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An Inquiry into the Implementation of ICT among Pre-Service English Teachers

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Abstract

In recent years, the trend toward globalization and the needs of an information-oriented society have become a focus of attention for science educators. However, many teachers are still struggling to adopt and implement computers into their classrooms. Some researchers contend that beginning teachers are not adequately prepared to integrate computers into their teaching. Furthermore, among teachers, differences exist in instructional decision-making and behaviors when implementing new innovations into their teaching practice. This study examines the implementation of ICT (Information and Communication Technology) into English language instruction. Through studying aspects of learning among pre-service teachers, the study seeks to review the studies done on the impact on their new understanding of teaching and decision-making. The results of this study can provide pre-service teachers with a direction that enables them to make the best use of technology such as ICT in learning to teach English and other core subject areas is necessary.

Keywords: Decision-making, pedagogical content knowledge, ICT, Pre-service teachers

Introduction

Science has played a predominant role in the development of our society, especially since the middle of the twentieth century, and, as a result, science education has been challenged and reformed to meet new demands both inside and outside schools (Hoffman et al., 2003; Davis & Falba, 2002). In recent years, the trend toward globalization and the needs of an information-oriented society have become a focus of attention for science educators. One example resulting from consequent reforms in education is the integration of Information and Communication Technology (ICT) into daily science lessons. This initiative is now being stressed as a part of the secondary science curriculum both nationally and internationally (Dani & Koenig, 2008; Wu et al., 2007).

However, many teachers are still struggling to adopt and implement computers into their classrooms (Dani & Koenig, 2008). Some researchers contend that beginning teachers are not adequately prepared to integrate computers into their teaching (Lyublinskaya & Zhou, 2008). Furthermore, among teachers, differences exist in instructional decision-making and behaviors when implementing new innovations into their teaching practice (Wang & Woo, 2007). Fullan and Stiegelbauer (1991) asserted that the implementation of a new curriculum program requires efforts that change teachers' existing instructional behaviors to accommodate to a new educational environment. Furthermore, Winther (2002) contend that behavior change occurs with cognitive change, pointing to the need to understand the cognitive processes that influence teachers and how they are reflected in their actions and practice. To be effective teachers, I believe that it is important for pre-service teachers to be appropriately prepared to implement new curriculum materials in their teaching practice.

The need for infusion of computers into Eng-

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lish teacher education

The effective use of computers in the classroom has received much attention (Dani & Koenig, 2008; Clark, 2006), and English teacher education programs are increasingly expected to graduate teachers with the professional knowledge and confidence to effectively integrate innovative tools into the English classroom. Even though prospective teachers are provided with technology courses in which they engage in various technology-based instructional activities (Byrum & Cashman, 1993) as a core or elective course, pre-service teachers are not provided with a context in which they can make a pedagogical connection between the use of computers and their teaching. Thus, it has been suggested that significantly more emphasis should be placed on integrating instructional technology into the existing teacher education curriculum rather than simply providing pre-service teachers with technical knowledge and skills (Gado, 2006; Taylor, 2004).

In order to meet the new educational revolution, the role of teacher education cannot be overemphasized. As Langone et al. (1998) argue, "a teacher preparation program may be the first effort toward graduating teachers who are at the beginning stages of [computer] technology implementation" (p.295). In an effort to respond to this educational reform, teacher educators have tried to infuse technology into the teacher education curriculum (Brown & Warschauer, 2006; Henriques, 2002), yet the lack of the pedagogical aspect of using technology becomes problematic and is "a major impediment to defining new pedagogical practice" (Crawford, 1999, p. 58) in teacher preparation programs.

In contrast to the traditional approach in which technology courses and computers are generally taught separately instead of being integrated into the studies of other subjects, the infusion of technology into English teacher education programs should stress that sufficient practice is required for pre-service teachers to learn how to plan instruction in a meaningful way. In this new educational environment, faculties become more responsible for providing explicit examples of modeling the integration of technology and incorporating authentic tasks as a part of their teaching of pre-service teachers (Davis & Falba, 2002). Considering that pre-service teachers often do not have an opportunity to teach with computers in a real context (Brown & Warschauer, 2006) and need to learn about strategies for effectively integrating technology in "the real world of teaching" (Clift et al., 2001, p. 42), the development of a coherent view of what it means to incorporate computers into science instruction should be emphasized as course and field requirements during English teacher preparation programs.

The Nature of Learning

Santrock (1986) defines learning as "a relatively permanent change in behavior that occurs through experience" (p. 153). How then can we understand changes in behavior? Behaviors can be seen as extended and inferred internal processes as in cognitive structures. Defining and understanding learning is a complex task (Lefrancois, 2000) since we must consider various factors to identify what the term 'learning' means.

To understand the nature of learning, we can explore two very different learning theories that were popular in the 20th century: behaviorism and cognitivism (Davis et al., 2000). In the beginning half of the 20* century, learning was seen as something observable and measurable by behaviorists. Behaviorists consider knowledge as a product that is transmitted from a teacher to a learner, and they believe that knowledge exists outside the world of learners. From this perspective, the connection between learners' experiences and behaviors was understood without considering inferred cognitive or mental processes (Davis et al. 2000; Lefrancois, 2000; Santrock, 1986). There was little desire to understand the internal aspects of learners that influence their learning and knowledge construction. Furthermore, learners were considered as passive information receivers rather than active participants in the learning process.

However, for the last several decades, there has been increasing interest in understanding the mental process of learners in the field of educational research (Crawford, 1999). In contrast to behaviorism, a mentalist or cognitive learning approach emphasizes the importance of cognitive factors in the learning process and tries to understand the learner-thinking processes that influence learning and the construction of knowledge. Here, cognitivists do not distinguish learners' mental activity from physical experience since learning involves the dynamic processes of brain activity (Davis et al., 2000). Cognitivists attempt to understand the role of cognitive processes that mediate the con-

nection between experience and behavior (Lefrancois, 2000; Santrock, 1986). From this perspective, "learning is no longer seen as a process of 'taking things in' but of adapting one's actions to ever-changing circumstances" (Davis et al., 2000, p. 65).

In the process of learning to teach, pre-service teachers have dual roles as learners and teachers (Britzman, 1991), and teacher educators need to understand the interaction between "mental and physical" and "thought and action" (Davis et al., 2000, p.63) rather than view them as separate. Doing so enables teacher educators to understand pre-service teachers' decision-making and teaching practices. Understanding learning as a process of modifying and altering existing ideas and knowledge through experience should be the goal when learning to teach, given that learning involves mental activity. From this perspective, "learning is seen as a process of conceptual change" (Pardhan, 2002, p. 20).

Learning as a Process of Conceptual Change

A substantial body of research explains, based on contemporary knowledge of the brain, how pre-existing concepts and knowledge change as individual learners engage in the learning process. In particular, over the last two decades, the significance of understanding conceptual change in the learning of science has been an international focus (Hewson, 1992).

In order to understand the process of conceptual change, it is important to identify what 'conceptual change' means. Hewson (1992) asserts that we need to "consider different interpretations of the idea of conceptual change" (p. 3) and the use of the word 'change' in different ways. Hewson introduces three metaphors that help us interpret the word "change" in different contexts: extinction, exchange, and extension. From my personal experience and other literature, I think that interpreting the word "change" as "extinction" is inappropriate for an educational setting since deeply rooted existing ideas and knowledge may not be completely changed to another view (Yerrick et al., 1997).

Piaget's Cognitive Theory

Even though Piaget initially began his career as a biologist, he is well known as a psychologist who became interested in the nature of thought itself, especially in the development of childrens' thinking and understanding. To explore this interest, Piaget began to ask what the underlying reasons behind childrens' actions were and to observe his own children in order to examine the development of the thinking and reasoning abilities of a child (Roblyer, 2003).

Through his observations, Piaget found that even infants have certain skills with regard to objects in their environment, and that these skills evolve over time. Piaget came to believe that the "human was a developing organism not only in a physical and biological sense, but also in cognitive sense" (Fosnot, 1996, p. 11). From this perspective, Piaget believed that the development of children from one stage to another was a gradual process, which he thought of as a fundamental "biological adaptation to the environment" (O'loughlin, 1992, p. 794). However, Piaget noticed that childrens' thinking does not develop entirely smoothly; instead, there are certain points at which it takes off and moves into completely new area and abilities (Singer, & Revenson, 1997).

Piaget argues that children develop as they confront new and unfamiliar features of their environment that do not fit with their current views of the world. According to Piaget (1985), this development happens when "disequilibrium" (p. 11) occurs; that is when the children seek to reinterpret an experience through one of two process of adaptation: assimilation and accommodation. Through this process of adaptation, the child either fits the new experiences into his or her existing view of the world, a process which he calls assimilation or changes the old schema or view of the world to incorporate the new experiences, a process which he terms accommodation. For Piaget, learning is seen as an adaptation, and he thinks that a child learns through the process of assimilation and accommodation.

Understanding 'cognitive equilibrium' helps us to better understand how humans develop their thinking and understanding as well as expanding their knowledge to adjust to a new environment. Fosnot (1996) argues that we must understand cognitive equilibration as "a dynamic 'dance' of progressive equilibria, adaptation and organization, growth and change" (p. 14) and thus as different from "mechanical equilibrium" (Piaget, 1977, p. 4).

As he continued his investigation of children, Piaget noted that there were periods in which assimilation dominated, periods when accommoda-

tion dominated, and periods of relative equilibrium, and that these periods were similar among all the children he observed in both their nature and timing. As a result of this investigation, Piaget developed the idea of stages of cognitive development (Singer & Revenson, 1997). This process is similar to Kuhn's history of science, which will be discussed in the next section. Although Piaget's cognitive psychology is sometimes criticized due to a lack of consideration of social factors on cognitive development, it is quite complex and profound in its attempt to understand how children's knowledge originates and develops (Roblyer, 2003; Fosnot, 1996). Two features of his work-the stages of cognitive development and the process of cognitive development that underlie his theory-have been widely recognized. As Flavell (1985) mentions, "Piaget's contributions to our knowledge of cognitive development have been nothing short of stupendous" (as cited in Roblyer, 2003, p. 15), and his view of how a child's mind works and develops has been highly influential especially on learning theory.

Kuhn 's Theory of Paradigm Shift in Scientific Revolutions

The process of science was viewed at one time as a steady and cumulative acquisition of knowledge, and scientific knowledge was viewed as being objective and absolute. However, according to Kuhn (1962), the acquisition of scientific knowledge is among other things a social process developed through intellectual struggle among scientists. In 1969, Kuhn published his famous book, The Structure of Scientific Revolutions. In it, Kuhn (1962) introduced the concept of paradigm shift, which describes the revolutions by which one conceptual worldview is replaced by another.

Kuhn's idea of a paradigm helps us to precisely understand in what sense science progresses, and how scientific knowledge is constructed. According to Kuhn, the authority of science exists in the community of scientists as they practice 'normal science,' which is defined by a paradigm. Kuhn described a paradigm as "the universally recognized scientific achievements that for a time provide model problems and solutions to a community of practitioners" (p. 45). In this sense, a paradigm is defined as a theoretical framework, or the collective beliefs that are accepted by the scientific community, a group of people who share similar ideas or worldviews. In a similar way, it can be seen that pre-service teachers establish their own paradigm of learning and teaching and develop their instructional strategies based on this paradigm, a collection of their beliefs and perceptions on English language education.

In science, once a new paradigm emerges, the scientific community initially resists the replacement of the old paradigm. However, eventually the competing theory proves relatively successful in explaining the anomaly, and it replaces the old paradigm. This replacement is what Kuhn (1962) calls scientific revolution. This notion of scientific revolution is similar to Piaget's idea of "accommodation." According to Kuhn, the adaptation of a new paradigm necessarily establishes the creation of a new research program since the scientists within the new discipline will see the world in a different way than scientists within the old paradigm. Once the old paradigm is replaced and the upheaval has ended, stable scientific inquiry re-emerges and flourishes, but eventually has to face the discovery of new anomalies.

From this perspective, as Zhou (2002) argues, Kuhn's philosophy of science views the process of science as both a social and a psychological process. Although Kuhn's philosophy of science developed mainly through a discussion of physics, the notion of paradigm shift provides educators with a general way of understanding how revolutions in our understanding of the world around us come about and how scientific reasoning occurs from a historical and a social perspective. In the next section, I introduce the conceptual change model that is a common between Piaget's cognitive theory and Kuhn's history of science.

Conceptual Change Model (CCM)

To help educators understand the process of conceptual change in language learning, Posner and his colleagues (1982) proposed a theory of conceptual change that was drawn from a parallel relationship between Kuhn's "history and sociology of science" (Feldman, 1999, p. 607) and Piaget's "development psychology" (p. 607). In their article, Accommodation of a scientific conception: toward a theory of conceptual change, Posner et al. focused on 'radical conceptual change,' which had been described by Piaget as 'accommodations,' raising the question, "How do accommodations take place" (p. 213) and under what conditions? In response to this question, Posner and his colleagues introduced

four conditions for science students' conceptual change that "must be fulfilled before an accommodation is likely to occur" (p.214).

1. There must be dissatisfaction with existing conceptions.

2. A new conception must be intelligible.

3. A new conception must appear initially plausible.

4. A new concept should suggest the possibility of a fruitful research program.

Relying on Kuhn's philosophy of science as the main source of their argument, Posner and his colleagues draw similarities between their idea of conditions for conceptual change and some necessary preconditions for scientific revolutions. For example, Kuhn's idea of unsolved puzzles or anomalies in normal science is considered as a fundamental condition for conceptual change in that it emphasizes that learners should be dissatisfied with their existing concepts. As has been discussed, in the state of crisis in which continuous anomalies occur, some scientists become unsatisfied with the current paradigm (Zhou, 2002). The intelligibility of a new concept is similar to "the appearance of a new paradigm that provides scientists with a choice" (p. 38) in the process of science. An initially plausible new concept is understood if that new concept is able to solve the problems generated by prior theory (Posner et al., 1982). As for the last condition for conceptual change, Posner and his collogues emphasize that "it [the new concept] should have the potential to be extended, to open up new areas of inquiry" (p. 214) in a way that is more compatible with the finding of other scientists or specialists.

In their study, Posner et al. see learning as inquiry, and they believe that learning, in a way similar to that of inquiry, occurs against the background of the learners' currently existing concepts. This idea is supported by the fundamental theme of Kuhn's argument that the typical developmental pattern of a mature science involves the successive transition from one paradigm to another through a process of revolution. In this respect, the most crucial factor for changing old concepts of the philosophy of science and of conceptual development or change results when a rival paradigm conflicts with the old paradigm and emerges to challenge the existing paradigm.

Teachers' Decision-Making as a Cognitive Process

In the previous sections, I discussed the nature of learning and a conceptual change model based on Piaget's cognitive psychology and Kuhn's history of science, focusing on their notion of adaptation and scientific revolution by considering pre-service teachers as learners in teacher education. By making a transition to teacher education, in this section, I discuss teachers' decision-making from the perspective that pre-service teachers are teachers.

What counts as teaching? The Holmes Group (1990) contends that "Teaching is essentially helping people [students] to get excited in a subject area, which leads them to engage in big ideas, cultural ideas" (as cited in Tobin et al., 1994, p. 45). Furthermore, Munby and his colleagues (2001) consider "teaching as a form of problem solving and decision-making" (Munby , 2001, p. 890) in which the role of the teacher is to facilitate the objectives/purposes of the class activity or instructional planning.

In an everyday classroom setting, individual teachers need to make decisions about what to teach and how to prepare lessons to help students improve their learning in a meaningful way within the confines of the curriculum or program of studies. As a result, teachers' different decisions about instructional strategies will influence the students' learning and, ultimately, the quality of their lives. How then should we understand the variety of instructional strategies that are implemented by individual teachers? How can we understand the rationale for teachers' unique decisions concerning their practices?

Over the past two decades, research on teaching has increasingly changed its focus from an emphasis on teachers' behaviors to an emphasis on beliefs and theories that account for their instructional decision-making and classroom practices (Meijer et al., 2001). Winther (2002) and Feldman (1997) view teachers' decision-making as a complex cognitive process that critically depends on the teachers' levels of understanding and use of appropriate instructional strategies. In this respect, as Clark and Peterson (1986) argue, teachers' beliefs and values should be clearly understood in order for us to understand what and how teachers decide through their teaching.

In considering the influence of teachers' thinking on their instructional practice, many researchers have investigated the influence of teachers' beliefs and perspectives on their implementation of curriculum and use of materials. For example, Clandinin (1986) examined what impact the teachers' image of teaching and learning had on their actions and practice. Together with Connelly, Clandinin (1988) also argued that the implementation of

a new curriculum program is influenced by the way teachers interpret the curriculum. This finding is also supported by Roberts (1988).

Through reviewing some studies, I found that teachers' decision-making about instructional strategies is based on their conceptual model of teaching in terms of how they develop or change their perspectives, beliefs, values, and knowledge, all of which are constructed from experiences. From my observations, individual pre-service teachers bring different perspectives on or, conceptions of teaching and learning English to the teaching role from the learning experiences they have had.

Practical Conceptual Change Theory in Decision-Making

In the previous section, I introduced the idea of teachers' decision-making as a cognitive process and suggested the need to understand the conceptual development process among pre-service teachers in order to understand how teachers reason when they decide on actions and practices, particularly focusing on the implementation of computers. Feldman (2002) believes that teachers' decision making is related to their pedagogical reasoning since teachers' actions are based on their beliefs, objectives, and intentions when planning instruction. Feldman argues that practical reasoning is similar to scientific reasoning. As an analogy to Posner's conceptual change model, Feldman developed a model of practical conceptual change which is a combination of Piaget's process of adaptation and Kuhn's functional paradigm.

With respect to what accounts for differences in the ways in which pre-service teachers have implemented the ICT outcomes and ICT, I believed that the nature of teachers' beliefs should be examined in order to understand teachers' instructional decision-making processes. Teachers' beliefs about subject matter and how it is taught and learned have an influence on their instructional practice. From my experiences as a learner and an educator, I came to realize that differences in teachers' conceptions of English appear to be related to differences in their views about language teaching, and thus teachers' conceptions of language teaching are likely to be reflected in their practice.

Several studies (Abell,1998; Blakey et al., 1992) have pointed out that pre-service teachers enter teacher education courses with personal theories about teaching and learning formed by their experiences, beliefs, and values. It has been also noted that pre- and in- service teachers prepare their lessons and act within their classrooms in ways deeply affected by the perspectives they have built up over a lifetime. In this sense, teachers' early experiences as pupils influence their expectations about teaching and, subsequently, their teaching behaviors (Feldman, 2002; Clandinin, 1986). As Winther (2002) argues, "the process of cognitive development was [is] -by its nature- idiosyncratic" (p. 31).

Like novice and experienced teachers, pre-service teachers enter a teacher education course to learn how to teach and with the desire to develop their knowledge and skills to effectively teach their subject area; doing so requires them to obtain knowledge of instructional decision-making. Indeed, as Langone and his colleagues (1998) argue, teacher education programs should encourage pre-service teachers to change their knowledge and attitudes and develop instructional strategies. I believe that one of the central objectives in teaching 'how to teach' is to promote changes in pre-service teachers' conceptions of teaching English and their practices. In this sense, Feldman's practical conceptual change model offers a useful way to help me understand how teachers modify and develop their practical theory and apply it to their pedagogical practice as they engage in learning to teach, especially in relation to the implementation of innovations such as ICT.

A Constructivist Paradigm on Pre-service Teacher Development

As an approach applied to learning and instruction, constructivism has influenced English education in many ways (Peers et al., 2003). According to von Glasersfeld, constructivism is described as a "theory of knowledge with roots in philosophy, psychology and cybernetics" (as cited in Murphy, 1996, Para, 2). The main consideration of constructivists is to understand the nature of knowledge, in particular how human beings learn and come to know specific/scientific phenomena. Constructivism therefore offers an epistemological framework for the learning process.

According to Hannafin and Hill (2002), epistemology is defined as "the branch of philosophy that is concerned with the nature of knowledge and understanding – their foundations, assumptions, and validity" (p. 71). On a continuum of an epistemological perspective, objectivists/positivists and con-

structivists hold highly opposing views. In contrast to objectivists/positivists, who believe that absolute truths exist in the world, constructivists believe that knowledge is relative and is constructed by each individual.

From the latter view, therefore, learning is described as a process in which learners actively participate in the construction of their personal knowledge. In this process, a learner is no longer considered as a knowledge producer or giver; rather, learners are considered as knowledge producers or meaning makers. In constructivist theory, the knower is incorporated into the process of producing knowledge.

Constructivists believe that knowledge "does not exist outside of a person's mind" (von Glasersfeld, 1996, p. 5) and that learning is the organization of the individual's internal cognitions and experiences rather than the discovery of an external and objective reality. The main emphasis of constructivism becomes the description of an individuals' cognitive and metacognitive development and other internal processes (Abdal-Haqq, 1998). In the constructivist view, learners' new understandings and knowledge build upon their prior knowledge, beliefs and ideas, which are, in turn, constructed from their prior experiences. In this regard, the role of prior experience is crucial in considering the role of existing belief and knowledge in "capturing new knowledge" (Hewson, 1992, p.4) in the learning process.

Although constructivists share common ideas with respect to how learners learn best and obtain knowledge, Geelan (1997) contended that there are six different forms of constructivism depending on their focus. However, the main two are Piaget's cognitive constructivism and Vygotsky's social constructivism. Despite the fact that Piaget's cognitive constructivism and Vygotsky's social constructivism share many of the same assumptions about how children learn, an important criticism of Piaget's cognitive psychology is its lack of consideration for social and cultural factors in the learning process. Cognitive psychology considers that an "[individual's] development is an ingrained, natural, biological process that is pretty much the same for all individuals," (Abdal-Haqq, 1998, p. 5). On the other hand, Vygotsky (1978) placed more emphasis on the social context of learning by emphasizing the critical importance of culture, and the social context for an individuals' cognitive development.

Given the idea that learning is both individual and social, I believe that Vygotsky's ideas are valuable for me to understand the dynamics of the learning to teach process. As Britzman (1991) states,

Learning to teach is a social process of negotiation rather than an individual problem of behavior. This dynamic is essential to any humanizing explanation of the work of teachers. Teaching concerns coming to terms with one's intentions and values, as well as one's views of knowing, being, and acting in a setting characterized by contradictory realities, negotiation, and dependency and struggle, (p. 8)

As a result, teaching should involve social, political, economic and cultural considerations. From this perspective, pre-service teachers' conceptual development (change) process is social rather than only individual because I believe that personal values, perceptions, and behaviors are products of social and cultural conditioning. As Tobin argues, "conceptual change is learning, which is a social process of making sense of experience in terms of extant knowledge ...Since all learning occurs in a social milieu, all learning is inherently social... Accordingly, all conceptual change [development] must be considered in a social-cultural context" (as cited in Hewson 1992, p. 2).

Considering learning as a social process, Vygotsky (1978) focuses on the "zone of proximal development," which "is the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86). As Vygotsky's best known concept, the zone of proximal development suggests that students can, with help from adults or children who are more advanced, master concepts and ideas that they cannot understand on their own. Even though this approach was developed for child development, this idea has important implications for teacher education. From a socio cultural perspective, teachers' thoughts and knowledge of their intentions and actions are influenced by the way they interact in various situations. With this in mind, this study attempted to understand how pre-service teachers negotiate in specific situations and make decisions about acting in a certain way through the process of conceptual development. When learning to teach, pre-service teachers are often interacting with others in multiple contexts such as inside a school setting or a university setting where they make connections to the lived experiences of others.

Pedagogical Content Knowledge (PCK)

Many researchers have focused on understanding the nature of teacher's knowledge with respect to what teachers should or need to know before teaching a particular subject. Traditionally, teachers' academic knowledge, which is referred to as subject content knowledge, was considered as essential and secondary teachers, in particular, are defined by subject specialization. From this perspective, Britzman (1991) argues that a dualism exists "between pedagogy and academic knowledge" (p. 40) when understanding the nature of teachers' knowledge. Given that instructional decision-making is a form of pedagogical reasoning (Peterson, & Treagust, 1995), it is important for teachers to have a sense of pedagogy, along with content knowledge of their subject for their practice.

In this regard, Shulman (1987) developed an idea of 'pedagogical content knowledge' which represents "the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction" (Bullough Jr., 2001, p. 655). Grounded in the teachers' wisdom of practice, Shulman's notion of pedagogical content knowledge emphasizes teachers' pedagogical judgment about particular teaching strategies when they design their instruction. These pedagogical judgments also affect teachers' decisions to change pedagogical approaches to create various learning opportunities for students (Jones, 2001).

As Bullough Jr (2001) argues, "much of the work to build teacher pedagogical content knowledge must take place within a teaching context" (p. 665) since this particular knowledge is developed through "an integrative process rooted in classroom practice" (van Driel, 1998, p. 677). It should be noted that teachers' conceptions of teaching are explicitly connected with their actual teaching practice, and from this perspective, prospective and beginning teachers often lack or have little pedagogical content knowledge of curriculum and teaching strategies compared with experienced teachers. As a result, pre-service teachers may bring less awareness of the purposes for their instruction and need to develop an instructional understanding that provides "good reasons" (Shulman, 1987, p. 7) for their instruction when learning to teach.

Given the idea that pedagogical content knowledge focuses on representation of scientific content/concept and various teaching strategies, pre-service science teachers should be able to facilitate students' learning of the subject matter through the presentation of scientific content in clear and meaningful ways through the integration of innovations such as computers. Pre-service science teachers need both the disciplinary knowledge to identify fruitful questions and the skills to help students focus on scientific concepts. In addition, teachers need the pedagogical content knowledge to support and scaffold students' learning so they can gain insights into scientific phenomena.

Pre-service teachers often lack pedagogical content knowledge regarding "effective implementation of a science curriculum innovation [such as ICT] (Peers et al., 2003, p. 102)." Thus, they should have experiences wherein they learn how to use technology, explore its potential for teaching and learning, and then develop instruction that will utilize it fully for solid pedagogical purposes for their grade and content area. As Britzman (1991) contends, "pedagogy demands and constructs complex social relationships" (p. 38) since complex reality of practice needs more richer and sensitive experiences within various social contexts.

Conclusion

Consideration of major findings and general matters that arose can lead to the need to understand the perspectives of pre-service teachers about issues related to the integration of instructional technology such as ICT in the field of English teacher education. Overall, the findings can indicate that the role of technology integration into the educational settings in EFL context in general and pre-service teachers' in Iranian EFL context, in particular. Of course, successful technology integration by teachers requires support from various sectors to create conditions that facilitate the process of computer integration. The issue related to technology integration is not only a matter for individual teacher, but also a matter for institutional, political, and social concerns. Furthermore, the findings form the studies on the role of technology integration in teaching English as a second or foreign language can indicate the important role of practical and varied experiences to enhance the development of practical theories related to teaching and computer integration amongst pre-service teachers. For teacher educators charged with the task of preparing teachers to teach with technology, the meaning

of this diversity of experiences and attitudes among pre-service teachers can suggest that instruction for teacher preparation must take these differences into account. Teacher educators can use the knowledge gained from individual diversity of practical theories to develop activities that will provide pre-service teachers with the technical skills and pedagogical knowledge that will help them continue to learn to teach with technology beyond the pre-service years. Finally, providing pre-service teachers with a direction that enables them to make the best use of technology such as ICT in learning to teach English and other core subject areas is necessary. Given that the teacher educators and co-operating teachers had a great impact on conceptual development and practice amongst pre-service teachers, the strengthening of PD for school teachers and university instructors must be considered as very important.

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