An In-Depth Look at the Importance of Information and Communication Technology in the Educational System

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Abstract:
The use of information and communication technologies (ICTs) in the formal education sector is analysed and discussed through a variety of theoretical frameworks and techniques. The approaches of a systematic literature review and literature search are used. The relationship between curriculum design, pedagogy and teaching practices is taken into account. Throughout the curriculum, the word "ICT" is discussed. The research of modern ICT conceptions in instructional practise is organised within a framework that is offered. In this approach, the three ICT curriculum dimensions of planned, implemented, and accomplished are used. In this approach, the three ICT curriculum dimensions of planned, implemented, and accomplished are used. In each of these three aspects, the structural methodologies that may be used to examine ICT are presented. The proposed is a connection between 1) the theoretical frameworks and policy goals for integrating ICT, proposed at the top level of policy making, 2) the practises of teaching and learning, implemented at the middle level of the educational system, and 3) the expected learning outcomes for students, expected at the base level of the educational system. The use of this approach in ICT curricula is claimed to be possible. Inconsistencies in the comprehension and application of ICT at different levels of educational systems will be found through this study's conceptual framework, which will be provided.
Keywords: pedagogy, information and communication technology.
DOI: 10.24297/j.cims.2023.07.3

1. Introduction

According to Paul (2002), Papert (1987), Voogt & Pelgrum (2005), Watson (2001), and Well-Strand (1991), using information and communication technology (ICT) will improve the standard of teaching and learning."Combination of computer, video, and telecommunication technology, as seen in the utilization of multimedia computers and networks and also services that are based on them," is how the abbreviation for information and communication technology (ICT) is described (Van Damme, 2003).

ICT in this paper refers to the programs that may be utilised to improve classroom teaching and are often available on desktop computers, digital cameras, recorders, etc. Technology in classrooms and schools "tends to draw school learners' attention and motivation," according to Lafferiere (Lafferiere, 1999). Although though it is widely believed that computers aid in the

teaching-learning process and that ICT use has suddenly become widespread, the idea of ICT in curriculum is still relatively new and is a word that is not well understood.

Several sets of ICT-related curriculum are referred to by a wide variety of terminology. Examples of these categories include tool (Taylor, 1980), cognitive tools (Solomon, 1986), and mind tools (Jonassen, 2000). According to Tagg, the job of ICT is to complement and enrich the current curriculum so that it may be delivered more successfully and also it serves as a tool to enhance and improve the current curriculum, facilitating more efficient curriculum delivery(Tagg, 1995). But, there are still gaps in our knowledge of the concepts behind the creation of computer learning environments, their implementation, and the pedagogical approaches that go along with them. According to Blenkin et al. (1992), curricular modification is impossible without a thorough understanding of emergent ideas. In addition, studies indicate that integrating technology into a curriculum is still a difficult task.

In the global study of, Pelgrum & Anderson (1999) discovered that despite significant investments, ICT use in education lagged behind schedule in several countries. Although the number of computers per student increased quickly, it seemed that usage was still only minimal in topics other than computer literacy and computer science courses. The fact that educational software is frequently isolated and not integrated with the textbooks that many teachers use is (one of the) key issues (Van den Akker, Keursten, & Plomp, 1992; Voogt, 2003). In addition, a lot of ICT applications don't fit the curriculum well (Voogt, 2003).

Although it is generally understood that ICT has a great potential to improve education, research has continually struggled to offer compelling data about the influence of ICT on student's achievement. This is primarily because ICT use frequently aids in the mastering of sophisticated cognitive abilities. Simple conventional assessments cannot be used to evaluate these kinds of skills.

In this study, ICT in the school curriculum is reviewed, and models of technology integration into the teaching-learning process are highlighted. In reality, educators and decision-makers who want to benefit from the studies and experiences of others will find it beneficial to comprehend the psychological and pedagogical approach. As a result, by defining the ICT curriculum, we may learn about the variations in learning theories and discover a better approach for current curriculum reform or change in our nation. It is hoped that policymakers would find the information from this study valuable in integrating ICT into the curriculum.

Structured literature reviews and documentary research methodologies provide the foundation of the applied research approach. There are six sections in the paper. Theoretical foundations are presented in the first portion, and a three-dimensional conceptual framework for the research of ICT in curriculum is offered in the second section. The intended, implemented or teaching and learning, and accomplished curriculum each have three analytical aspects. ICT

curriculum models are examined in the third part. In section four, fundamental facets of ICT pedagogy are explored. The components of the interdisciplinary curricular model are explained in the fifth section. The interconnections between all dimensions are studied in the last section.

2. Theoretical Basic of ICT Curriculum

According to curriculum theory and practise, early studies were categorised into four groups: 1) as a body of information to be delivered; 2) as an effort to achieve specific goals in students' work; 3) as a process; and 4) as practice that is based on Aristotle's (1976) definition. He claimed that three disciplines were part of the influential knowledge categorization: The three categories shown in Figure 1 are: 1) theoretical, 2) productive, and 3) practical.

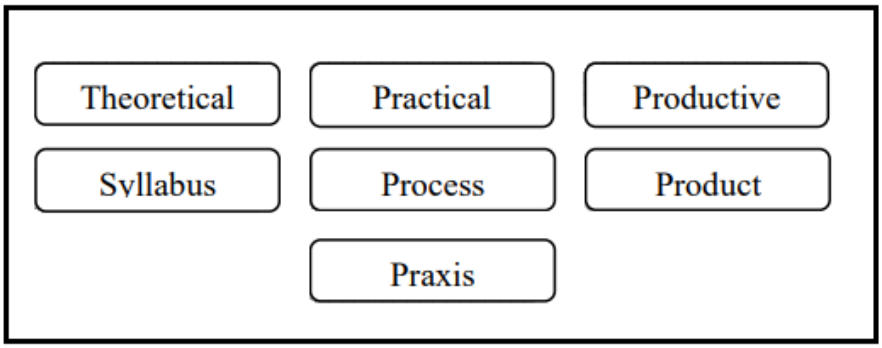

Figure1. Curriculum theory and practice (Smith, M., 1996-2000)

Syllabus curriculum has been emphasised as knowledge material and/or subject in the main frame of this method. Education is a process that learners have received through the most efficient means possible (Blenkin et al., 1992: 23). Even so, the most productive education is frequently seen as a technical activity in which goals are established, a strategy is created, and then it is put it into practice. Investigating the results (products) comes last (Bobbitt, 1918-1928; Tyler, 1949; Taba, 1962). Process-based analysis is a different method to view the curriculum. the connection of instructors, students, and knowledge is, in this sense. What really takes place in the classroom, as well as what students do to be ready and get graded, is what is known as the curriculum. The dynamic interaction of action and reaction is how the curriculum as practice itself develops. According to Grundy, "curriculum is not only a collection of plans to be carried out, but is instead created through an important process in which planning, acting, and assessing are all mutually connected and incorporated into the process" (Grundy, 1987). In light of this, it is important to consider the social environment. The praxis model has been criticised for placing less focus on context, but other methods have also been subject to similar criticism.
Curriculum, according to Cornbleth (1990), is a certain kind of function, and it is established that curriculum is what actually occurs in classrooms. He described it as a continuous social process made up of exchanges between students, teachers, context, and knowledge. So, without taking into account its situation or context, curriculum as practise cannot be comprehended effectively or modified significantly; as a result, curriculum has been shaped contextually. Although some studies have discussed the significance of context (Cornbleth, 1990; Jeffs, & Smith, 1990, 1999),

the presence of context-school is occasionally disregarded. Even so, the concept of curriculum only makes sense when associated with ideas like class, instructor, course, lesson, and so on. In order to describe the process of gaining information, developing abilities, and comprehending how to solve issues, several theories have been produced throughout the past century. These approaches are depicted in Figure 2 .

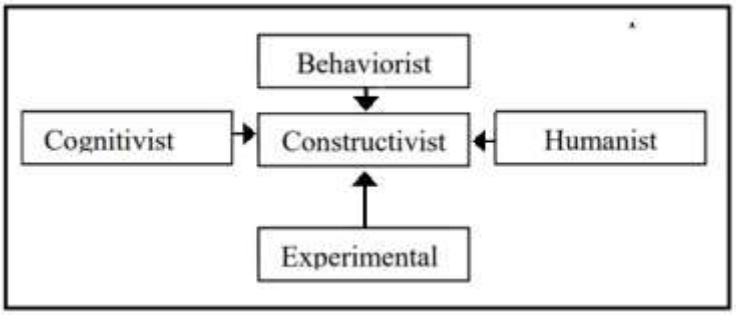

Figure 2. Conceptual model in curriculum development

Figure 1 depicts the ICT curriculum as practical, and Figure 2 depicts the learning approach as constructivist approach. Practical imagines a link between action and theory in which neither one dominates; rather, the relationship that exists between the two things does (Mezirow, 1991). Critical pedagogy in practical goes farther than just placing educational experiences into the context of the learner's experiences. Both the learner's and the teacher's prior involvement in various activities, such as discussion and bargaining, is necessary for this process. It prepares and motivates people to acknowledge and address the true issues in their lives and relationships. Students will experience their own oppression when they address the true issues in their lives (Grundy, 1987). The development of two opposing thinking skills—inductive reasoning when moving from action to theory and deductive reasoning when creating action from theory—is a key component of praxis. Learning is a process to build these divergent reasoning abilities and essential elements of experience learning in the praxis method.

Constructivism, a philosophical perspective focused on how we comprehend, is comparable to the Rorty's pragmatic philosophy (1991). Instead of acquiring information directly from the outside world, constructivists contend that learning involves building knowledge from one's experiences (Resnick, 1987; Collins, Brown, & Newman, 1989). Constructivism is a learning philosophy that places a strong emphasis on the value of experience, exploratory learning. It developed from the writings of Piaget and Bruner, who emphasised the need of building meaningful, direct knowledge via encounters with the outside world (Collins & Green, 1992).

The scientific method used in scientific research is reflected in the constructive model of learning. Consider/question, research, find, and explain stages are among the key components of a constructive method. The learning domain is based on the updated Bloom taxonomy (Anderson & Krathwhole, 2001). The taxonomy starts out by defining knowledge as the ability to recall information that has already been learnt. The lowest level of learning outcomes in the

cognitive domain, according to Bloom, is knowledge. Communication skills, the capacity to understand stuff, and knowledge that is just beyond that come next. The capacity to employ newly learned material in novel and tangible concepts and ideas is referred to as application, which is the next region in the hierarchy of knowledge after comprehension.

Understanding at a deeper level than comprehension is needed for application. Since there are different types of thinking processes, it is necessary to specify them for all students, from the simplest to the most complex: knowledge (recalling facts), comprehension (understanding, ability to explain, and using own words), application (using knowledge in a practical setting), analysis (dissecting complex ideas into simpler related parts), synthesis (combining elements to create a new, original entity), and evaluation (making judgements) (chee and Wong, 2003). Yet, learning theory in this area includes: 1) students identifying relationships between ideas; 2) students discovering their own knowledge; and 3) educators giving context for learning and assisting students in their quest to find specific information or expertise.

Constructivist educational approaches place a strong emphasis on critical analysis, problem-solving, real-world learning experiences, social negotiation of knowledge, and teamwork. This shifts the teacher's role from information provider to learning facilitator, supporting students as they actively engage with the information and resources to build their own understandings. Students therefore learn how to research rather than merely what to research (Forman & Pufall, 1988; Newman, Griffin, & Cole, 1989; Piaget, 1973; Resnick, 1989).

3. Theoretical framework: Dimension of ICT curriculum

The planned, implemented, and attained curricula are the three aspects of the conceptual framework that is utilised in studies on the uses of ICT in education. The intended curriculum is the one that is specified in terms of learning outcomes and instructional strategies established at the level of the country's school system. The learning objectives or goals of a lesson are referred to as the planned curriculum at the classroom level. The educational activities taking place in schools and classrooms are referred to as implemented curriculum, and it is explained in terms of the chances for student learning. As shown in Figure 3, the reached curriculum refers to the learning outcomes that students can acquire through their classroom or school-based learning experiences.

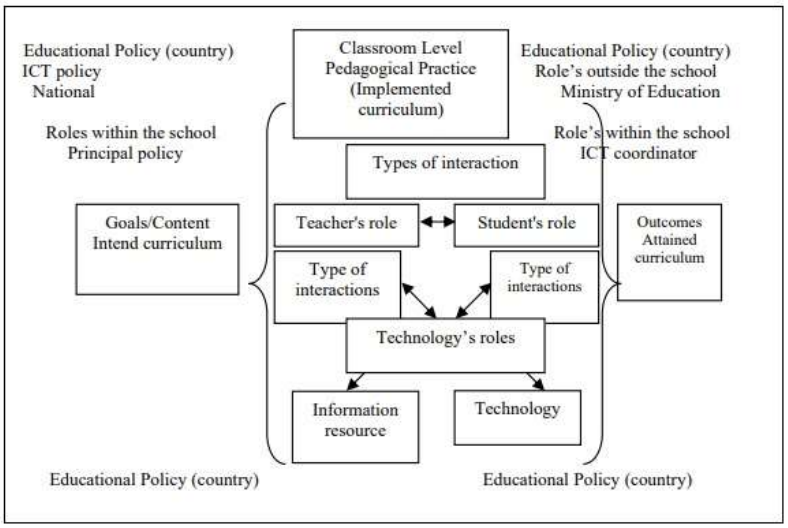

Figure 3. An overview of theoretical framework ICT curriculum

Any educational practice's effectiveness is mostly dependent on the interaction between the instructor and the students. Such practises take place in the educational setting, which is also impacted by outside forces at the district, regional, and national levels. As a result, the three concentric contexts of the micro level (the classroom), superficial level (the campus), and macro level (the community) must be examined in order to fully understand the curriculum context for learning ICT practises. These layers interact with one another, and their borders are not well defined (Kozma, 1999).

On the flip side, establishing balance and consistency across these many curricular representations is one of the main obstacles to implementing curriculum reform. ICT applications, according to Voogt's 2003 research, are not well matched to the curriculum. The use of ICT is also hampered by various practical factors. In a research on ICT use in the Silicon Valley area, Cuban (2001) discovered that teachers barely alter their lesson plans when utilising ICT. ICT frequently does not fit into the current teaching culture, according to Olson (2000), and may reduce a teacher's sense of efficacy.

Practises were identified by Pelgrum, et al. (1997) as having a "emerging paradigm". However, it is still unclear how the term "emerging paradigm" will be transformed into instructional practise. In other words, there may be a discrepancy between the curriculum that was planned and what was actually taught (Voogt & Pelgrum, 2005). The three-way interaction between students, teachers, and computers is said to need to be taken into account while implementing ICT in education, while also taking into account the larger environment in which students and instructors operate (Squires & McDougall, 1994). Despite the fact that research suggests that ICT has an impact on students' attitudes (Cox, Abott, Webb, Blakely, Beauchamp, & Rhodes, 2004), studies demonstrate that several barriers exist to ICT integration into the curriculum. On the other hand, because the majority of computer-based teaching's features depend on context, such as the backdrop of the curriculum or the organisational structure of schools, they are not

under the control of instructors. They are mostly shaped by frameworks for school administration and educational policy. The elements that lead to effective educational improvements have been the subject of much research (Fullan, 1998). Additionally, studies have shown that initiatives with the principal's backing are more likely to be successful because the principal's participation shows that the project is taken seriously and aids in recruiting both material resources and human resources.

According to Venezky and Davis (2002) the availability of infrastructural resources, is the most important element advancing innovation. But having access to ICT isn't enough on its own; it also needs adequate and effective technical and instructional assistance (Pelgrum & Anderson, 1999). Additionally, a lot of innovations fail because instructors lack the knowledge of the underlying theories and inadequate training in the technical skills required to apply the innovations they are supposed to implement. They frequently fail to recognise how the technology fits with their teaching objectives and aims (Cuban, 1986). Last but not least, the Impact 2 (2001) recommended combining mechanical and ICT clusters to solve the issues and produce the best outcomes.

4. ICT Curriculum Models

In respect to ICT, Nicholson (1995) distinguished between two types of curricular models: techno-centric and humanistic. In the technologically focused curriculum, the focus is on giving the students the abilities they'll need for their future careers. This strategy, which predominated in the 1980s, placed a strong focus on mastering the technology in order to better match the expectations of business. Typically, senior ICT courses or "computer awareness" classes at a lower level are used to provide this sort of curriculum. In many instances, there is no effort made to incorporate the use of this computer knowledge into the mainstream curriculum, and the computer continues to be a technological object to be studied in an abstract manner. The core idea of humanistic computing is that computers should function similarly to pencils—not as a separate class but as tools that provide kids information, critical-thinking abilities, and different approaches to addressing problems.

Four concepts have been presented by Passey and Ridgway (1992): a) ICT as a separate subject; b) ICT as a curricular area within technology; c) ICT as a discrete topic, applied in a variety of other areas; and d) ICT throughout the curriculum, as a theme in all the subjects. The National Curriculum Education Technology's most recent model calls for ICT to be taught as a stand-alone topic as well as across the curriculum. Every model has benefits and drawbacks; for instance, the cross-curricular model is suitable for elementary schools, small classrooms, and institutions with competent coordinators.

Voogt & Pelgrum (2005) identified three types of curriculum: 1) Single-subject curriculum with novel teaching practises embedded in discipline-based topics that were supported by ICT. ICT was largely employed to enhance topic, matter, content, and concept knowledge; 2) thematic

curriculum emphasis, the innovative educational practises that were supported by ICT were cross-curricular in character. Thematic delivery of curriculum material and the use of ICT to promote the implementation of lifelong learning objectives. 3) school-wide curricular emphasis the integration of ICT-supported innovative pedagogical practises across the curriculum. ICT helped the school's vision for teaching and learning come to fruition. ICT curriculum model is therefore dependent on academic content.

Model for an integrative curriculum in ICT

ICT focuses on giving students the resources they need to alter their learning and improve their learning environment. Students can create new ways of thinking and learning that result in original and creative discoveries thanks to the information, skills, and behaviours that have been identified for this area. Additionally, it helps them express themselves in modern and socially relevant ways, communicate locally and globally to solve problems, share knowledge, understand the implications of using ICT, and understand their social and ethical obligations. It also helps them develop more productive ways of working and solving problems on their own. Thus, it consists of three phases: phase 1) which emphasises mastering and applying engineering's technical fundamentals. phase 2) specialisation, during which time students acquire and put to use in-depth information in the subjects of their choice. phase three) realisation, where they apply what they've learned to real-world issues as they approach professional practise. In all three phases of the curriculum Students are involved in disciplinary that demand them to apply theory into practice.

Nevertheless, in the field of ICT we can suggest a few domains of knowledge that approaches are utilised by researchers as well as practitioners: 1) engineering, which includes methods for choosing materials, equipment, and processes with characteristics needed for a specific purpose, as well as for designing, building, and configuring systems and devices; 2) psychology for understanding how people relate to technology; 3) mathematics for the logical and algebraic linkages and structures that support the storing, retrieving, and processing of information; 4) Sociology, in the context of the larger effects of ICT on interpersonal interactions and behaviour (Kennewell et al., 2000). While, the method to education should place special emphasis on the growth of higher order abilities and on: 1) Significant student autonomy in resource and tool choices; 2) Students actively participate in the process of planning and assessing the usage of ICT in challenging circumstances; 3) the involvement of educators in the form of emphasising questions to help students in the form of broad generalizations; 4) demands that students explain their thoughts about the possibilities and limitations that are provided by ICT techniques, methods, and approaches, which they have encountered; 5) that teaching should increase students' interest and trust about ICT; that students should be given opportunities to utilise technology in a variety of ways (Kennewell et al., 2000).

Success in ICT education depends on having strong planning and evaluation abilities, which include: 1) teaching goals and learning objectives; 2) suitable teaching techniques; 3) evaluation

possibilities. 4) Student background knowledge; 5) lesson planning, activity sequencing, and variation; 6) the applicability of context; 7) The value of recapping and reviewing; 8) Tempo and timing; 9) Expectations for students' academic success and an unambiguous goal; 10) the students' growth in knowledge (Kenewell, 2003).

5. ICT Pedagogical Theory: A literature Review

According to Taylor (1980), Solomon (1986), and Jonassen (2000), there are several ways that ICT is used in education, depending on the role that the technology plays as a tutor, tool, or tutee. In a review of the pedagogy research literature, Watkins and Mortimore (1999) claim that the pedagogy models held by academics and researchers have evolved over time to include, for instance, recent advances in our knowledge of cognition and meta cognition. Schulman (1987) had instead concentrated on the teaching processes, which included the knowledge transformation and the teaching methods (pedagogical content knowledge). As a result, the teacher plays a key part in this experience. If the teacher's lesson plan does not take into account the students' thought processes or give a framework for analysing student-teacher interactions, it may neglect to address the significant experiences brought on by the usage of ICT (Banks et al., 1999). According to this paradigm, it's crucial for new technologies to grasp or pinpoint learners' thought processes. Thus, research has demonstrated that ICT introduces students to new modes of learning and representations.

Pedagogical techniques

Dreyfus & Halevi (1991) demonstrated the efficiency of using computers to promote constructivist teaching. They demonstrated how using computer software to create an open learning environment allows students to explore within bounds. They said that even poor students were able to engage in-depth discussion about a challenging subject, proving that the role of teacher was as a guide. McLoughlin and Oliver (1998) outlined the pedagogical responsibilities that instructors should play in a classroom that uses technology. These roles included setting up collaborative work, rotating duties, encouraging students to take charge of their own learning, supporting metacognition, encouraging various viewpoints, and scaffolding learning. Here, it is assumed that the use of ICT has altered the pedagogical duties of teachers, and Hawkridge (1990) argues that one of the strongest arguments for utilising ICT in schools is its ability to function as a catalyst for changing the teaching and learning process.

The relationship among instructor, students, and technology is influenced by several educational patterns. Expository method, for instance, refers to the dissemination of knowledge from the knowledgeable to others who are unaware (Ormrod, 1990). According to Martin (Martin, 2003), "the educator is the source and owner of knowledge" in expository education. Expository educators predominate in the delivery of courses and employ techniques including lectures and demonstrations (De Jong et al., 1998). The entire lecture has been divided into pre-structured phases. Each phase is started by the teacher presenting information or by asking questions. The teacher will give evaluative comments when the student answers and then follow

up on the student's response. Through such cycles of Initiation-Response-Evaluation (IRE), the teacher exerts strong control over the evolution of the classroom discourse. ICT is used for a variety of tasks related to teaching and learning, such as: (1) to offer study material and drawings to support the educator's presentation, (2) to situate the subject of study in an engaging environment, (3) to provide resources that serve as conversation starters, and (4) to give visualisation to aid in the comprehension of dynamic processes. Despite the use of ICT in the session, there were frequently other forms of activities, such paper and pencil work

Learning through a problem-oriented approach:

The use of problem-based learning (PBL) in education has become widespread. According to Duch, Groh, and Allen (2001), PBL education focuses on developing students' abilities to: 1) think critically, be able to analyse and solve challenging real-world situations, 2) cooperate in teams and small groups, and 3) exhibit flexible and effective communication skills, both verbal and written. PBL starts learning by exposing students to an unorganised, untidy real-world challenge. By asking students to define, analyse, make hypotheses about the problem, and identify learning concerns, the problem serves as the catalyst for the learning. Students then debate the problem situation in small groups. They question themselves about what they already know from the issue scenario that is being presented, what they still need to know, and what solutions they can think of to the problem that the instructor has put forward (Aspy, Aspy, & Quimby, 1993).

PBL requires students to have the following skills: 1) intelligently pose questions about a given issue by creating plans and strategies and carrying out investigations; 2) gather data; 3) mechanically analyse data; 4) use a computer and spreadsheet programmes (such as Excel) as a tool for statistical calculation; 5) represent data graphically using Excel; and 6) interpret data and come to conclusions. Biggs (1999) asserted that, despite factors including student aptitude, instructor characteristics, and resource availability, there is no one, all-purpose ideal technique of instruction. It depends on how we see the teaching procedure when utilising ICT to create educational materials and deliver positive learning experiences for students in the future.

Learning through a task-based approach:

Willis (1996) claims "The task is a goal-oriented activity in which learners use language to achieve a real outcome". In order to complete a problem, complete a puzzle, play a game, or discuss and compare experiences, learners use any resources available in the target language. Several educators working in the area of ICT education have made a strong case for ideas that are similar to TBL activities. Those that support constructivism and apprenticeship learning theories are included in this (Kafai & Resnick, 1996; Lave & Wenger, 1991).These opinions cast serious question on the efficacy of traditional declarative knowledge learning, which is removed from the real physical and social context. The teacher generally takes an active part in educating the students how to utilise the technology and presenting the task's backdrop at the start of the course. In a task-based class, the students are given a significant amount of time to work on the activity, either alone or in groups. The students are actively participating in the process and their

work. Here, the teacher exerts indirect control by defining the task goal and direct control by conversing with the students as they work. Here, the teacher exerts indirect control by defining the task goal and direct control by conversing with the students as they work. Most of the time, teachers take a less directive role in talks with the students. They frequently coach reactively, which means that they respond to what the kids want for in terms of guidance or support. They only offer counsel after asking for and comprehending the students' opinions, and they make every effort to think along the same lines that the students do.The instructor occasionally serves as the students' go-to resource for technological issues. The instructor listens to the students describe what they want to achieve (but are unable to do), and then the teacher explains the technical steps that could be done. Some teachers would have the entire class conduct an interim or final review of the task products. The professors' responsibility in these review sessions would be to facilitate. They draw attention to important queries and request feedback from the students.

6. Conclusions

ICT in curriculum is described in this research as a transferrable set of skills connected to ICT use. The concept is consistent with technology as tools that may be used in a variety of situations. Three ICT curriculum dimensions—intended, implemented, and achieved—were researched in order to comprehend ICT curriculum in a particular setting. The intended curriculum refers to top-level policy making objectives and strategic attitudes; the implemented curriculum refers to middle-level teaching and learning approaches; and the achieved curriculum refers to base-level empirical learning activities, students' experiences, and outcomes. Each dimension is related to various levels and aspects of an educational system. Despite the gap between these dimensions, links and interactions between them could be found, as shown in Figure 3. The following is a summary of the closing statements about the usage of ICT: ICT implementation, in the first place, emphasises various ICT-related competencies. As stated in several countries, the objectives for integrating ICT into the curriculum are ambiguous and demand very specific tools. Second, the conceptual foundations of ICT in the curriculum are based on constructivism; nevertheless, education in many countries is still centred on behaviourism, and the educational system has to shift attitudes. Third, several kinds of factors that affect the use of ICT in education must be taken into account. Fourthly, a lot of studies claimed that an integrated paradigm is necessary for ICT pedagogy. The ICT curriculum model also places a heavy emphasis on trans disciplinary learning and knowledge- and tool-cantered ICT capability learning. Thus, technical ICT knowledge, skills, and tool-focused teaching and learning processes are now integrated with other subjects. They include technical ICT skills with fundamental ICT literacy and essential academic courses. Higher-order thinking or "meta cognition" outputs are prioritised in the cognitive process.

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