An Analysis of Factors Affecting the Use of Computer Technology in English Language Teaching and Learning

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Abstract—Although the situations for effective computer technology integration involve ready access to technology, trained teachers, and a favorable learning environment, high-level technology use is still surprisingly low. This means that additional obstacles, particularly related to teachers' pedagogical beliefs, should be at work. The impact of teachers' beliefs on classroom instruction specifically in English Language Teaching (ELT) has been paid enough attention by previous researchers, but little research has been conducted to establish a similar relation between teachers' pedagogical beliefs and classroom uses of computer technology. The first goal of this paper is to define teacher beliefs. The second goal is to discuss the nature of beliefs. The third goal is to explain the process of forming beliefs. The fourth goal is to elaborate the process of changing beliefs. The fifth goal is to discuss the relationship between beliefs, practices, and teacher change. The last goal is examine teacher beliefs, contextual factors, and computer technology usage. It is expected that by gaining a better understanding of this complex relationship we might gain a greater understanding for why more teachers aren't using computer technology in their classrooms.

Index Terms-Beliefs, nature, form, change, practices, computer technology, usage

I. INTRODUCTION

Computers serve as a valuable and well-functioning instructional tool in classrooms in which teachers: a) have convenient access, b) are adequately prepared, c) have some freedom in the curriculum, and d) hold personal beliefs aligned with a constructivist pedagogy [1]. Computer technology is now considered by most teachers to be an integral part of providing a high-quality education. While the first three conditions seem to have been almost met, the fourth (teachers' beliefs) is much less understood less resolved. This may be due to the fact that the first three conditions have required changes that might best be described as first-order [2]; that is, changes that adjust current practice in an incremental fashion without changing existing structures or beliefs. However, the fourth component consists of a second-order change-change that confronts teachers' fundamental beliefs and requires new ways of both seeing and doing things.

While first-order changes are reversible, second-order changes are seen as irreversible: once you begin, it is impossible to return to your previous routines and habits [3]. These types of changes are riskier for teachers, as well as more difficult to achieve. Knowing how to facilitate and

support these types of changes is much less familiar to staff developers who typically have been concerned with facilitating first-order change [4]. While many teachers are using computer technology for numerous low-level tasks (word processing, Internet research), higher-level uses are still very much in the minority. For example, results of a survey conducted by Michigan Virtual University as part of a program to give every Michigan teacher a laptop computer (completed by over 90,000 teachers) indicated that while most teachers reported knowing how to get information from the Web and send email, only a small percentage of the teachers (sometimes only 1 in 9) knew how to use high-tech tools such as spreadsheets, presentation software, or digital imaging to enhance their lessons [5].

Therefore, while computer technology use appears to be increasing, the most common and frequent uses have resulted in only incremental, or first order, changes in teaching style and remain far removed from the best practices advocated in the literature [6]-[7]-[8].[6] classified exemplary computer technology users based on standards that "suggest a classroom environment in which computers were both prominent in the experience of students and employed in order that students grow intellectually and not merely develop isolated skills" (p. 294). Low-level technology uses tend to be associated with teacher-centered practices while high-level uses tend to be associated with student-centered, or constructivist, practices [6]-[9].

According to [10]-[11]-[6], and [12], it takes five to six years for teachers to accumulate enough expertise to use computer technology in ways advocated by constructivist reform efforts. The assumption is that increased computer technology use will actually prompt teachers to change their practices toward more constructivist approaches. While this may be true, it has yet to be verified by empirical research [5]-[13]. [14] noted that few fundamental changes in the dominant mode of teacher-centered instruction had occurred even in computer-based classes, teacher-centered instruction was the norm. Cuban and his colleagues postulated that these results might have been due to the "deeply entrenched structures of the self-contained classroom, departments, time schedules, and teachers' disciplinary training" (p. 83).

Although changes in these structures might create more opportunities for teachers to use student-centered approaches, other second-order barriers (barriers that are intrinsic to teachers and that challenge their beliefs about current practice) may limit their efforts [15]. Although culture and context create norms of teaching practice, teachers can choose, within these limits, the approach that works for them. This autonomy provides teachers with choices to adopt, adapt, or reject an instructional reform [8]. Therefore, the decision regarding whether and how to use computer technology for

instruction rests on the shoulders of classroom teachers. If we are to achieve fundamental, or second-order, changes in classroom teaching practices we need to examine teachers themselves and the beliefs they hold about teaching, learning, and computer technology. Full integration of computers into the educational system is a distant goal unless there is reconciliation between teachers and computers. To understand how to achieve integration, we need to study teachers and what makes them use computers [11]. [16] supported this and stated that it's not a problem of resources, but a struggle over core values.

The purpose of this paper is to examine the relationship between teachers' pedagogical beliefs and their computer technology practices. While previous researchers have documented the influence of teachers' pedagogical beliefs on classroom practices related to teaching mathematics [17], science [18], history [19], and literacy [20], few have examined how these beliefs influence teachers' adoption and use of computer technology. It is expected that by gaining a better understanding of this complex relationship we might gain a greater appreciation for why more teachers aren't using computer technology in ways advocated in the literature. This may enable us to facilitate a better alignment between research, practice, and beliefs and to provide more effective ways of supporting and documenting teacher change. Finally, the goal is to facilitate uses of computer technology that lead to increased student learning.

II. DEFINITION OF TEACHERS' BELIEFS

According to [21], an important concept in understanding teachers' thoughts, perceptions, behaviors, and attitudes is teachers' beliefs. All teachers hold beliefs about their work, their students, their subject matter, and their roles and responsibilities [22]. That is, teachers' beliefs are thought to have a filtering effect on teachers' conceptions of teaching, decisions, and judgments. It is very difficult to define teachers' beliefs. There has been no consensus on what the construct of teachers' beliefs refers to, and the term has acquired a rather non-specific, indistinct usage. [22] who is known to have provided one of the most extensive theoretical syntheses of teachers' beliefs, reviewed 20 different researchers' definitions along with distinctions they make between beliefs and knowledge, but did not find a consensus on how to define teachers' beliefs. The difficulty in studying teachers' beliefs has been caused by definitional problems, poor conceptualizations, and differing understandings of beliefs and belief structures [22].

The most complex issue in research on teachers' beliefs is how to distinguish beliefs from knowledge [23]-[22]-[24]-[25]-[26]-[27]-[28]. It is difficult to describe where beliefs end and knowledge begins or vice versa. [29] concept of teachers' personal practical knowledge, which refers to how a teacher understands a classroom situation, includes both teachers' beliefs and knowledge. [29] treated teachers' beliefs about subject matter as part of their subject matter knowledge. [22] suggested that knowledge and what he termed the belief system, which consists of beliefs, attitudes, and values, are "inextricably intertwined" (p. 325). [30] also decided to use the terms 'beliefs' and 'knowledge' interchangeably in her analysis of methodological issues

involved in studying teachers' knowledge. [31] stated that "in the mind of the teacher, components of knowledge, beliefs, conceptions, and intuitions are inextricably intertwined" (p. 446). [32] suggested a subject matter representation. According to these ESL specialists, the subject matter representation lies at the intersection of teachers' knowledge of a particular discipline, their knowledge of learners and learning, their knowledge of contexts, and their assumptions and beliefs about each of these elements (p. 89).

Some researchers use terms or concepts that can include both beliefs and knowledge. [22] proposed the concept of teachers' belief systems. [33] argued that the terms 'knowledge,' 'assumptions,' and 'beliefs' do not refer to distinct concepts, but are points on a spectrum of meaning. Woods proposed an integrated network of beliefs, assumptions, and knowledge. [34] suggested beliefs to be a subset of meta-cognitive knowledge, which refers to "the specialized portion" of an acquired knowledge (p. 435). [34] argued that "beliefs are distinct from meta-cognitive knowledge in that they are value related and tend to be held more tenaciously" (p. 436). [35] used the term, "teachers' personal pedagogical systems," which were defined as "stores of beliefs, knowledge, theories, assumptions, and attitudes" (p. 9). [36] then adopted the term "teachers' cognition" and defined it as the sum of "the beliefs, knowledge, theories, assumptions, and attitudes that teachers hold on all aspects of their work" (p. 95). [28] redefined teachers' cognition as "the unobservable cognitive dimension of teaching – what teachers know, believe, and think" (p. 81). This notion of teacher cognition was also adopted by [27]. [22] used the term in such a way that it largely referred to teachers' educational beliefs, while [26] used the same term in a more specific way: in her usage, teachers' beliefs mean "teachers' pedagogical beliefs, or those beliefs of relevance to an individual's teaching" (p. 187).

Despite the lack of agreement in definition and possible confusion in usage, researchers have been trying to clarify conceptualizations of teachers' beliefs by looking into common features identified in various empirical works, accounts, and definitions. [23] identified four features that can be used in distinguishing beliefs from knowledge. The features include a) existential presumption, b) alternativity, c) affective and evaluative loading, and d) episodic structure. First, according to [23], 'existential presumption' refers to personal truth about students, their leaning, their ability, their maturity, and so on. Therefore, beliefs state the existence or nonexistence of entities such as maturity in relation to students' achievements. This reification of abstract characteristics into concrete ones is important because such entities tend to be seen as beyond the teacher's control or influence. Second, 'alternativity' refers to conceptualizations of ideal situations differing significantly from present realities, and beliefs often incorporate a view of an ideal or alternative state that contrasts with reality. In this respect, beliefs serve as means for defining goals and tasks and organizing the knowledge and information relevant to the tasks. Third, beliefs are strongly associated with 'affective and evaluative components'. So beliefs are often expressed in the form of feelings, moods, and subjective evaluations based on personal preferences. Finally, beliefs are characterized by their 'episodic structure', that is, they are often found to be

related with particular, well-remembered events. [23] also suggested that beliefs tend to be organized in terms of larger belief systems. These larger belief systems are loosely bounded networks and may contain inconsistencies and even contradictions.

According to [23], this inconsistent nature of belief systems helps to simplify and deal with complex situations such as classroom teaching. [22] provided a more extensive list, consisting of 16 "fundamental assumptions that may reasonably be made when initiating a study of teachers' educational beliefs" (p. 324). Among the assumptions are the notions that: a) beliefs have stronger affective and evaluative components than knowledge; b) due to their potent affective and evaluative nature, beliefs affect behavior more strongly than knowledge, c) beliefs function as filters through which new phenomena or information are perceived or interpreted, and d) changes in beliefs during adulthood are rare (pp. 324-326). In contrast, [26] lists four features: a) a belief is accepted as true by the individual holding it, while knowledge must be true in some external sense, b) beliefs guide people's thinking and action, c) individuals may be conscious or unconscious of their beliefs, and d) beliefs have an evaluative aspect (p. 186).

Based on these discussions of major features of beliefs, it can be stated that: a) teachers' beliefs are of personal truth, b) teachers' beliefs are affective and evaluative, c) teachers' beliefs influence their behavior, d) teachers' beliefs function as filters through which information is perceived, e) teachers' beliefs serve as means of defining goals and tasks and organizing the knowledge and information relevant to those tasks, and f) teachers' beliefs are not easily changed.

III. THE NATURE OF TEACHERS' BELIEFS

Beliefs "travel in disguise and often under alias – attitudes, values, judgments, axioms, opinions, ideology, perceptions, conceptions, conceptual theories, internal mental processes, action strategies, rules of practice, practical principles, perspectives, repertoires of understanding, and social strategy" [22]. According to [22], teachers' personal philosophies involve beliefs, values, and action preferences that are grounded and contextualized in the classroom events. They stated that teachers' beliefs about instruction indeed show their views of curriculum implementation including the roles they assume, the roles they assign to their students, and their approaches to how they teach the content in the pertaining learning environments that teachers create for teaching and learning.

According to [23], belief is an important factor about how teachers organize their knowledge to arrange the classroom activities or tasks. He claimed that the relationship between beliefs and tasks are highly complex, since belief systems are "loosely-bound with highly variable and uncertain linkages to events, situations, and teachers' knowledge system" (p.321). [37] expressed that teachers' thinking, knowledge, experience, and beliefs and actions are interrelated, and they play a key role in their perceptions of implementing instructional strategies. Teachers' general pedagogical knowledge "includes knowledge of various strategies and arrangements for effective classroom managements; and more fundamental knowledge and beliefs about learners, how

they learn, and how that learning can be fostered by teaching" (p. 39).

[38] referred to teachers' beliefs as teachers' implicit theories in his research on teacher thinking, and stated that teachers develop and hold implicit theories about their students, the subject-matter, and their roles in the classroom. [38] defined teachers' implicit theories as being "generalizations drawn from personal experience, beliefs, values, biases, and prejudices" (p. 6). Teachers' implicit theories are not as neatly nor clearly defined in practice as they are in the textbooks, and tend to be eclectic and cause-effect related. [38] declared that these theories play an important role in the judgments and decisions teachers make in their teaching. "Teacher beliefs can be considered from the situated cognition point of view and they are context bound (situational). Teacher beliefs are not rooted in general theories of learning, cognition, or instruction, but in what had evolved in the past situations, particular instances, trial and error, and muddling through. Teacher beliefs are knowledge, experience, and environment-based. Teachers are pragmatic, and may establish or validate their beliefs in context specific environments where their instructional experience is successful. Teachers justify their beliefs or may attain new sets of beliefs when they successfully experiment with new instructional approaches that work in a given context.

Beliefs are defined as socially viable learned knowledge that can be observed in the classroom practices of teachers. Teacher learning cannot be separated from the social situations in which the curriculum is implemented. Teachers' classroom practices are led by their beliefs; however, teachers' beliefs and knowledge are always situationally determined. Therefore, teachers' classroom decisions are not only related to what they know, but also how their knowledge is indicated in their social setting, where teaching and learning happen. Based on the above reviewed research, it can be indicated that beliefs are context-bound [39], implicitly defined [38], and ill-structured [23]. Beliefs can neither be clearly defined, nor do they have a single correct clarification. Beliefs involve attending to multiple and sometimes conflicting perspectives. Teachers' beliefs tend to be more experience-based than theory-based. Teachers' classroom approaches to teaching are important referents in our understanding of their beliefs and knowledge base.

IV. THE PROCESS OF FORMING BELIEFS

According to [22] beliefs are created through a process of enculturation and social construction; they can be formed by chance, an intense experience, or a succession of events. Early experiences tend to color later experiences even to the extent that subsequent, contradictory information will be manipulated to fit with earlier interpretations. [40] claimed that this is due to the fact that beliefs serve both cognitive and affective/social functions. Therefore, people might accept a certain idea independent of its coherence with relevant knowledge, or perhaps even change a belief, despite reducing conceptual coherence, because it enables the achievement of affective or social goals. Given this, personal theories and beliefs are rarely sufficiently revised and, thus over time, become deeply personal, highly engrained, and extremely resistant to change.

Due to the fact that few teachers have experienced the use of technology in their own schooling, they are unlikely to have many preconceived ideas about how technology should be used to achieve student learning. Yet, based on the nature of beliefs, both inexperienced and experienced teachers are likely to respond to these new instructional situations by depending on previous beliefs and experiences [30]. Even new information about technology, if attended to at all, will be filtered through these existing belief systems. Therefore, teachers are likely to think about technology in the same way they think about other teaching methods, tools, or reform initiatives, depending on if/how they classify technology into one of these categories. Whereas some teachers may think of technology as just another tool they can use to facilitate student learning, others may think of it as "one more thing" to do (i.e., an innovation). These early perceptions and classifications result in different beliefs regarding if, when, and how to use the tool.

If technology is treated as an instructional innovation, beliefs will play a significant role in whether/how it is adopted and implemented [41]-[42]-[18]. Based on the reported relationship between teachers' beliefs and their implementation of reform initiatives, [43] suggested that teachers use technology in ways that are consistent with their personal beliefs about curriculum and instructional practice. That is, if technology is presented as a tool for enacting student-centred curricula, teachers with teacher-centred beliefs are less likely to use the tool as advocated. Rather, they are more likely to use it to support the kinds of traditional activities with which they are comfortable.

The further a new practice is from existing practice, the less likely it will be implemented successfully [44]. Given this, we might consider introducing technology as a tool to do that which is already valued. Then, once the tool is valued, the emphasis can switch to its potential for doing additional or new tasks, including those that are supported by broader, or different, beliefs [45]. For example, once a teacher becomes comfortable using email to communicate with parents, she may be more willing to consider allowing her students to use email to communicate with peers across the state or even across the world, an activity that has the potential to affect her beliefs about using technology to achieve higher-level goals (authentic writing activities; cross-cultural collaborations).

V. THE PROCESS OF CHANGING BELIEFS

[46] stated that beliefs vary in strength and kind; the ease with which a teacher can change his/her beliefs is related to the strength of the particular beliefs under scrutiny. Stronger beliefs are those that are more central to an individual's identify [47], quite possibly because they were established during earlier experiences and were used in the processing of subsequent experiences [22]. The centrality of a belief relates to its connectedness: The more a given belief is functionally connected or in communication with other beliefs, the more implications and consequences it has for other beliefs and, therefore, the more central the belief [47].

Using the similarity of an atom, [47] described a belief system as being anchored by a nucleus, or a set of core beliefs, and outlined five types of beliefs that vary along this central-peripheral dimension. At the centre are "Type A beliefs", that is, core beliefs that are formed through personal experiences, strengthened through social agreement, and highly resistant to change. "Type A beliefs" involve beliefs about one's identity or self, as well as beliefs that are shared with others. "Type B beliefs" are formed through direct experience but because they are held privately, tend to be unaffected by persuasion. "Type C beliefs" relate to which authorities to trust, and while they are resistant to change, it is expected that opinions about them will differ. "Type D beliefs" are derived from the authorities in which we believe and which can be changed, providing the suggestion for change comes from the relevant authority. Finally, "Type E beliefs" are located at the outermost edge and involve unimportant beliefs that are necessarily matter of personal preference. [47] did not particularly address teachers' beliefs about teaching but it would not be surprising if some beliefs about the nature of teaching are formed over many years of experience as a student and are resistant to change because they have been supported by strong authority and broad consensus [48]. If this is true, then core beliefs about teaching will affect how new information about teaching is processed [30], including ideas related to teaching with technology.

Belief revision was described as being highly subject to motivational influence and epistemological values [40]. Participants in their study showed that, even if presented with sound conflicting evidence, they would not be willing to change their affect-based beliefs (belief in an afterlife; disbelief in evolution), but were relatively willing to change their knowledge-based beliefs (belief in evolution; disbelief in an afterlife). The authors explained that affect-based beliefs, by means of their lack of coherence with the conceptual framework might be immune to threats posed by conflicting information. Any new information is likely to be changed, and if it is correctly comprehended, it will have little effect. According to [47] scheme, it may be that affect-based beliefs, because they are more intimately connected to our personal identities, reside in a more central position in our belief systems, while knowledge-based beliefs, because they are less personal, exist somewhere on the periphery.

[23]-[22] expressed that although beliefs are not readily changed, this does not mean that they never change. According to [23], beliefs change, not through argument or reason, but rather through a conversion process. In order for beliefs to change, individuals must be dissatisfied with their existing beliefs. This is most likely to happen when either existing beliefs are challenged or new beliefs cannot be assimilated into existing conceptions [48]. If a teacher education or professional development program is to be successful at promoting belief change among teachers, it must require them to make their pre-existing personal beliefs explicit; it must challenge the adequacy of those beliefs; and it must give novices extended opportunities to examine, elaborate, and integrate new information into their existing belief systems [30].

[49] suggested that there "can be no institutional vision of technology use that exists separately from beliefs about learners, beliefs about what characterizes meaningful learning, and beliefs about the role of the teachers within the vision" (p. 202). Based on their study of the implementation

of a laptop initiative in one middle school, they recommended that members of the school community hold public conversations to show their beliefs about learners and learning and to make explicit the ways in which technology can facilitate progress toward shared goals, based on those beliefs.

VI. RELATIONSHIP BETWEEN BELIEFS, PRACTICES, AND TEACHER CHANGE

Teacher beliefs are derived from prior experiences [50]-[51]-[25]. Existing beliefs serve as a filter to affect how new events or situations are interpreted [52]-[53]-[22]-[37]-[54]. Prior experiences are incorporated into a person's belief systems through which this person reacts to new situations. [52]-[53] showed how teachers reacted to a new educational policy. Although the goal of the reform was to basically change the teachers' instruction through requiring them to adopt new instructional approaches and materials, many teachers interpreted the requirements based on their existing beliefs. As a result, their instruction presented the effect of their beliefs.

Three types of experiences may shape the knowledge and beliefs of teaching: personal experience, experience with schooling and instruction, and experience with formal knowledge [55]. Teacher beliefs are closely related to teacher practices. Teachers may change their beliefs before or after they change their practices. [55] argued belief-change and practice-change are interactive and the process of teacher change may start with either. [54] described how two teachers reacted to the process of changing instructional strategies. One teacher decided to conduct certain new activities consistent with her changed beliefs. The proposed new activities challenged the other teacher's beliefs and the inconsistency resulted in her belief change.

According to [56], the process of changing in behavior and beliefs is reciprocal and ongoing. Belief change affects how well the teacher does in a classroom, and changes in practices provide the teacher with necessary experiences to develop new thinking and understanding. Research shows teachers' beliefs are not necessarily consistent with their practices [21]-[20]-[57]-[58]. [21] explained a teacher's practices did not show her beliefs because the teacher was undergoing the process of changing beliefs and practices.

Changing teacher beliefs is never an easy task. [56] advocated important innovation should be multidimensional and three components of change are involved: (1) new or revised materials and resources such as new curriculum materials or technologies, (2) new teaching approaches, and (3) belief change. Acquiring new materials and resources may be the most visible and easiest change to accomplish, but changing teaching approaches presents a bigger challenge because new skills and knowledge to conduct new strategies and activities are needed. Therefore, changing teacher beliefs is the most difficult task because teachers' core values need to be made explicit, to be understood, and to be confronted.

Some beliefs are particularly resistant to change because they are more central in the belief system and connect to more beliefs. The longer a belief has been incorporated into the belief systems, the more difficult it is to be changed. These beliefs tend to become the believers' core values and are self-definitive of a person [47]-[22]. Therefore, beliefs derived from personal experiences are particularly resistant to change because they are usually formed earlier in life. Existing beliefs influence future perceptions and information processing and are strengthened again and again. Individuals may hold onto existing beliefs or simply make some superficial change [23]-[22]. Therefore, when implementing new materials or instructional strategies, teachers may keep their beliefs and mistakenly think they are undertaking innovations [52]-[22]-[59].

Even though teachers are willing to change their own pedagogical beliefs, they may still struggle with conflicting beliefs, goals, knowledge, and constraints held by colleagues, students, parents, policy makers, and other stake holders [57]. Contextual factors in schools and classrooms significantly influence the process of changing teachers' beliefs and knowledge [55]. According to [60], complex classroom life includes various activities and processes with different purposes. Many events occur simultaneously or even haphazardly, and these events usually demand the teacher's immediate attention. To manage this complexity, teachers may develop different coping strategies which may not be inconsistent with their own beliefs [61].

Consistency of teacher beliefs and practices is a consequence of an ongoing negotiation process with which an individual teacher resolves conflict between organizational supports and constraints [62]. Teachers do not always make decisions based only on their pedagogical beliefs. To understand and change a teacher's practice, the teacher's beliefs and knowledge, the context surrounding the teacher, and others factors affecting the teacher's decision-making process should all be primary concerns [63]-[33]-[56]. [33] argued finding and categorizing all contextual factors could not uncover teachers' decision-making process because all elements related to the process are interactive dynamically. Thus, a teacher never simply changes one particular belief because it is certainly related to other beliefs and contextual factors.

VII. RELATIONSHIP BETWEEN TEACHER BELIEFS, CONTEXUAL FACTORS, AND TECHNOLOGY USAGE

As teacher beliefs are closely related to teacher practices, teachers' technology usage is naturally affected by their pedagogical beliefs. The important role teacher beliefs play in technology integration has been emphasized by [64]. For teachers to use technology, they must believe: (1) technology can help them achieve higher-level goals more effectively; (2) no other more important goals will be disturbed by the technology usage; and (3) they have sufficient ability and resources to use technology. They explained that teachers may be unwilling to adopt technology if the promoted usage is inconsistent with their existing beliefs or practices. Although various factors may affect teachers' technology integration, teachers' beliefs serve as a filter to decide priorities of different factors. Certain factors can be regarded as more close to the core beliefs. Thus, what types of applications and to what degree technology will be integrated into a classroom depend on the teacher's perception [65]. Technology is usually used in ways to meet teachers' instant needs, to conform to their cost-benefit concerns, and to

support the current practices [14]-[65].

Technology usage requires teachers to change their pedagogical beliefs and teaching approaches [66]-[67]-[68], and these changes may be against their higher-order goals or maybe too demanding to undertake so teachers may resist the innovations [64]. Teacher beliefs need to be consistent with the theoretical foundations of practice. Conducting a practice without a congruent theory may result in unsatisfactory implementation or even no implementation [25]. The study findings of [44] approved that incompatibility between teachers' pedagogical beliefs and their technology usage can lead to unsuccessful results. Integrating technology with instruction adds additional workload to already stressed teachers [10]. It also requires teachers to cope with novelty and uncertainty. For teachers, discarding their current routines and practices and changing their beliefs may put them into a very sensitive situation [69]. It is no wonder they are reluctant to accept the transformation.

Most teachers have very limited understanding and experience about how technology should be integrated to facilitate teaching and learning. While attempting to incorporate technology to their instruction, these teachers tend to refer to their existing beliefs and prior experiences. Their early perceptions can influence developing beliefs about technology integration and the following practices [70]. Therefore, teacher beliefs should be taken into account at different stages of technology integration. Although teacher beliefs are recognized as a crucial factor in technology integration, various contextual factors may cause the inconsistency between expressed pedagogical beliefs and implemented practices with technology [70].

Many researches address various factors and barriers affecting technology integration [71]-[14]-[72]-[73]-[74]-[75]-[76]-[77]. According to [44], the theoretical and practical values of such studies will be limited if they do not clarify the characteristics of each factor, the applied context of the factors, and the relationships among different factors. [78] developed a systematic framework which consists of three dimensions--culture, capability, and infrastructure--to evaluate how to achieve successful reform. [79] proposed four dimensions that would impact technology integration: school structures, classroom dynamics, teacher beliefs, and student behaviors. Both research teams considered different factors as interrelated and argued that simply addressing isolated issues will not lead to successful integration and transformation.

VIII. CONCLUSION

While it is not clear whether beliefs precede or follow practice, what is clear is that we cannot expect to change one without considering the other. If we hope to increase teachers' uses of computer technology, particularly uses that increase student learning, we must consider how teachers' current classroom practices are rooted in existing pedagogical beliefs. When considering ways to change teachers' practice, particularly their uses of computer technology, it is impossible to overestimate the influence of teachers' beliefs. It is important to remember that we do not need to change teachers' beliefs before we introduce them to various computer technology applications. A more effective approach might be to introduce teachers to the types of computer technology uses that can support their most immediate needs. This should increase teachers' confidence for using computer technology so that higher-level uses become more plausible. As schools continue to acquire more and better hardware and software, the benefit to students increasingly will depend on the skill with which teachers are able to use these new tools. Given that these skills are unlikely to be used unless they fit with teachers' existing pedagogical beliefs, it is necessary that we increase our understanding of teachers' beliefs as part of our efforts to increase teachers' computer technology skills and uses. This will not only enable teachers to use computers to their full potential but will enable students to reach theirs as well.

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