the attention of educational policy makers in the Kingdom of Saudi Arabia (Ministry of Education, 2014). The precursor of this huge governmental support stems at the weak performance of Saudi science students in TIMSS results (Mullis, Martin, & Foy, 2008).

As a governmental response to those and previous national TIMSS results, the Ministry of Education in the Kingdom launched a large-scale science education reform that requires Saudi science teachers to shift from traditional teaching methods to spending more time developing their subject knowledge, shifting from less shallow coverage of facts and procedures, to more in-depth focus on concepts and 'hands-on' engagement (AL-Abdulkareem, 2004; Alghamdi & Al-Salouli 2013). The reformed science curriculum required advanced teachers' capacity to implement inquiry-based practices, and create an investigative culture in the science classroom that encourages students' use of critical thinking and problem solving skills (Forawi, 2012; Santau, Maerten-rivera, & Huggins, 2011).

However, teachers' professional development programs in the country are undertaken as short training sessions and workshops that centered on theoretical pedagogical knowledge and ignore practical, skills, and the content knowledge (Almazroa & Aloraini, 2012; Author, 2012; Mansour, Alshamrani, Aldahmash, & Alqudah, 2013). The training programs are neither well organized nor are systematic. Rather, they are scattered and disorganized. The ministry of education does not have a clear vision for the science teachers' provisional growth or CPD. The Excellence Research Centre for Science and Mathematics Education (ECSME) in the country has addressed the need for carrying out a research project to help develop a national vision for CPD programs for Saudi science teachers (Author, 2012).

literature (Buczynski & Hansen, 2010). They may be characterized by being too conventionally taught, too top–down, and too isolated from school and classroom realities to have much impact on practice. Verloop (2001) added that ignoring teachers' existing knowledge, beliefs, and attitudes has also contributed to the failure of several professional development programs. Furthermore, many teachers insist, based on their experience, that the most effective development programs were self-initiated (National Research Council [NRC], 2007).

Guskey (1986) explained two sets of crucial factors that contributed to the infectiveness of CPD: (1) programs that do not take into account what motivates the teachers to engage in professional development and (2) programs that neglect the processes whereby change in teachers typically occurs.

In the same route, researchers (Kennedy, 1998; Loucks-Horsley, Hewson, Love, & Stiles, 1998) suggested several remedies for unsuccessful CPD through; exploring the needs of teachers to teach science in the classroom, designing CPD programs that enable teachers to encourage students' discussions and sharing of ideas in the science classroom (Lemke, 1990).

To that end, the ECSME Centre has set a goal to assess the impact of CPD opportunities that Saudi science teachers have received and the impact of those opportunities on their teaching practices. It is the hope that assessing the impact of CPD opportunities would significantly help CPD providers to better suit the professional needs of Saudi science teachers and support them in implementing the reformed instructional practices.

Conceptual framework

The conceptual framework of CPD described by Desimone (2009) was used to guide the conduct of the study. Desimone argues that to assess how CPD works to influence teacher and student outcomes, several factors need to be considered; the critical features of professional development, teacher knowledge and beliefs, classroom practice, and student outcomes. As shown in the figure below, a theory of action for CPD follow four main steps (Desimone, 2009);

1. Teachers experience effective professional development.
2. The professional development increases their knowledge and skills and/or changes their attitudes and beliefs.
3. They use their knowledge and skills, attitudes and beliefs to improve the content of their instruction or their approach to pedagogy (or both).
4. The new instructional practices result in increased student learning.

In this study, we will use Desimone (2009) framework of CPD to understand Saudi teachers' perspectives on the continuing professional development opportunities they receive (see Figure 1).

METHODOLOGY

Participants

The population for this study was 3150 science teachers in three educational administrations in Saudi Arabia (Mecca, Taif, & Almajmah). However, for the sample of this study, the researchers targeted about one third of the population, so the researchers selected some educational districts under each educational administration with the consideration that the selection should cover both the urban and suburban areas. These educational districts were chosen because they were part of the partnership program with the Center of Excellence Research in Science and Mathematics Education which sponsors this study. Not all of the educational districts were selected, as responses of teachers participating in the study would give a possible indication of their experiences through attending PD throughout 5 years. The criteria used in the selection process took into consideration covering both urban and suburban areas in each administration. Three out of nine educational districts under Mecca educational administration were selected. For Taif, three educational districts out of ten were selected. For Almajmah, two educational districts out of four were chosen (El. Deghaday et al., 2014).

The total number of teachers within the selected schools and districts was 1052 (485 males and 567 females). A total of 609 teachers across all subgroups returned the surveys, with a response rate of 57.88%. Out of the 609 teachers, 138 were teaching primary stage, 160 were teaching middle stage, and 311 were teaching secondary stage students. Most of the participating teachers held a B.S. in education (n = 569), whereas 25 teachers held a diploma in education and 15 teachers had earned a master degree. Their majors were biology (n = 195), physics (n = 133), chemistry (n = 166), general sciences (107), and earth science (8). At the time of the study, they were teaching general science (n
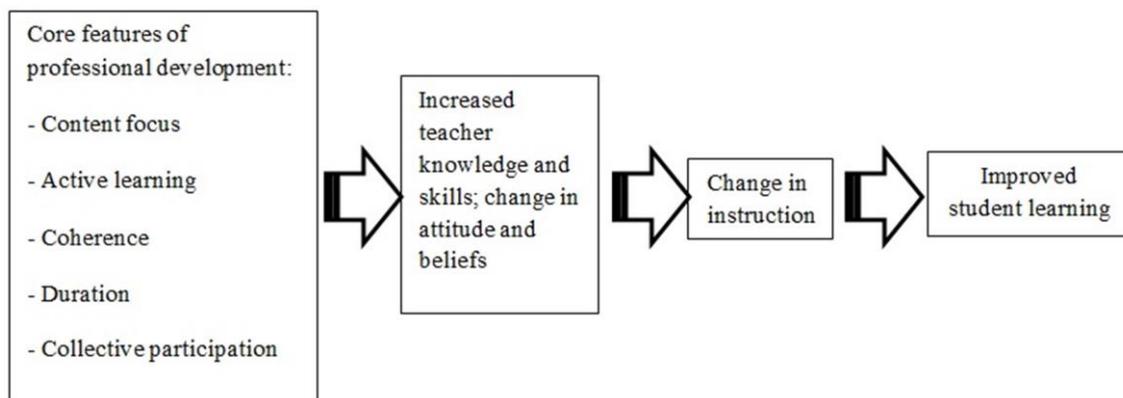

Figure 1. A theory of action" for teachers' PD (adapted from Desimone, 2009, p. 185)

= 299), biology (n = 91), physics (n = 99), chemistry (108), and earth science (n = 12). The teaching experience of participants was less than 5 years for 217 teachers, and 6-10 years for 120 teachers while it was more than 11 years for 272.

The study took place during the 2012/13 academic year. During that time, open ended questionnaires were distributed to participants and 9 teachers (3 females and 6 males) were interviewed later to obtain a greater, in-depth understanding of their perceptions of the CPD programs that they took. The initial number of teachers who agreed in the questionnaire to be interviewed was 23 teachers with 16 male and seven female teachers. Eight teachers left the interviews while six teachers apologized due to time constraints. This left us with only nine teachers whose responses are illustrated throughout the study. It should be noted that interviews are not that customary in the Saudi context and, with such an instrument, females are less comfortable to open up and provide detailed responses (El. Deghaday et. al., 2014).

Data Collection Tools

Based on the nature of research questions and the issues being investigated, a mixed method approach of both qualitative and quantitative data collection was used. The mix data collection approach provides a rich empirical basis upon which we have made judgments about teachers' previous experiences and views on CPD opportunities and their preferences of future CPD. Three types of data collection tools were used closed ended questionnaire, open ended questionnaire, and participants' interviews.

Closed Ended Questoinnare

Closed ended questionnaire was handed out to 311 Secondary, 160 intermediate and 138 primary science teachers at study;s schools. The questionnaire asked them a range of questions about the impact of CPD in their schools. SThe questionnaire asked several questions about the impact of CPD models offered to teachers, the impact of CPD on selected professional practices and the barriers teachers face while implementing what they learned throughout their participating in the CPD programs. These questionnaires were personally collected by the researchers and field workers. The respondents were re-assured that they would remain anonymous and that all information supplied by the respondents in the questionnaire would be confidential.

Content validity was tested and developed by taking expert advice about both the close end and open end questions. Three science education experts were consulted after the questionnaires got translated into

Arabic. To calculate the reliability of the closed- ended questionnaire a pilot study with 60 science teachers was used to determine the reliability of the questionnaire. Cronbach's coefficient alpha was used to calculate the internal consistency coefficients of the questionnaire. A result of the reliability analysis showed that the items in the instrument have a satisfactory reliability coefficient was 0.867 (Field, 2005; Pallant, 2013).

Opend Ended Questoinnare

Open-ended questionnaire was also given to 293 science teachers. The first part of the questionnaire covered demographic and academic background variables that provided information on the sample member, years of experience, classes taught, qualifications, educational directorate (district), college/university attended, and the CPD programs they participated in.

The second part of the questionnaire consisted of 8 open ended questions intended to get in-depth understanding of the sort of CPD programs that teachers participated in and their perspectives of such participation (See appendix 1).

Each completed questionnaire was numbered and coded according to participants' responses and similar responses were put into one category. Frequencies and percentages were then extracted for each category. All responses were translated into English, organized according to the issues addressed by the questions, and assigned to a primary set of five themes concerning the participants' perceptions of their previous CPD experience and the impact of that training in their science instruction.

Assigning responses to these five categories revealed problems (e.g. duplication) so the categorization process was refined until all responses could be placed into mutually exclusive categories.

Follow-up Interviews

Follow-up interviews were conducted with nine participants who had different levels of qualifications. The interviews were conducted (a) to clarify issues that came out after analyzing the data collected by the questionnaire and (b) to get a more in-depth understanding of teachers' perceptions of their previous CPD experiences and the impact of participating in such CPD programs in classrooms. The interview questions were prepared after analyzing the questionnaires.

All interviews were conducted individually, each lasted at least 50 min, and tape-recorded and transcribed. Interviews were conducted in which the following topics were addressed:

- Keeping up with the job and with new developments;

- Learning from teaching;
- Challenging situations;
- Personal and professional development during their career;
- Participation in and appraisal of extra-curricular activities;
- Collaboration with colleagues.

The translated transcriptions of the interviews were read several times and coded first by identifying themes as the subjects expressed them. Next the themes were reformulated in more theoretical words and turned into categories. Finally, the list of the categories was reduced by grouping topics that relate to each other.

It is important to note that the data collection dealt with ethical issues such as participants' permission, promises to maintain their privacy, as well as the effect of the research on the participants. In this study, the necessary procedures to protect participants' anonymity and confidentiality were considered. The participants have been informed by the aims of the research and that they can withdraw from the research at any time. Researchers fulfilled the needed technical and ethical permissions prior to administering the study's instruments.

Data Analysis

Both processes of data collection and analysis occurred simultaneously throughout the period of the study. Right after collecting data through both instruments, we coded participants' responses and transcribed and analyzed them in three major stages; open coding, selected emergent themes, and focused coding (Emerson, Fretz, & Shaw, 1995).

In open coding, we read data of each participant line-by-line to identify and formulate all ideas, themes, or issues they suggest, no matter how varied and disparate. During this stage, we wrote initial memos reflecting a variety of ideas to begin the preliminary analysis of data. After arranging our all data and coding them, we again reviewed the data and attached meaningful notes and defined the core themes and the sub themes as well that emerged from analysing the data.

In the stage of focused coding, we subjected our data to fine-grained, line-by-line analysis on the basis of topics that we identified as of particular interest from the earlier open coding analysis. In the focused stage of our data analysis, we combined the coded data under our selected themes and wrote reflective memos on each theme (Bogdan & Biklen, 1998).

In reviewing our interview transcripts, we identified patterns or themes emerged from the data (Glesne, 1999) and organized them into broad categories. We carefully cross-checked the themes that emerged from

each subject's transcripts to enable ourselves to link related data from different interviewees. Then we grouped them under one theme and marked them with accompanying interpretive notes.

In this study, rigor is a major factor that shapes data analysis. To ensure the rigor of the findings of this study, the researchers followed Patton's (1990) strategy of triangulation. Patton (1990) recommends considering multiple data sources to support proposed themes. In this study, results from both participants' open ended questionnaires and interviews were checked for consistency.

Member check was another strategy that the researchers used to ensure the rigor of their findings (Glesne, 1999). To do so, the tentative results of the data analysis were checked by a number of authorized faculty members, to ensure that the data were analysed correctly. Too, collecting data from a diverse range of teachers, with different levels of qualification and different geographic areas, and using three methods of data collection helped us ensure the validity of our data results. However, since the language of all collected data was Arabic, all interviews' excerpts used in the results section of this study were translated into English (Sperber, Devellis, & Boehlecke, 1994) by three bilingual faculty members. Furthermore, to confirm that the translation process was accurate and reflected the meaning that the interviewees meant, each participant was given a draft of the results section and feedback was considered in correcting any comment from the participants.

FINDINGS

The analysis of the collected data revealed five major themes: (1) Perspectives of participating in CPD, (2) Features of distinguished CPD programs, (3) Perceptions of ways to improve the impact of CPD, (4) The Impact of CPD on Teachers' Classroom Teaching, and (5) Barriers to implement what teachers' learned from CPD in the classroom. The following passages discuss these major themes in detail.

Perspectives of Participating in CPD

The analysis of both open ended questionnaire and participants' interviews indicated that the majority of participants learned from participating in several CPD programs throughout their work as teachers (88%). Their tendency to receive CPD becomes further significant for them as they rarely dedicate a special time for their individual development.

> My personal efforts to professional develop is very little as I can't free some time out of my busy schedule. However, I only learn new things in

Table 1. Frequencies and Percentages of Teachers' Views of the Impact of CPD on Selected Professional Practices

Impacts of CPD	Yes	Rank
Prompted me to use new curriculum materials	452 (74.2 %)	1
Improved pupils' performance or outcomes	410 (67.3 %)	2
Improved my teaching skills	408 (67 %)	3
improved pupil behavior	406 (66.7 %)	4
Improved pupil learning practices	397 (65.2%)	5
Prompted me to seek further information or training	381 (62.6 %)	6
Made me aware of teaching and learning issues	381 (62.6 %)	6
Improved the learning environment	381 (62.6%)	6
Changed my views of teaching and learning	372 (61.1 %)	7
Improved my leadership skills	358 (58.8 %)	8
Improved my self confidence	350 (57.5%)	9
Changed the way I think about teaching and learning	331 (54.4 %)	10
Improved school-level practices	327 (53.7 %)	11
Changed my beliefs about pupil learning	321 (52.7%)	12
Led to a change in school-level organization or structures	221 (36.3 %)	13
Led to professional promotion	144 (23.6 %)	14

teaching whenever I face a problem. (Interview with Ali[1])

However, whenever they find free time to professionally develop, teachers rely on either what is available in the internet or through teachers' internet forums where teachers share their teaching experiences.

Due to time limitations, I sometimes navigate certain educational websites to learn some new teaching strategies (Interview with Mohammad)

I mainly rely on visiting some teachers' internet forums to learn from others experiences. (Interview with Reem)

Learning through these two major sources has attracted teachers more than other traditional training programs. Perhaps these two learning venues match teachers' needs to conveniently grow without interfering with their other work and life duties.

Often, we think teachers pay no attention to receive theoretical foundations concerning what they teach and just want to receive practical ideas or instructions that help them how to teach. However teachers' comments revealed that they were appreciative about receiving helpful foundational and theoretical knowledge about students' scientific thinking. Whether through receiving training to expand their understanding of science content, validating their prior content understanding, and clarifying their misconceptions. Saudi science teachers indicated that content enrichment they received from the training has enhanced the effectiveness of their teaching.

I can't actually deny the benefits that I received from the training. I enriched my content understanding and learned new teaching strategies to teach my students… in total the CPD programs

that I participated in were very helpful and beneficial to me (Interview with Azza)

Results from the closed ended questionnaire (Table 1) confirmed that a high percentages of teachers thought that CPD activities had an impact on their students' outcomes (67.3%), their teaching skills (67%), students' behavior (66.7%), students' learning practices (65.2%), prompted them to seek further teaching (62.6%), made teachers aware of teaching and learning issues (62.6%), improved learning environment (62.6%), changed their views of teaching and learning (61.1%). However, a relatively low percentage of teachers (36.3%) believed that CPD activities led to a change in school-level organization, and only 23.6% of science teachers believed that CPD led to professional promotion.

These promising percentages confirm that the teachers' participation in the CPD programs is fruitful and can make a difference in the quality of teaching that students receive. Although teachers believe that their participation in the CPD programs have significantly impacted their classroom practices as well as their students' learning, several studies debated the impact of such change in the classroom and student achievement (Darling-Hammond, 2000).

To illustrate teachers choice of the sort of CPD that can significantly impact science teachers' classroom practices, we asked our participants to rank the impact of 13 suggested CPD models. The analysis of teachers' responses indicated that among the thirteen CPD types, observation of peers ($\overline{X}$ = 3.31) received the highest impact on teachers' teaching (Table 2). Other models such as coached by other teachers, coaching the other teachers, and Independent study were rated by teachers to have relatively high impact on teaching. On the other hand, conferences ($\overline{X}$ = 2.95), university accredited courses ($\overline{X}$ = 2.83), and non-university accredited

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[1] Participants' names are pseudonyms

Table 2. Descriptive Statistics of Teachers' Perspectives of the Impact of CPD Models

Types of CPD	Impact		Ranking Impact
	Mean	SD	
Observation of peers	3.31	0.696	1 (highest impact)
Coaching done by other teachers	3.23	0.772	2
Coaching for other teachers	3.22	0.888	3
Independent study	3.22	0.933	3
In-school workshops	3.17	0.825	4
Out-of-school workshops	3.15	0.758	5
Attend a lecture or presentation	3.14	0.76	6
Cooperating with teachers in doing research in school	3.06	0.98	7
Collaborated as a colleague with other teachers	3.04	0.925	8
Online – CPD	3.03	0.948	9
Conferences	2.95	0.982	10
University accredited courses	2.83	0.928	11
Non-university accredited courses	2.76	1.05	12 (Lowest impact)

courses were among the least effective models of CPD based on science teachers' views.

Features of Distinguished CPD Programs

Throughout their teaching experience, teachers have developed their own measures about the helpful CPD experiences. Gusky (2002) points out that what attracts teachers to professional development is their belief that it will expand their knowledge and skills, contribute to their growth and boost their effectiveness with their students. Through interviews, teachers indicated that they consider the CPD program to be distinguished when it gives them something new about how to teach science in a better and meaningful way. When the content of the program matches their needs and interests, they become encouraged to participate. Therefore, the future Saudi CPD programs need to be structured in a way that helps teachers learn new teaching strategies such as inquiry science teaching and learning and 21st century science practices, through modeling them during the training. Such training will help teachers transfer what they learned to their classrooms.

> The most helpful training for me is that teaches me how to apply the new knowledge in my classroom. I don't like to be lectured… I like to be trained through doing activities that allow me to learn how to apply the new strategies in my classroom. (Interview with Ameera)

As indicted in their responses in the open ended questionnaires, the majority of teachers reported that the CPD programs they participated in were very helpful and enhanced their understanding of the good practices of teaching and learning. Because these same teachers had earlier indicated that they wanted professional development that would targets classroom implementation, we believe that several of the offered CPD programs delivered on that promise. The part of professional development that teachers most valued was:

> The deeper understanding I gained and how that relates to what we teach our students. (Survey # 11)

Perceptions of Ways to Improve the Impact of CPD

The analysis of the responses to the open-ended questionnaire indicated that 64% of participants refrain from participating in any form of CPD program offered by Saudi MOE. Participants attributed their weak participation to several logistical and pedagogical factors. When asked about the reasons behind their weak participation, 30% of them refereed that to the unsuitability of time and place of the offered CPD programs, while 20% pointed to their huge teaching and social responsibilities that prevent them from participating in the CPD programs. Similar results were also found in participants' interviews. For example Azza argues that teachers like to receive CPD but several logistical factors reduce their participation:

> The problem of weak participation in CPD programs is not because teachers don't like to participate but because of the discouraging contextual factors that surround them (i.e., time and place of CPD programs, transportation) (Interview with Azza).

Another participant, Reem, added to those factors, the assignments that are required from participating in the CPD programs.

However, to increase teachers' participation in the CPD programs, CPD providers need to consider several elements. Thirty four percent of participants asked for some sort of financial and emotional incentives to encourage their participation. A similar percentage (32%) asked to choose a suitable place and time to hold CPD programs. However, only 8% of the participants requested enhancing the quality of the offered CPD programs to fulfill teachers' needs.

Participants also offered several recommendations and suggestions to enhance the quality of the CPD programs. Some of their suggestions concerned the way to advertise about the programs, the time and place of the programs, the content of the training material, and the training style and approach.

With respect to the way to advertise training programs, 25% of participants suggest using electronic communications with teachers (i.e., SMS, Email, websites). The majority of them (68%) also prefers to hold the training workshops during vacations and before the academic semester begins. Whereas 70% of the participants suggested holding the training workshops in training centres but not in schools or universities.

For the content of the training materials, 46% of the participants suggested that the training materials need to be specifically designed to deal with the content of the science curricula in order to help teachers transfer what they learn in the training to their classrooms.

In addition, around 60% of the participants suggested providing trainees with practical training exercises (i.e., teaching a lesson) and avoiding lecturing the trainees in order to make the training more applicable for teachers.

Exact responses were also found in the follow up interviews with participants. For example Ameera, suggests that the training content needs to reflect the need of the teachers to help them make use of it in their classroom teaching. She said:

Training programs need to be designed based on the needs of the teachers and offered through activities to help teachers make use of it inside their classrooms, and conducted in training centres. (Interview with Ameera)

The Impact of CPD on Teachers' Classroom Teaching

Participants' responses on the open ended questionnaire showed that over 87% have benefited from the CPD programs they participated in. An example of what they learned is knowing about new instructional strategies to teach science (role play, cooperative learning, project based learning). However, when it comes to implementing their learning inside the classroom, only 6% indicated that they used new teaching strategies in their classrooms and 64% of teachers did not utilize what they learned from the training inside their classrooms.

These percentages demonstrate the problem of transferring the impact of training in classrooms. In spite of the knowledge that science teachers gain from participating in CPD programs, this knowledge doesn't appear to be transferrable to their classrooms due to the aforementioned obstacles.

I honestly learned a lot from participating in CPD programs but I feel that I am not able to implement my knowledge in the classroom. I think that the training should provide me with specific knowledge on how to apply these new strategies in my classroom. (Interview with Reem)

Another participant added:

I personally feel that I used implement only 20% of what I learned from the training programs, because my classroom environment does not help me…I have a big number of students and a small room. (Interview with Ameera)

Barriers to implementation of professional development

The analysis of the open ended questionnaires indicated that over than 60% of teachers share the same concerns while trying to implement what they learned in the training inside their classrooms. Challenges related to school and classroom environments were the major concerns cited by teachers. The small classroom and big number of students in each classroom overwhelm teachers and distract them from utilizing new teaching strategies. These big size classrooms force teachers to exhaust their energy managing students instead of implementing new teaching strategies.

I honestly can't use these strategies while having big size classrooms… it pushes me to lecture as I see it the easiest way to deliver science content to students quickly. (Interview with Ameera)

Too, results from analysing the closed ended questionnaire showed that the work load ($\overline{X}$ = 4.26) is perceived to be the strongest barrier that teachers face while implementing what they have learned in the CPD in the classroom (Table 3). The timing of provision during the day had the second highest ranking as strong barrier ($\overline{X}$ = 3.84). On the other hand, the suitability of provision and financial cost had the lowest mean scores indicating that they received the lowest ranking as barriers according to teachers.In addition to these difficulties, teachers also face a time limitation through pressure to keep up with their mandated curriculum and teachers' guides. It is important to note that those guides were carefully developed by education specialists and were intended to move students at a reasonable

Table 3. Descriptive Statistics of the Barriers Teachers Faced While Implementing What They Learned in the CPD

Factors	Mean	Standard Deviation	Ranking
Workload	4.26	1.03	1
Timing of provision during the day	3.84	1.09	2
Location of provision	3.63	1.18	3
Timing of provision	3.61	1.20	4
Personal circumstances	3.36	1.17	5
Financial cost	3.28	1.45	6
Suitability of provision	3.11	1.11	7

speed through the textbook. However, the guides do not necessarily reflect attention to the topics addressed in the professional development programs.

> The problem is not we don't have the tendency to use the new teaching strategies in our classrooms, but we feel that these strategies require more time which makes us behind from finishing the curriculum. (Interview with Azza)

These challenges become further complicated when teachers receive little or no support from their schools' principals. Example of the support that principals can offer is coordinating the use of science lab and equipment between different science sessions in the school. Another example is providing teachers with the needed teaching aids (i.e., models, charts) to facilitate their teaching of science.

> Applying what we learn from CPD programs require collaboration between teachers and schools' principals. Principals play a critical role in securing the needed teaching aids and equipment that facilitate the teaching of science. (Interview with Mohammad)

Furthermore, the availability of certain logistics to support the implementation of new teaching strategies inside the classroom was also cited by the participants. Over (60%) of participants complained from the absence of logistical support in schools. Examples of the logistical support that teachers requested are having some ICT equipment, suitable classroom structure that support working in groups.

Additionally about 13% of participants requested receiving specific and applied training on how to teach a scientific concept in their curricula. They argue that the training they received is theoretical and most of the time not applicable in the classroom setting. For example one participant explained in his interview:

> The training is theoretical and trainers tend to lecture us instead of involving us in practical instructional examples to make the training transferrable to our classrooms. (Interview with Shami)

A common misconception about the affectivity of professional development programs is that they consider effective when teachers have high willingness to apply knowledge learned through the professional development experience. However, most of the time, trained teachers often face difficulties that are beyond their control. The Saudi CPD programs provided teachers with reasonable help to overcome certain barriers such as making use of the surrounding available resources. But other barriers were not so easily overcome. For example, science testing requirements is deeply influencing Saudi teachers' classroom practices and behavior. Also, time allocated to implement what teachers learn from CPD programs are not internally built into the teacher's guide, thus teachers "fall behind" when focusing on investigations.

In conclusion, the matter is not that trained teachers do not have the ability to adjust their classroom teaching practices; there are several obstacles that get in the way of reformed based science instruction. Saudi teachers have little assistance to overcome their barriers by themselves. Being provided by strategies to address possible obstacles in using the reformed teaching approaches will help them actively deal with the issues.

DISCUSSION

The results of this study showed that the CPD opportunities offered to Saudi science teachers were generally helpful to them. Teachers had a chance to strengthen their understanding of the content of science textbooks and to some extent apply what they learned in their classrooms.

Although teachers generally support receiving more training to enhance their teaching and learning skills, many of them were not able to implement what they learned in their classrooms (Mansour, El Deghady, Alshamrani, & Aldahmash, 2014). While the continual deepening of knowledge and skills is an integral part of any professional development program, providing teachers with practical strategies to transfer what they learned in the classroom seem to be more important.

Literature on CPD describes that in addition to providing teachers with content knowledge, offering them opportunities for active learning, such as reviewing student work or obtaining feedback on their teaching and opportunity to plan for classroom

implementation, observe and be observed teaching, and give presentations and demonstrations can significantly impact and facilitate the transfer of the impact of CPD to the classroom setting.

Utilizing these types of active learning opportunities can allow teachers to gain an understanding of students' assumptions, reasoning and solution strategies (Schifter, 1996; Carpenter, Fennema, Peterson, Chiang, & Loef, 1989). They can also help teachers develop skills in diagnosing student problems and designing lessons plans at an appropriate level of difficulty. However, participants in the study named the workshop as the dominant format to deliver CPD programs. This form of training has been widely criticized in the literature as being ineffective in providing teachers with sufficient time, activities, and content necessary for increasing teacher's knowledge and in fostering meaningful changes in their classroom practice (Loucks-Horsley, Hewson, Love, & Stiles, 1998).

Saudi CPD providers need to consider using non-traditional forms to deliver CPD activities. Examples of such activities are; utilizing summer institutes, courses, and teachers' conferences are other forms of professional development that can be utilized to deliver CPD in Saudi Arabia. However, although these forms are still similar to what happen during the workshops as they tend to take place outside of the teacher's school or classroom, they can still offer Saudi teachers different experience rather than completely relying on workshops. These types of activities, as Darling-Hammond (2000) argues, may be more responsive to teachers' needs and goals.

Another strategy that CPD providers can consider to provide Saudi science teachers with active learning opportunities is encouraging group work of each school's science teachers. Such opportunities can provide Saudi science teachers a unique opportunity to discuss their concepts, skills, and problems related to their own school's context. Through this professional development activity, CPD providers in Saudi Arabia can help science teachers in each school address and deal with their own concerns and needs. That helps teachers adapt their instruction to their students' needs and build a community of change in their school or district.

Assigning science teacher leaders in each Saudi school can also help advance the work of trained teachers. Those school science teacher leaders, who have the appropriate technical, interpersonal, emotional, and ethical predispositions, can make a significant impact on their fellow teachers. According to Hickey & Harris (2005) teacher leaders can have a strong passion for improving the lives of the students, care about the advancement of their teaching practice, have exceptional abilities to analyse students' performance problems and provide solutions for these problems, model good

instructional practices, plan, manage and monitor change, respect diversity of opinion, help resolve conflict, engage in good ethical behavior, and understand the importance of community involvement. Teacher leaders can spend a significant portion of their working day in direct contact with teachers, in their school and classrooms. Their mission is to assist teachers in learning and applying the new knowledge and skills necessary to improve the academic performance of the students (Smylie, Conley, & Marks, 2002).

Another good practice in CPD programs that can offer a great help for Saudi science teachers and impact their classroom teaching practices is allowing each school's teachers to plan their own classroom implementation. Through this activity, science teachers in each school can have a chance to link the ideas introduced during professional development experiences to the teaching context in which they work.

A critical feature of the CPD programs that Saudi CPD providers also need to consider is making their programs coherent. Several Saudi science teachers complained about the lack of coherence between the different CPD programs offered to them. Such a lack makes teachers disconnect their learning to their classroom teaching. Recent research indicates that a professional development activity is more likely to be effective in improving teachers' knowledge and skills if it forms a coherent part of a wider set of opportunities for teacher learning and development.

Researchers emphasize that CPD programs and activities need to be sustained over time in order to create an impact on science teachers' classroom practices. Loucks- Horsley et.al (1998) believe that longer activities are more likely to provide an opportunity for in-depth discussion of content or science textbooks, student understanding and misunderstanding of various scientific concepts , and pedagogical strategies. Furthermore, they mention that once these activities extend over time, they become more likely to allow teachers to try out new practices in the classroom and obtain feedback on their teaching.

IMPLICATIONS & CONCLUSION

It is imperative that science teachers who participated in this study are benefiting from participating in CPD programs. However, the data of this study suggests that in order for CPD programs to effectively impact teachers' classroom practices, they have to be personally meaningful to teachers. The challenge for policy and management is therefore to find ways to understand what science teachers want and what they will find personally meaningful, and to design CPD programs that respond to the teachers' needs. We therefore argue that teachers should not only be

involved in the planning of the programs, but that the programs should be aligned with the personal circumstances and motivations of the teachers. As Chapman (1997) states, change occurs most when people want to change and when they see some benefit in doing so.

This study also highlighted obstacles to implementing what science teachers learn as presented in professional development workshops. The impact of such training on teachers' classroom practices will not advance until CPD programs consider, in addition to providing content knowledge to participants, active learning practices that help trainees relate their training to their classroom practices and make the overall CPD program coherent and not disconnected to help teachers perceive that their participating in every part of the CPD program adds something new to their knowledge and enhances a facet of their teaching.

It also provided science teacher educators insights into how teachers view their professional roles. It helped science educators and decision makers to determine the types of experiences that are important for teachers as they enter the profession (Author, 2010). However, there is a need to repeat the needs assessment from time to time so as to modify and adapt the existing design of the program to meet the emerging and changing needs of science teachers.

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Appendix 1. Open-ended Questionnaire

Background profile
Please put a tick [V] where appropriate
1- Gender   1) Male [] 2) Female []
2- Nationality   1) Saudi [] 2) Non-Saudi []
3- Your specialism:
1) Biology [] 2) Physics [] 3) Chemistry [] 4) Earth sciences [] 5) General science [] 6) Mathematics []
7) Other   []
4- The subject you teach:
1) General science [] 2) Biology [] 3) Physics [] 4) Chemistry [] 5) Earth sciences [] 6) Mathematics []
7) Other   []
5- Years of your teaching experiences
        5 years [] 2) 6-10   [] 3) 11-15   [] 4) 16-20 [] 5) > 21   []
6- Type of your qualification:
Educational []   2)Non-educational []
7- The latest qualification:
Diploma in Education
B.Sc. in Education
Master in Education
PhD in Education
Others, (please, specify)...
8- The school you are working in:
Government   []   2) Private   []
9- the school level you are working in :
primary,
intermediate,
secondary
All
.
Q10: what are the factors that help teachers' successful application of the skills learnt in CPD programs?
....
....

Q 12: were you consulted about specifying the topics to be included in the CPD programs that you participated in or about to participant (yes-no). Explain and State examples.
....
....

Q 13: have you transferred any experiences from attending CPD programs to your colleagues whether in the same school or different schools?
....
....

Q 14: Are there any means of contact with CPD providers after participating in CPD programs in regards to its content and implications? (yes- no)
....
....

Q15: what are your suggestions in order to develop CPD programs in regard to: announcement, timing, location, content and strategy
....
....

Q16: What were the training strategies used in CPD programs
....
....

Q17: describe the preferred strategy used in CPD programs
....
....

Q18: Did you find any of the attended CPD programs effective (yes-no). Kindly clarify the reasons that made you think that they were effective.
....