A CLOSE LOOK IN TO ROLE OF ICT IN EDUCATION

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Theoretical approaches and frameworks which are helpful to understand the use of information and communication technology (ICT) in the formal education sector are reviewed and examined. The structured literature review and documentary research techniques are applied. Relationships between ICT, curriculum development, pedagogy, and practice in classroom setting are considered. The term 'ICT', in curriculum is discussed. A framework for the investigation of contemporary understandings of ICT in pedagogical practice is presented. Three dimensions of ICT curriculum: 1) intended; 2) implemented; and 3) achieved are employed in this framework. The structural approaches that can be applied for the examination of ICT in each of these three dimensions are discussed. The proposed is a link between 1) the theoretical approaches and aims that policies integrated ICT, proposed at the top-level of policy making; 2) teaching and learning practices, implemented at the middle-level of educational system; and 3) student's learning outcome, expected at the base-level of educational system. It is argued that this framework can be applied in ICT curriculum. This study will provide a conceptual structure for discovering inconsistencies in the understanding and use of ICT at various levels of educational systems.

Key Words: information and communication technology, curriculum, pedagogy

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INTRODUCTION

There is a consensus that use of Information and Communication Technology (ICT) will enhance the quality of teaching and learning process (Paul, 2002; Papert, 1987; Voogt & Pelgrum, 2005; Watson, 2001; Well-Strand, 1991). ICT, which is the acronym for information and communication technology can be defined as: "combination of computer, video and telecommunication technologies, as observed in the use of multimedia computers and networks and also services which are based on them" (Van Damme, 2003).

ICT in this paper refers to the applications found on most desktop computers, digital cameras, recorders, etc. that can be used to enhance curriculum in the classroom. Lafferiere stated that "ICT in schools and classrooms tends to attract school learner's interest and motivation" (Lafferiere, 1999). Although it is assumed that computer supports teaching-learning process and the use of ICT has suddenly emerged, but the concept of ICT in curriculum is still very new and this term is poorly understood.

Many different terms are used to describe various sets of ICT-related curriculums. Tool or tutee (Taylor, 1980), cognitive tools (Solomon, 1986) and mind tools (Jonassen, 2000) are examples of these categories. Tagg identifies the role of ICT as a tool to support and enhance the existing curriculum that enables more effective delivery of the curriculum. He also defines it as a tool to extend the curriculum method, content, product and process to new and useful territories which have not been possible in the past (Tagg, 1995). However, there are still deficiencies of our understanding of the principles behind the design and implementation of computer learning environments and the development of associated pedagogies. Blenkin et al. (1992) argued that without a full appreciation of emergent theories, curriculum change can not take place. Furthermore, research shows that the implementation of ICT within a curriculum is a complex process.

Pelgrum & Anderson (1999) in their international study found that many countries experienced that, despite major investments, ICT implementation in education proceeded slower than expected. Although a rapid improvement in computer-per-student was observed, it appeared that the use of computers in subjects, except for computer literacy and computer science courses, was still marginal. (One of the) major problems is that the educational software is often isolated and not integrated with the textbooks that many teachers use (Van den Akker, Keursten, & Plomp, 1992; Voogt, 2003). Moreover, many ICT applications are poorly attuned to the curriculum (Voogt, 2003).

Although it is generally assumed that ICT has high potential for improving education, research consistently has had difficulty in providing convincing evidence on the impact of ICT on student's performance. This is mainly due to the fact that the use of ICT often contributes to the mastery of complex cognitive skills. These types of skills cannot be determined by means of simple standard tests.
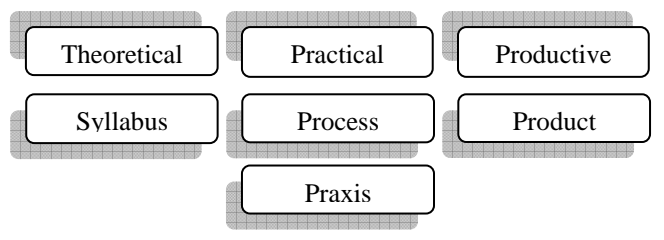
This paper reviews ICT in the school curriculum and highlights models of integrating technology into teaching-learning process. In fact, understanding the psychological and pedagogical approach is helpful for educators and policymakers who would like to learn from the research and experiences of others. Thus, by describing ICT curriculum, we may find out the differences of learning theories, and might be able to find a better way for recent curriculum reform or change in our country. It is hoped that the knowledge gained from this paper would be useful for policymaker to integrate ICT to school curriculum.

The applied research methodology is based on structured literature review and documentary research techniques (May 1997). The paper is structured into six sections. In the first section, theoretical basic is discussed, and in the second section a three-dimensional conceptual framework for the investigation of ICT in curriculum is presented. It includes three analytical dimensions of intended, implemented or teaching and learning, and attained curriculum. In the third section, ICT curriculum models are discussed. Fundamental aspects of the ICT pedagogy are investigated in the section four. In the fifth section, the curriculum interdisciplinary model elements are discussed. Finally in the last section, the relationships between all dimensions are explored.

Theoretical Basic of ICT Curriculum

Early researches were divided into four categories based on curriculum theory and practice: 1) curriculum as a body of knowledge to be transmitted; 2) curriculum as an attempt to achieve certain ends in students' products; 3) curriculum as a process; and 4) curriculum as praxis that is based on Aristotle (1976) description. He stated that the influential knowledge categorization included three disciplines: 1) theoretical; 2) productive, and 3) practical that is depicted in Figure 1.
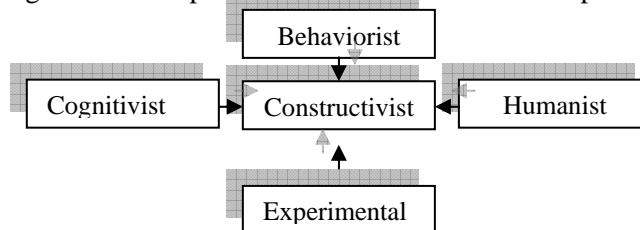
Figure 1. Curriculum theory and practice (Smith, M., 1996-2000)

Theoretical	Practical	Productive
Syllabus	Process	Product
	Praxis	

The body of this approach has focused on syllabus curriculum as knowledge-content and/or subject. Education is the process which has transmitted to students by the most effective methods that could be devised (Blenkin et al., 1992: 23). But, the dominant productive education is most often considered as a technical exercise in which objectives are set, a plan is drawn up, and then applied. Finally, the outcomes (products) are investigated (Bobbitt, 1918-1928; Tyler, 1949; Taba, 1962). Another way of looking at the curriculum is via process. In this sense curriculum is the interaction of teachers, students and knowledge. In fact, curriculum is what actually occurs in the classroom and what people do to be prepared and evaluated. The curriculum as praxis itself develops through the dynamic interaction of action and reaction. As Grundy declared: 'curriculum is not simply a set of plans to be implemented, but rather is constituted through an active process in which planning, acting and evaluating are all reciprocally related and integrated into the process' (Grundy, 1987). So, the role of social context should not be ignored. One of the criticisms of the praxis model is its less emphasis upon context, and this is a criticism that can also be laid at the door of other approaches.

Cornbleth (1990) stated that curriculum is a particular type of process; and illustrated that curriculum is what actually takes place in classrooms. He explained it as an ongoing social process comprised of the interactions of students, teachers, knowledge and milieu. Thus, curriculum as practice cannot be understood adequately or changed substantially without considering its setting or context; therefore, curriculum has shaped contextually. Although some researchers (Cornbleth, 1990; Jeffs, & Smith, 1990, 1999) have argued about the importance of context, the existence of context-school is sometimes ignored. But, curriculum only makes sense when considered alongside notions like class, teacher, course, lesson and so on. Therefore, during the last century, various theories were developed to explain the way of increasing knowledge and skills and understanding how to solve the problems. These approaches are depicted in Figure 2 .

Figure 2. Conceptual model in curriculum development

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                    ┌──────────────┐
                    │  Behaviorist │
                    └──────┬───────┘
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  ┌─────────────┐   ┌──────▼───────┐   ┌────────────┐
  │ Cognitivist │──▶│ Constructivist│◀──│  Humanist  │
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                    │ Experimental │
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According to Figure 1, ICT curriculum is praxis, and according to Figure 2, learning approach refers to constructivism. Praxis conceptualizes a relationship between action and theory where neither action nor theory predominate; what dominates is the relationship exists between the two items (Mezirow, 1991).

 In praxis, critical pedagogy goes beyond situating learning experiences within the experiences of the learner. This process needs the experiences of both the learner and teacher in different activities such as dialogue and negotiation. It prepares and encourages them to recognize and confront the real problems of their existences and relationships. When students confront the real problems of their existences, they will also be faced with their own oppression (Grundy, 1987). The significant part in praxis is the development of two contrasting reasoning skills; inductive reasoning when moving from action to theory, and deductive reasoning while developing action from theory. In praxis approach, learning is a process to develop these contrasting reasoning skills and fundamental components of experiential learning .

Constructivism is a philosophical view based on the way we understand or recognize and it is similar to the pragmatic philosophy of Rorty (1991). Constructivists believe that learning is a constructing knowledge obtained from one's experiences rather than directly receiving information from the outside world (Resnick, 1987; Collins, Brown, & Newman, 1989). Constructivism refers to a learning approach that emphasizes on the importance of experiential exploratory learning. It is evolved from the writings of Piaget and Bruner who focused on the relevance of direct meaningful knowledge construction through experience of the world (Collins & Green, 1992).

The constructive model of learning reflects the typical approach of scientists to scientific investigations. The fundamental elements of a constructive approach includes ponder/question, explore, discover, and explanation phases, and learning domain is based on revised Bloom taxonomy (Anderson & Krathwhole, 2001). The taxonomy begins with definition of knowledge as remembering of previously learned material. Knowledge, according to Bloom,

represents the lowest level of learning outcomes in the cognitive domain. Knowledge is followed by communication, the ability to grasp the meaning of material and goes just beyond the knowledge level. Comprehension is the lowest level of understanding, and application is the next area in the hierarchy which refers to the ability to use learned material in new and concrete principles and theories.
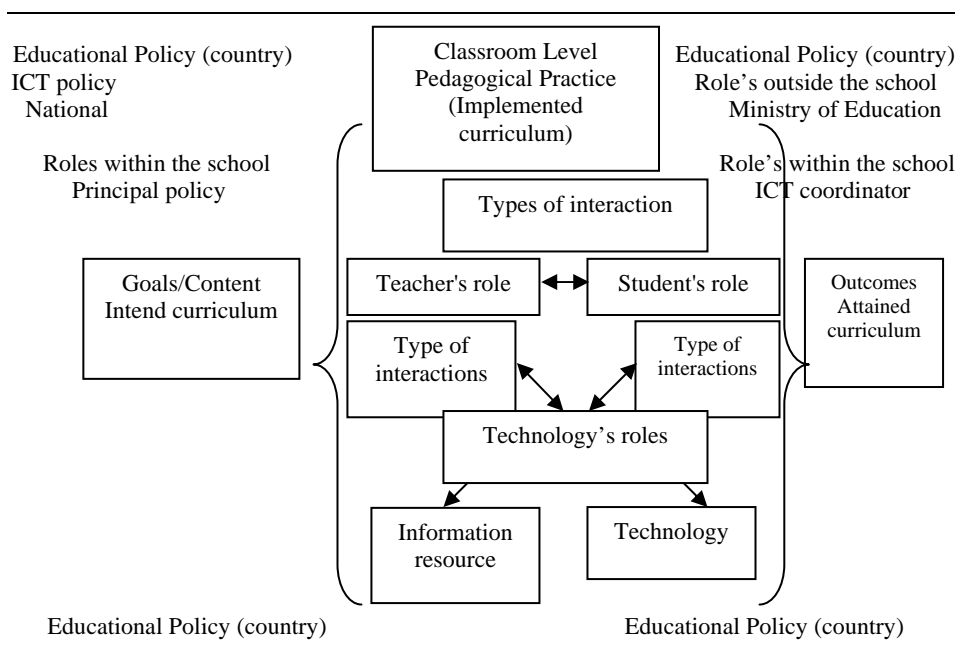
Application requires a higher level of understanding than comprehension. Therefore, students, ranging from simple to complex, require specifying the different types of thinking process: a) knowledge (knowing facts, recalling information); b) comprehension (understanding, ability to explain, and using own words); c) application (applying knowledge to practical situation); d) analysis (breaking down complex concepts into simpler related parts); e) synthesis (combining elements to form new original entity); and f) evaluation (making judgments) (chee and Wong, 2003). However, learning theory in this domain includes: 1) personal knowledge discovery; 2) students, discovering relationship between concepts; and 3) educators, providing instructional context and guiding students to discover certain answers or knowledge.

Constructivist emphasizes on critical thinking, problem solving, authentic learning experiences, social negotiation of knowledge, and collaboration-pedagogical methods that change the role of teacher from disseminator of information to learning facilitator, helping students as they actively engage with information and materials to construct their own understandings. That is, students learn how to find out, not just what to learn (Forman & Pufall, 1988; Newman, Griffin, & Cole, 1989; Piaget, 1973; Resnick, 1989).

Theoretical framework: Dimension of ICT curriculum

Conceptual framework used in studies on applications of ICT in education is divided into three dimensions of intended, implemented and achieved curriculum. The intended curriculum refers to the curriculum described in terms of achievement targets, and educational processes defined at the national school system level. At the classroom level, the intended curriculum refers to the learning goals or objectives of a lesson. Implemented curriculum refers to the educational processes happening at the school and classroom levels, and it is described in terms of learning opportunities for students. Finally, the attained curriculum refers to the students' learning outcomes which can be achieved from the learning experiences at school or classroom levels as depicted in Figure 3.

Figure 3. An overview of theoretical framework ICT curriculum

The success of any pedagogical practice is essentially accompanied with the relationship between the teacher and the learners. Such practices occur in the school context, which are also influenced by external factors at district/regional/national levels. Thus, the entire curriculum context for studying ICT practices has to be studied within the three concentric contexts of micro level (classroom), meso level (school), and macro level (community). These levels are mutually interacting and the boundaries between them are not distinct (Kozma, 1999).

In the other hand, one of the major challenges in realizing curriculum change is to create consistency and balance between these different curriculum representations. Voogt (2003) found that ICT applications are poorly attuned to the curriculum. Also, some practical reasons hinder the implementation of ICT. Cuban (2001) in a study on ICT use in the Silicon Valley region found that teachers hardly change their teaching routines when using ICT. Olson (2000) argued that ICT often does not fit into the existing teaching culture and may even undermine the teacher's sense of efficacy.

Pelgrum, et al. (1997) found characterized practices having "emerging paradigm". However, what the description of "emerging paradigm" will be translated, in terms of pedagogical practice is still not clear. In other words, there is a potential gap between the intended, implemented and attained curriculum (Voogt & Pelgrum, 2005). In order to implement ICT in education, it is stated that, the three-way interaction between learners, teachers, and computers is needed to be considered, while regarding the wider context in which teachers and learners work (Squires & McDou`gall, 1994).

Although research shows that ICT affects students' attitude (Cox, Abott, Webb, Blakely, Beauchamp, & Rhodes, 2004) but findings illustrate that many factors inhibit the implementation of ICT in the curriculum. In other hand, most of the characteristics of computer-based teaching are context dependent, such as curriculum context, or the organizational set up in schools; therefore they do not lie under the control of teachers. They are rather determined by school management and educational policy frameworks. Many researchers have studied the factors that contribute to successful educational changes (Fullan, 1998). Moreover, studies have found that the projects receiving the principal's support were more likely to succeed, since the principal's involvement indicates that the project is being taken seriously, and it helps in recruiting both material resources and psychological support (Marsh, 2001).

Venezky and Davis (2002) illustrated that, the most crucial factor contributing to the advancement of innovation is the availability of infrastructure resources. However, the availability of ICT alone is insufficient and it must be accompanied by sufficient and efficient technical as well as pedagogical support (Pelgrum & Anderson, 1999). Moreover, many innovations fail because teachers do not have an understanding of the principles behind the innovations they are expected to carry out, and have not had sufficient training in the skills needed to use the technology. They often do not see a fit between the technology, their goals and intentions as teachers (Cuban, 1986). Finally, the Impact 2 (2001) suggested a mixture of ICT and mechanical clusters for solving the problems and achieving ideal results.

ICT curriculum models

Nicholson (1995) identified two kinds of curriculum models in relation to ICT: the techno centric and the humanistic. In the techno centric curriculum, the emphasis is on equipping the learners with the necessary skills that will be important for their vocational future. This model that dominated in the 1980s, put emphasis on learning the technology to better meet perceived requirements

of industry. This type of curriculum is usually presented as senior ICT courses, or at a lower level, as "computer awareness". In many cases there is little attempt to integrate the use of this computer knowledge into the mainstream curriculum and the computer remains a technological entity to be studied in an abstract way. The fundamental tenet of humanistic computing is that the computer should be like a pencil, not as an isolated class but as a tool which empowers children with knowledge, thinking skills and problem solving alternatives.

Passey & Ridgway (1992) have outlined four models: a) ICT as a discrete subject; b) ICT as a curriculum area within technology; c) ICT as a discrete subject, used in a number of other areas; and d) ICT across the curriculum, as a theme in all the subjects. The latest model suggested by the National Curriculum Education Technology, involves the delivery of ICT, both across the curriculum and as a discrete subject. Each model has its advantages and disadvantages, for example, the cross curriculum model is appropriate for primary schools, small classes, and schools with good coordinator.

Voogt & Pelgrum (2005) found three curriculum patterns: a) single-subject curricular focus; the ICT-supported innovative pedagogical practices were situated within discipline-based subjects. ICT was primarily used to improve understanding subject, matter, content and concepts; b) thematic curricular focus; the ICT-supported innovative pedagogical practices were of a cross-curricular nature. Curriculum content was offered through themes and ICT was used to facilitate the implementation of lifelong learning goals; c) school-wide curricular focus; the ICT-supported innovative pedagogical practices were integrated throughout the school curriculum. ICT facilitated the realization of the school's vision on teaching and learning. Therefore, ICT curriculum model depends on school curriculum.

ICT interdisciplinary curriculum model

ICT, as an interdisciplinary domain, focuses on providing students with the tools to transform their learning and to enrich their learning environment. The knowledge, skills and behaviours identified for this domain enable students to develop new thinking and learning skills that produce creative and innovative insights. It also develops more productive ways of working and solving problems individually and helps them to express themselves in contemporary and socially relevant ways, communicating locally and globally to solve problems, sharing knowledge, understanding the implications of the use of ICT and their social and ethical responsibilities. Therefore, it includes three phases: phase1) foundation emphasis; mastering and applying technical fundamental in engineering; phase2) specialization, in which, students develop and apply in-

depth knowledge in their chosen fields; and phase3) realization, in which, they bring their education to bear on problems, approaching professional practice. In all three phases of the curriculum students are engaged in disciplinary that required them to put theory into practice.

However, we can identify a number of fields of knowledge whose content or methods are used by researchers and participants in the field of ICT: 1) engineering for methods of selection of materials, tools and techniques with properties required for particular purpose, and for the design, construction and configuration of devices and systems; 2) mathematics for the structures and relationships of logic and algebra which underlie information storage, retrieval and processing; 3) psychology for the ways in which humans interact with machines; 4) sociology for the broader impact of ICT on human activity and relations (Kennewell et al., 2000).

In other hand, teaching approach should focus on the development of higher order skills and should emphasize on: 1) significant pupil autonomy in the selection of tools and resource; 2) active participation by pupils in the process of planning and evaluating the use of ICT in problematic situations; 3) teacher intervention in the form of focusing on questions to assist pupils in the formation of generalizations; 4) demands that pupils articulate their thoughts about the opportunities and constrains offered by ICT techniques, processes and strategies, which they have experienced (articulation may be verbal, written or via e-mail, but should be interactive); and 5) that teaching should develop pupils' enthusiasm and confidence about ICT; that pupils should be given opportunities and encouragement to reflect formally on their ICT learning (Kennewell et al., 2000).

The key skills of planning and evaluation are fundamentals to success in ICT teaching which includes: a) teaching aims and learning objective; b) possible teaching strategies; c) assessment opportunities; d) pupils' prior knowledge; e) structuring lessons, sequencing activities and providing variety; f) the relevance of context; g) the importance of recap and review; h) pace and timing; i) expectations for pupils' achievement and specific target; j) progression in pupils' learning (Kenewell, 2003). Consequently ICT planning includes: 1) identifying aims and objectives; 2) selecting teaching strategies; 3) identifying assessment opportunities. Therefore, don't changed curriculum and we still follow initial routine.

Pedagogical theory of ICT: A literature review

A review of literature showed the use of ICT in education and the modes of usage according to the functions played by the technology as tutor, tool or tutee

(Taylor, 1980), as cognitive tools (Solomon, 1986) or as mindtools (Jonassen, 2000). Watkins and Mortimore (1999), in a review of research literature on pedagogy, assert that the models of pedagogy held by researchers and academicians have become more complex over time, incorporating, for example, recent developments in our understanding of cognition and meta-cognition. However, Schulman's (1987) had focused on the teaching processes, which contained the transformation of knowledge and the ways of teaching (pedagogical content knowledge). Therefore, teacher has a main role in this experience, as result does not incorporate pupils' thinking processes or provide a basis for analyzing pupil–teacher interactions, it may fail to address the important experiences resulting from ICT use (Banks et al., 1999). In this model understanding or identifying the thinking process of learners is important for new technologies. Thus, research has shown that new ways of learning and representations are presented to pupils through ICT.

Alexander (1992) identified that teaching methods and pupil's organizations are the two facts of pedagogy. He illustrated that the pedagogy of ICT should be understood within a broader framework of educational practice. Laurillard et al. (2000) have developed a 'conversational framework' about learning the productive and unproductive approaches in different contexts using various learning methods. Consequently, recent research suggests that the developments of ICT in education need to design a new 'integrated pedagogy' (Cornu, 1995).

Pedagogical approaches

Use of computers to support constructivist pedagogy was shown to be effective by Dreyfus & Halevi (1991). They showed that the use of computer programs to provide an open learning environment allowed pupils to explore within a framework. They also declared that the teacher was working as a guide; even weak students were able to deal in depth with a difficult topic.

McLoughlin & Oliver (1998) defined pedagogical roles for teachers in a technology-supported classroom, including settings of joint tasks, rotating roles, promoting student to be self manager, supporting meta-cognition, fostering multiple perspectives and scaffolding learning. An assumption here is that the use of ICT has changed pedagogical roles of teachers, and a compelling rationale for using ICT in schools is, its potential to act as a catalyst in transforming the teaching and learning process (Hawkridge, 1990).

Different types of pedagogical patterns influence on the interaction between teacher, students, and technology. For example, expository approach refers to the transmission of information from expert to novice (Ormrod, 1990). Martin stated that in expository instruction "teacher is the source and owner of

knowledge" (Martin, 2003). Instructors using expository methods dominate the presentation of lessons, and use strategies that include lectures, demonstrations, and videos (De Jong et al., 1998). The whole lesson follows a pre-structured sequence of steps. The teacher initiates each step by providing information and/or posing questions. The student responds, and the teacher will then provide evaluative feedback and follow up the student's response. The teacher exercises strong control over the development of the classroom discourse through such cycles of Initiation-Response-Evaluation (IRE). The functions performed by ICT during the teaching and learning process would include: 1) to display notes and drawings to supplement the teacher's oral presentation, 2) to locate the topic of learning in an interesting context, 3) to supply stimulus materials to elicit ideas from students for discussion, 4) to provide visualization for the understanding of dynamic processes. The teachers also provided the names of web sites so that the students could do follow up reading after the teachers' exposition. Although ICT was used in teaching the lesson, there were often other types of activities such as paper and pencil work.

Task-Based Approach to learning: Historically, Task-Based Learning (TBL) seems to be an approach in language learning. According to Willis (1996), "the task is a goal-oriented activity in which learners use language to achieve a real outcome…learners use any target language resources, in order to solve a problem, do a puzzle, play a game, or share and compare experiences". Some educators in the field of ICT education have also put ideas similar to TBL activities forward quite strongly. This includes those who advocate theories of constructivism and apprenticeship learning (Kafai & Resnick, 1996; Lave & Wenger, 1991). These views raise fundamental doubts about the validity of conventional learning of declarative knowledge, which is distanced from the actual physical and social context. At the beginning of the lesson, the teacher usually takes an active role in providing the background of the task (reviewing related knowledge, introducing the purpose of the task, and so on) and in teaching the students how to use the technology.

In task-based lesson, a substantial part of the time is allocated either to students to work on the task, individually or in groups. In the process, the students are playing an active role in their work. Here, the teacher's control is exercised indirectly through the definition of the task goal and directly through the discussion with students during their work. In discussions between the teacher and the students, the teachers typically play a less prescriptive role. They often coach reactively, in the sense that their directions or assistance is given based on what the students want. They give their advice only after they have solicited and understood the ideas of the students, and try as much as possible to follow the students' line of thinking. In some cases, the teacher works as a technical

support person for the students. The students tell the teacher what they want to do (but cannot do), and the teacher tells them what technical steps could be taken. Some teachers would conduct an interim or final review of the task products by the whole class. In these review sessions, the teachers would play a facilitating role. They highlight key questions and invite comments from the students.

Problem-Based Approach to learning: The early applications of Problem-Based Approach (PBL) were in medical schools in the 1960s. It is now widely used in the field of education. The PBL instruction addresses the ability to: 1) think critically and be able to analyze and solve complex, real-world problems, 2) work cooperatively in teams and small groups, and 3) demonstrate versatile and effective communication skills, both verbal and written (Duch, Groh, & Allen, 2001). In PBL, learning begins with facing a messy, unstructured real world problem. The problem triggers the learning by having students define the problem, analyze the problem, generate hypotheses, and identify learning issues. Students then work in small group to discuss the problem scenario. They ask themselves questions, such as what they know from the problem scenario presented, what they need to know and what ideas come to their minds to solve the problem proposed by the teacher (Aspy, Aspy, & Quimby, 1993).

PBL includes students' abilities to: a) pose questions and/or answer, questions about a suitable issue intelligently by formulating strategies/plans and conducting investigations, b) collect data, c) analyze data mechanically, d) use the computer and spreadsheet programs (Excel) as a tool for statistical calculation, e) represent data graphically using Excel, and f) interpret data and draw conclusions. However, Biggs (1999) stated that there is no single, all-purpose best method of teaching such as available resourcing, students' abilities, and individual strengths and weaknesses as a teacher. It depends on how we conceive the process of teaching using ICT to produce learning resources and provide successful learning experiences for students in the future.

DISCUSSION AND CONCLUSIONS

Various terms have been used for the definition of ICT-related curriculum. This discussion has shown that semantic differences between various terms still are not clear; however different words entail different conceptual understandings of the scope and nature of ICT-related curriculum. This paper defined ICT in curriculum as a transferable set of capabilities related to ICT use. This definition conforms with technology as tools, relevant to various contexts.

To understand ICT curriculum in a specific context, three dimensions of ICT curriculum-intended, implemented and achieved were investigated. Each

dimension is related to different levels and aspects of an educational system: intended curriculum refers to top-level policy making aims and strategic attitudes; implemented curriculum relates to middle-level teaching and learning approaches and achieved curriculum refers to base-level empirical learning activities and students' experiences and outcomes. Although there is a gap between these dimensions, some links and interactions could be found between them as depicted in Figure 3.

Concluding remarks about the use of ICT are summarized as follows: First, ICT implementation emphasizes different aspects of ICT-related capabilities. As mentioned in many countries, goals of implementation of ICT in curriculum are not clear and need some equipment. Second, theoretical basic ICT in curriculum is based on constructivism; but education in many countries is still based on behaviourism, and need to change the attitudes in educational system. Third, many factors that influence on ICT implementation in education need to be considered. Fourth, many researchers argued that ICT pedagogy need an integrated model. Finally, ICT curriculum model has strong emphasis on interdisciplinary model, and focuses on knowledge and tool-centred learning of ICT capabilities. Thus, teaching and learning processes which have focused on technical ICT knowledge, skills and tool are integrated with other subjects. They integrate ICT technical capacities into basic ICT literacy and core school subjects. In the cognitive process emphasis is on higher-order thinking "meta cognition" outputs.

Discussed article is a survey of literature and a documentary research that has been employed for the analysis of ICT curriculum in theoretical and conceptual framework studies. This review shows that ICT use in curriculum needs more investigations. It provides a structure for researchers to understand and apply ICT curriculum at various levels of educational systems.

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