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### Discovery Education Transformative Professional Development Model in Egypt: A phenomenological study

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Program: International & Comparative Education

Supervisor: Dr. Heba El Deghaidy

Title: **"Discovery Education Transformative Professional Development Model in Egypt: A phenomenological study"**



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Cc: Dena Riad

From: Atta Gebril, Chair of the IRB

Date: Feb 6, 2019

Re: Approval of study

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This is to inform you that I reviewed your revised research proposal entitled "**Discovery Education Transformative Professional Development Model in Egypt: A case study**" and determined that it required consultation with the IRB under the "expedited" category. As you are aware, the members of the IRB suggested certain revisions to the original proposal, but your new version addresses these concerns successfully. The revised proposal used appropriate procedures to minimize risks to human subjects and that adequate provision was made for confidentiality and data anonymity of participants in any published record. I believe you will also make adequate provision for obtaining informed consent of the participants.

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A handwritten signature in black ink, appearing to read "Atta Gebril".

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**THESIS PROPOSAL APPROVAL (AUC Form)**

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Thesis Title: **Discovery Education Transformative Professional Development Model in Egypt: A phenomenological study**

*Please attach the thesis proposal to this form.*

Proposed Graduation Date: Summer 2019

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Running head: DISCOVERY EDUCATION PD MODEL IN EGYPT

The American University in Cairo

Graduate School of Education

Discovery Education Transformative Professional Development

Model in Egypt: A phenomenological study

A Thesis Submitted to

Department of International & Comparative Education

In partial fulfillment of the requirements for  
the degree of Master of Arts in International & Comparative Education

by Rezk Marey

Under the supervision of Dr. Heba El-Deghaidy

Summer 2019

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This thesis would not have been possible without my family's unwavering and unselfish love and support at all times. Loads of thanks to my wife and my two kids for bearing with me in difficult moments, and for their sacrifices.

## **Abstract**

This phenomenological study aims to explore teachers' and principals' personal experiences with and perspectives on the features of "STEM Now Egypt" program as a transformative professional development (PD) model. It also seeks to examine "STEM Now Egypt" PD program participants' perceived skills. This study was guided by constructivist principles which were thought to yield transformative PD results. It was conducted in fifteen public schools in Greater Cairo in Egypt and employed a qualitative phenomenological study approach by conducting one to one semi-structured interviews with twelve teachers and three principals selected based on their participation in the two-year "STEM Now Egypt" PD program. All data collected were coded. A thick descriptive representation of findings in almost all participants' responses was used to find out similar themes and generate conclusions. The research findings reveal general agreement among all participants' perspectives on PD transformative features, perceived skills, and professional learning pertaining to the literature review and as implemented in "STEM Now Egypt" PD program. All teachers and principals were found to hold positive perspectives toward "STEM Now" extended, and experiential workshops; expert mentoring for follow-up support; principals' participation in the PD program side by side with teachers; embedding technology in content-based and contextualized training; coherence in addressing digital curricula, research-based instructional strategies and ways of assessing 21st century skills; face-to-face and online professional learning communities; and ongoing feedback and reflection.. The study also generated some recommendations that might transform future PD programs in Egypt.

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## **List of Abbreviations**

**PD:** Professional Development

**PLC:** Professional Learning Community

**ZPD:** Zone of Proximal Development

**STEM:** Science, Technology, Engineering and Mathematics

**DEN:** Discovery Education Network

**EKB:** Egyptian Knowledge Bank

**MOE:** Ministry of Education

**IRB:** Institutional Review Board

**CAPMAS:** Central Agency for Public Mobilization And Statistics

## **Chapter 1: Introduction**

According to the Egyptian 2014 constitution, teachers are regarded as the backbone of education (UNESCO, 2014), and are viewed as an integral pillar of education reform (Singh, 2013; Nolan & Hoover, 2011). Additionally, the Egyptian Ministry of Education (MOE) 2030 vision mandates that “without the teacher, all other factors ... cannot affect or develop the educational path” (p.36). Therefore, the Egyptian constitution states that “the state guarantees the development of [teachers’] academic competencies and professional skills” (UNESCO, 2014, p. 12).

As a matter of fact, student achievement is positively impacted by several factors, such as teacher education, experience, quality, and professional development (PD) (Darling-Hammond, 2000; Desimone Smith & Ueno, 2006). In this regard, Guskey (1994) affirms that “we cannot improve schools without improving the skills and abilities of the teachers within them” (p. 9). As a result, PD needs to be a key element in educational reforms (Kennedy, 1998; Kent & Lingman, 2000). Furthermore, Wilson and Berne (1999) consider PD as the “ticket to reform” (p. 173), and Handoussa (2010) holds that PD is a major catalyst for change in education.

This introductory chapter outlines both the study background and context so as to provide the reader with a bird’s eye view on why the study addresses the topics at hand. Elaboration on the PD status followed by the statement of the problem will focus the reader’s attention on the basic reasons for tackling the PD issue in Egypt. Besides the research questions, the study purpose and significance will be pinpointed. The introduction ends up with analyzing deficiencies of previous studies and the main definitions in the study.

### **The Study Background**

Despite all the above-mentioned Egyptian constitution articles and research findings, the Egyptian formal MOE trainings have not exposed teachers for years to practicing or modeling up-to-date instructional approaches or provided them with instructional resources. In addition, administrators do not participate in PDs or support teachers' collaboration but overload them with non-teaching tasks (El-Bilawi & Nasser, 2017). In fact, MOE PD "training programs are often (a) of poor quality, (b) ill-timed to when teachers need the training and support, and (c) usually one-off site trainings unconnected to teachers' specific needs or focused on isolated subject-matter content" (World Bank, 2018, p.3). The researcher, who used to attend MOE trainings for years before Teachers First and "STEM Now" kick-off, attributes MOE PD poor quality to several reasons. For one thing, the researcher was forced to attend these passive, boring, one-shot trainings just to get its release letters which were basic requirements for promotion purposes. Moreover, these hit-and-run workshops were general, theoretical, and unsupported by expert follow-up, and were conducted by unprofessional trainers.

The MOE traditional PD model "is not designed to develop the teacher expertise needed to bring about improved student learning" (Rhoton & Stile, 2002, p. 1). Piper and Spratt (2017) hold that the PD model which is built on the belief that attending training without any interactivity or hands-on experience is enough to affect change is not enough guarantee for anticipated changes in classroom practices. According to Lord (1994), these traditional workshops have been "criticized for being decontextualized.....random, and unpredictable" (p. 174). Teachers consider these sit-

and-get PD sessions as “too complicated or too much work. ....[as a] result of the design flaws inherent in so many PD programs” (Piper & Spratt, 2017, p.5). During these one-shot trainings, teachers’ voices are often silent, and the training message might be ignored, modified, abused, or misinterpreted (Towndrow, et al., 2010). Moreover, Yoon, Duncan, Lee, Scarloss and Shapley (2007) suggest that traditional training programs that cover less than 30 hours have no significant impact on student learning.

Surprisingly, these traditional in-service training days are described as days-off or waste of teachers’ real work time (Bredeson, 2000). Moreover, Mansour, Alshamrani, Aldahmash and Alqudah (2013) question the validity of applying a single PD training program to fit all the teachers’ needs. They also argue that these one-shot workshops are not enough, incapable of impacting classroom practices, and unsustainable (Mansour, et al., 2013). As a matter of fact, the traditional PD model is viewed as a thing of the past (Loucks-Horsley, Stiles, Mundry, & Hewson, 2009). Furthermore, it is criticized for its lack of connection to contextualized classroom applications because the PD content is theoretical and teacher trainees are not given opportunities to model, test or reflect on these instructional practices (Kennedy, 2014). Consequently, these PD programs need to be less off-site, and more transformative, continuous, and contextualized programs (Towndrow, Tan, Yung, & Cohen, 2010; Gilles & Wilson, 2004).



### **The Study Context**

This study examines transformative PD features according to a research consensus on effective PD characteristics and several PD models (Darling-Hammond, et al., 2017; Desimone, 2009; Guskey, 2009; Guskey & Yoon, 2009; Kennedy, 1998; Kennedy, 2014), a body of research on transformative PD (Ali & Wright, 2017; Bandura, 1997; Johnson & Marx, 2009; King, 2011; Simos & Smith, 2017; Whitelaw, Sears, & Campbell, 2004), and literature reviews on PD constructivist principles (Bada & Olusegun, 2015; Baviskar, Hartle, and Whitney, 2009; Bayar, 2014; Day, 1999; Kinnucan-Welsch, 2007; Senge, Cambron-McCabe, Lucas, Smith, Dutton, & Kleiner, 2000; Vygotsky, 1978; Zucker, Shields, Adelman, Corcoran, & Goertz, 1998).

These PD transformative characteristics encompass delivery and follow-up reform modes, extended duration of PD activities, teachers' professional communities of learning, teachers' engagement in active learning, PD consistency with other reforms and PD focus on content and pedagogy (Garet, Porter, Desimone, Birman, & Yoon, 2001). Additionally, transformative PD models are based on 'the get, attempt, and reflect' PD model, and constructivist principles, such as active learning, reflection, modeling, communities of practice, mentor's scaffolding, and engaging teachers in ongoing reflection on beliefs and attitudes to transform practices, assumptions, skills and perspectives (Ali & Wright, 2017; Bandura, 1997; Johnson & Marx, 2009; King, 2011; Simos & Smith, 2017; Whitelaw, et al., 2004).

As such and in contrast to the Egyptian MOE traditional PD model, this study explores Discovery Education "STEM Now Egypt" PD program as a transformative PD model (See <https://en.discoveryeducation.ekb.eg/about/> ). Discovery Education, being a

## DISCOVERY EDUCATION PD MODEL IN EGYPT

global leader in transforming teaching and learning, was selected by the Egyptian government to provide online science, technology, engineering, and maths (STEM) digital media content aligned to national curricula and equip Egyptian teachers and principals with a professional learning program known as “STEM Now Egypt”

According to the Discovery Education partnership with the Ministry of Education (MOE), cohorts of teachers and principals were chosen from schools to be trained over a two-year PD program on STEM instructional best practices. Teachers participated in eight full-day training modules and principals attended six training modules dispersed over a year accompanied and followed by another year of school mentoring. Discovery Education PD program fosters a school-wide change with committed mentors conducting school visits, focus groups, and one on one meetings with delegates. Besides connecting education communities to each other through the Discovery Education Network (DEN) Arabia online and social media platforms, in person and online events supporting community member growth were also initiated.

Through the support of trainers who conduct all the PD modules in person, teachers and principals receive coaching and mentoring to apply the new methods learned during the face to face PD Modules. Trainers deliver the face-to-face training and work closely with teachers and principals in their own schools acting as mentors throughout the “STEM Now” PD program life cycle. They support teachers with action plans, lesson design, implementation, lesson observation and feedback, STEM Club support, practical mentoring, and advice. Furthermore, these mentors liaise with and provide feedback to the school principals. They also support school focus groups and the wider online DEN Arabia community, which aims to support educators by connecting them to each other.

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Discovery Education “STEM Now Egypt” PD workshops include interactive, hands-on and digitally orientated sessions which address STEM culture; protocols designated for success analysis stories and action research; a myriad of the best researched teaching strategies, Web 2.0 tools embedded in the training content as educational, helpful tools not as an end in themselves; design thinking process; building community capacity and the 21<sup>st</sup> century skills. Following each training module and in collaboration with their mentors, participating teachers were requested to set up an action plan to implement what they learnt. The same trainers who deliver workshops mentored the teachers at their schools.

Discovery Education “STEM Now Egypt” PD model promotes building different communities, including teachers, students and parents' physical and virtual communities. Connected educator is one of the main themes which aimed to promote the new culture of professional learning communities (PLCs) (Kinnucan-Welsch, 2007) inside and outside schools. Principals support their teachers and share responsibility with them. Participating teachers were requested to form focus groups, train neighboring schools, hold parents and students' special days and support school STEM clubs and camps during school days and summer holidays.

### **Statement of the Problem**

This study explores the Discovery Education “STEM Now Egypt” PD model as a transformative PD program according to studies by (e.g. Ali & Wright, 2017; Bada & Olusegun, 2015; Bandura, 1997; Baviskar, et al., 2009; Bayar, 2014; Darling-Hammond, et al., 2017; Day, 1999; Desimone, 2009; Guskey, 2009; Guskey & Yoon,

2009; Johnson & Marx, 2009; King, 201; Kennedy, 1998; Kennedy, 2014; Kinnucan-Welsch, 2007; Senge, et al., 2000; Simos & Smith, 2017; Vygotsky, 1978; Whitelaw, et al., 2004; Zucker, et al., 1998). This transformative PD model is in contrast to the conventional teacher training models previously offered by the Egyptian MOE. The MOE workshops used to be “weak” (UNESCO, 2014, p. 37) in its structure which was based on sit-and-get, passive and lecturing models; inadequate (Hargraves, 2001) because they used to be theoretical and for promotion purposes only; and lacking practice and support (Sewilam, McCormack, Mader, & Raouf, 2015). Additionally, “almost 30% of the total teachers are not educationally qualified...[and] this has a direct negative effect on the quality of the educational process especially with the weak professional development and the lack of educational qualification” (UNESCO, 2014, p. 37). Besides not being efficiently prepared or using up-to-date instructional strategies as main factors that affect the quality of education in Egypt, teachers are not supported after their training (Khouzam & Aziz, 2005).

### **Purpose of the Study**

Drawing on the above-mentioned PD deficiencies, this study intends to investigate possibilities for a transformative PD model appropriate to the new educational reform policies in Egypt by exploring teachers' and principals' perspectives on the features of the Discovery Education “STEM Now Egypt” PD program as a transformative PD model. The purpose of this study is also to examine “STEM Now Egypt” PD perceived content knowledge, instructional, technological and personal skills. Building on these reflections, participants will recommend what works better for their

future professional learning. Therefore, the study presents some recommendations for a future transformative PD model in Egypt.

### **Research Questions**

The following research questions will guide the study:

1. What are PD features that Discovery Education “STEM Now” PD model employs as a transformative model?
2. What are participants’ perceived skills, motivation, and continuous professional learning opportunities in Discovery Education “STEM Now” PD model?
3. What are participants’ suggestions for future PD programs based on their experience with “STEM Now Egypt” PD model?

### **Definition of Terms**

*Constructivism:* A learning theory which is based in psychology suggesting that humans learn by constructing knowledge and meaning from their experiences (Bada & Olusegun, 2015).

*Professional Development:* An array of different formal, non-formal and informal educational experiences which enhance teachers’ knowledge, awareness, attitudes, skills and abilities individually or collectively in order to ultimately empower teachers’ performance and increase students’ outcome (Mukan, Fuchyla, & Ihnatiuk, 2017).

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*Mentoring:* A form of dialogue between an experienced mentor who behaves as a guide, friend, and role model to support and empower the mentees' skills pedagogically, intellectually, and psychologically (Pitton, 2006).

*Action Research:* A means of PD and self-reflective enquiry in which teachers participate in practical reflection on their performance and student learning (Day, 1999).

*The Internet and technology-supported Constructivist PD:* opportunities for teachers to construct their own knowledge, give personal opinions, and argue for or against viewpoints leading to teachers' reconstruction of knowledge, skills, attitudes and practices and building communities at local, national and international levels (Tam, 2000).

*Communities of practice:* A transformative PD principle that gathers teachers together to collectively and critically reflect on, experiment with and decide on the best instructional practices (Kinnucan-Welsch, 2007).

*Phenomenological Approach:* Phenomenological studies, to which this study belongs, capitalize on deep understanding and thick analysis of participants' lived experiences to get closer insights into how meaningful these participants' perspectives and experiences are (Starks & Brown Trinidad, 2007; Groenewald, 2004).

*Transformative PD:* Mezirow affirmed the transformative nature of the 'get, attempt, and reflect' PD model by concluding that transformative learning occurs as a

result of undergoing new experiences, reflecting on them, transforming their meanings, and producing new outcome (as cited in Ali & Wright, 2017, p. 335).

### **Deficiencies of Previous Studies**

The need to introduce a transformative PD model in the Egyptian educational system is currently pressing hard to replace the conventional training which is critiqued due to the gap between its content and real classroom practices, along with its authoritarian stakeholders who manipulate its content to their own advantages, and teachers' being prevented from interactive participation (Kennedy, 2014). Furthermore, studies investigating different areas of transitional or transformational PD models such as roles of mentors or communities of practice are limited (Loughran & Hamilton, 2016; Wasburn, Wasburn-Moses, Moses & Davis, 2012).

The researcher has spotted no mention of expert mentoring or PD follow-up activities as a new PD requirement in Egyptian studies as per Loughran and Hamilton's (2016) study of 426 published research studies from 1990 to 2014 (p.107). Additionally, the researcher has conducted a selective literature review using study key words, such as transformative PD, PD constructivist principles, mentoring, communities of practice, principals' roles in PD, roles of technology and social media in PD, and PD transformative characteristics. However, rarely has the researcher come across PD face-to-face or online mentoring, principals' roles in PD, communities of practice, embedding technology in PD, or PD transformative features in Egyptian studies.

Therefore, this study addresses Acedo, Adams, and Popa's (2012) call for "formally organized professional development activities, ...[and] ongoing guidance and support-at both the interpersonal and policy/system levels" to Egyptian teachers, supervisors and administrators so as to "deepen and sustain" current reform policies (p.64). Moreover, the researcher had not come across any form of PD programs in Egypt which promoted communities of practice, or mentoring for the past 20 years of his experience as an MOE teacher or PD trainer till Teachers First and "STEM Now Egypt" PD programs were launched in 2016.

On the other hand, PD studies have basically addressed measuring teachers' attitude change and satisfaction for years rather than targeting the process by which it has worked (Desimone, 2009). Therefore, this study made use of Desimone's (2009) conclusion about a quantitative and qualitative research consensus on the core features of effective PD which can be used as a basis for effectiveness studies of PD. In addition, the study derived its focus on transformative PD models from a constructivist lens (Drago-Severson, 2006; Kinnucan-Welsch, 2007) and other comparable studies (e.g. Darling-Hammond, et al., 2017; Desimone, 2009; Guskey, 2009; Guskey & Yoon, 2009; Kennedy, 1998; Kennedy, 2014).

Consequently, the researcher believes that this research is an addition to research in Egypt on exploring the transformative features of PD programs by capitalizing on mentoring, principals' sharing PD with teachers, extending PD workshops, embedding active learning, embedding technology in PD, and communities of practice as presented in the Discovery Education "STEM Now" PD model.



### **Significance of the Study**

Based on this research findings and recommendations, future Egyptian MOE PD programs are hopefully required to consider the findings of this study models and approaches, particularly those new to training culture in Egypt like communities of practice, experiential and hands-on workshops, embedding technology in content-based trainings, addressing the digital content with new research-based strategies and assessment techniques, principals' participation in the training, and mentoring. In addition, principals and other officials will be given insights into the importance of their engagement in future training programs. Moreover, teachers will adopt new attitudes and beliefs regarding PD programs.

## **Chapter 2: Literature Review**

Reviewing PD literature provides an insight into past research findings and guidance into transformative PD models scaffolded by constructivist principles. The literature review is conducted by means of researching related studies, journal articles and books. This review uses the most common PD terminologies as search keywords such as, constructivism, transformative PD, mentoring, communities of practice, etc. Setting PD objectives, models, impact on teachers and students, along with PD characteristics and relationship to constructivism are among the reviewed topics. In this chapter, the theoretical framework will be outlined. Then, PD importance and its impact on teachers and students will be highlighted. Next, this study PD structure, PD constructivist structure, and characteristics will be also illustrated.

### **Theoretical Framework**

Merriam (1998) asserts that each study has a theoretical framework which scaffolds its main structure. Constructivism represents this study's conceptual framework as one of the big ideas in education and its implications for how teachers teach and learn to teach are remarkable (Bada & Olusegun, 2015). According to constructivism, teachers are learners like students (Senge, et al., 2000). Additionally, teaching is essentially a learning opportunity (Darling-Hammond & Sykes, 1999).

Therefore, Drago-Severson (2006) claims that effective PD reflects constructivist perspectives which value teachers' own ways of constructing beliefs, knowledge and practices by employing the instrumental PD phase which deepens teachers' perspectives; the networking PD phase which helps teachers share knowledge with others and reflect

on their own practices to create theirs; and the self-mentoring PD phase which assists teachers in conceptualizing others' practices and views. Contrary to viewing learning as transmission and acquisition of skills and facts, constructivist perspectives affirm that learning is a change and construction of meaning and understanding based on experience (Tam, 2000).

For this reason, Dexter, Anderson and Becker (1999) hold that constructivist teachers' roles have changed into adopting transformative practices, employing innovative instructional approaches, contextualizing content, favoring content discovery over covering it, utilizing technology as helpful tools, reflecting on their practices, engaging students in inquiry techniques, applying collaborative learning, integrating formative assessment, motivating their students to be task-oriented, and behaving as facilitators as opposed to traditional teachers. Tam (2000) claims that a constructivist teacher supports autonomy, uses multiple resources, adopts enquiry techniques, encourages pair and group work, promotes questioning and discussions, and provides time and space for creativity and engagement.

Therefore, it is important to understand the implications this theory of learning has for teaching and teacher professional development (Tam, 2000). Zucker, et al. (1998) emphasize this notion by concluding that commitment to constructivist perspectives is the basis of high-quality PD. Kinnucan-Welsch (2007) argues that professional development of teachers can be guided "through a constructivist lens" (p. 271). Kinnucan-Welsch (2007) reveals that constructivist perspectives yield the best PD results in case the following considerations are taken seriously. First, acknowledging teachers as learners who need to be engaged in intensive, extensive, and meaningful experiences to construct

their repertoire of content and pedagogy knowledge is crucial to a successful PD design. Second, PLCs in which teachers interact with and learn from others are keys to guaranteed, high quality, and sustainable PD. Third, providing contextualized, extensive and expert assistance is crucial to putting theories into practice and ensuring continuous PD (Kinnucan-Welsch, 2007).

### **Transformative Professional Development**

Bell and Gilbert (1994) view PD as a process in which teachers learn and modify their attitudes, knowledge, beliefs, and practices not as a product of others' endeavors to change teachers. Consequently, PD includes formal and informal situations that capitalize on teachers' personal, collective, instructional and professional needs (Day, 1999).

Darling-Hammond (2010) claims that transformative PD centers on building and investing in teachers' capacities as the educational front lines rather than top down or controlled regulations and directives. Beyer (2002) contends that PD is highly recommended for nations to be globally and economically competent. Thus, studying top performing countries indicates that "investments in teachers and teaching are central to improving student outcomes" (Darling-Hammond, 2010, p. 510). As a result, reforming educational systems rely heavily on teacher professional development (Zucker, et al., 1998). Additionally, teachers are thought to be the heart of reform (Cuban, 1988).

Therefore, Day (1999) asserts that investing in PD and considering teachers as agents and assets of learning and change can raise standards of teaching, learning and achievement.

The ‘hit-and-run’ workshop or the ‘sit and get’ PD transmission model has little impact on classroom practices (Darling-Hammond 2010; Kinnucan-Welsch, 2007). One-shot PD workshops which mandate top-down change without considering teachers’ context, capacities or willingness and give little due care to PD follow-up are doomed to failure (Dexter, et al., 1999). Zucker, et al. (1998) assert that traditional short, one-time workshops lacking any follow-up support fail to meet reform expectations.

Some PD models are less intensive in time, content and reach (Zucker, et al., 1998). Day (1999) calls for a transition from long- held routines to a new loop of formal, informal learning, reflection, and reassessment which transform schools into communities of practice where teachers work out the best instructional methods individually and collectively. Day (1999) also believes that a learner-focused PD model is more successful than a training-focused model. He also concludes that learning can happen in different settings inside and outside schools (Day, 1999). Zucker, et al., (1998) state that short, one-shot workshops followed by little or no support are incapable of sustaining desired classroom reforms or presenting a systematic PD model. Day (1999) assures that the focus of traditional PD on its content and modes of delivery limits its impact whereas “modelling, coaching and mentoring are the preferred modes of learning.” (p.69).

The researcher entirely contends that traditional PD which does not consider teachers’ overall context, capacities or willingness, does not engage teachers in modeling or reflecting on instructional practices, does not encourage communities of practice, and lacks support is ineffective. However, he critiques studies which overestimates the only

role of PD and disregard other catalysts in parallel with PD such as, teacher education, experience, quality, etc.

### **Professional Development Impacts on Teachers**

In addition to an array of other factors which impact teachers' instruction and students' learning such as, teachers' qualifications, experience, class density, etc., high quality PD is believed to empower teachers' effectiveness and professionalism which, in its turn, boosts student academic performance (Colbert, Brown, Choi & Thomas, 2008; Desimone, 2009). Research findings confirm that PD positively influences teachers' capacities and efficiencies and leads to enhancing students' achievement (Darling-Hammond, 2000). Other studies pinpoint teachers' effectiveness as a more crucial and positive determinant in students' achievement than other factors such as, gender and class size (Sanders & Rivers, 1996). Fullan (2007) indicates that PD "is a great way to [accept] change because it lessens the pressure for change, [and] diverts people's energy into thinking they are doing something valuable" (p.35). Cheng (1996) expounds that highly qualified and trained teachers are keys to improving education quality. Supovitz, Mayer and Kahle (2000) claim that well-structured and extended PD programs positively influence teachers' mindsets towards understanding, adjusting and implementing aspired reforms. Another report illustrates that "teachers who receive substantial professional development...can increase their students' achievement by about 21 percentile points" (Yoon, et al., 2007 p.1).

According to Desimone's PD model (2006) illustrated in *Figure 1*, and characterized by being content-based, active learning driven, coherent, extensive, and

collaborative, PD impacts teachers' knowledge, skills, attitudes and beliefs. This impact positively leads to enhancing classroom instruction and pedagogies. Consequently, student learning outcome improves. What brings about this change is also taking in consideration all the situational, social, psychological, political and economic contexts in addition to curriculum, school environment, and stakeholders' characteristics to pay off the best PD results.

The researcher views taking such considerations into account as effective catalysts in improving instruction, enhancing learning, and basic requirements for advancing or reforming education along with transformative PD. In the researcher's point of view, PD cannot be a stand-alone factor in improving teaching and learning if curriculum, assessment, and instruction along with all the situational, social, psychological, political and economic contexts are not enhanced.

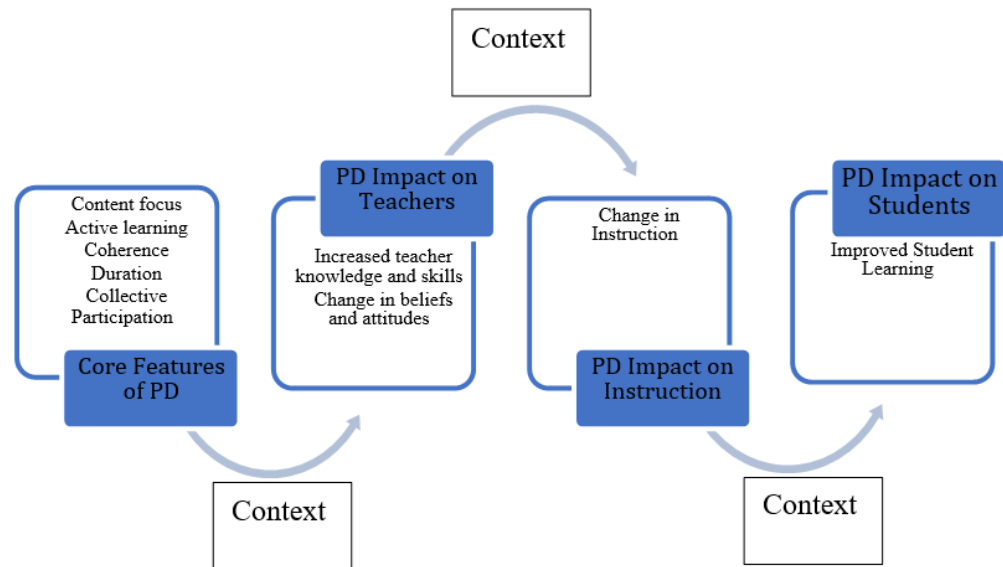


Figure 1. Desimone's proposed PD model. Adapted from *Improving impact studies of teachers' professional development: Toward better conceptualizations and measures*, by Desimone, 2009, retrieved from <https://journals-sagepub-com.libproxy.aucegypt.edu> Copyright 2009 AERA.

## Professional Development Impacts on Students

Despite the fact that the influence of high-quality teachers on student learning and achievement has been debatable because of the interference of other factors, such as teacher education, quality, income, experience, etc., several studies refer to a significant relationship between teacher effectiveness and student achievement (Boyle, While, & Boyle, 2004; Hodge & Krumm, 2009; Pedder, James, & MacBeath, 2005). PD programs are believed to positively influence students' achievement because they enhance teachers' performance, which in turn, increase students' achievement (Yoon, et al. 2007). Results of several PD programs refer to their program content as making a difference and having a positive impact on student learning than programs that target changing teaching behaviors" (Kennedy, 1998, p. 9). Opfer and Pedder's (2011) study claims that teacher



effectiveness defines students' progress. In their PD survey including more than 1000 teachers, Birman, Desimone, Porter and Garet (2000) indicate that PD programs focusing on collaboration among teachers have positive effects on students' outcome. A study of 207 teachers from 5 states in the United States report that PD outcomes are highly connected to teachers' high-quality performance (Desimone, Garet, Birman, Porter, & Yoon, 2003). Accordingly, PD increases student achievement due to its influence on teachers' reflection and collaboration (Heller, Daehler, Wong, Shinohara, & Miratrix, 2012). Additionally, several studies claim that teacher PD can improve student achievement (Blank, de las Alas, & Smith, 2007; Roth, Garnier, Chen, Lemmens, Schwille, & Wickler, 2011; Saxe, Gearhart, & Nasir, 2001). In an underprivileged school, PD led to considerable progress in students' reading achievement due to enhancing teachers' capabilities (King & Newmann, 2000). Students who are taught by several ineffective teachers have significantly lower achievement than those who are designated to several highly effective teachers (Sanders & Rivers, 1996). *Figure 2* illustrates how transformative PD impacts teachers' knowledge and skills. As a result, classroom instruction is affected and results in impacting students' achievement. Other considerations such as, standards, curricula, accountability, and assessment need to be taken into account as well.

The researcher firmly believes in the positive impact which transformative PD can bring about as affirmed by the above body of research; however, he holds that PD needs to be a constituent part of the whole reform process in curriculum, instruction, assessment, and other contexts.

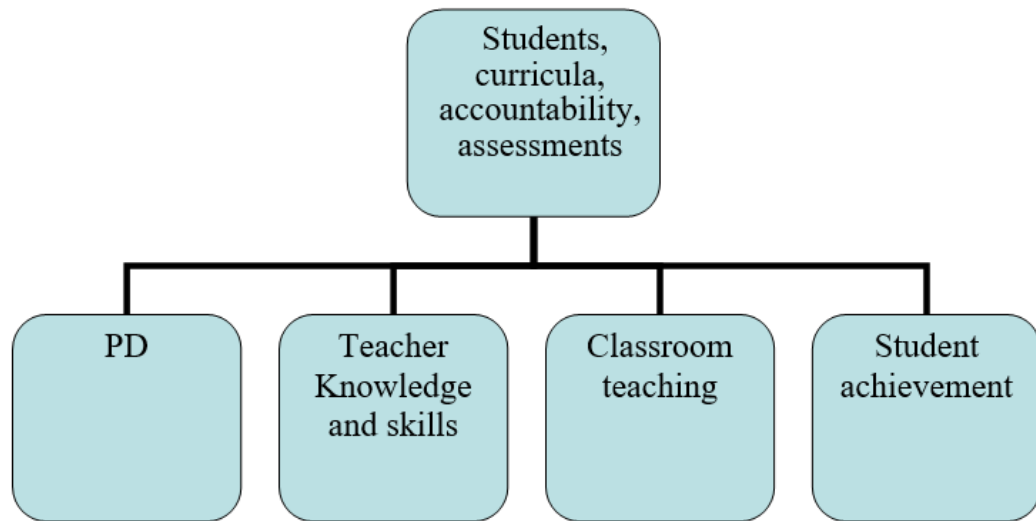


Figure 2. PD impact on student achievement. Adapted from *Reviewing the evidence on how teacher professional development affects student achievement. Issues & Answers*, by Yoon, et.al, 2007, retrieved from [https://ies.ed.gov/ncee/edlabs/regions/southwest/pdf/REL\\_2007033.pdf](https://ies.ed.gov/ncee/edlabs/regions/southwest/pdf/REL_2007033.pdf)  
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### The Study Guiding Theory

In contrast to the “hit-and-run” or “sit and get” PD transmission models which have little impact on classroom practices (Darling-Hammond 2010; Kinnucan-Welsch, 2007), this study highlights and is guided by constructivist perspectives as the basis of high-quality PD (Bada & Olusegun, 2015; Baviskar, et al., 2009; Bayar, 2014; Day, 1999; Kinnucan-Welsch, 2007; Senge, et al., 2000; Vygotsky, 1978; Zucker, et al., 1998). First, constructivist principles regard teachers as active learners (Senge, et al., 2000; Kinnucan-Welsch, 2007). Second, its PLCs of practice are pivotal to high quality, and sustainable PD (Kinnucan-Welsch, 2007). Third, “‘modelling’, ‘coaching’ and ‘mentoring’ are the scaffolding techniques for learning.” (Day, 1999, p.69). Fourth, “formal and

informal learning opportunities develop in response to teachers' and principals' felt needs" (Darling-Hammond, 1997, p. 325). Fifth, action research and narrative inquiries in the form of shared stories, insights, problem solutions, and opinions assist in co-constructing teachers' beliefs (Day, 1999). Sixth, principals' sharing the same training journey with their teachers present a new model in which both teachers and the administrators share responsibilities (Kennedy, 2014; Rhodes & Beneicke, 2003). Seventh, technology-supported collaboration lends itself to constructivist perspectives because they provide various social learning contexts via the internet and its social media applications (Tam, 2000).

The same core features of effective PD which this study explores and which Desimone (2009) views as a basis for effectiveness studies of PD according to her findings of qualitative and quantitative research consensus are reflected in a myriad of constructivist perspectives. These PD transformative characteristics include various reform forms of delivery and follow-up, extensive duration of PD activities, teachers' professional communities of learning, teachers' engagement in active learning, PD consistency with other reforms and PD focus on content and pedagogy (Garet, et al., 2001).

Based on Baviskar, et al.'s (2009) review of literature, constructivism addresses evaluating learners' background knowledge, awareness of new information, putting new knowledge into contextualized practice followed by support and feedback and finally reflecting on the learning outcome. Pedagogical goals of constructivist learning are: 1) providing constructive learning opportunities; 2) assessing different experiences; 3) presenting contextualized learning; 4) adopting a learner centered approach; 5) promoting

collaboration; 6) using various learning modes and tools; and 7) encouraging reflection (Bada & Olusegun, 2015). The dynamic nature of PD is an ongoing, continuous, and embedded process in teachers' daily lives in the form of mentoring, reflection, discussions, teacher network, study groups, engagement in online activities, action research, and involvement in a curriculum development process (Desimne, 2009).

PD main characteristics include setting practical goals, integrating instructional theories and classroom practice, team work support, and real change in both student achievement and teachers' classroom performance (Mukan, et al., 2017). Theoretical instructional practices compose one aspect of professional development and the other aspect is enacting and assessing them collaboratively and over extensive duration with concurrent feedback and support (Bell & Gilbert, 1994). High-quality professional development focuses on keen knowledge of content and pedagogy, the provision of coherent professional development supported by follow-up during the school year, allocating intensive and sufficient time, prioritizing teachers' active learning, engaging colleagues socially and intellectually, involving teachers in the design, delivery and follow up, and differentiating PD according to teachers' learning and contextual modalities (Zucker, et al., 1998).

Research findings highlight PD that is built on teacher and school needs, teachers' being engaged in PD planning, collaboration, being extended over sufficient time, and well-prepared trainers as main features (Bayar, 2014). Furthermore, effective professional development needs to be ongoing, accessible, inclusive, and school-based; prioritizing practice, feedback, adequate time, follow-up support, reflection and collaboration; focusing on student learning, constructivist approaches in teaching and learning; and

recognizing teachers as professionals and adult learners (Abdel Haq, 1996). Guskey (2003) has spotted 21 most commonly and frequently researched PD characteristics, such as content-based, collective activities, school-centered PD, and coherence.

### **The Transformative Structure of the Targeted PD Model**

Ali and Wright (2017) contend that transformative PD applies constructivist principles which emphasize transforming educators' practices due to constructing meaning from personal experiences. What boosts transforming instructional practices is an ongoing reflection which assists educators in assessing their long-held assumptions to construct valid beliefs (Ali & Wright, 2017). Mezirow also affirms the transformative nature of the 'get, attempt, and reflect' PD model by concluding that transformative learning occurs as a result of undergoing new experiences, reflecting on them, transforming their meanings, and producing new outcome (as cited in Ali & Wright, 2017, p. 335).

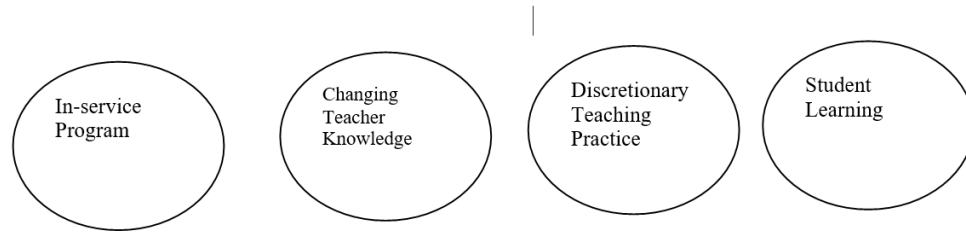
Whitelaw, et al. (2004) echo the theory of transformative learning in which teachers as adult learners critically examine their past or current experience, get new insights, review their opinions, and come up with new perspectives. This conclusion is summed up by Canton who states that "development requires moving beyond the acquisition of new knowledge and understanding into questioning our existing assumptions, values, and perspectives" ( as cited in Whitelaw, et al., 2004, p.96).

Transforming PD requires engagement in an ongoing conversation among teachers, creating new knowledge, questioning, and reflecting on their beliefs to transform practices in agreement with constructivist approaches (Donnelly, Morgan,

DeFord, Files, Long, Mills, & Styslinger, 2005). The transformative PD model encompasses three main elements and outcomes: 1) sustaining effective instructional methods and enhancing student learning, 2) fostering caring and collegial relationships, and 3) sharing successes, visions and positive expectations to create a robust school climate (Johnson & Marx, 2009).

In alignment with this study second question, and in accordance with Bandura's (1997) reference to self-efficacy, transformative PD increases teachers' self-confidence in turning teaching into fun and adds self-confidence to their expectations that their teaching for fun would appeal to students. In examining PD virtual communities along with face-to-face communities, King (2011) reveals that transformative PD can be brought about by providing a secure and supportive learning environment in a socially constructed context. Moreover, Beyer (2002) underscores the importance of this transformative PD model which gives priority to skills and knowledge. Additionally, mentoring is also believed to transform teaching practices if it is applied as a continued growth experience not as remediation (Simos & Smith, 2017).

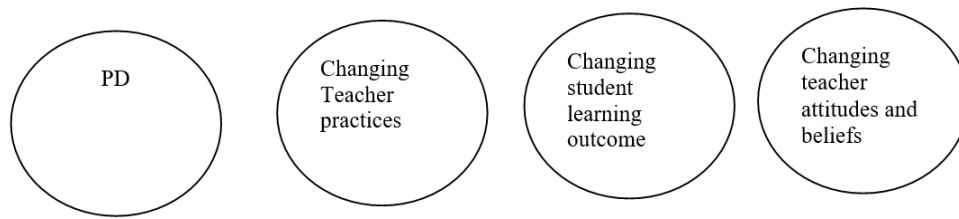
This study explores transformative PD models as shown in the above literature reviews and *Figure 1* and *Figure 2* which consolidate teachers' 'get, attempt and reflect' design as a replacement to the 'sit-and-get' style by optimizing teachers' instruction, experimenting with their teaching strategies and working collaboratively with colleagues to receive mutual feedback (King & Newmann, 2000).



*Figure 3.* Kennedy's PD change model Adapted from Form and Substance in Mathematics and Science Professional Development by Kennedy, 1998, retrieved from <https://files.eric.ed.gov/fulltext/ED435552.pdf> Copyright 1999 ERIC

The study PD model is also inspired by Kennedy's (1998) model as illustrated in *Figure 3*. PD changes teachers' knowledge which, consequently, leads to teachers' reflective thinking about what works for their students. Therefore, formal training sessions need to "be interspersed with classroom practice rather than concentrated, and ...allow teachers to work in groups, rather than in isolation" (Kennedy, 1998, p. 1).

As shown in *Figure 4*, Guskey's (2002) claims that change in teachers' classroom practices result from PD which in turn positively impacts student learning outcome and finally leads to another positive effect on teacher's attitudes and beliefs. Guskey's (2002) model describes PD as an attempt to change teachers' instructional and personal skills, and improve students' learning outcomes.



*Figure 4.* Guskey's PD model Adapted from Professional development and teacher change, by Guskey, 2002, retrieved from <https://doi-org.libproxy.aucegypt.edu/10.1080/135406002100000512> Copyright 2002 Taylor & Francis Ltd

While the traditional transmission PD model regards teachers as passive knowledge recipients, the transitional PD model represented in mentoring and PLCs motivates teachers to be actively engaged in discussions about their own perspectives, views, and expectations in a secure atmosphere (Kennedy, 2014). Kennedy (2014) identifies the transformative PD model which empowers teachers in playing key roles in educational reform theories and practices, as an integration of other models and can't be defined as a stand-alone model as shown in (Table 1).



Table 1

*Kennedy's PD models*

CPD Models	Purpose of Models
The training model	Transmission
The award-bearing model	
The deficit model	
The cascade model	
The standards-based model	Transitional
The coaching/mentoring model	
The community of practice model	
The action research model	Transformative
The transformative model	

“Adapted from Kennedy, A. (2014). Models of continuing professional development: A framework for analysis. *Professional Development in Education*, 40(3), 336-351. p. 248”

**PD delivery reform modes**

Tam (2000) contends that constructivists present the apprenticeship model which promotes scaffolding and coaching to assist in delivering and implementing authentic PD tasks. Similarly, Kinnucan-Welsch (2007) views assisted performance as a basic underlying principle in constructivism and asserts that the support which a teacher gets from an expert other based on Vygotsky's zone of proximal development (ZPD) aids teachers in putting theoretical ideas into practice efficiently and increases chances of powerful PD (Vygotsky, 1978). Tam (2000) states that Vygotsky's theory of social constructivism confirms that teachers' interactive social development for learning purposes requires support as explained in Vygotsky's ZPD by providing scaffold and support from others (Vygotsky, 1978).

According to Beaudry (2011), several studies underscore the importance of training delivery forms such as, coaching/mentoring over longer time to impact teacher practice. Garet, et al. (2001) regard mentoring, coaching, networking, principals' support and other informal learning opportunities as new types of PD reform forms. They also illustrate that these new PD reform types occur during regular school hours, coincide with classroom instructional applications, disperse over long periods of time and maintain setting up communities of practice in and among schools (Garet, et al., 2001).

Pitton (2006) defines mentoring as a form of dialogue between an experienced mentor who behaves as a guide, friend and role model to support and empower the mentees' skills pedagogically, intellectually and psychologically. This mentoring model which engages teachers in a supportive, collegial, trustful relationship with more experienced colleagues encompasses the PD transmission and transformative paradigms (Kennedy, 2014).

Hirsh (2009) indicates that mentoring/coaching supports and consolidates skill applicability and learning transfer as a basic PD characteristic. Kinnucan-Welsch (2007) highlights the fact that providing teachers with practical assistance doesn't exist in traditional models. These new PD transformative forms are linked with classroom applications, sustained over sufficient time for learning and practice and built on widely accepted theories of how teachers learn (Ball, 1996). Hence, the provision of expert support and assistance is instrumental for practical, sustainable PD (Kinnucan-Welsch, 2007). As such, mentoring and other new PD structures can positively affect teachers' performance (Loucks-Horsley, 1996).

Beaudry (2011) defines a mentor as a person who works with a group of teachers to provide individualized, face-to-face guidance, support resources, model lessons and provide techniques that focus on teachers' needs better than workshops which addresses multiple teachers at the same time. Therefore, mentors' roles encompass observing teachers, assisting in aspired lesson planning, and providing teachers with timely, constructive feedback. In such a trusting, nonthreatening, supportive mentoring atmosphere, teachers have voice and choice in their interactions with mentors and in making adjustment, accepting or even discarding mentors' feedback (Kinnucan-Welsch, 2007).

Rhodes and Beneicke (2003) state that the PD mentoring model requires communication skills because mentoring targets counselling and professional collaboration. These mentors' regular assistance to teachers is needed to effect change (Jackson & Davis, 2000). As current change indicators, new parameters of mentoring have been introduced to cope with these changes and technological advancements such as, study or focus groups, tele-mentoring, mentoring via video-conferencing and other internet capabilities (Strong, 2005).

Mathur, Gehrke and Kim (2013) agree with other researchers that effective mentoring depends on the type of mentoring, the frequency of contact, and mentors and mentees' teaching practices. Although mentoring is regarded as hierarchical, it is still an important PD tool that helps teachers face reform pressure (Vula, Berisha, & Saqipi, 2015). Mathur, Gehrke, and Kim (2013) consider improving mentees' reflective practices, shouldering responsibilities, building self-esteem, advancing mentees' instructional knowledge, assessment, reflections, and all their school practices, are some

benefits of mentoring. They also believe mentoring needs to be viewed as a process with frequent meetings based on collaboration rather than an event celebrated whenever teachers are free (Mathur, Gehrke, & Hee Kim, 2013).

In addition, Barnett (2002) underscores the importance of follow up on PD programs whose absence is a major problem facing PD programs, so he suggests keeping these programs' momentum via well-planned follow-ups. This support can occur by coaches or mentors who are originally "teachers identified for excellence and released from teaching duties full-time for 2–3 years—who provided mentoring to teachers new to the district or the profession, and intervention for identified veteran teachers experiencing difficulty" (Goldstein, 2005, p.238). Therefore, Sewilam, et al. (2015) call for PD trainers' long-term follow-up school visits following PD sessions. Mentors' similar roles can be performed by creating "master teacher "roles within schools to encourage professional achievement and development; and changing the role of school inspectors and headmasters to encourage improvement in pedagogy and professional development activities" (El Baradei & El Baradei, 2004, p.51)

### **Other structural features of PD delivery modes**

Besides mentoring, new PD reform activities include "networks for developing teaching within specific subject matter areas, interschool visitations; and a variety of formal and informal learning opportunities developed in response to teachers' and principals' felt needs" (Darling-Hammond, 1997, p. 325). Employing expert teachers as trainers, hiring follow-up mentors and reliance on volunteers and highly motivated teachers are crucial to high quality PD (Zucker, et al., 1998).

Kinnucan-Welsch (2007) uses the immersion and distancing PD model in which teachers are immersed in training workshops after which teachers depart from these workshops to hold meetings during the school day or PD summer activities to actively engage in constructing meanings from their training experiences by sharing, discussing, examining and reflecting on them. Kinnucan-Welsch (2007) views engaging teachers in active learning experiences which lead to changing long-held beliefs and practices as immersion opportunities. During such immersion, teachers are provided with experiences and opportunities to construct deep understanding by exploring both content knowledge and pedagogy (Kinnucan-Welsch, 2007). On the other hand, Distancing in which teachers are given sufficient time to reflect on their practices follows immersion stages. With the help of mentors and through school visits, follow up meetings, collecting experience construction artifacts and sharing ideas with others orally, electronically or in writing, PD is transformed to distant implementation in place, context and duration (Kinnucan-Welsch, 2007).

### **Inquiries as forms of action research**

Action research is also more effective than workshops as it practically tackles several traditional issues of concern and finds solutions to them (Beaudry, 2011). It aims “to improve the rationality and justice of (a) their own social or educational practices, (b) their understanding of these practices and (c) the situations in which these practices are carried out” (Day, 1999, p.36). Day (1999) offers an alternative method to action research represented in narrative inquiries which provide opportunities for teachers to learn by hearing, telling and retelling stories of their own growth, best practice and achievement.

These narrative inquiries in the form of sharing stories, insights, problems, solutions, and opinions assist in co-constructing teachers' beliefs by transcending exchange to critiquing with the help of peers and principals (Day, 1999).

### **The role of the principal in PD**

Day (1999) affirms that change must be led by principals who are clear in their vision and committed to promoting learning for teachers as well as students and “articulate a vision, promote shared ownership, and engage in evolutionary planning, dealing with culture, and the long-term change” (p.82). Therefore, principals' sharing the same training experiences which their teachers get engaged in establishes the transformative PD model as opposed to the traditional training accountability which views teachers as the only people in charge of instructional change (Kennedy, 2014). Principals' crucial role as educational leaders is to support PD not as an add-on but as an essential component of every school learning community and to engage teachers in formal, informal, individual and collaborative learning experiences (Day, 1999). That's why Rhodes and Beneicke (2003) believe that poor teachers' performance is not only brought about by individual teachers, but it is also caused by management practices. Therefore, a collective model in which both teachers and the administrators share responsibilities needs be adopted and promoted. Day (1999) states that “change at deeper sustained levels involves the modification or transformation of values, attitudes, emotions and perceptions which inform practice, and these are unlikely to occur unless there is participation in and a sense of ownership of the decision-making change processes” (p.98). To put this belief into action, Phelps and Bredeson underscore the importance of

increasing principals' capacity to "be strong and consistent instructional leaders" (as cited in Guskey, 2003, p.13).

According to this model, principals will be leading, supervising caring, trustful, and strongly having confidence in teachers' talents (Senge, et al., 2000; Jackson & Davis, 2000). Therefore, principals must change their traditional leadership styles to motivate teachers to continue their PD, practice what they learn, discuss their application during meetings, and should be in favor of workplace collective events (Thompson, Gregg & Niska, 2004; Boreham, 2004).

According to Thompson et al. (2004), principals should create a respectful exchange of ideas and non-threatening school environments. Elmore (2000) elaborates on this issue by clarifying that the principal does not only need to be the instructional initiator or leader, but to improve staff skills and knowledge, inspire them towards a new practical culture of implementing these skills, supports the staff collective union, and defines individual teachers' responsibilities. Elmore (2000) also suggests that by means of improving instructional practices, continuous learning, modeling, unanimous expertise, reciprocity of responsibilities and potentialities, quality distributed leadership will be beneficial to all stakeholders. In addition, principals have a strong impact on building up a school PLC that improves student learning (Thompson et al., 2004).

### **The Internet and technology-supported constructivist PD**

Day (1999) presents transformative PD networking models in which "work does not belong to any one individual or interest group. It is jointly owned by each of the participants. The voices of both are listened to and heeded" (p.190). Tam (2000) holds

that virtual experiences represented in social media tools, posts, photographs, and videos provide opportunities for sharing, reviewing, and reflecting on PD opinions, experiences, and practices as the core of constructivism.

Tam (2000) argues that technology-supported collaborations lend themselves to constructivist perspectives because they provide various social learning contexts via the internet and its social media applications which offer endless opportunities for teachers to interact, exchange opinions, and learn from each other. Due to this fact, PD is transformed from controlled knowledge transmission to collaborative critical inquiries and constructivist learning experiences in which learners are reflective, debating and questioning new knowledge based on their individual and social context (Tam, 2000).

Schrader (2015) concludes that technological and social media result in interactions, forming network communities, learning opportunities, making meanings and constructing knowledge that reflect constructivist perspectives and practices. Social media formulate communities of learners in which they collaborate and engage in dialogues, communication and online activities. Social media is used for transformative PD purposes in which educational posts, digital content or insights are shared, and feedback is sought and given collaboratively leading to creating learning communities and knowledge co-construction through (Schrader, 2015).

### **Professional communities of learning**

PLCs make up the second element of constructivism (Kinnucan-Welsch, 2007). Tam (2000) refers to active professional learning and the interwoven relationship among teachers, their communal context and problem-based issues as the core of constructivism.



Vygotsky's sociocultural theory represents a framework for teachers' learning and development in which teachers' interactions and collaboration with their peers and knowledgeable others provide support and a zone of proximal development to collectively construct knowledge (Vygotsky, 1978; Albert, 2012). According to Vygotsky, both individual and collective learning are so linked that individual teachers' development builds on knowledgeable others' social context and scaffolding (Vygotsky, 1978). Cobb (1988) confirms the same notion by stating that constructivism views teachers as reflective problem solvers whose construction of knowledge and professional development autonomy arise from negotiations with knowledgeable others and their own practice.

Kinnucan-Welsch (2007) states that from a constructivist viewpoint, communities of practice characterize high quality PD and are crucial to its success provided they sustain an ongoing, collective engagement. PD lends its foundation to the constructivism theory in which "learners actively construct knowledge through interactions in the environment as individuals and as members of groups by making meaning of the world through an ongoing interaction between what they already know and believe and what they experience" (Kinnucan-Welsch, 2007, p.271).

Previous research suggests that high quality professional development is basically derived from constructivist perspectives in which active construction of knowledge, transformational connections of learners' past experiences with new experiences and forming professional communities are pillars of a long-term cycle of professional learning (Mukan, et al., 2017). Kinnucan-Welsch (2007) believe that communities are essential to impactful, capacity building and sustained PD experiences; therefore, a body

of PD research confirms the optimal role of communities of practice as a pivotal PD feature as mandated by constructivism on condition they are intensive and sustainable. Garet, et al. (2001) deem that communities of practice allow teachers to debate insights, skills and perspectives; exchange experience and advice on students' interests, needs and learning modalities; share ideas on best practices, instructional methods, problems and solutions; build teachers' capacities; enhance the professional culture; consolidate supportive grounds for reform and change; and collectively benefit from in-school and out of school mentoring and support.

These communities of professional learning and practice capitalize on: 1) being mutually and socially engaged in learning activities at each school or district level such as, exchanging class observations and students' learning outcomes and artifacts; 2) collegially negotiating and arranging for PD engagement, structure and ways of delivery among members as opposed to forcing teachers for participation; and 3) formally and informally sharing supportive and professional resources, insights, best practices and conversations (Kinnucan-Welsch, 2007).

It is worth mentioning that teachers' social and emotional engagement in PD activities is pivotal (Zucker, et al., 1998). When teachers collaborate in fulfilling their tasks purposefully and collectively by means of collegial engagement, common understanding, and sharing experiences and dialogues, they establish communities of practice that range from school colleagues to national and international scales (Kinnucan-Welsch, 2007). Keiny (2008) expounds that communities of practice play a pivotal role in conceptual change since knowledge is collaboratively constructed throughout the

contributions of participants in a non-threatening discourse, exploration, critical thinking and reflection.

Kinnucan-Welsch (2007) elaborates on his finding that communities of practice come into the PD landscape in various aspects. First, teachers engage in collegial participation which boosts learning and prompt them to socially and mutually construct their knowledge and implicate best practices. This engagement occurs when teachers exchange class visits, share artifacts, and participate social media interactions with their peers or beyond their school walls. Second, teachers have their voice and choice in building their communities of practice. Therefore, these communities prioritize teachers' urgent needs and focus on their learning goals. Third, teachers' shared verbal and online dialogues about their practices and their students increase, broaden and reconstruct teachers' knowledge. Tam (2000) is among constructivism advocates who think teachers construct their knowledge from multiple sources and collaborative situations.

Collaboration during and following PD is important because “articulating one's beliefs for others encourages a reexamination and rethinking of those beliefs, a process that serves as a powerful impetus for teacher growth” (Nolan & Hoover, 2011, p. 173). King and Newmann (2000) believe that collaboration among teachers inside and outside schools enhances teacher effectiveness.

A powerful and positive learning and teaching environment is created by professional learning communities (PLCs) that take into consideration individual experiences and the wisdom of the whole group consensus (Kennedy, 2014). A PLC involves transforming culture, turning the learning environment into more exploration and learner centered approaches and encouraging discussions about teaching pedagogies,

inquiries and reflections (LaFee, 2003; Thompson et al., 2004). Therefore, Duffy, Mattingly, Randolph (2006) assert that PLC necessitates the entire school to share the vision of improving student learning, collaborative and collegial work and a principal who shares authority and decision making.

Little (1982) illustrates that teachers in four successful schools have more sense of friendship, continuous development, and professional interrelations than teachers in two unsuccessful schools. Besides, Rosenholtz (1989) concludes that most of the underachieving 78 schools in Tennessee pay no attention to common good goals and have no team work commitment or fellow collegial contacts. For this reason PLC needs to make use of time effectively, encourage collaborative learning, engage teachers in focus team experience exchange, and consider technology as a means of empowering learning and teaching (Sparks, 2004). Consequently, it is crucial to engage parent and communities to support a healthy learning environment inside and outside schools, guarantee continuous communication between home and school, follow up on students' schoolwork progress, and assist in providing required school services, such as learning after school hours and ideas for school improvement (Jackson & Davis, 2000).

### **School-based focus groups**

Some PD programs promote grouping neighboring schools “to improve the quality of teachers through professional discussions, experience sharing and more specific training in teaching skills” (Pellini & Bredenberg, 2015, p.422). School-based PD activities “might be easier for teachers to reveal what they do not know (so that they might learn more) in contexts” (Wilson & Berne, 1999, P. 187). Guskey (2003) holds that

site-based educators are “essential to optimize the effectiveness of PD” (Guskey, 2003, p.13).

### **PD duration**

Beaudry (2011) asserts that PD has no specific standardized duration. However, dispersing PD over extensive periods of time and allocating a considerable number of hours of PD contact is what increases PD efficacy. This substantial amount of time allows teachers to actively engage in enacting new instructional methods, mastering subject matter content and reflect on their practices (Beaudry, 2011). Kinnucan-Welsch (2007) argues that in case PD is not sustained or supported over time, it turns into being unproductive. This is because translating PD theories and workshops into practice requires sufficient time to explore, test and adopt their efficacy and practicality (Kinnucan-Welsch, 2007)

Sufficient duration of time allocated to PD is second to content and pedagogy as PD's most effective and common feature (Guskey, 2003). Wei et al. (2009) highlight the importance of intensive and focused PD. Intensive and extensive time is required for a successful PD (Zucker, et al., 1998). Extending PD activities over a longer time is of utmost priority because teachers are given an ample time to get engaged in deep discussions, reciprocal networking and exposure to various instructional approaches (Garet, et al., 2001). Day (1999) holds that PD strength lies in maintaining an ongoing development that transforms teachers' practice over time

Yoon et al. (2007) argue that a body of research has averaged 49 PD contact hours as required to raise student learning outcome. Garet, et al. (2001) conclude that several

recent studies suggest that the duration of PD empowers teacher change in teachers' skills, knowledge and beliefs and effective PD is thought to extend over longer duration. They confirm that PD activities that last longer time make it easy for teachers to share ideas, exchange best practices and establish collegial relationships among members of communities of practice. Extending PD delivery and follow-up form long duration provide teachers with enough time to experiment with, discover and reflect on their teaching (Garet, et al., 2001).

Kinnucan-Welsch (2007) contends that the need for sufficient time to reconstruct a new belief system, consolidate deep understanding and translate PD into practice is key to the development of communities of practice, and intensifying its engagement.

Research proves that “activities of longer duration have more subject-area content focus, more opportunities for active learning and more coherence with teachers' other experiences than do short activities” (Birman, et al., 2000, p.30). Characteristics of “good in-service programs include that they be lengthy rather than brief... that the scheduled meetings be interspersed with classroom practice rather than concentrated” (Kennedy (1998, p.1). Day (1999) affirms that “the provision of time and opportunity as well as the abilities of teachers to learn from and with one another inside the workplace and from others outside the school are key factors in continuing PD” (p.20).

### **PD content**

PD provides opportunities for teachers to construct meaning and understanding by supplying them with experiences and activities which builds a strong relationship

between content knowledge and pedagogy (Kinnucan-Welsch, 2007). Enhancing teachers' content and pedagogical knowledge is the most frequently mentioned feature in the PD characteristic list (Beaudry, 2011; Guskey, 2003). Garet, et al. (2001) conclude that focusing PD on pedagogies and content knowledge boosts and modifies teachers' knowledge, skills and practice.

Striking a balance among knowledge of technology, content, and pedagogy helps teachers make the best use of their PD activities (Beaudry, 2011). PD activities that target mathematics and science content, methods of learning and teaching, new curricula methods and materials are beneficial to students' achievement changing teaching practice (Garet, et al., 2001). Training teachers on subject matter content and how students learn it positively influences students' outcome (Kennedy, 1998). Garet, et al. (2001) affirm that high-quality professional development is affected by the degree of its content focus.

Subject-matter mastery and pedagogical knowledge is crucial to successful PD (Garet, et al., 2001). Zucker, et al. (1998) underscore that subject matter knowledge and knowledge about teaching methods are basic requirements for high-quality professional development include. Developing teachers' content and instructional knowledge. Teachers' capacities are built by focusing more on developing specific subject matter content along with its methods of teaching than generic PD (Birman, et al., 2000). Kennedy (1998) confirms that "more successful programs provided tended not to be purely about the subject matter...[but] how students learn that subject matter" (p.17). Beyer (2002) underscores the importance of the PD model which gives priority to skills and knowledge over attitudes and values.

### **Promoting active learning**

According to Bada and Olusegun (2015), and in contrast to traditional learning in which knowledge is passively transmitted and received, constructivism considers learning as an active process in which learners actively construct knowledge by adopting new experiences, adapting prior knowledge or even rejecting both. Kinnucan-Welsch (2007) concludes that the transmission model is not suitable for adult learners because effective PD requires deep understanding, ongoing support and engagement. Constructivist principles indicate that learners are active agents whose learning is influenced by beliefs, attitudes and context and is attained through experiencing things, reflecting on those experiences and finally constructing knowledge (Bada & Olusegun, 2015). Active learning must be at the heart of PD and” encourages teachers to become engaged in meaningful discussion, planning, and practice” (Birman, et al., 2000, p. 30).

Among the multitude of principles that underlie constructivism as the essence of PD are considering active learning as its approach, and constructing knowledge as an engaging, personal, collaborative, meaningful and problem-solving based process (Mukan, et al., 2017). Furthermore, one of the central tenants of constructivist learning is that it must be an active process; therefore, “any constructivist learning environment must provide the opportunity for active learning” (Tam, 2000, p. 67). In addition, Day (1999) views PD as a direct and an indirect learning experience in which teachers are not passively developed but actively and professionally develop. Similarly, Dexter, et al. (1999) consider constructivism as a model for teachers learning, decision making, social learning and active participation in which teachers construct and organize their knowledge by adopting, adapting or rejecting their previous or/and current experiences



over time. Mukan, et al. (2017) define learning to teach as a constructivist perspective in which “an active mode of learning is enabled, and social knowledge forming is encouraged” (p.11).

A major constructivist principle is learners’ interactions as individuals and community members based on what they know and experience in contrast to the "sit and get" model whose learning opportunities and impact is unnoticeable (Kinnucan-Welsch, 2007). Tam (2000) deems constructivist learning as an active mental process of constructing knowledge based on experience by means of active participation and not passive reception. During this active learning process, learners judge whether prior and new knowledge are relevant or irrelevant to assimilate, accommodate or modify their understanding (Bada & Olusegun, 2015). Bada and Olusegun (2015) assure that learners are active creators of knowledge whose end goal is constructing this knowledge through contextually and socially experiencing things, reflecting on them, adopting, adapting or even discarding them.

This constructivist design of professional development places teachers as central learners in need of meaningful experience to construct their own PD understanding (Kinnucan-Welsch, 2007). According to Bada and Olusegun (2015), constructivism prioritizes the roles of teachers as facilitators who promote students’ active participation and construct meanings from prior experience and new knowledge. Various forms of constructivism hold that “meaning making and learning are created through active engagement with knowledge and in social interaction” (Schrader, 2015, p.23). Piagetian constructivism employs assimilation and accommodation to enable individual learners to construct knowledge, whereas Vygotsky constructivism considers social interactions

scaffolded by the ZPD of colleagues and expert others as a learning mechanism (Schrader, 2015; Vygotsky, 1978).

### **Modeling and reflection**

Bada and Olusegun (2015) assume that any constructivist learning environment must provide the opportunity for active learning through incorporating new experiences into old ones as assimilation or reframing their old experiences in what is known in constructivist concepts as accommodation. Garet, et al. (2001) deems that various PD opportunities for active learning can be displayed in several PD procedures. First, teachers observe expert teachers modeling best practices, are observed while teaching by mentors, peers or principals and get engaged in reflections. Second, teachers collectively plan to put their instructional methods and concepts into practical classroom context, and analyze students' problems and outcome, teaching approaches or curriculum content. Third, teachers conduct in-school or cascading PD sessions, lead informal PD discussions and share ideas with others (Garet, et al., 2001).

Day (1999) concludes that adults learn by action and reflection on these experiences. Zucker, et al. (1998) assert that giving opportunities for teachers to be active learners is an effective dimension for high quality PD. Actively engaging teachers in productive debates, practices and follow-up mentoring support and feedback is a fundamental PD characteristic (Garet, et al., 2001). Bada and Olusegun (2015) view learning as an active process in which learners actively modify their knowledge to accommodate the new understanding, assimilate new experiences or even discard them. Immersing teachers in active learning experiences is an essential element of PD success.

This active engagement and immersion occurs during training activities by learning through various modalities and different hands-on approaches (Kinnucan-Welsch, 2007).

### **Fostering coherence**

Garet, et al. (2001) refer to PD activities which lend themselves to a coherent wider scope of teachers' formal or informal professional learning and boost teachers' knowledge and skills. Supported coherent professional development with intensive follow-up during the school year is a basic guarantee of PD success (Zucker, et al., 1998). This coherence can be ensured in multiple ways. First, PD activities can draw on earlier experience and be followed up with more advanced work. Second, PD practices and insights can be aligned with the curriculum and assessment national standards which are aspired to be implemented as pillars of reform. Third, coherence in PD activities can be achieved by forming and sustaining wider networks and communities in which teachers communicate, share opinions, reflect on best practices and reform teaching practices. Fourth, empowering what and how teachers teach from various resources warrants and fosters PD coherence and consistency (Garet, et al., 2001).

Aligned with other reforms and modeling high quality instruction, PD plays a key role in modelling high quality teaching and learning (Kent & Lingman, 2000). PD needs to be "coherent, focused on clear learning goals" (Guskey, 2002. p 578).

### **Chapter 3: Methods**

This phenomenological study is designed to investigate Discovery Education PD model application in Egyptian public schools as a transformative PD model in contrast to traditional models. The study design is also selected to explore Discovery Education “STEM Now Egypt” PD characteristics based on the participating teachers and principals’ perspectives. Because limited studies have addressed transformative PD design and its characteristics in Egypt, this phenomenological study provides a deep analysis of how applicable such models to the Egyptian context are. To achieve these goals, the researcher employed a qualitative phenomenological study methodology by holding semi-structured interviews with targeted teachers and principals. The following questions were answered in this study:

1. What are the PD features that Discovery Education “STEM Now” PD model employs as a transformative model?
2. What are participants’ perceived skills, motivation, and continuous professional learning opportunities in Discovery Education “STEM Now” PD model?
3. What are participants’ suggestions for future PD programs based on their experience with “STEM Now Egypt” PD model?

This research design, setting, participants, data collection and analysis are elaborated on below in the light of this qualitative phenomenological study methodology.

#### **Research Design**

Phenomenological studies, to which this study belongs, capitalize on deep understanding and thick analysis of participants’ lived experiences to get closer insights

into how meaningful these participants' perspectives and experiences are (Starks & Brown Trinidad, 2007; Groenewald, 2004). According to Creswell (2007), this phenomenological study examined participants' perspectives on "STEM Now" transformative characteristics and investigated what transformative PD features these participants experienced and how they experienced them. In addition, a phenomenological analysis helped the researcher to delve into and capture "STEM Now" transformative PD characteristics, and examine participants' perspectives and experiences by constructing meaning from these subjective, but knowledgeable experiences (Starks & Brown Trinidad, 2007).

Thus, this phenomenological research relied on semi-structured interviews as its data collection strategy. In-depth interviews are commonly utilized by phenomenologists to gain insights into participants' experiences (Pathak, 2017). Moreover, semi-structured interviews in which elicitation techniques were employed to elicit participants' lived and detailed "STEM Now" PD experiences work well for this phenomenological study (Starks & Brown Trinidad, 2007; Morse, 1994). To get the best out of these interviews, the researcher tried to maintain communicative skills, rapport, respect and trust during them (Newton, 2012; Lester, 1999). The researcher was also keen to be an active listener who first asked participants to give general accounts of their experience and then posed probing questions to encourage them to elaborate on details. This helped the researcher to get closer investigations and keep participants attached as close and analytic to their lived experiences as possible (Starks & Brown Trinidad, 2007; Groenewald, 2004). To ensure that participants did not fall under the "interviewer effect" as he conducted interviews himself, the researcher clarified the purpose of the study at the beginning of interviews

and made them feel at ease that they were not evaluating the program or being evaluated (Newton, 2010). Furthermore, semi-structured interviews gave the researcher freedom and flexibility to investigate participants' perspectives in this phenomenological study, allowing for thematic data analysis, by starting with broad and more general questions rather than specific questions which emerged during the exploration of these topics and sub-topics (Pathak & Intratat, 2016).

The researcher developed the interview questions after conducting an extensive literature review (e.g. Ali & Wright, 2017; Bada & Olusegun, 2015; Bandura, 1997; Baviskar, et al., 2009; Bayar, 2014; Darling-Hammond, et al., 2017; Day, 1999; Desimone, 2009; Guskey, 2009; Guskey & Yoon, 2009; Johnson & Marx, 2009; King, 201; Kennedy, 1998; Kennedy, 2014; Kinnucan-Welsch, 2007; Senge, et al., 2000; Simos & Smith, 2017; Vygotsky, 1978; Whitelaw, et al., 2004; Zucker, et al., 1998) on what transforms and works for PD. In addition, the research questions investigate the core features of effective PD viewed as a basis for PD effectiveness studies and keys to understanding the success or failure of education reforms according to qualitative and quantitative research consensus and multiple PD models (Desimone, 2009; Guskey, 2009; Guskey & Yoon, 2009; Kennedy, 1998; Kennedy, 2014). These transformative PD characteristics include various experiential and reflective delivery forms, expert follow-up, extensive duration of PD activities, teachers' PLCs, teachers' engagement in active learning, PD consistency with other reforms and PD focus on content and pedagogy (Garet, et al., 2001). Furthermore, the study instrument examined the transformative PD dynamic nature as an ongoing, continuous, and embedded process in teachers' daily lives in the form of mentoring, reflection, discussions, teacher network, engagement in online

activities, and involvement in a curriculum development process (Desimne, 2009). The study also explores Guskey's (2009) model which describes PD as an attempt to change teachers' instructional practices and improve students' learning outcomes. Moreover, this study also reflects Kennedy's (2014) definition of transformative PD model as an integration of other PD models. Furthermore, the study's instrument is based on Darling-Hammond, et al. (2017) report which reviewed 35 rigorous studies over the past three decades and specify definite effective PD features encompassing content-focused PD, active learning, collaborative PLCs, models of effective instruction, expert support, feedback, reflection, and sustained duration.

The semi-structured interview included twelve open-ended questions in which the first question presents a general introduction about how and why participants happen to participate in the program in order to create some rapport required for actual questioning. The same concepts and steps, which were taken to develop the teachers' interview questions, were used again to develop a similar set of questions to the school principles. The only variation was in questions three, four, nine, ten and twelve where there was focus on principals' instructional leadership and their roles in supporting teachers' PD.

### **Context and Participants of the Study**

The study phenomenological approach employed a purposive sampling method to examine participants who experienced and took part in "STEM Now" PD (Starks & Brown Trinidad, 2007). Pathak (2017) regards purposive sampling as the most suitable sampling technique in phenomenological studies. Since an individual participant's experience can provide multiple perspectives, this study focused on examining a small

sample of fifteen “STEM Now” PD participant teachers and principals from fifteen different schools out of the one hundred schools participating in the program (Starks & Brown Trinidad, 2007). Detailed accounts of this small sample of participants’ lived experiences revealed some “STEM Now” transformative PD features (Starks & Brown Trinidad, 2007).

The researcher employed a purposive sampling approach in which “information-rich cases” were purposefully selected to get “insights and in-depth understanding rather than empirical generalizations” (Patton, 2002, pp. 272-273). The study maximum variation technique encompassed wide variations of participants interested in taking part in “STEM Now”, having cut-across diversities of different primary, preparatory and secondary school stages, and sharing similar patterns of being public school teachers and principals (Patton, 2002).

This sample included four participating teachers and one principal from each of the primary, preparatory and secondary stages. All the schools were public schools in Greater Cairo. The study participating teachers and principals were selected based on their involvement in the program. The researcher had his colleague trainers nominate some well-informed and available teacher and principal trainees from a wide and different range of school stages. Therefore, participants were chosen for being so knowledgeable, valuable sources of data, accessible and representative of a wide range of teachers and principals having various primary, preparatory and secondary school perspectives (Creswell, 2012). Despite the study sampling limitations, this sampling added to the trustworthiness of the study and facilitated deep dives in its perspectives and conclusions. In addition, it helped the researcher to look at the phenomenological



study from all angles and gain insights into an array of experiences, attitudes, skills and PD characteristics.

On conducting the interviews, the researcher visited targeted schools to get the consent forms signed and the interview conducted; however, the participants' schedules were so busy and their workload was so heavy that it took the researcher a week to conduct two interviews. Therefore, the researcher decided to visit schools to have the consent forms signed and arrange for phone-call interviews to conduct the other thirteen interviews. The researcher texted participants via WhatsApp asking them to set their most convenient time for interviews and notify him in advance. Participants shared some pictures of their "STEM Now" PD training and classroom practices to help probe further during interviews by applying 'elicitation techniques. In addition, all interviews took place during weekends because of teachers' and principals' busy schedules at home and schools.

The targeted interviewees were twelve teachers and three principals from fifteen different participating schools from primary, preparatory and secondary stages. Interviews were conducted with four teachers and a principal from each stage (Table 2). The sample was fairly distributed among seven males and eight females. Principals' and teachers' disciplines included 8 mathematics, and 7 science. This variation increased possibilities of multiple insights and perspectives into the phenomenological study analysis.

For confidentiality issues, the primary, preparatory and secondary stages would be coded A, B and C consecutively. Primary school teachers would be coded as T1A, T2A, T3A, T4A and the primary principal would be coded as P1A. Preparatory school

teachers would be coded as T1B, T2B, T3B, T4B and the preparatory principal would be coded as P1B. Secondary school teachers would be coded as: T1C, T2C, T3C, T4C and the secondary principal would be coded P1C (Table2). Seven participants (P1C, T4C, T4B, T4A, T3B, T2A, T2B) were males, whereas eight (P1A, P1B, T3C, T3A, T2C, T1B, T1A, T1C) were females. As for school subjects, five participants were science teachers while seven were mathematics teachers plus three principals among whom two principals worked originally as science teachers and the third worked as a mathematics teacher.

Table 2

*Participants' Data*

Participants' numbers	Primary Teachers	3
	Primary Principals	1
	Preparatory Teachers	3
	Preparatory Principals	1
	Secondary Teachers	3
	Secondary Principals	1
Participants' Gender	Male	7
	Female	8
Participants' School Subjects	Mathematics	8
	Science	7

Table 3

*Participants' codes in each Stage*

Stage	Stage Code	Teachers' codes	Principals' codes
Primary	A	T1A, T2A, T3A, T4A	P1A
Preparatory	B	T1B, T2B, T3B, T4B	P1B
Secondary	C	T1C, T2C, T3C, T4C	P1C

**Data Collection and Analysis**

The study's instrument, represented in its semi-structured one-to-one open-ended questions aimed to investigate participants' perspectives and helped them voice their beliefs, attitudes, and views on their experiences with Discovery Education "STEM Now" PD program (Creswell, 2012). The researcher was keen to pose broad questions along with other probing and clarifying questions that aided in digging deep into the participants' views, knowledge and experiences to gain the maximum data (Turner, 2010). The researcher took into account being flexible, preparing follow-up prompts for further exploration and reconstructing questions to reduce misunderstanding during interviews (Creswell, 2012). Furthermore, the researcher also ensured that the interview questions were as neutral as possible, and were asked one at a time and clear (McNamara, as cited in Turner, 2010).

The researcher piloted the semi-structured interview questions in this phenomenological study to fix any flaws or weaknesses within the interview design and/or wordings, and made necessary revisions before conducting the intended study

(Kvale, as cited in Turner, 2010). The pilot test was conducted with main participants' colleagues who were interested and involved in the same PD program (Turner, 2010). They suggested separating sub-question nine about DEN online communities from sub-question six about digital content and tools.

Before the actual interviews, the researcher received the Institutional Review Board (IRB) (see Appendix A) and the Central Agency for Public Mobilization and Statistics (CAPMAS) approvals to conduct the study (see Appendix B). After receiving the security permission of the MOE and its stakeholders, participating teachers and principals were asked to sign consent forms before conducting the research (see Appendix C). The researcher explained to the participants that their personalities and comments would be anonymous and confidential, and asked for their permission to have the interviews audiotaped and archived PD pictures be shared.

During interviews, the participants' responses were audiotaped for later transcription and coding into themes (Creswell, 2012). The researcher used Arabic language during audiotaping the interviews which were transcribed and translated into English later on. The researcher had a language specialist review the translation of the interview questions into Arabic and reviewing their translation back into English. For accuracy, the same thing was done with checking the Arabic transcription and double-checking its translation into English after transcribing the audiotaped interviews.

In order to combine relevant topics and ideas into themes, the researcher thoughtfully read the repetitive ideas and collected data, and tried to anticipate some common and apparent themes based on participants' responses and the literature review analysis. The researcher's extensive literature review and the consensus he could come

across (e.g. (Ali & Wright, 2017; Bada & Olusegun, 2015; Bandura, 1997; Baviskar, et al., 2009; Bayar, 2014; Darling-Hammond, et al., 2017; Day, 1999; Desimone, 2009; Guskey, 2009; Guskey & Yoon, 2009; Johnson & Marx, 2009; King, 201; Kennedy, 1998; Kennedy, 2014; Kinnucan-Welsch, 2007; Senge, et al., 2000; Simos & Smith, 2017; Vygotsky, 1978; Whitelaw, et al., 2004; Zucker, et al., 1998) on characteristics of transformative and effective PD helped him generate the study themes and sub themes. In addition, the way the research questions and their sub-questions were listed aided the researcher in generating relevant themes that match the study focus on what made “STEM Now” a transformative PD model. The researcher combined all the relevant thoughts in separate documents so that he could extract meaningful quotes and list similar themes and sub themes. Afterwards, these similar quotes and related ideas which might assist in answering the research questions were highlighted in same colors, combined and coded.

This study phenomenological analytic process followed a process of analyzing, coding, categorizing specific statements into clusters of meanings, and exploring common experiences and features (Creswell, 2012; Groenewald, 2004). Additionally, the researcher went through what van Manen described as a process of writing and rewriting similar to story writing which focuses on detailed experiences and ends up with expected conclusions (as cited in Starks & Brown Trinidad, 2007, p. 1377).

The study participants were coded and categorized based on their number in each school stage: A for primary; B for preparatory and C for secondary; therefore, (T1A, T2A, T3A, T4A and P1A) represent four primary teachers and one principal; (T1B, T2B, T3B, T4B and P1B) represent four preparatory teachers and one principal and (T1C,

T2C, T3C, T4C and P1C) represent four secondary teachers and one principal (Tables 2 & 3). In total, there were interviews with twelve teachers and three principals. One major theme was generated from all the three questions plus ten, four and six sub-themes were generated from questions one, two and three consecutively. The generated themes were used to answer the three research questions of the study.

### **Role of the Researcher and Ethical Considerations**

The researcher was originally an MOE expert teacher and acting as a Discovery Education trainer and mentor. However, this study was solely conducted, transcribed and analyzed by the researcher with external help in translation and review issues. The researcher honestly disclosed that he was an observant researcher who was engaged in “STEM Now” PD program as a trainer and mentor as well. Therefore, the researcher was aware not to get exaggerated answers either by directing participants to respond according to what or how he liked or elaborating on participants’ answers in ways that might affect their responses. These ethical obligations required the researcher be detached, unbiased at all the research stages, and aware of the jeopardy of conflict of interests.

Despite the fact that Discovery Education PD officials knew about the study, they did not set any requirements, obligations or ask for any reviews at their end. They just provided the researcher with documents about their PD context which is publicly available on their EKB portal. Additionally, the researcher got attached to the participants’ language and had a colleague review the study to ensure better and honest

connection between the researcher's interpretations and the participants' experiences (Gill, 2014).

The rights of all the study participants were ethically protected by first obtaining the (IRB) and (CAPMAS) approvals. Next, MOE security permits were requested and the researcher didn't make use of his circle of acquaintances in the MOE to accelerate the process of issuing these permits, but went through this long process of documents and stamps at all levels from the MOE to Moderyiats (Governorates), Edaras (Districts) and finally schools. Once they were granted, they were displayed or shared with the interviewed principals and teachers. Then, participants were introduced to the study purposes, informed of the study confidentiality and anonymity of their identities, and asked to sign consent forms. All the study documents, audio files and transcriptions, data analysis were saved online and on the researcher's computer. The researcher's relationship with participants were based on so much trust, support and respect that they collaborated with the researcher honestly and objectively.

### **The Study Trustworthiness**

The researcher tried to uphold faithfulness to participants' data, honesty about detaching his own beliefs and perspectives, and awareness about not misrepresenting, or deleting findings (Starks & Brown Trinidad, 2007; Lester, 1999; Miller, 2003).

Furthermore, the researcher maintained an interest in 'bracketing' participants' experiences by attending to their views and avoiding bias with an open mentality (Starks & Brown Trinidad, 2007; Lester, 1999). Bracketing and putting aside the researcher's assumptions rendered the researcher as neutral as possible (Pathak, 2017). According to

Pathak (2017), bracketing is a phenomenological research method which maintains data collection and analysis trustworthiness.

According to Shenton (2004), and in order to maintain the study trustworthiness, the researcher 1) derived PD features and methods from comparable studies (e.g. Ali & Wright, 2017; Bada & Olusegun, 2015; Bandura, 1997; Baviskar, et al., 2009; Bayar, 2014; Darling-Hammond, et al., 2017; Day, 1999; Desimone, 2009; Guskey, 2009; Guskey & Yoon, 2009; Johnson & Marx, 2009; King, 201; Kennedy, 1998; Kennedy, 2014; Kinnucan-Welsch, 2007; Senge, et al., 2000; Simos & Smith, 2017; Vygotsky, 1978; Whitelaw, et al., 2004; Zucker, et al., 1998); 2) examined the findings of these previous transformative PD literature reviews; 3) took Merriam's (1998) advice for data detailed and thick description by using elicitation techniques to dig deeper into their answers; 4) had translation drafts and findings reviewed by a trusted peer (Yin, 2003); 5) and was well-informed about the study PD program due to being a teacher and PD trainer at the same time.

Providing the study contextualized background in a detailed description was another trustworthiness factor which might ensure transferability (Shenton, 2004). The study guiding theory, the researcher's admissions of his roles, and his study limitations might ensure the study conformability which may add to its trustworthiness (Shenton, 2004).



## **Chapter 4. Findings**

In this chapter, the researcher will draw conclusions from participants' responses. First, ways of generating themes from the semi-structured interview responses will be explained. Then, findings for each research question will be detailed.

In order to combine relevant topics and themes, the researcher thoughtfully read repetitive ideas and collected data, and tried to anticipate some common and apparent themes based on participants' responses and the literature review analysis. The researcher's extensive literature review, and the consensus he could come across (e.g. Ali & Wright, 2017; Bada & Olusegun, 2015; Bandura, 1997; Baviskar, et al., 2009; Bayar, 2014; Darling-Hammond, et al., 2017; Day, 1999; Desimone, 2009; Guskey, 2009; Guskey & Yoon, 2009; Johnson & Marx, 2009; King, 2011; Kennedy, 1998; Kennedy, 2014; Kinnucan-Welsch, 2007; Senge, et al., 2000; Simos & Smith, 2017; Vygotsky, 1978; Whitelaw, et al., 2004; Zucker, et al., 1998) on characteristics of transformative and effective PD. Moreover, the way the research questions and their sub-questions were listed helped to generate relevant themes. The researcher combined all the relevant thoughts and answers from each sub-question under topics in separate documents so that he could find agreement on the same topic. Then, the researcher followed the narrative, color-coded agreement on similar topics and extracted relevant quotes. Afterwards, these similar quotes and related ideas which might assist in answering the research questions were highlighted in same colors, coded and combined under similar topics.

The researcher developed a set of themes to answer the three research questions. These themes were generated from interviewed participants' responses. First, the major theme of transformative PD features that Discovery Education "STEM Now" PD model

employs as a transformative model answered the first research question. That first theme has six sub-themes about 1) experiential and active learning, 2) communities of Practice, 3) content and technology-based PD, 4) PD coherence and consistency, 5) PD duration, and 6) expert support. Second, the general theme of “STEM Now” participants’ perceived skills along with its three sub-themes about 1) content knowledge skills, 2) instructional and technological skills, and 3) personal skills answered the second question on “STEM Now” participants’ perceived skills. Third, the theme of future PD encompassing four sub-themes about 1) adopting transformative PD features, 2) instructional leadership roles and expert PD mentoring, 3) PD sustainability, comprehensiveness and incentives, and 4) PD applicability and contextualization answered question four about what works for future PD in Egypt.

### **Findings of Research Question One**

In this section, the collected data from interviews revealed one main theme and six sub themes which answered the first research question about the PD features that Discovery Education “STEM Now” PD model employs as a transformative model (see Table 4). All themes are explained in detail below.

Table 4

*Generated Themes under Research Question One*

Research Question One	Generated Themes
1. What are PD features that Discovery Education “STEM Now” PD model employs as a transformative model?	1. “STEM Now” Transformative PD Features A. Sub Theme One: Experiential and active learning B. Sub Theme Two: Face-to-face and online Communities of Practice C. Sub Theme Three: Content-Based and Technology Supported PD D. Sub Theme Four: PD Consistency and Coherence E. Sub Theme Five: PD Duration F. Sub Theme Six: Expert Support and Follow-up

**Theme one: “STEM Now” transformative features**

Participants agreed that “STEM Now” characteristics were different from all the features of the PD programs they attended before. By means of comparison between “STEM Now” PD model and participants’ previous PD trainings, and their detailed answers to sub-questions from two through six which addressed effective PD features as concluded in the study literature review, participants highlighted and affirmed “STEM Now” effective and transformative characteristics. Participants’ responses emphasized that during their previous PD workshops, they used to be “kept seated”, prefer “back seats”, attend for certificates and release letters, and feel “fed up” with such “boring” trainings (T1A; T4B; T4C) as stated by T4C:

I have first attended “STEM Now” aiming at exploring its approach, but this training has appealed to all my senses and found out that it is not a routine

training which is not suitable for today's students. I have been more engaged in the training and had a hands-on experience (T4C).

Additionally, teachers elaborated on the 'get, attempt and reflect' nature of "STEM Now" PD and its effective and transformative features as explained by T1C:

I had no idea about its details or how to apply its strategies at its beginning and thought of it as sort of mind refresher. Then, I became reflective about the training material and strategies presented to us and started to wonder how to modify these strategies to adapt them to my students and their learning (T1C).

The same notion was asserted by T1A who "learnt from this approach which provoked my thinking all the time about how to make use of such simple and available tools or materials to do my job well." T3A also thought that "STEM Now" workshops were different because "During training we always anticipated something new: information, technology, strategies, or capacity building and this added to our passion to learn and know about each training workshop content."

Not only teachers but principals also confirmed "STEM Now" unique transformative features when P1C commented:

I think if "STEM Now" activities and strategies were applied at schools, students would find school a fun place to learn. It's fun for both the teacher and student because the teacher's job would not be to silence students, but to search for fun activities and engage them in what is taught (P1C).

P1A explained how "STEM Now" focused her attention toward other areas she didn't use to consider as expressed in her words:

Although I attended the training as a principal, I participated actively in doing the strategies which the teachers used in their classes. When we returned to school, I supported teachers in applying the training strategies inside and outside their classes in the school playground or even labs. I encouraged my school teachers to form a community of practice (P1A).

The researcher, who has been a teacher for over twenty years and attended multiple MOE PD trainings, has never witnessed such a similar PD experience to “STEM Now” transformative features such as, active learning, reflections, modeling, expert support from mentors and principals, communities of practice, extended duration, and content and technology-based PD.

### *Sub-theme one: experiential and active learning*

Interviewed participants responded that the workshops had been experiential, engaging and interactive when they were asked generally about the difference between “STEM Now” PD and previous MOE trainings. Therefore, T2C confirmed this belief by reporting that:

The whole program is based on active learning at its core, so its workshops have targeted hands-on implementations of active learning. The training strategies have been presented to us in innovative approaches different from the ways which we have accustomed to doing for years (T2C).

The difference between “STEM Now” PD and participants’ previous trainings was also elaborated on by T3B who thought that:

“STEM Now” practicality was different from other trainings which I attended and was almost theoretical in nature ....We used to have experiential and active workshops in which tasks were assigned to us to practice how strategies could be applied. Then we used to cooperate, hold discussions and reflect on making models of these strategies (T3B).

According to T4B, he got “immersed” into “Web 2.0 tools and hands-on design engineering projects which have put us in students’ shoes and given us an enlightening perspective how students feel accordingly”. But for “STEM Now” “professional trainers” and engaging workshops, T2B and T2C who were seated among teachers from language schools “could sort out the challenge of surviving among teachers from language schools” (T2B; T2C).T1C who used to have shy participation at the beginning of the training, recounted her story with her class:

I tend to be conservative, yet I almost got dragged into behaving as if I were a student who wanted to participate and voice my opinions. I wondered why I was hesitant about applying STEM Now strategies with my students while I enjoyed being in their seat as a trainee during training... The following day was my positive turning point with these students when my students practiced QR code trails and enjoyed it so greatly (T1C).

Having hands-on experience with all “STEM Now” training content enabled all teachers to apply the training message and strategies when they returned back to their schools. In T4B’s words, “I had almost copied most applications in my classes when I returned from trainings”. According to T2B, “during our applications to these strategies at school, students were as fully engaged and active as we had been in our workshops”.

T3C summed it up by mentioning that “teachers who attended the workshops returned back with much more applicable and realistic approaches”.

As stated by teachers above, principals had the same opinion that “STEM Now” PD had been an activity-based experience. Principals affirmed that they “participated actively in doing the strategies which the teachers used in their classes” (P1A). P1C reported that:

During the training we were immersed actively in all the tasks. When we returned back to schools, teachers who attended the training were supported by me to train others. I helped them arrange for these trainings. There was interactivity among teachers and their colleagues which was a shy beginning but later on most teachers started to mimic what others were doing (P1C).

P1B asserted they were encouraged “to play the roles of both teachers and students and gain insights into how best lessons can be delivered and students can learn”. P1B claimed that he “wanted to implement every point and convey the training to our colleagues at school”. P1B and P1C hinted to their workshop immersive experiences in which they applied the same instructional strategies which their teachers employed with their students at schools.

As a PD trainer and mentor, the researcher has clearly seen how principals and teachers were engaged in modeling instructional strategies and digital tools inside workshops and implementing them in their classes or instructing their colleagues on them when they returned from training sessions.

*Sub-theme two: face-to-face and online communities of practice*

The study participants willingly formed in-person communities of practice inside and outside their schools to extend the training message to other teachers and schools that had not attended the initial training. T2C contended that “communities of practice connected teachers and allowed them to exchange experiences and experiments. A lot of teachers were more willing to transfer their knowledge to others and use informal talks as professional learning experiences.”

At their beginnings, communities of practice were so challenging that they took much time to come into existence because other teachers not participating in the program were not convinced by its end goals. In P1C’s view, “It was a shy beginning but later on most teachers started to mimic what others were doing.” T4B justified less acceptance to such communities at its beginnings because:

Before “STEM Now”, communities of practice were routine practices where few teachers used to meet to exchange strategies and take photos. With “STEM Now”, teachers themselves have excitedly asked for regular meetings and exchange of everything that belongs to “STEM Now” applications.

T3B thought his skill to employ Web 2.0 tools and “STEM Now” strategies in different disciplines during the mini-workshops he held for his fellow mates and teachers from outside his schools appealed to them and they “asked for more training during summer holidays” (T3B). T3C had such an open mindset that she invited her colleagues to see for themselves how “STEM Now” strategies and Web 2.0 tools were applied and even her students “were also excited and conveyed the training ideas to their teachers” (T3C).



Interviewed principals gave much boost to these face-to-face communities of practice. According to P1A, “I encouraged my school teachers to form a community of practice with their other fellows at school and in the surrounding schools. We invited these teachers and shared with them the strategies which we learnt during training” (P1A). The same assistance was offered by P1C whose teachers “were supported by me to train others”. T4C asserted that due to the “principal’s support”, he could train all his colleagues at school. P1A and P1C invited officials from Edara (District) to recognize “STEM Now” delegates who succeeded in training not only their colleagues at schools but teachers from Edara schools as well. The researcher was invited to several workshops which the delegates held during summer in-school trainings.

As for online communities of practice, interviewed participants revealed that (DEN) Discovery Education Network and online community on social media played a key role in disseminating “STEM Now’ training best ideas and practices. Participation in DEN online community was seen by principals as a “golden opportunity to exchange experiences, learn from and give feedback to each other” (P1A); an “influential... platform through which we exchanged experience and acquainted with others who might not have attended the training with what we were doing” (P1B); and a means that “urged others to follow their example and little by little many teachers were dragged to that circle of social media interactions” (P1C).

Interactions between T1A and educators everywhere “made me take pride in what I am doing” (T1A). Learning from others and exchanging classroom experience with them were very “informative” (T1C) and the training “big advantages” (T1B). Without being a DEN active member, T2A wouldn’t have had the “skills and advice” he acquired

from exchanging and interacting with others. Sharing posts, comments and in most cases “mentors’ follow-up on what we were posting” increased T2B’s “enthusiasm” to share the best practice; added “a positive empowerment” to T2C; gave “me trust, positive feedback from followers and made me reflective as well” (T3A); and “motivating teachers through professional jealousy to emulate and display best practices” (T3B).

T4C whose school community of practice was not so “advanced or professional,” could find satisfaction and gain “much knowledge” from DEN interactions. Other teachers’ posts on the DEN community “learning platform” “created a sense of reciprocal exchange and collaboration for the benefit of our students and our professional development” (T4B); and “developed my thinking, added to my experience and refined some of my own teaching ideas” (T4A). All participants shared several posts, videos and pictures of “STEM Now” PD applications on DEN Arabia. They made friends and interacted with a lot of educators all over Egypt.

Despite participants’ firm belief in the impact of face-to-face and online communities of practice, they thought that these communities could not arise in a vacuum, i.e. these communities need to be supported and mentored. T2C and T1C asserted that communities of practice might lose momentum unless these communities were recognized, organized, addressed critical educational issues, and followed upon by mentors, principals and other stakeholders.

### ***Sub-theme three: content-based and technology supported PD***

Interviewed teachers agreed that “STEM Now” program addressed science and mathematics. They preferred this subject matter content-based focus. T2B illustrated this

clearly by reporting that “content-based training benefits teachers more than general training which ends up with strategies that don’t fit the content or context of some subjects” (T2B). Similarly, T1A deemed training on science which is her subject matter “more appealing to me as general training”. In like manner, T3C thought that “content-based PD training is more impactful.”

Despite all the interviewed teachers’ arguments for basing PD on subject matter content, they all concluded that “STEM Now” strategies and technological tools could be applicable in all subjects. T1C affirmed that “almost all the strategies that we were trained on can be used in different contexts and with different subjects”. According to T3C, “other disciplines have made use of her discipline strategies and Web 2.0 tools”. T4A used to tell these colleagues they could find something relevant to their subject matter in “STEM Now” training even if they were not science or mathematics.

Additionally, interviewed participants were in favor of utilizing technology as a means to an instructional end not a separate PD focus. All the three interviewed principals highly commended technology integration in the training and its impacts on students. P1B elaborated on employing technological tools in class as a reason for students’ “engagement and enjoyment” and considered their instructional usage as “more rewarding and appealing than focusing on technology itself”. P1A “encouraged students to create accounts and learn” from the digital content on the EKB. The third principal, P1C, emphasized aligning, specifying and applying technology to each discipline when he stated, “from what I saw in classes where technology was used, I think training on technology should be aligned to each subject matter and specify how teachers could apply these technological tools with different topics in different specialties.

T1B, and T2B had a similar past experience in which training on “technology in general... had less impact on my performance as a teacher than “STEM Now” (T2B); and as regards to T1B, MOE training on technology “was theoretical in nature”, whereas “STEM Now” training focused on how to “implement these tools in class” (T1B). T2A affirmed how more “beneficial” teaching technological applications in relation to disciplines could be than direct instruction on technology. T3A and T4C who presented themselves as “expert in technology” and “technology savvy” admired “STEM Now” technology integration in instructional practices. T3A believed that “STEM Now” Web 2.0 tools have been a big addition ....and useful to teachers” (T3A). Technological applications utilized during “STEM Now” were “easy to be implemented for both the teacher and students” (T4C).

But for the idea of “STEM Now” PD “embedding technology in teachers’ training or students’ learning”, teachers might have become “passive ...about the unlikelihood of their applications” (T1C) or had “resistance to the whole program” (T3B). However, training teachers on Web 2.0 applications practically and in relation to their disciplines turned technology to be “available for diverse ability teachers” (T3B) who also got “excited” (T1C) to learn and apply. T3B elaborated on embedding technology in instruction by saying:

“STEM Now” presented technology and Web 2.0 tools as a basic component and not as an add-on or fully technology dedicated program. Without such well-planned combination between strategies and Web 2.0 tools, there might have been resistance to the whole program from those who were less technology oriented (T3B).

Although participants' general consensus toward embedding technology in subject matter content and pedagogy training, only three teachers (T1A, T3C & T4B) were in favor of teaching general technology because T1A assumed that "most elderly teachers ... are almost computer illiterate"; T3C claimed that "specifying training for teachers in general on Web 2.0 tools might be beneficial to technology expert teachers"; and T4B believed that such general training targets "overcoming ... phobia of technology and consolidating such knowledge". T1A and T4C expressed their concern about incomplete technological logistics or capabilities at schools and were hopeful that schools would be provided with enough, functional and up-to-date computers, technological tools, and available internet connections.

### *Sub-theme four: PD consistency and coherence*

"STEM Now" vision and goals were in alignment with other concurrent PD programs like Teachers First. All teachers and principals asserted that both Teachers First and "STEM Now" PD programs had "harmony and coordination" (P1B); "common goals" (P1A); and were not "in complete contrast with their overall visions" (P1C). Participants emphasized the fact that both programs focused on empowering teachers' performance but in different ways. On the one hand, Teachers First focused on disseminating teachers' basic professional behaviors in all disciplines. Moreover, participants were fully aware that both Teachers First and "STEN Now" "had some commonalities" (TA4); and that Teachers First was "consistent in its big ideas with "STEM Now", but it has been theoretical in nature" (T2B). Furthermore, Teachers First three-session workshops were scheduled over three months, weren't content based, and

did not target EKB digital content or supported by mentors' regular visits to schools. However, "STEM Now" targeted science and mathematics teachers, engaged teachers from all disciplines by means of its DEN portal, digital content, and instructional strategies on the EKB, 21<sup>st</sup> century skills, its dissemination of STEM culture as 'student teacher energizing minds', mentors' regular school visits and principals' participation. Therefore, both programs focused on building teachers' capacities but with different features and procedures. T4B elaborated on the "general consistency in general professional development between "STEM Now" and other trainings although "STEM Now" has been more content based". T1C added that "STEM Now" and the Teachers First PD program "were in harmony in their message to maintain teachers' growth but in different methods".

The researcher attended Teachers First PD program and agreed with participants that Teachers First PD program laid foundations of general teaching skills, whereas, "STEM Now" focused on the subject-matter content of science and mathematics in addition to mentors' regular visit to schools, embedding Web 2.0 tools and training on digital content delivery.

Interviewed teachers and principals participating in the study clearly identified "STEM Now" PD program focus on training teachers to deal with the digital content of the Egyptian curricula on the EKB by using research-based strategies and Web 2.0 tools. These strategies and tools were capable of transforming traditional instructional methods and assessing higher thinking skills. P1B assumed that this "connection" among the EKB educational videos, "STEM Now" strategies and the digital tools used for assessment was "obvious". P1A believed her primary school students would do better in case a digital

source like videos on the EKB replaced their textbooks in the future because her students “became more knowledgeable about technology, educational videos on the EKB and their teachers were well trained” (P1A). P1C affirmed that the content on the EKB along with the “STEM Now” instructional strategies and technologies dedicated to teaching digital content were “so curated that they could result in well-prepared students” (P1C).

T1A claimed that her “STEM Now” teaching methods and videos on the EKB “transformed my traditional instruction, direct lecturing and boring lessons into fun lessons” (T1A). T1B clarified more explicitly that:

Training has formed such a considerable consistency among teaching methods, the digital content from the EKB videos and the assessment I do during every class that my students whom I taught last year still remember what they studied last year and this was not the habit with the majority of the students who memorize information and forget about it so fast (T1B).

T2A and T3B viewed the way “STEM Now” PD dealt with curriculum, instruction and assessment as having “consistency” (T3C), being “at the heart of “STEM Now” (T2A) and “interwoven during “STEM Now” training” (T3B). This coherence was achieved by means of relating “what students learn to real life context and ...21st century skills like critical thinking, communication, collaboration and communication” (T3B) and “professional experiential learning, enquiry based learning, engineering design challenges, problem solving techniques, critical thinking, assessment in the form of projects” (T4A). T4B stated that “this consistency in the way we have delivered our STEM Club projects in which the three elements have been on the same wavelength of

digital curriculum for 21st century skill learning, using learner centered strategies and performance-based assessment. T4C also expounded that:

in contrast to my traditional spoon feeding way of teaching,... the need for “STEM Now” pedagogies to deliver this content in an interesting and learner-centered approach has been the training priority. So, students look up more information and challenge me and their mates to solve these challenges. My own way of assessment has been monthly quizzes and end of the year exams, yet with “STEM Now” I have learnt to embed formative assessment during each lesson or at its end and see how effective my teaching is (T4C).

In spite of participants’ consensus on the importance of the EKB digital content, T3C spoke for herself and on behalf of her other teacher colleagues to add digital content to other school disciplines and align instructional approaches to this new digital content. T1C went further and required more interactivity on the EKB platform so that students could practice with the digital content anytime and anywhere as much as what they already do by watching, listening or reading it and their teachers align classroom strategies to fit this content.

### ***Sub-theme five: extended PD duration***

Interviewed principals and teachers thought “STEM Now” extended duration and scheduled workshops at intervals had been to their advantage and assisted in giving them time to experiment with and implement their training content and applications. They regarded scattering workshops at scheduled periods during the school year as “effective” (P1C); “brilliant idea” (T2A); “suitable” (T2C); “practical” (P1A); “rewarding” (T2B); “extremely helpful” (T3B); and “beneficial” (T3C). Giving teachers’ enough time to



“practice”, “apply” and “implement” what they had been trained on after each workshop were almost the common words among most interviewed participants (P1A; T2A; T3A; T4A; P1B; T1B; T2B; T4B; T1C and T3C). T3C reports that “getting Training on strategies periodically and applying them at schools with a continuous follow-up is much beneficial and practical than other programs in which trainees get training for a week or then it is over.”

Interviewed participants gave various reasons why they preferred having workshops at dispersed durations. Distributing workshops at “closer” durations would give a chance to “seek advice on what I have not been able to implement” (T1A), especially “my mentor’s advice if necessary” (T3A); otherwise; the training “might be forgotten with our responsibilities and heavy workload” (P1B). It also helped “to prioritize what to experiment with and what to skip” (T3B). These intervals between workshops enabled teachers to have “hands-on experience and master its [training] applications; otherwise, I would get overwhelmed, lose my concentration and some practices or ideas might not be covered efficiently” (T4A). T4B admired the idea that he “could not have imagined myself for example taking all the “STEM Now” content in say a week and going to school to implement what I was taught.” T1C illustrated how crucial extensive PD scheduling by stating:

Being trained and given enough time to practice, experiment and test with the new strategies worked so remarkably with me that I have been more reflective and keen to jot down every detail to try it out with my students. I think this process is more beneficial than getting intensive training without being given opportunities to evaluate its efficiency. I am against training during summer vacations as there

will be no students implement training with them and I might forget that training material (T1C).

T1B, T3B and T1C highlighted the words: “reflect and reflective” as they believed interval periods between trainings would give them opportunities to adopt, adapt or change the strategies which they learnt during training and implemented in classes.

T1A and P1C favored extensive PD period but were not in favor of other participants’ opinions of holding training during working school days because of teachers’ heavy workload. T1A think summer holidays were the best fit while P1C believed that non-working days during school year might be the best times for training on condition that teachers were financially compensated.

### ***Sub-theme six: expert support and follow up***

Interviewed principals and teachers’ responses highly appreciated “STEM Now” mentorship which followed each training module and was “not the traditional way of supervision which focuses on paper work and syllabus coverage, but ... guides us and updates us on the latest pedagogies” (T1B). In a principal’s view, “STEM Now” mentors:

...didn’t attend to school to find out mistakes, but to support and encourage other teachers...[and] impact students as well because if teachers were not stressed out by inspection policies or supervisors’ traditional paper work demands, they would be creative inside classes, be attracted attend to school again and enjoy learning (P1C).

T3B claimed that mentor’s visits were “less stressful than what I used to have with traditional supervision”. T4B resembled the mentor’s visit to his classes as “a sort of

instructional vitamin of encouragement and motivation without which I might lose momentum and passion to sustainably and professionally develop. T1A highlighted the strong relationship between her and her mentor which was not built on “enforcement or critiquing”, but “respect and learning from him”. Similarly, T2C asserted that “the trust our mentor has put in our efforts has given us a boost to keep up excellent work”. T1C confirmed this concept as she thought “STEM Now” trainers were not living in “an ivory and ideal tower” because they got their perspectives from the “field” by visiting them in classes.

Mentor’s visits to schools after each workshop were viewed as 1) “motivating” and offering “consultation or support” (T1B); 2) consolidating training; and without which “I would have definitely forgotten about lots of this training” (T4B); 3) opportunities for sharing “other teachers’ takeaways and solutions” (T1C); 4) occasions for raising “morale”, showing “care” and without which “ideas might not be put into practice as intended and teachers might lose momentum” (T2A); 5) accountability “for executing the action plans we have agreed upon” (T2B); 6) “fruitful ...abundant in positivity ... encouraging” (T3B); 7) “indescribable” in being taken seriously from all the school teachers (T3C); 8) “pivotal in explaining or answering our questions” (T4C).

Interviewed principals also commended the role played by “STEM Now” mentor which varied from “facilitating to my teachers what they might not understand or apply well” (P1A); or “assisting teachers in reaching their planned and desired goals” (P1B); to “learn [ing] from him, attend[ing] the refreshing training he might hold or accompany[ing] him during his visits” (P1C).

Nevertheless, few interviewed participants pinpointed the fact that reducing mentors' number of visits or stopping them negatively "affected our momentum and enthusiasm" (T3A). Likewise, T4B "felt so attached to my mentor that once he has other duties and taken longer times to visit us at school, I got less motivated and needed his support".

Interviewed principals and teachers commented positively on principals' participation in "STEM Now" PD program with their teachers. Getting acquainted with what their teachers had taken during the training and applied in their classes represented the minimum benefit the three interviewed principals gained. As stated by T3A, "principals need to be convinced of the philosophy of change in order to support teachers; otherwise, teachers will find it hard to apply any training ideas". As a result of a principal's being "well informed... convinced.... and engaged", his teacher trainees "got empowered and got credited at the Edara level for our big achievement in building a big community of practice and obtaining a "Hub School" title" (T4C).

The three principals appreciated the training benefit from which they "could follow up on my teachers, encourage them and know what they were doing inside their classes" (P1A). To P1C, "STEM Now" training could "raise my awareness about the training content and get me updated on what the teachers do inside classes and students' reactions". P1B praised her "being engaged during workshops [which] allowed us to play the roles of both teachers and students and gain insights into how best lessons can be delivered and students can learn. Despite the long years of experience as teachers and principals which the three principals had, "STEM Now" program added to their instructional skills to "assess which strategies were working and how I could support my

teachers or suggest a different strategy to fit their students' learning styles" (P1A). In P1C's own words, "STEM Now" program highlighted my instructional role and paid my attention to the fact that students' enjoyment of their learning could be an important catalyst in the success of any school management". Therefore, this (P1C) principal had much more understanding to emphasize that:

Collaborative work...[which] engaged students and transformed their passive learning into active participation and having their voices heard than caring too much .. about disciplining students and making them sit still and keep silent as the sign of respect and good learning (P1C).

P1A, P1B and P1C reflected on their pictures and videos while getting involved in PD session hands-on activities and their engagement at schools while helping teachers put the PD strategies into practice.

As for interviewed teachers, they all thought positively of principals' sharing the "STEM Now" journey with them. Principals' participation made them "fully aware of" (T2B), and "fully understand" (T1A) the training content; be "supportive" (T1B and T3B); be encouraged "to apply new technological applications by allowing my students to use their mobile during Kahoot classes" (T2A); help to "sort out problems" (T2C); "scaffold and be in the back of their teachers to assist and support" (T4B); (T3C); and "understand changes that the PD might make" (T3B).

Without the principal's attending the training and support when the teachers return back to schools, "he would have been a big obstacle"; therefore, he understood why students needed to bring their smart cellphones to schools although they were prohibited and also realized "why my students make noise or want to leave the class to do

outdoor class activities” (T1B). T1A recounted the story of her “STEM Now” colleague who was on a loan to another school and “suffered a lot because there had been no support from that principal [who didn’t attend the training] but critiquing and misunderstanding to what she was doing in her class” (T1A).

### Findings of Research Question Two

In this section, the gathered data from interviews revealed one main theme and three sub themes that answered the second research question about the perceived skills in Discovery Education “STEM Now” transformative PD model. (See Table 5). All themes are explained in detail below.

Table 5

*Generated Themes under Research Question Two*

Research Question Two	Generated Themes
2. What are participant’s perceived skills, motivation, and continuous professional learning opportunities in Discovery Education “STEM Now” transformative PD model?	1. Theme One: “STEM Now” Participant’s Perceived Skills A) Sub Theme One: Content Knowledge Skills B) Sub-Theme Two: Instructional and Technological Skills C) Sub-Theme Three: Personal Skills

#### **Theme one: “STEM Now” participants’ perceived skills**

Interviewed participants revealed common consensus on an array of content, instructional, technological, and personal skills perceived during “SETM Now” PD. (T2C) considered “STEM Now” program “as a tree giving fruit little by little but it yields

quality fruit”. Principals assured that “STEM Now” training was so “positive” (P1A) and gave them such a “positive energy” (P1C) that without attending it, they couldn’t have understood, supported, encouraged their teachers, “gained all these new experiences or got excited about implementing them” (P1C). (T1A) recounted her experience as follows:

I used to think that Egyptian teachers are miles away from foreign teachers’ professionalism” but “STEM Now” training ....provoked my thinking all the time about how to make use of such simple and available tools or materials to do my job well.(T1A)

From teachers’ responses, it was also clear that “STEM Now” PD program meant a lot to their professional and academic career as educators (T4A & T4B). T2B assumed that “STEM Now” “made a huge difference in my skills, style of teaching, technological creativity and implementations” (T2B). During the two-year program, T3B gained an equivalent of his “20 years of repetitive experience” (T3B). “STEM Now” PD experience had been appealing to all three principals as indicated by P1A who thought it “added a lot to my skills as a principal.”

There were other “STEM Now” program skill improvements as recorded by T1C whose “motivation to read and search more” increased; T1B whose “motivation and self-esteem” were strengthened; T2A whose “instructional performance skills have improved”; T3B whose “personality and professionalism” got rid of “the boredom which has engulfed the whole education system and fixed teachers’ mindsets”; T4B whose “presentation skills have given me much self-esteem. ...[and] transformed me from an amateur teacher into a professional teacher who seeks for learning and developing”; T3A who “have become more self-confident .... more logical. .... more communicative and

interactive with people”; T1B, T3C and T2A whose “self-confidence has increased so greatly that I have obtained a new identity as a teacher in its full sense”; T2B who “was so much motivated”

### ***Sub theme one: content knowledge skills***

“STEM Now” encouraged participating teachers “to academically consolidate my content knowledge” (T4A); urged them to be “well informed about my specialty, open minded (T3C); and empowered (T1B)’s “content skills.” There were other “STEM Now” program skill improvements as recorded by T1C whose interest and “motivation to read and search more” didn’t only increase, but “the program biggest achievement was encouraging her students to be knowledge seekers” as well. (T1C). T1A pinpointed that “STEM Now” ... has refreshed my knowledge”. T4C elaborated on the fact that “the EKB with its digital content has been used by my students” and I made use of its aligned, research-based instructional strategies to teach this content. P1A “encouraged students to create accounts and learn from these videos at home” although the school was located in an impoverished area. When the researcher wondered how such poor students had access to the internet, P1A recalled that she asked parents to access the EKB from their smart phones, help their children log in , and watch the EKB digital content.

### ***Sub-theme two: instructional and technological skills***

T3B deemed that “STEM Now” “armed me with the knowledge and strategies and by doing so it has saved my personal efforts and time and advanced my



professionalism.” It instructed participants on ways to “look for application to what is being taught in class” (T1A); prioritized “technology in practice .... [as] more important than having theoretical knowledge” (T4C); and “sowed the seed of keeping up with the latest trends” (T3C). “STEM Now” training also “developed my own way of teaching” (T2C), “updated me with all the new technologies” (T3C), and empowered T1B’s pedagogical skills.

Interviewed teachers claimed that without participating in “STEM Now” PD, they would have “ [been] traditional teachers feeding students and dictating them what is written in their textbook without any creativity or change” (T1A); “been following my old methods of teaching” (T1C); “[been] the same traditional teacher who used to do the same routine for over 20 years” (T2A); and “missed the most empowering PD chance in my career” (T4A).”

Because of these new practices, (T4C) also learnt that traditional “spoon-feeding is ineffective” in education. As simply but thoughtfully described by (T4C), the impact with “STEM Now” strategies is so engaging that “I got the habit of moving everywhere in the class” (T4C). P1B and P1A considered technology and its integration in the training as a “new addition” (P1A) and a “great lesson” (P1B).

P1B viewed participation in this program as being “an unprecedented experience” and made her “knowledgeable and better informed” about the instructional strategies learnt during the training and applied by her teachers in classrooms. Principal (P1C) felt so “impressed and positive” that he concluded that “if “STEM Now” activities and strategies were applied at schools, students would find school a fun place to learn.”

According to (T2A), “STEM Now” training turned teachers into reflective thinkers about their own ways of teaching. T1C elaborated on this finding by saying “I became reflective about the training material and strategies presented to us and started to wonder how to modify these strategies to adapt them to my students and their learning.” T1B highlighted such an “indefinite appeal created” in his students towards his new ways of teaching that “students have liked my own way of teaching and have been interested in science more” (T1B). (T1A)’s “students wait passionately for my classes and never want to leave the lab after the lesson finishes.” (T4C)’s students “used to make absences on certain days, but with “STEM Now” strategies, my students used to attend my classes and never miss any of them” (T4C). T3B claimed that the “impact of this program on my students has been immense” (T3B).

Several interviewed participants described the positive impacts of “STEM Now” training on their classroom practices. (T2A) reported that “my new way of teaching tamed one of the most troublemaking classes who had entirely changed into smart kids due to the “STEM Now” strategies which I have applied with them.” (T1B) contended that “my students started being interested in how I was teaching and never made absence from classes I was assigned to teach them ... [They] appreciated me and the subject matter so much. It has been fun for both me and my students. T4B had the similar results with “grade nine students who used to study at home [but] became passionate and interested in attending to school.” Furthermore, (T4B) thought that he enjoyed “teaching with a new taste of “STEM Now” by embedding its application during my instruction so professionally and efficiently” and this shift encouraged students from other classes to

attend his class. (T2B) contended that “STEM Now” training “made a huge difference in.... classroom performance” (T2B).

### *Sub-theme three: personal skills*

Interviewed teachers contended that “STEM Now” training helped teachers acquire “skills” (T4A & T1A) “including those critical thinking and creativity skills ... which required defining problems, finding solutions, and testing them.” (T4A) believed “STEM Now” added a “sense of collaboration for learning and development”. T4B illustrated how to “STEM Now” helped him “be more communicative with my students and my colleagues” (T4B); instilled in teachers how to “have personal interest in them [students] as humans and they must express themselves in different ways not just memorizing knowledge” (T4C).

T2C revealed that “STEM Now” helped her “to be creative, and curious to develop my career” (T2C). T3A confirmed that “STEM Now” boosted “creativity....[and] logical thinking and broadened my horizon” (T3A). “Opening the opportunity windows for me to be curious and innovative” were T3C’s words in recognizing “STEM Now” additions to her. According to T1A, “STEM Now” “assisted me in getting rid of the feeling of depression arising from doing the same job in the same way for 20 years”.

T1B’s “motivation and self-esteem” were strengthened; T3B’s “personality and professionalism” got rid of “the boredom which has engulfed the whole education system and fixed teachers’ mindsets”; T4B’s “presentation skills have given me much self-esteem....[and] transformed me from an amateur teacher into a professional teacher who

seeks for learning and developing”; T3A “have become more self-confident ....more logical. .... more communicative and interactive with people”; T1B, T3C and T2A’s “self-confidence has increased so greatly that I have obtained a new identity as a teacher in its full sense”; and T2B became “so much motivated.”

It did not take participants a long time to realize how different “STEM Now” PD had been. P1C expounded that “after the first hour of my training had passed, I felt that such training could solve education problems in Egypt.” This principal was addressing the problem of favoring private tutoring and evading schools which might be sorted out, in P1C’s view, by applying “STEM Now” PD program fun activities and strategies which transform teachers’ jobs from silencing students, or covering syllabus into “search[ing] for fun activities and engag[ing] them in what is taught. ... The teacher was not just doing a task but presenting an atmosphere of attraction to students.” (P1C). T1B took pride in his assumption that his students “trust me and ask me for advice and support” and that “smart students and even weaker ones have become more creative” (T1B). T1C had a realization that “having rapport with students, turning learning into fun, and making my students self-directed to learning came true with “STEM Now” program” (T1C). Because of his mathematical mindset, T2A presumed statistically that with the help of “STEM Now”, “I have acquired the needed skills that have enabled me to increase students’ affection to me from 60% into 90%.”

### Findings of Research Question Three

In this section, the gathered data from interviews revealed one main theme and six sub-themes about interviewed participants' suggestions for future PD programs based on their experience with "STEM Now Egypt" PD model that answered the third research question (see Table 6).

Table 6

#### *Generated Themes under Research Question Three*

Research Question Three	Generated Themes
3. What are participants' suggestions for future PD programs based on their experience with "STEM Now Egypt" PD model?	1. Future PD Programs  A) Sub Theme One: Adopting Transformative PD Features B) Sub Theme Two: Instructional Leadership Roles and Expert PD Mentoring C) Sub Theme Three: PD Sustainability, Comprehensiveness and Incentives D) Sub Theme Four: PD Applicability and Contextualization

#### **Theme one: future PD programs**

What works for future PD programs in Egypt was revealed in participants' responses all through the interviews. Their opinions were sought and their ideas were pooled for some future recommendations based on their participation in "STEM Now" PD. Interviewed participants' experiences with "STEM Now" paid their attention to several elements in "STEM Now" transformative PD features. The researcher maintained consistency in generating participants' views with the study guiding theory, literature

review and participants' exact words during interviews. These recommendations were generated in the following sub-themes:

### *Sub theme one: adopting transformative PD features*

Interviewed participants' recommendations tended toward technology-oriented trainings which address more technology applications in disciplines than general training on technology. According to (P1A), "I think curating technology and training to the needs of the curriculum and students is what matter the most to students and their teachers' training will prepare them and provide them with the needed skills to deliver such content."

T1A, T3A, T3B, T3C and T4C suggested that technology be a basic component of future training programs by being embedded in subject matter instruction. According to T3B, "strategies along with some technological tools need to be presented together during future PD programs". Similarly, T3C hopes that "technology and specific PD goals need to be included in future PD programs in Egypt". T3A also recommends that technology be "at the heart" (T3A) and "basic characteristics" (T3C) of PD programs along with instructional "strategies as well" (T3A). T4C holds that "applying technology in relation to real context is an advantage." Although T1A prefers "keeping abreast with new technological advances", she needs "provide[ing] schools in less advantaged areas with necessary logistics to make technology accessible and available to both teachers and students." In agreement to that suggestion, T4A prioritizes "resources, [and] internet connectivity."

### ***Sub theme two: instructional leadership roles and expert PD mentoring***

Instructional leadership as a part of “STEM Now” program in which principals were trained side by side with teachers “will increase their skills and potentials to interact with teachers, support, guide, and motivate them” (P1B). The same principal seconded the idea that “training both principals and supervisors on the same strategies which their teachers apply is a considerable empowerment and pillar of building capacity” (P1B). That same point was echoed by P1C who thought of “having principals attend the training and getting them engaged like students and teachers ... [as] advantageous to... students, teachers and our roles as principals”(P1C).

Having a “mentor in charge of training and following up the whole school all over the school year” (P1C) is worth being a PD program pillar. In like manner, T3C’s idea to “mentor trainees and follow up on training implementations” is a great addition to any PD program. T1C believed “mentorship is very effective but with unscheduled visits” and T1C also supports the idea of “exchanging school visits systematically among schools to have a close picture on how these schools work in reality” (T1C). T2B claimed that mentors’ “follow-up visits can ensure and yield the best results.” T3A admitted that “follow up is also essential”. T4B wished “mentoring would be in effect as its follow-up on their periodic training would empower teachers.”

### ***Sub theme three: PD sustainability, comprehensiveness and financial incentives***

“Scheduling workshops at reasonable intervals which accommodate enough time for practice and reflection” (T2B) is key to PD success. According to T1C, “PD timing

needs to be during school year as teachers need time for practice”. As a school principal who might be suffering from teachers’ PD frequent releases during school year suggests holding PD sessions during days off or “after school time” (P1C). “Extending training at intervals to allow teacher to get enough time for practice is also a PD priority” (T4A).

T2A’s insight that “PD sustainability which starts off enthusiastically and gradually vanishes” needs to be based on “STEM Now” program “strong instructional foundations, ....[and] creativity” (T2A). This sustainability was stipulated by T2C’s hope that “other PD providers’ programs ....[need to]...be unified in the MOE PD programs.” In the meantime, T4C hoped “STEM Now” will “become a wide country initiative and not focus only on Greater Cairo”. T3B also hoped that “STEM Now” Egypt needs to target all teachers all over Egypt because I think it will appeal to teachers and students as well”. According to T3C, PD programs need to have “a specific goal with a well-planned perspective”. In this regard, T4B wished “other programs would be one step in advance of up-to-date approaches to keep teachers well-informed and efficiently qualified for tomorrow’s requirement.” Making it accessible for teachers to “participate in different PD programs in different aspects of their development....helps...teachers professionally change and develop, [and] students improve and make progress” (T2C).

P1C calls for having teachers “incentivized, or reduce teachers’ workload” in case they attend training during their days off. T2A agreed on “incentivizing ....[teachers’] achievements and progress” and “measuring and evaluating teachers’ performance”(T2A). T3A recommended that “trainees need incentives”. T2C held that “if the Ministry of Education gives due care to training and makes teacher at the heart of interest and reform, teachers will be welcoming to the idea of PD....[as] the teacher is the



Ministry weapon in making its reform a success”. “Crediting teacher trainees is encouraging to them and needs to be in practice all the time” (T4C).

### *Sub theme four: PD applicability and contextualization*

What matters most to interviewed participants and T4A is “hands-on practice ...[not] theoretical lecturing when it comes to training.” T4A reports that “experiential learning needs to be essence of all future PD programs because lecturing might pass unnoticed, but learning by doing will be memorable and more applicable in classes.” Training also needs to capitalize on “content applicability” (T2B). T1A commends “contextualizing what is being taught and learnt....adopting and implementing learning for fun”. In T1B’s opinion, similar trainings like STEM training “has had a positive impact on my career....[because of] active learning during the training and modeling strategies on us as if we were students.” T1C’s preference to “communities of practice ... face to face interactions” and extending “reflection during training time” are practical vehicles for experience exchange.

Because of their contact with student teachers during their practicum at their schools T1A and T1B believed the necessity of “ embedding such programs in their preparation programs” (T1A) and the need to “learn about teaching in their college programs as we have done with “STEM Now” (T1B).

## **Chapter 5. Discussion**

The study aimed to explore features of “STEM Now Egypt” PD program as a transformative PD model. Additionally, it examined participants’ perceived skills during “STEM Now” PD. Furthermore, it made some recommendations for future PD programs in Egypt. The main findings of the study indicated that interviewed teachers and principals participating in the study had common perspectives toward the “STEM Now Egypt” PD program transformative features, skills, and continuous professional learning opportunities. Their recommendations for future PD based on their “STEM Now Egypt” program experience are appropriate for transforming future PD models in Egypt as discussed in this section.

Participants’ perspectives were in alignment with this study constructivist theoretical framework regarding its implications on how teachers teach and learn to teach and other studies such as, (Bada & Olusegun, 2015; Baviskar, et al., 2009; Bayar, 2014; Day, 1999; Kinnucan-Welsch, 2007; Senge, et al., 2000; Vygotsky, 1978; Zucker, et al., 1998). Interviewed teachers and principals in this study reported the same PD constructivist principles illustrated by Drago-Severson (2006) and as discussed below.

First, the PD active learning phase was present in “STEM Now” extended and experiential workshops in which teachers and principals were immersed in an active learning environment where they had hands-on practice on all the strategies, protocols, 21<sup>st</sup> century skills, project-based learning, and Web 2.0 tools. Teachers acted as if they were students during workshops. What gave boost to this notion was the structure on which every training module and even every segment was designed. Modules and segments flow from general exploration and prior knowledge brainstorming to hands-on

practice and finally to reflections. Connection to practice was a basic constituent of each instructional strategy, project-based learning activity or Web 2.0 tool.

Second the networking PD phase was crystal clear in “STEM Now” focus groups and Discovery Education Network (DEN) online communities which helped teachers share knowledge with others and reflect on their own practices to construct meanings out of past and current experiences. Since teachers and principals mastered training concepts and practices and modeled them during workshops, they became capable of sharing them with a wider audience of colleagues inside or outside their schools and all over Egypt via DEN online communities.

Third, the self-mentoring and reflective PD phase was demonstrated in the way “STEM Now” PD participants reflected on their practices using multiple conversation and coaching protocols. These reflections were conducted by applying success analysis protocols which gave trainees opportunities to reflect on their successful practices, micro-lab protocols which structured trainees’ speaking and listening skills, fish bowl protocols which modelled how best conversations and questioning techniques could be delivered, divide and slide instructional strategy protocol which allowed trainees to interact in a timely and structured manner, and the comfort zone protocols which nurtured risk-taking experiences, initiatives and thoughts.

In agreement with studies by (Baviskar, et al., 2009; Bada & Olusegun, 2015; Schrader, 2015), the present study findings imply that constructivist learning engages teachers in exploring prior knowledge, hands-on practice, modeling instructional practices and technological applications, working collaboratively, reflecting on PD content, and connecting it to practice. In the same respect, “STEM Now” program also

implemented Kinnucan-Welsch's (2007) constructivist considerations which yield transformative PD results by acknowledging teachers as learners behaving as if they were students during workshops; having principals and mentors' scaffold and support their teachers; and constructing meaningful experiences out of the PD real life applicability. "STEM Now" PD program conclusions are also similar to Bada and Olusegun (2015), Mukan, et al. (2017) and Kinnucan-Welsch's (2007) findings in in which teachers as adult learners actively construct their own knowledge by adopting new experiences, adapting these experiences to their work context, or even rejecting both, along with deep understanding, ongoing support, and engagement. Moreover, participants' digital artifacts and the researcher's role as a PD trainer and mentor asserted "STEM Now" workshops as being active, engaging, interactive, and collaborative to both teachers, and principals.

In alignment with "STEM Now" participants' perceived skills and in accordance with Bandura's (1997) reference to self-efficacy, participants revealed that "STEM Now" increased their self-confidence in turning their teaching into fun and they confidently expected that it would appeal to students. In examining PD virtual communities which were "STEM Now" PD pillars along with face-to-face communities, King (2011) reveals that transformative PD can be brought about by providing a similar "STEM Now" secure and supportive learning environment in a socially constructed context. Mentoring, which is another basic component in "STEM Now" PD is believed to transform teaching practices if it is applied as continued growth experience not as remediation (Simos & Smith, 2017).

According to a body of research which capitalized on PD perceived skills (Colbert, Brown, Choi & Thomas, 2008; Darling-Hammond, 2000; Desimone, 2009),

interviewed teachers and principals claimed that “STEM Now” PD program so positively influenced their content knowledge, instructional, technological and personal motivation, and self-confidence skills that they could make their schools and classes attractive to smart students. This attraction can be ignited by “STEM Now” focus on the 21<sup>st</sup> century skills, latest research-based instructional strategies, the EKB digital content, and Web 2.0 tools such as, Kahoot, Plickers, Padlet, QR codes, AnsweGarden, WordCloud, Popplet, Google forms, etc. Troublemaker students found “STEM Now” classroom practices so appealing that they used to show up at schools once they knew their teachers would use Web 2.0 tools or “STEM Now” instructional strategies.

According to interviewed participants’ responses which coincided with Desimone’s (2009) PD model and other studies (Opfer and Pedder, 2011; Heller, et al., 2012; de las Alas, & Smith, 2007; Roth, et al., 2011), “STEM Now” PD program impacted teachers’ and principals’ knowledge, skills, motivation and professional learning network so powerfully that they could cascade the training content with almost no funding, bear with critiques from their colleagues or students’ parents, solve slow internet connections, and create an extended social media network to post their best practices and exchange knowledge and experience with others.

“STEM Now” coherent approaches aligned to newly developed EKB digital content by employing research-based instructional strategies, formative and higher thinking assessment techniques echoed Fullan’s (2007) findings that PD could be an important catalyst in reducing the new change pressure and focusing people’s attention on the reform valuable components along with other important elements. “STEM Now” PD educators were among the strong believers in the validity of the EKB digital content

because the PD trainings taught them how to make use of its resources. Hence, “STEM Now” PD was inclusive in updating teachers’ skills with downloadable instructional strategies hosted in Discovery Education portal on the EKB. These strategies were provided with videos which explain how these strategies can be applied. Formative assessment strategies, questioning formulating techniques and adopting Web 2.0 tools to assess students’ progress were basic components of “STEM Now” PD program. As a result, “STEM Now” PD program exemplified a coherent treatment to the EKB digital content, methods of teaching this content and means of assessing it. Similarly, Garet, et al. (2001) and Guskey’s (2002) findings are reflected in the way “STEM Now” PD program empowered PD consistency in what and how teachers teach from various resources, such as the EKB, and its aligned research-based strategies.

“STEM Now” PD program features concur with Kennedy’s (2014) definition of the transformative PD model as a ‘get, attempt, and reflect’ model. According to Kennedy’s (2014) model, “STEM Now” PD model can be claimed to be transformational in its in-person and online PLCs, activity-based workshops, scaffolding mentoring and follow-up, cascading training, reflection, modeling, extended duration, technology-oriented training, and content-based focus.

The present research findings echoed findings of other studies (e.g. Ali & Wright, 2017; Bada & Olusegun, 2015; Bandura, 1997; Baviskar, et al., 2009; Bayar, 2014; Darling-Hammond, et al., 2017; Day, 1999; Desimone, 2009; Guskey, 2009; Guskey & Yoon, 2009; Johnson & Marx, 2009; King, 2011; Kennedy, 1998; Kennedy, 2014; Kinnucan-Welsch, 2007; Senge, et al., 2000; Simos & Smith, 2017; Vygotsky, 1978; Whitelaw, et al., 2004; Zucker, et al., 1998) on what transforms and works well for

PD. “STEM Now” PD features reflect the qualitative and quantitative research consensus reached by (Desimone, 2009; Garet, et al., 2001) on PD effectiveness studies. Among “STEM Now” transformative PD characteristics are multiple forms of experiential training delivery modes, follow-up mentoring, extensive duration of PD activities, teachers’ professional communities of learning, teachers’ engagement in active learning, PD consistency with other reforms, PD focus on content, pedagogy, reflection, discussions, engagement in online activities, and action research. “STEM Now’s” transformative characteristics are similar to the research by Mukan, et al. (2017) as displayed in integrating instructional theories and classroom practice, team work support, and real change in teachers’ classroom performance. Interviewed participants confirmed Bayar’s (2014) findings that collaboration, extending training over sufficient time and well-prepared trainers are effective PD features.

Expert support and follow-up mentoring, which was a major “STEM Now” PD transformative feature, presented an instructional supervision model appreciated by all the interviewed participants and matched other studies by (Beaudry, 2011; Pitton, 2006; Kennedy, 2014; Hirsh, 2009; Kinnucan-Welsch, 2007; Beaudry, 2011; Vula, Berisha, & Saqipi, 2015). Similar to the findings of these studies, “STEM Now’s” mentor’s role was not to inspect for mistakes, but to coach, assist, explain, effectively listen, and constructively give feedback. Furthermore, study findings conform to Mathur, Gehrke and Kim (2013) and Sewilam, et al.’s (2015) research findings in which effective mentoring depends on the frequency of contact and PD trainers’ long-term follow-up school visits following PD sessions. Mentor’s visits to schools after each workshop were motivating, giving opportunities for consultations and support, consolidating the

implementation of PD content, boosting experience and knowledge exchange, and finding solutions to common challenges.

Reflection is also a major “STEM Now” PD transformation which resonated Beaudry’s (2011) notion of action research as an application which is more effective than workshops because it practically tackles several traditional issues of concern and finds solutions to them. Every training module and its segments were designed to end up with reflections on the PD content and practices. “STEM Now” participants were asked to connect and contextualize the PD activities or tools with classroom or school practices. They were also required to wrap up every training module with “I will” statements in which trainees change modules’ learning objectives into actionable behaviors. Moreover, PD modules engage participants in reflective protocols in which they recount their success stories and utilize questioning techniques as in success analysis protocols, state their challenges and how to solve them as in comfort zone protocols, and employ knowledge sharing while maintain active listening as in micro-lab, divide and slide and fish bowl protocols

Similar to Kennedy’s (2014) study findings about principals’ sharing the same training experiences with their teachers, “STEM Now” PD program highly valued this partnership as a key transformative PD feature. Teachers were supported by principals who regard instructional leadership as vital as administrative leadership. All “STEM Now” participants’ views match other findings by (Thompson, Gregg and Niska, 2004; Boreham, 2004). Principals were put in their teachers’ and students’ shoes during training and this helped them gain insight into how best classrooms need to look like. Principals also benefited from the PD content which touched on coaching and mentoring skills



through which principals learnt to be effective listeners, give constructive feedback, build on successes, and work collaboratively with their teachers.

The study findings also echo Schrader's (2015) conclusions that technological and social media could be used for transformative PD purposes. Participation in DEN online community was so inclusive that educators from different backgrounds, and grades all over Egypt networked together and exchanged their experiences.

Vygotsky's studies on teachers' collaboration with their peers and knowledgeable others as a zone of proximal development (Vygotsky, 1978) in addition to (Kinnucan-Welsch, 2007; Keiny, 2008; Albert, 2012) research findings are similar to "STEM Now" communities of practice in this study in which the connected educator was a basic PD component and requirement. This study also affirms (Kennedy, 2014; Pellini & Bredenberg, 2015; Nolan & Hoover, 2011; Mukan, et al., 2017) study conclusions that the positive learning and teaching environment created by PLCS, and experience sharing is pivotal for teachers' development. "STEM Now" PD program PLCs were not only limited to school or Edara (District) educators, but were also so extensive that educators from all over Egypt joined DEN online communities in which they exchanged best practices and experiences. DEN online community, as a social media platform, played crucial roles in sustaining a strong PLC.

There is agreement between findings in this study and other studies by Beaudry (2011) and Kinnucan-Welsch (2007) that dispersing PD over substantial periods of time increases PD efficacy and allows teachers to explore, test and adopt the training theories and practices. Extending "STEM Now" PD program over two years in which the first year, the PD training modules plus mentoring were scheduled at intervals and the second

year was dedicated to mentoring. Participants were given opportunities and time to put into practice and test the PD training content.

Embedding technological applications as displayed in Web 2.0 tools, the EKB digital content and “STEM Now” instructional strategies in “STEM Now” PD content helped the interviewed participants make the best use of their PD activities and resonated what Beaudry (2011) established in his study as well. Participants didn’t learn about technology in isolation but in relation to what they teach and use. Despite slow or absence of internet connections and not being savvy about technology in general, participants were motivated to utilize EKB resources and the Web 2.0 tools and overcome arising challenges. They used the off-line application download capability to download videos from the EKB at home and use them inside classes.

## **Chapter 6. Conclusions and Recommendations**

### **Conclusions**

This study reveals that the transformative PD models of which “STEM Now” is an example are based on the ‘get, attempt, and reflect’ PD mode, applying constructivist principles, such as active learning, reflection, modeling, communities of practice, mentor’s scaffolding, and engaging teachers in ongoing reflection on beliefs and attitudes to transform practices, assumptions, skills and perspectives (Ali & Wright, 2017; Whitelaw, et al., 2004; Johnson & Marx, 2009; Simos & Smith, 2017; King, 2011; Bandura, 1997). Therefore, this phenomenological study explores “STEM Now” participants’ experiences and perspectives on the transformative PD characteristics of “STEM Now” PD model which were concluded by a body of research (e.g. Darling-Hammond, et al., 2017; Desimone, 2009; Guskey, 2009; Guskey & Yoon, 2009; Kennedy, 1998; Kennedy, 2014), and the literature review of constructivist PD principles (e.g. Bada & Olusegun, 2015; Baviskar, et al., 2009; Bayar, 2014; Kinnucan-Welsch, 2007; Senge, et al., 2000; Day, 1999; Zucker, et al., 1998; Vygotsky, 1978).

For this reason, fifteen participant teachers and principals from fifteen different schools out of the one hundred schools piloting “STEM Now” PD program in Greater Cairo schools in Egypt were selected to take part in semi-structured interviews. As a result, the study findings reflected general participants’ positive agreement and perspectives on what works for a transformative PD model in the light of their participation in “STEM Now Egypt” PD program. Based on these findings, participants’ conclusions and recommendations for future PD programs in Egypt were introduced.

Among the transformative PD experiences implicated from this study is PD activity-based experiential learning in which teachers, principals, and mentors are immersed in hands-on instructional practices which replicate what is expected to be followed at schools and delivered in classrooms. Moreover, mentoring and principals' participation in PD programs side by side with teachers set high standards of new instructional leadership based on trust, respect, encouragement and experience exchange, and are viewed as major transformative features in this study. Principals' sharing the same training journey with their teachers present a new model in which both teachers and the administrators share responsibilities (Kennedy, 2014; Rhodes & Beneicke, 2003).

In addition, scaffolding PD programs through face-to-face communities of practice and other online communities gives a boost to transforming PD programs and extending informal professional learning networks. "STEM Now" DEN online communities transformed technology-supported collaboration and social learning contexts which lend themselves to constructivist perspectives and enrich teachers' professional learning (Tam, 2000).

Furthermore, embedding Web 2.0 technological tools in the "STEM Now" PD research-based instructional strategies, EKB digital curricula and tools of assessing the 21<sup>st</sup> century skills has empowered participants' capabilities and highlighted "STEM Now" PD program ways of addressing instruction, digital content and assessment.

Other transformative and effective PD characteristics concluded by this study is scheduling training over extended periods to help PD participants 'get, attempt and reflect' on what they have been taught. Furthermore, content-based training has also proved to be transforming PD from general theories into subject matter applications

which have appealed to this study participants. Moreover, making use of the PD participants to scale up training message transforms and cascades PD from inside schools to a large scale audience outside schools. Moreover, the study participants have also gained a lot of content knowledge, instructional and technological skills in addition to increasing participants' reflective practices, self-confidence, motivation, self-improvement, transcending their comfort zones, research, networking and eagerness to learn more.

The theory of “constructivism” was recommended to guide the present study. Therefore, acknowledging teachers as active learners whose learning is attained through experiencing things, reflecting on those experiences and finally constructing knowledge in social interactions is a pillar constructivist principle found in this study and concluded by other studies such as, (Bada & Olusegun; 2015; Schrader's, 2015; Kinnucan-Welsch's, 2007). Moreover, body of research conclusions (e.g. Albert , 2012; Keiny, 2008; Kennedy, 2014; Mukan, et al., 2017; Nolan & Hoover, 2011; Pellini & Bredenberg, 2015; Vygotsky, 1978) on collaboration between peers and knowledgeable others as zones of proximal development (ZPD) are echoed in “STEM Now's” communities of practice, mentors' expert coaching and principals' support. This ZPD is defined as “the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers” (Vygotsky, 1978, p. 86). In addition, the study asserted Day's (1999) conclusions that “PD 'modelling', 'coaching' and `mentoring' are scaffolding techniques for learning” (p.69), and that action research and narrative inquiries in the form of shared stories, insights, problem solutions, and opinions assist in co-constructing teachers' beliefs.

### **Recommendations**

Drawing on interviewed participants' lessons learnt from "STEM Now" PD program and applicable to future PD programs in Egypt, the researcher wraps up below some of their recommendations.

First, technological applications in education need to be integral features of future PD programs in Egypt because presenting tools such as Web 2.0 or the EKB digital curricula separately in theoretical trainings makes it hard for less technology-oriented teachers to grasp the best benefit out of such trainings. In this regard, technology needs to address an instructional end goal. The more such technologies are also tailored to different school disciplines, the easier teachers will utilize them in their classes. It is also imperative that technological logistics be available and internet connectivity be accessible during training sessions; otherwise, PD providers notify teachers in advance to bring their smart phones or personal computers for training workshops if possible. Workshops are required to focus on hands-on practice for the presented technological tools. In case the EKB curricular digital content is presented, trainees need to get acquainted with the research-based instructional strategies that fit the context of teaching such digital content.

Second, it is recommended that principals, mentors, supervisors, and teachers be exposed to the same instructional theories and practices in teachers' PD programs. It is pivotal that all these stakeholders gain insights into what their teachers are taught to do. New concepts and skills of instructional leadership are required to be injected into such trainings in order to turn the idea of inspection into mentoring and coaching. The relationship between the teacher and the mentor, supervisor or principal needs to be built

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on trust, respect, positive feedback, and active listening skills. Doing so requires introducing principals, mentors and supervisors to instructional leadership kits of coaching or mentoring techniques, procedures and skills. These requirements need to be practiced during training workshops in school-like situations.

Third, mentors' scheduled and unscheduled school follow-up visits need to be planned as regularly as possible during PD programs. Having the PD trainers act as mentors is advisable because of a solid relationship arising between trainers and their teacher or principal trainees can be maintained all through the PD journey. Coaches or mentors can originally be "teachers identified for excellence and released from teaching duties full-time for 2–3 years—who provided mentoring to teachers new to the district or the profession, and intervention for identified veteran teachers experiencing difficulty" (Goldstein, 2005, p.238).

Fourth, PD workshop sessions are preferably to be held at reasonable and extensive intervals to provide participants with enough time for practice and reflection. Training sessions need to be scheduled during the school year not summer holidays to give participants opportunities to put training content into practice and reflect on their performance.

Fifth, experiential learning and hands-on practice during workshops is suggested to be a PD essential component. Much time needs to be allocated to participants' reflection during each workshop. These reflections can be conducted by applying success analysis protocols which give trainees opportunities to reflect on their successful practices, micro-lab conversation protocols which structure trainees' speaking and listening skills, fish bowl protocols which model how best conversations and questioning

techniques can be delivered, divide and slide instructional strategy which allows trainees to interact in a timely and structured manner, or comfort zone protocols which nurture risk-taking. Contextualizing what is being taught and learnt during PD programs, adopting and implementing concepts of learning for fun, and modeling instructional strategies are basic PD considerations. Training teachers of the same school disciplines from the same grades together works well for their benefit unless the intended training targets different exchange of experiences among various disciplines. In addition, PD trainers need to be highly qualified and have professional contact with experts to master the PD content and deliver it efficiently.

Sixth, having teachers incentivized or their workload reduced during training time can be encouraging and motivating. Furthermore, it is advisable to adopt policies, procedures and tools to measure and evaluate PD impact on teachers' performance and students' achievement. PD programs are also required to have needs assessment administered and surveyed in order to base these PD programs on data-driven approaches.

Seventh, PD programs and providers are required to be unified in their visions and missions in case multiple providers or programs are reform mandates. Furthermore, educators' framework and PD structure is recommended to be enhanced and aligned to worldwide, high standards, national context and reform requirements. PD pilot programs presented by non-governmental or international organizations need to be assessed, analyzed and their stories of success are required to be adopted and applied on a large scale. PD training in Egypt is recommended to be standardized, comprehensive, and scaled up all over Egypt with as much high quality and follow-up support as possible.



It is highly recommended to incorporate various PD models from which a suitable model can be selected (Pritchard & Marshall, 2002). It is also essential to establish partnerships between individual PD providers or between colleges of education and schools or Edaras. Political will is key to fruitful and sustainable PDs; otherwise, efforts will yield nothing in the end (Little, 1993). Basically, system support is key to impacting teacher participation in PD programs (Pritchard & Marshall, 2002). These PD programs need to be a basic component of the whole reform package and not scheduled to fix separate educational issues (Bredeson, 2000). Fullan (1994) recommends that “it is necessary to adopt bottom-up and top-down models in structuring PD that is effective and sustainable” (p.14).

Additionally, Wilson and Berne (1999) emphasize the need to unify the voluntary, mandated, and fragmented system into a competent PD collective system. In addition to other several factors, Guskey and Yoon (2009) claim that “in the history of education, no improvement effort has ever succeeded in the absence of thoughtfully planned and well-implemented professional development” (p. 498). The voluntary and non-profit PD efforts in Egypt need to be coordinated with and unified under a planning and monitoring entity (Pritchard & Marshall, 2002).

Eighth, face-to-face communities of practice and online communities or groups are recommended to be basic PD pillars in order to extend the scope of experience exchange and reflection. Additionally, schools and Edaras (Districts) need to assist educators set up such communities and support them financially, logistically, or even by providing slots of time for educators’ conferences, or sessions in which educators exchange experience and knowledge. The researcher recommends covering teachers’

classes during training by other personnel, scheduling early release days, using regular staff or Edara meetings for professional growth, and scheduling specific days per year for PD activities (Abdel Haq, 1996).

Ninth, PD high cost and change resistance can be rationalized and reduced, according to Dutro, Fisk, Koch, Roop and Wixson, by creating a critical mass of “a community of teacher leaders who are willing to share their learning with others.... strengthening effective teachers, helping them create local communities with other strong teachers, and giving them time to reflect on district or school conditions and their colleagues’ learning” (as cited in Fifield & Kedzior, 2004, p.5).

### **Research Limitations**

Patton (2002) elaborates on the complete reliance of phenomenological qualitative studies on the human factor as a sign of both weakness and strength. The researcher’s roles represented in gathering data and analyzing it can weaken its trustworthiness because of the bias incurred if not avoided. However, in-depth and thick description can add to the strength of phenomenological studies. Another phenomenological limitation is the amount of dedicated time, and hard work on data analysis (Creswell, 2014). In addition, the chance of generalizing findings in phenomenological studies is too weak and its trustworthiness is questionable, and can’t be tested (Patton, 2002).

Taking all these limitations into account, the researcher did his best to stay unbiased, communicate what the data analysis revealed, attach to the participants’ language, have research questions and translation peer-reviewed, embed bracketing as a

phenomenological research method to maintain trustworthiness, and provide a detailed study context description (Patton, 2002; Gill, 2014; Pathak, 2017; Shenton, 2004).

Furthermore, the researcher addressed these limitations by freeing the study analysis from presuppositions, focusing on participants' experiences, and digging deeper into their best intentions (Abah, Abakpa, & Agbo-Egwu, 2017).

### **Future Research**

Future mixed-method research employing a larger sample of teachers, principals and mentors might give a big picture, and generate PD participants' perspectives on what works well for PD. Researching the impact of PD programs in Egypt impact on students' achievement and teachers' performance needs to be addressed as well. Furthermore, roles of PLCs need to be investigated in depth. Instructional leadership, and parents' partnership are other major missing areas of research which might transform PD programs and visions in Egypt.

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## Appendix A: IRB Approval

CASE #2018-2019-069



To: Rezk Mahrous  
Cc: Dena Riad  
From: Atta Gebril, Chair of the IRB  
Date: Feb 6, 2019  
Re: Approval of study

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This is to inform you that I reviewed your revised research proposal entitled "Discovery Education Transformative Professional Development Model in Egypt: A case study" and determined that it required consultation with the IRB under the "expedited" category. As you are aware, the members of the IRB suggested certain revisions to the original proposal, but your new version addresses these concerns successfully. The revised proposal used appropriate procedures to minimize risks to human subjects and that adequate provision was made for confidentiality and data anonymity of participants in any published record. I believe you will also make adequate provision for obtaining informed consent of the participants.

This approval letter was issued under the assumption that you have not started data collection for your research project. Any data collected before receiving this letter could not be used since this is a violation of the IRB policy.

Please note that IRB approval does not automatically ensure approval by CAPMAS, an Egyptian government agency responsible for approving some types of off-campus research. CAPMAS issues are handled at AUC by the office of the University Counsellor, Dr. Ashraf Hatem. The IRB is not in a position to offer any opinion on CAPMAS issues, and takes no responsibility for obtaining CAPMAS approval.


This approval is valid for only one year. In case you have not finished data collection within a year, you need to apply for an extension.

Thank you and good luck.

A handwritten signature in black ink, appearing to read "Atta Gebril".

Dr. Atta Gebril  
IRB chair, The American University in Cairo  
2046 HUSS Building  
T: 02-26151919  
Email: [agebril@aucegypt.edu](mailto:agebril@aucegypt.edu)

Appendix B: CAPMAS Approval

  
الجهاز المركزي للتعبئة العامة والإحصاء

القيـد: .....  
التاريخ: ٢٠١٩ / ٢ / ١٧

الموضوع: .....  
المرفقات: .....

**السيد الأستاذ الدكتور / مستشار الجامعة الأمريكية بالقاهرة**  
**تحية طيبة وبعد ،،،**


بالإشارة لكتاب سيادتكم ومرفقاته الوارد للجهاز في ٢٠١٩/٢/١٣ بشأن طلب الموافقة على قيام الباحث / رزق محروس محمد مرعي - المسجل لدرجة الماجستير / قسم التربية المقارنة بكلية التربية للدراسات العليا / الجامعة الأمريكية بالقاهرة - بإجراء دراسة ميدانية بعنوان: (برنامج ديسكفري أيدوكيشن في مصر كنموذج لتغيير التنمية المهنية دراسة حالة).

وذلك وفقا للإطار المعد لهذا الغرض.


يرجى التكرم بالإحاطة بأن الجهاز المركزي للتعبئة العامة والإحصاء يوافق على قيام الباحث / رزق محروس محمد مرعي - بإجراء الدراسة الميدانية المشار إليها بعلية وفقا للقرار رقم (١٤٨١) لسنة ٢٠١٩/٢٠١٨ اللازم في هذا الشأن وعلى إن يوافق الجهاز بنسخة من النتائج النهائية كاملة فور الانتهاء من إعدادها طبقا للمادة رقم (٧) من القرار .

**وتفضلوا بقبول فائق الاحترام ،،،**

٢٠١٨  
مصاد /  
مجدى محمد جاد  
القائم بأعمال  
مدير عام الإدارة العامة للأمن



**جمهورية مصر العربية**



**الجهاز المركزي للتعبئة العامة والإحصاء**

**قرار رئيس الجهاز المركزي للتعبئة العامة والإحصاء**  
بالتفويض

**رقم (١٢٨١) لسنة ٢٠١٩/٢٠١٨**

**فى شأن قيام الباحث / رزق محروس محمد مرعى - المسجل لدرجة الماجستير / قسم التربية المقارنة بكلية التربية للدراسات العليا / الجامعة الأمريكية بالقاهرة - بإجراء دراسة ميدانية بعنوان: (برنامج ديسكفر أديوكيشن فى مصر كنموذج لتغيير التنمية المهنية - دراسة حالة).**

**رئيس الجهاز**

- بعد الإطلاع على القرار الجمهوري رقم (٢٩١٥) لسنة ١٩٦٤ بشأن إنشاء الجهاز المركزي للتعبئة العامة والإحصاء.
- وعلى قرار رئيس الجهاز رقم (٢٣١) لسنة ١٩٦٨ فى شأن إجراء الإحصاءات والتعدادات والاستفتاءات والاستقصاءات.
- وعلى قرار رئيس الجهاز رقم (١٣١٤) لسنة ٢٠٠٧ بشأن التفويض فى بعض الاختصاصات.
- وعلى كتاب - الجامعة الأمريكية بالقاهرة - السوارى للجهاز فى ٢٠١٩/٢/١٣.

**قصر**

**مادة ١:** يقوم الباحث / رزق محروس محمد مرعى - المسجل لدرجة الماجستير / قسم التربية المقارنة بكلية التربية للدراسات العليا / الجامعة الأمريكية بالقاهرة - بإجراء الدراسة الميدانية المشار إليها عليه.

**مادة ٢:** تجرى الدراسة على عينة حجمها (١٥) خمسة عشر مفردة من مديري ومعلمي المدارس الحكومية المطبقة لبرنامج ديسكفر أديوكيشن " سيتم " وذلك بمحافظات (القاهرة - الجيزة - القليوبية).

**مادة ٣:** تجمع البيانات اللازمة لهذه الدراسة بموجب الاستمارة المعدة لذلك وعدد صفحاتها خمس صفحات معتمدة كل منها بخاتم الجهاز المركزي للتعبئة العامة والإحصاء.

**مادة ٤:** تقوم وزارة التربية والتعليم - وتحت إشراف إدارة الأمن بها - بتيسير إجراء هذه الدراسة الميدانية على أن تقوم الوزارة بتحديد أسماء المدارس المستهدفة - ومراعاة الضوابط الخاصة بتقييم درجة سرية البيانات والمعلومات المتداوله مسبقا بمعرفة كل جهة طبقا لما جاء بخطة الأمن بها.

**مادة ٥:** يراعى موافقة مفردات العينة - وسرية البيانات الفردية طبقا لقانون الجهاز رقم (٣٥) لسنة ١٩٦٠ والمعدل بالقانون رقم (٢٨) لسنة ١٩٨٢ وعدم استخدام البيانات التي يتم جمعها لأغراض أخرى غير أغراض هذه الدراسة.


**مادة ٦:** يجري العمل الميداني خلال شهرين من تاريخ صدور هذا القرار .

**مادة ٧:** يوافق الجهاز المركزي للتعبئة العامة والإحصاء بنسخة من النتائج النهائية لهذه الدراسة.


**مادة ٨:** ينفذ هذا القرار من تاريخ صدوره.

**صدر فى: ٢٠١٩/٢/١٧**

**مجدى محمد جاد**  
القائم بأعمال  
مدير عام الإدارة العامة للأمن



## Appendix C: Consent Form

 **الجامعة الأمريكية بالقاهرة**

**استمارة موافقة مسبقة للمشاركة في دراسة بحثية**

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**عنوان البحث :** (دراسة حالة عن برنامج ديسكفري اديوكيشن في مصر كنموذج لتغيير التنمية المهنية للمعلمين)

**الباحث الرئيسي:** ( رزق محروس محمد مرعي – معلم خبير بوزارة التربية والتعليم )  
**البريد الإلكتروني:** rizkmarey@aucegypt.edu  
**الهاتف:** 01069092998

انت مدعو للمشاركة في دراسة بحثية عن (دراسة حالة عن برنامج ديسكفري اديوكيشن في مصر كنموذج لتغيير التنمية المهنية للمعلمين).

**هدف الدراسة هو :** ( تتقصى هذه الدراسة إمكانية التوصل إلى نموذج تنمية مهنية مختلف للمعلمين في مصر ومناسب لسياسات الإصلاح التربوي الحالية من خلال استكشاف آراء المعلمين ومديري المدارس المشاركين في برنامج "ستيم الآن" للتنمية المهنية لمهارات العلوم والتكنولوجيا والهندسة والرياضيات والمقدم من مؤسسة ديسكفري اديوكيشن العالمية كنموذج لتغيير نظريات وممارسات التنمية المهنية للتربويين. وتهدف الدراسة أيضا إلى التوصل إلى اقتراحات وتوصيات لبرامج التنمية المهنية المستقبلية في مصر من خلال تحري ممارسات وخبرات المشاركين في البرنامج التدريبي لـديسكفري اديوكيشن).

**نتائج البحث** سننشر في (دوريه متخصصه أو مؤتمر علمي أو ربما كليهما).

**المدة المتوقعة للمشاركة في هذا البحث ( 40 دقيقة )**

**اجراءات الدراسة** تشتمل على ( مقابلات مع المشاركين في برنامج "ستيم الآن" للتنمية المهنية لمهارات العلوم والتكنولوجيا والهندسة والرياضيات والمقدم من مؤسسة ديسكفري اديوكيشن العالمية من معلمين ومديري مدارس وتوجيه مجموعة أسئلة تتقصى ملامح التغيير في برنامج التنمية المهنية وكذلك المهارات والإستراتيجيات والخبرات المكتسبة من البرنامج وأخيرا الإقتراحات الخاصة بتطوير برامج التطوير المهني في المستقبل )

**المخاطر المتوقعة من المشاركة في هذه الدراسة ( لا توجد مخاطر )**

**الاستفادة المتوقعة من المشاركة في البحث:** ( مراجعة تأملية لما قام/ت به المشارك/ة من ممارسات وخبرات تربوية تُثري من الممارسات الصفية وتعطي إنطباع بقيمة وتعزيز الثقة بالمشاركة في أفضل ما تم اكتسابه من برنامج ديسكفري اديوكيشن للتنمية المهنية والإحساس بقيمة التملك لهذه الخبرة من خلال إعطاء توصيات لبرامج تنمية مهنية مستقبلية في مصر).

**السرية واحترام الخصوصية:** المعلومات التي ستدلي بها في هذا البحث سوف تكون (المعلومات التي ستدلي بها في هذا البحث سوف تكون سرية).

ان المشاركة في هذه الدراسة ماهي الا عمل تطوعي. حيث أن الامتناع عن المشاركة لا يتضمن أى عقوبات أو فقدان أى مزايا تحوز لك. ويمكنك أيضا التوقف عن المشاركة في أى وقت من دون عقوبة أو فقدان لهذه المزايا.

**الامضاء:** .....

**اسم المشارك :** .....

**التاريخ :** ١٩/٠٥/٢٠٢٠

## **Appendix D: The Study Instrument**

### **Teachers' semi-structured interview questions:**

The researcher developed the interview questions after conducting an extensive literature review (e.g Desimone, 2009; Guskey, 2009; Guskey & Yoon, 2009; Kennedy, 1998; Kennedy, 2014; Darling-Hammond, et al., 2017; Ali & Wright, 2017; Whitelaw, et al., 2004; Johnson & Marx, 2009; Simos & Smith, 2017; King, 2011; Bandura, 1997; Bada & Olusegun, 2015; Baviskar, et al., 2009; Bayar, 2014; Kinnucan-Welsch, 2007; Senge, et al., 2000; Day, 1999; Zucker, et al., 1998; Vygotsky, 1978) on what transforms and works for PD. The research questions investigate the core features of effective PD viewed as a basis for PD effectiveness and according to qualitative and quantitative research consensus (Desimone, 2009). These transformative PD characteristics include various delivery forms, expert follow-up, extensive duration of PD activities, teachers' professional communities of learning (PLC), teachers' engagement in active learning, PD consistency with other reforms, and PD focus on content and pedagogy (Garet, et al., 2001).

Furthermore, the study instrument examines "STEM Now" participants' lived experiences and perceptions with the transformative PD dynamic nature as an ongoing, continuous, and embedded process in teachers' daily lives in the form of mentoring, reflection, discussions, teacher network, engagement in online activities, action research, and involvement in a curriculum development process (Desimne, 2009). The semi-structured interview questions explore Guskey's (2009) model which describes PD as an attempt to change teachers' instructional practices and improve students' learning

outcomes, and reflect Kennedy's (2014) definition of the transformative PD model as an integration of other PD models. In addition, the study instrument is based on Darling-Hammond et al.'s (2017) report which reviews 35 rigorous studies over the past three decades and specify definite effective PD features encompassing content-focused PD, active learning, collaborative PLCs, models of effective instruction, coaching, expert support, feedback, reflection, and sustained duration.

The semi-structured interview encompasses twelve open-ended questions in which the first question presents a general introduction about how the teachers happen to participate in the program in order to create some rapport required for actual questioning. The same concepts and steps, which were taken to develop the teachers' interview questions, were used again to develop a similar set of questions to the school principals. The only variation was in questions three, four, eight, ten and twelve where there was focus on principals' instructional leadership and principals' roles in supporting teachers' PD.

1. How and why have you participated in the STEM Now PD program?

Questions two through ten will focus on the data needed to address the first research question that investigates the features of Discovery Education "STEM Now" program as a transformative PD model as follows:

2. How would you describe your Discovery Education "STEM Now" PD journey psychologically, instructionally and professionally?

3. To what extent does Discovery Education "STEM Now" PD reflect any of the following PD features for you as a teacher: active or passive engagement during and after the training workshops, professional

learning communities, follow-up support, consistency with the new STEM instructional practices and other national PD programs, content-based training, and the PD duration?

4. Elaborate on the principal's attending your same training modules on separate days and supporting you in putting the new instructional strategies into practice.

1. How have you viewed Discovery Education mentor's regular school and class visits after each training workshop delivery?

5. Elaborate on the ways in which the technological Web 2.0 tools have been used in Discovery Education "STEM Now" PD program.

6. How has Discovery Education "STEM Now" PD program addressed the EKB digital curricula via instructional strategies and Web 2.0 tools used for assessment?

Questions eight through ten answer the second research question that addresses teachers' perceived Discovery Education "STEM Now" PD skills, motivations, and professional learning networks:

7. Have you perceived any teaching, learning, motivation skills presented in Discovery Education "STEM Now" PD program? Why? Why not?

8. Elaborate on the role played by Discovery Education Network (DEN) Arabia online communities.

9. How would your teaching be like if you did not participate in Discovery Education "STEM Now" PD program?

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Questions eleven and twelve answer the third research question that addresses suggestions for future PD programs based on teachers' experience with "STEM Now Egypt" PD model:

10. What lessons do you think you have personally and professionally learnt from Discovery Education "STEM Now" PD program?
11. Which Discovery Education "STEM Now" PD features discussed earlier would you like as a teacher to be incorporated or contextualized into future PD programs in Egypt?

### **Principals' semi-structured interview questions:**

The same concepts and steps, which were taken to develop the teachers' interview questions, were used again to develop a similar set of questions to the school principals. The only variation was in questions three, four, eight, ten and twelve where there was focus on principals' instructional leadership and principals' roles in supporting teachers' PD.

The semi-structured interview encompasses twelve open-ended questions in which the first question presents a general introduction about how the principals happen to participate in the program in order to create some rapport required for actual questioning.

1. How and why have you participated in the STEM Now PD program?

Questions two through ten will focus on the data needed to address the first research question that investigates principals' perspectives on the features of Discovery Education "STEM Now" program as a transformative PD model as follows:



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2. How would you describe your Discovery Education “STEM Now” PD journey psychologically, instructionally and professionally?
3. To what extent does Discovery Education “STEM Now” PD reflect any of the following PD features for you as a principal: active or passive engagement during and after the training workshops, professional learning communities, follow-up support, consistency with the new STEM instructional practices and other national PD programs, content-based training, and the PD duration?
4. Elaborate on your attendance as a principal in training modules presented to your teachers on separate days and how this has been viewed by your teachers.
5. How have you viewed Discovery Education mentor’s regular school and class visits after each training workshop delivery?
6. Elaborate on the ways in which the technological Web 2.0 tools have been used in Discovery Education “STEM Now” PD program.
7. How has Discovery Education “STEM Now” PD program addressed the EKB digital curricula via instructional strategies and Web 2.0 tools used for assessment?

Questions eight through ten answer the second research question that addresses the principals’ perceived Discovery Education “STEM Now” PD skills, strategies, and professional learning networks:

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8. Have you perceived any leadership, learning, motivation skills presented in Discovery Education “STEM Now” PD program?  
Why? Why not
9. Elaborate on the role played by Discovery Education Network (DEN) Arabia online communities.
10. How would your leadership be like if you did not participate in Discovery Education “STEM Now” PD program?

Questions eleven and twelve answer the third research question that addresses suggestions for future PD programs based on principals’ experience with “STEM Now” PD model:

11. What lessons do you think you have personally and professionally learnt from Discovery Education “STEM Now” PD program?
12. Which Discovery Education “STEM Now” PD features discussed earlier would you like as a principal to be incorporated or contextualized into future PD programs in Egypt?