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A Blended Theoretical Framework for Integration of ICT within Early Year Education: an Overview

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Abstract

This paper describes a blended theoretical framework of socio- cultural theory and Bronfenbrenner's ecological systems model to considerations of integration of ICT in early year's education. The theories are reviewed and its extended version which uses the idea of different system to help analyse the use of technology in context described. Two model of use computer technology are described: one exploring the use of ICT within various socio-cultural contexts and the other exploring the use of ICT in different geological system. A Sociocultural approach towards the study of Information and Communication Technologies (ICT) in early year's education rejects the view that ICT can be studied in isolation; it must be studied within the broader context in which it is situated. The ecological systems model enables the investigation of numerous issues surrounding the integration of ICT into early year's education via exploring perspectives of involved stakeholders, at all ecosystemic levels: education officials at the macro- and exo-levels, parents and head teachers at the meso-level, and teachers and children at the micro-level. This allows for the acquisition of rich and diverse data that provide an in-depth picture of ICT practice in early childhood settings.
Keywords: socio- cultural theory, ecological systems model, ICT, Computer technology, Early Years Education

1.1 Introduction

The use of a theory in any study means provision of theoretical framework that explains the links among the phenomenon to include visions that lead to exploration of relationships, and the theory is a representation of reality and provides researchers with scientific methods for analysis the results of studies via provision of evidence and justifications (Tudge *et al.*, 2009). In the following two sections, two most common and widely utilised theories in research will be discussed: Socio-cultural theory and Bronfenbrenner's ecological model of development.

1.2 Sociocultural Theory

Socio-cultural theory (SCT) was derived from Vygotsky theory (1978), Constructivist theory (SCT), and Bronfenbrenner's ecological model of development. SCT considered the socio-cultural and historical dimensions of the individual's daily activities, and seeks to understand the performance and behaviour of individual within the context in which they live (Lave and Wenger, 1991; Fleer, *et al.,* 2009). The theory illustrates all targeted human activities realized via physical, social and psychological tools. Some tools can solely be realized through their socio-cultural and historical context (Lantolf, 2000; Villamil and Guerrero 2006).

The fundamental concept of SCT is that human brain demands mediating tools to communicate with others and express ones-own self (Lantolef, 2000; Lantolf and Thorne, 2006). However, these tools comprise symbols, numbers, signs, and more importantly, is the language where these tools fall within the socio-cultural context. According to (Vygotsky, 1978), such tools are inconstant and varied according to situation; they are passed from generation to generation; each generation amends and develops them to meet their current socio-cultural and political needs. In case of SCT, understanding of human brain and individual's activity demands recognition of mediating tools by understanding the environment in which they appeared, including the surrounding physical, social and historical environment in addition to individual's beliefs and knowledge (Murphy and Lvinson, 2003). Socio-cultural theory focuses on semiotic mediation, particularly, speech which provides useful information and data for research (Daniels, 2004). Vygotsky's perception indicates that human communication occurred through the use of language as a mediator (Vygotsky, 1978). Language, as a means of communication, enables us to understand ourselves and others including myriad diverse contexts and situations in our world. Accordingly, the

socio-cultural theory was adopted in this study as part of theoretical framework as it provides an insight as to the reality of the use of ICT in Jordanian kindergartens context from the stakeholders' perspective as the language is the principal mediation tool which the researcher would never arrive at this knowledge without it.

However, in order to achieve a profound understanding and creation of this knowledge, the researcher should be fully aware of the culture in which such knowledge occurs. Further, the researcher should place this knowledge, derived from the sample of study, within the current socio-cultural context and links it to the bigger picture of this situation. Interpreting and analyzing data derived from the sample of study depends heavily on the researcher who should be, ideally, part of the culture of the sample of study.

Furthermore, socio-cultural theory underscores the significance of the socio-cultural context in which learning occurs, including the impact of context on what is learned (Vygotsky, 1978). The individual's mental performance, naturally, lies within socio-cultural, institutional and historical contexts. In order to understand human's thinking and learning, the context and conditions in which learning and thinking occur must be considered (Bonk and Cunningham 1998). Thinking cannot be understood independently of people's feelings and responses (Murphy & Lvinson 2003). Among the key strengths of SCT is that it considers people's feelings towards attitudes to include their reactions. Not only it focuses on people's cognitive responses, but also considers emotional ones (Murphy and Lvinson 2003; Villamil and Guerrero, 2006). The selection of SCT as a theoretical framework that considers socio-cultural and historical basis including knowledge, views, attitudes, expectations and feelings is extremely significant since values, feelings, perceptions and behaviours of the sample of current study reflect the way they live and interact with their environments. Thus, SCT represents an ideal and critical tool for the ongoing research.

Kindergarten's environment comprises numerous internal entities such as children, teachers, school administration, staff, parents, resources, curriculum, facilities, funding, rules and regulations, educational policies which may interact and affect each other, creating a constant evolution and change in the kindergarten. On the other hand, kindergarten's learning environment is influenced by a number of external factors that affect them such as the surrounding community, other kindergartens, MoE, local education authority, socio-economic status of the area including people's beliefs. Introduction of ICT in curricula and classroom activities in kindergarten might be considered a critical factor that creates development and changes in the teaching and learning process. However, the use of ICT by children and teachers in kindergarten's context might be affected by various internal and external factors which might have adverse impact on children's learning and development. According to Jonassen and Rohrer (1999), human activity (the use of ICT) cannot be understood and analyzed outside the context in which it occurs. Thus, the use of ICT on early years education seems to be appropriate as it represents the activity that should be understood and analyzed within the local cultural context.

Vygotsky (1978) argued that human cognition develops gradually due to learning via more advanced tools. He recognizes the importance of available artifacts or cultural tools within educational environments. These tools can be symbolic such as reading and writing, or physical such as pens, papers, books, computers, cameras and suchlike (Rogoff, 2003). This was proved by Downes *et al.* (2001, p. 4) who states: '*in the 21st century these cultural tools include digital as well as paper- based communications and information tools, artefacts, and media'*.

Indeed, social mediation in Vygotsky's theory is a constant concept in educational discourse which provides interpretations to children's learning and development. In ECE, the concept of mediated learning is apparent regarding the focus on relationships that mediate the learning process. SCT learning approach focuses on the relationships developed by the child in various contexts. These relationships might be with people, places or objects. As a result of these relationships, children's knowledge about the world they live in is developed (Fleer *et al.*, 2009). According to Vygotsky (1978) and Rogoff (2003), learning is constructed socially and culturally where learning is a result of relationships between peers and adults and social context where development can be created. Specifically, children learn participation in society and culture through interaction with socio-cultural tools which mediate between them and adults. Likewise, Lave and Wenger (1991, p 31), described learning as *'an integral and inseparable aspect of social practice'*. These perspectives can be illustrated through Hayes's view (2006) who pointed out that when ICT is used to obtain knowledge, it may include: knowledge about computers, knowledge that can be learned through computer, knowledge how to learn when using computer and knowledge of how computer may affect people's life.

Accordingly, it could be concluded that Socio-cultural theory in ECE emphasizes the crucial role for socially and culturally mediated learning together with mutual relationships among children themselves, people, places and objects. This indicates that the suitable approach for the development of children's ICT skills in early years as in this study involved the improvement of ICT literacy since it will form a critical pillar in the lives of children (Siraj-Batchford and Whitebread, 2003; O'Hara, 2008).

Among the strengths of Socio-cultural theory is the ability to illustrate entwined between learning and development. As Vygotsky (1978, p. 86) defined the 'zone of proximal development' (ZPD) as ' *it is the distance between the actual developmental level as determined by independent problem solving and the level of*

potential developments as determined through problem solving under adult guidance or in collaboration with more capable peers'. This concept refers to the new information and knowledge that the learner acquires by the assistance of another person such as the teacher, peer or adult. The role of mediator between the learner and knowledge is played by this person where he tries to assist the learner to realize the goals that unlikely to be realized by the learner alone. From this perspective, learning is not an individual process; it is a social process resulted from various forms of cooperation and interaction (Rogoff, 2003).

The previous discussion indicated that SCT highlights the roles played by others (teachers, adults, peers) in the lives of learners, who work as mediators in supporting ZPD (Williams and Burden, 1997). ZPD is a feature of an individual's learning which depends on the amount of support, intervention and assistance offered by the teacher, adults and peers which, in turn, assists in guidance of learner's development through collaborative and interactive activities. ZPD concept underscores that individuals are interdependent and social processes have crucial roles in the development of all forms of knowledge (Xu et *al.*, 2005).

Among the methods utilized by teachers to provide the necessary effective support to ZPD is through 'Scaffolds' (Vygotsky, 1978). Vygotsky's concept of the Scaffolds highlights the role of teachers' experts in provision of the necessary assistance and support to novice learners to develop their understanding and acquisitions of new concepts that enable them construct their own understanding. This is considered a form of effective teaching (Fleer *et al.*, 2009). According to DeVillar and Faltis (1991), scaffolding comprises re-formulation of previous knowledge to clarify the link between the new and old information. Vygotsky (1978) concluded that adults represent mediators who bear the responsibility to facilitate children's learning. He considered the teacher's method in interpretation of stances and incidents as a principal element in guidance of children's learning and arrived at positive learning outcomes. However, the need for explanation of the environmental and external factors is still needed.

1.3 Bronfenbrenner's Ecological Systems Model

Bronfenbrenner's ecological system model explores child's environment as regards quality and context; and how the surrounding environment assists or hinders child's incessant development. Ecological model attempts to explain individual differences in knowledge, development, competencies through guidance, support and structure of the society in which they live (Paquette and Ryan, 2001). In other words, ecological systems theory provides an inclusive overview of environments impact on development through the placement of developing child as part of complex relationships affected by multiple levels of surrounding environment. These levels expand beyond the direct child's environment to incorporate other social environments that affect him/her (Bronfenbrenner, 1997). The importance of Bronfenbrenner's model is that he underscores the significance to consider all aspects of children's environment where he weighed great importance to the nature of relationships inside and between broader socio-cultural contexts and their impact on children's development.

Therefore, Bronfenbrenner (1979, 1992) suggests that the child is the centre of five overlapping environmental systems and is influenced by the nature of these experiences and interactions related to each one of these levels. Microsystem is the most influential on child; it highlights the relationships between the child and immediate environments in which most of his interactions and relationships occur. Most important of these environments are child's family, peers, school, neighbours, neighbourhood, playgrounds and the like. This means that Microsystem comprises settings where individual lives and spends most of the time; thus, most researchers focused on this system (Bronfenbrenner, 1993).

Ecological model has four systems where people, in Microsystem have strong impact on child, i.e. if the relation between child and people, in immediate environments, break down, this affects child's ability to easily explore the parts of his environment (Paquette and Ryan, 2001). Fundamentally, this model assumes that the child's development is a result of ongoing and mutual interactions between the child and Microsystem contexts. In this context, Dokett and Perry (2003) argued that *'children exist within a web of meaningful social relationships; what is important to them and what they know derives largely from the interactions within these relationships'* (p 9).

The second level is Mesosystem which indicates to the network of relationships and interactions between immediate environments in Microsystem. This system affects child's development indirectly (Bronfenbrenner, 1979). For example, difference in perspectives between teachers and parents as regards child's teaching. Moreover, children discarded by parents might find it difficult to develop positive relationships with others, or faces difficulty in school. The Exosystem refers to social settings that affect the child's immediate environment settings. For example, parent's duty station, mother's job, pressure of job on parents, salary, school curriculum and educational policies.

Finally, Macrosystem refers to social ideologies, overall cultural values or extended social structure where the individual lives. According to Bronfenbrenner (1993), it comprises cultural values and belief systems such as *'resources, hazards, lifestyles, opportunity structures, life course options and patterns of social interchange'* (p 25). The following figure provides more details of Bronfenbrenner's ecology model.

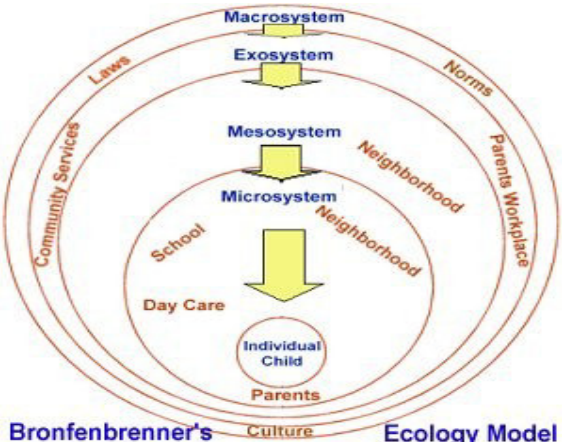

Figure 1: Bronfenbrenner's Ecology Model (adapted from Witt, 2008)

Recently, the concept of Chronosystem was added to Bronfenbrenner's ecology model which refers to environmental events and transitions over life to include impacts resulted from time or critical periods in development (Bronfenbrenner and Morrise, 1998). These changes might occur more frequently in the life of a child or once. For example, transition from pre-school to primary school, and adverse impact of divorce on children.

In more contemporary adjustments to ecology model, Bronfenbrenner and Morris (1998) developed the theoretical framework of the model and suggested naming it Bio-ecological model which gave extraordinary importance to the biological traits and qualities as part of mocrosystem. In addition, it provides information regarding the development of individual's role in environment. Bio-ecological model comprises four key vital components, they are: process-person-context-time (PPCT) which became elements that form the essence of Bronfenbrenner model (Bronfenbrenner, 2005).

The first element of model's component is process. It includes construction of forms of interactions between the individual and environment called 'proximal process', which, over time, works as key driver for the production of human development. The second element focused on characteristics and traits of developing person. There are three types of person's characteristics which most influence the shaping of future development, they are: demand, resources and power traits. Examples on demand characteristics are age, gender, skin color, and physical appearance. These characteristics might affect the types of preliminary interactions due to expectations formed immediately. Resource characteristics relate to mental and emotional resources such as past expertise, knowledge, skills, intelligence as well as characteristics related to physical and social resources such as access to food and housing, parental care, access to appropriate educational opportunities, and other needs of the community. These characteristics affect the individual's ability to participate effectively in proximal processes (Bronfenbrenner and Morrise, 1998).

Power traits relate to mood, motivation, perseverance and success. For example, two children might have the same resources and characteristics; however, their development tracks might be quite different if one of them has the motivation to succeed and move forward when the other lacks such motivation (Bronfenbrenner and Morris, 1998). These elements of person's characteristics form his/her future development. Bronfenbrenner and Morris (1998) indicated that notwithstanding the importance of person's traits as regards relationship with others, objects and symbols, they emphasized the importance of environment's traits.

As ecological systems theory appeared prior to technology revolution, and in response to the increase in the use of communication tools and technology in ECE, Johnson and Puplampu (2008) recently suggested the addition of 'techno-subsystem' as a component of microsystem. Techno-subsystem comprises child interaction with human and non-human elements such as ICT tools at both school and home. The spread of technological tools provides access to information and support 'scaffolding cognitive' such as (communication, chatting, playing, learning, research) which allows supreme operations to solve problems (Johnson, 2008; Nickerson, 2005). According to Joinson (2003), the use of ICT represents a complex set of behaviours that vary widely among individuals, and affected by person's cognitive and personal characteristics. The following figure clarifies the Ecological Techno-Subsystem as a component of Microsystem.

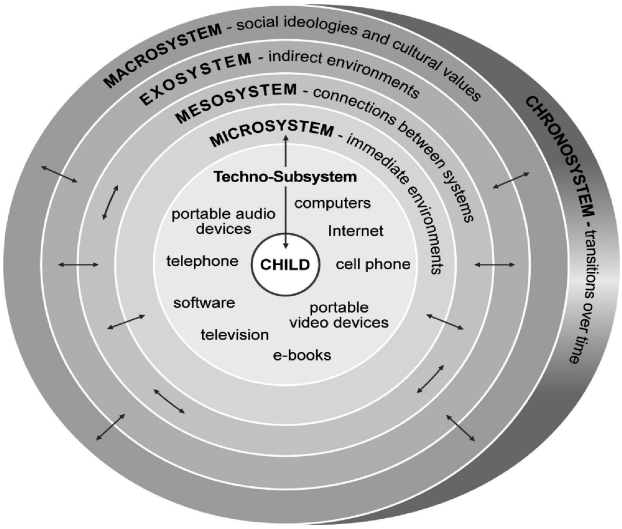

Figure 2: The Ecological Techno-subsystem (adapted from Johnson & Puplampu, 2008)

Most recently, Johnson (2010) suggested ecological techno-microsystem. This model refers to the use of a variety of ICT tools such as (computer, Internet and camera) in immediate environments such as school and home. As shown in the following figure, Ecological Techno-Microsystem focuses on the importance of ICT in the enhancement of children's development in ECE, and suggested that the child's social, emotional, cognitive and physical growth is a result of ongoing and mutual interaction among the child's characteristics (bio-ecology) and a wide set of ICT tools (techno-subsystem) in microsystem contexts (Johnson, 2010).

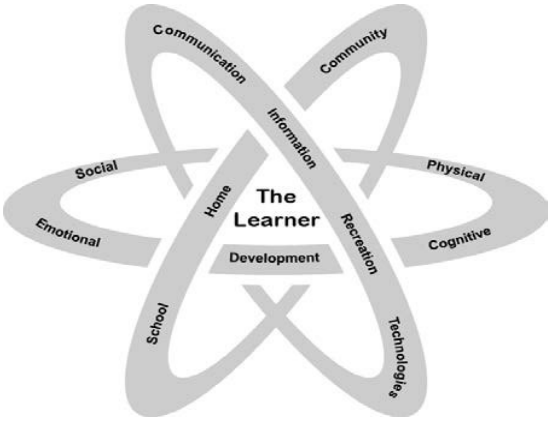

Figure 3: The Ecological Techno-Microsystem (adapted from Johnson, 2010)

Literature review related to factors that thwart integration of ICT in educational process, blended of models and theories such as Davis' technology acceptance model (1989), Ely's eight condition (1976, 1999), and Tearle's Whole School Factors (2002) indicated the existence of internal factors in (Micro-system) affecting the teacher such as knowledge, skills and attitudes as to integration of ICT. In addition, there exist plethora of external factors in (Meso system) that affect teachers within pre-school settings such as location, planning, bases, work division, school timetable and ICT facilitations. The third category represents external powers that affect integration of ICT imposed from outside pre-school environment including educational policy, policy-makers, parents, and community (Exos and Macro-system). Each one of these might affect the teachers' use of technology as well as integrating of ICT in kindergartens' learning (Davis, 1989; Ely, 1999; Tearle, 2002).

Davis' technology Acceptance Model (TAM) (1989) is among the most common models that anticipate how teachers' attitudes and trends affect levels of ICT integration in classroom settings (Moon and Kim, 2001, Teo et *al.*, 2008). Davis (1989) identified two variables related to teacher's beliefs which are supposed to affect integration of ICT in classroom settings: teachers' beliefs as regards the advantage of ICT usage in teaching including ease of use and acceptance. TAM model suggests that teachers' beliefs and behaviours would have numerous consequences on their practices and decisions as to the use of teaching tools. Davis, in his model, concluded that teachers, who believe that ICT is useful, and is enthusiastic to use it, would have positive attitude towards the use of ICT in classroom settings (Moon and Kim, 2001, Teo et *al.*, 2008).

In practice, Tearle (2002; 2003; 2004) in her investigation as to integration of ICT in high school in the UK focused on several elements that had impact on teachers during implementation of ICT. Moreover, investigation focused on teachers' practices at school taking into account internal elements within the school and external elements. Tearle (2003) suggested that, in mesosystem, in order to successfully integrate ICT, some factors must be considered such as: mutual trust between leadership, practitioners and students to exhibit high levels of practices, the use of ICT must include other pedagogical activities; collaboration and positive attitude towards learning; and staff must have motivation to use of ICT. Tearle (2003) concluded that practitioners' competence, resources, role of ICT coordinator, and support were considered as key elements in the successful integration of ICT. In addition, the researcher underscored the availability of hardware, and how often these resources were employed. This might indicate that the researcher, in her work regarding factors affecting the integration of ICT, had never focused on teacher as an individual; rather, she focused on settings at meso level for 'whole school' as an integrated organization.

Following a careful review of literature regarding assessment of technological processes of change in the field of education, Ely (1976) noticed numerous observations in the ongoing researches that facilitate the implementation of ICT innovation in education. The researchers identified eight conditions that facilitate implementation of innovation technology, which might impact creativity and innovation in three level of the system (macro, exo, and meso-system) (Ely, 1999; 1976). These conditions included dissatisfaction with the status quo, availability of knowledge and skills, incentives, participation, commitment, leadership, time and resources (Ely, 1999). The following table summarizes Ely's eight conditions that facilitate the implementation of educational technologies innovation.

Necessary Condition	Description	Key Factors	Relevance to ICT in Early Childhood
Some dissatisfaction with the status quo	There is an existing impetus for change	Leadership	The feeling that ICT may improve current teaching practice
Knowledge and Skills	Practitioners need to have the skills necessary to put the innovation into practice and need to be aware of possible innovations	Experience, skills, intuition and knowledge	Practitioners need skills in using ICT tools for pedagogical purposes
Participation	There should be shared derision – making and communication amongst all parties or at least a representation of all thoughts on the process of change	Time, commitment, knowledge, skills and incentives	Teachers must feel that they are having an input into change, not only head teachers and external stakeholders
Commitment	There must be a commitment by all the stakeholders and practitioners involved to making the innovation possible. A sole innovator is likely to fail but if they are joined by another respected practitioner their chances increase and if they have the backing of more senior practitioners or stakeholders than the plan is more likely succeed.	Teamwork, Leadership and Knowledge	The head teacher should ensure that her staff are equally committed to ICT integration
Resources	Suitable human and material resources should be provided that can support the implementation	Funding, incentives and knowledge	The local authority needs to financially support the integration process and the teachers need the knowledge and skills to use such resources
Time	Time should emphasize as a separate resource and its important cannot be overestimated. The time put aside for implementation should not be the leisure time of practitioners but allocated as part of their professional day.	Leadership, knowledge, funding and commitment	Training time should be provided for teachers during timetabled hours
Incentives	The innovation must provide some reward for the practitioners involved, e.g. it may increase their job's efficiency in the long term and free up some of their professional time.	Incentives, knowledge and skills	ICT should be proven to be time efficient
Leadership	There must be strong leadership by a practitioner that exudes qualities of charisma, vision, authority and persistence. Strong leadership, however, requires that all the pervious stage concerned with practitioners and resources be in place.	Leadership, knowledge, skills and resources	The head teacher must be knowledgeable of ICT, have the resources to hand and have motivated practitioners under her control

Table 1: shows Ely's eight conditions, adapted from Ely, 1999 (p. 300)

The above table illustrates how Ely's conditions might contribute to achieve deeper understanding as to factors that impede the implementation of ICT in ECE. According to Ely's model, it is apparent that teacher is not alone in micro-level; besides, he/she is affected by a number of elements in different systems; for example, in meso-system he/she is affected by head teachers and colleagues; in exo-system he/she is influenced by the available resources; whereas in macro-system he/she is influenced by societal pressure to modernize education. Accordingly, Ely's eight conditions are strong evidence and useful framework in support of these researches to ensure integration of ICT in early years settings. The following figure provides an overview of the theoretical framework for research regarding use of computer technology or ICT in early year's education.

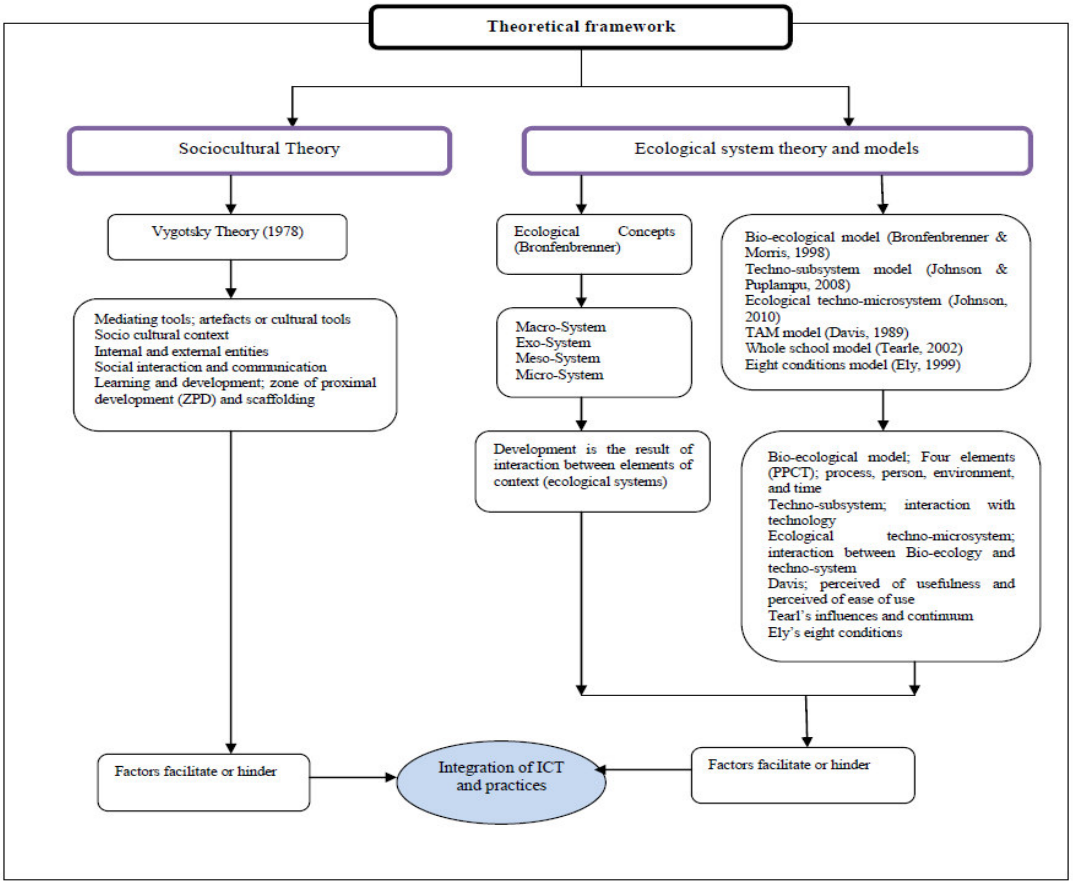

Figure 4: an overview to illustrate the theoretical framework

1.4 Conclusion

From discussion presented above, the need for a theoretical framework for any study that seeks to investigate use of computer by young children appears to be critical. It could be stated that the increased availability of ICT tools in children's environments suggested the need to the theoretical proposal where Socio-cultural theory and Bronfenbrenner's ecological systems model and related models appear to be suitable. Indeed, fully understanding of the data about the integration of computer technology within early years education cannot be achieved through other theories and the need for adopting the both theories becomes vital. This fully understood can be achieved through the theoretical framework that the socio- cultural theory offers as discussed above and the ecological model.

The selection of these theories and model as a lens for any study can provide an appropriate theoretical framework that enables the researcher to investigate the use of ICT in early years education within various socio-cultural contexts and analyse data through this lens. Finally this paper argues for a more holistic approach of studying ICT in early years settings by adopting a sociocultural perspective, with the activity system as a unit of analysis that is surrounded by different levels of ecological circles.

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