
Designing Pedagogical Learning Environment in ICT

By
Group Members

Al Maruf Hassan
ID: 011 123 036

Tanjum Tamanna
ID: 011 123 057

Tanjum Tabassum
ID: 011 131 086

Tanjina Afrin
ID: 011 132 135

All of Undergraduate Students
United International University
Dhaka, Bangladesh

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Department of Computer Science and Engineering (CSE)
United International University (UIU)

The work presented in this thesis report is the outcome of an investigation performed by the group of Al Maruf Hassan, 011 123 036; Tanjum Tamanna, 011 123 057; Tanjum Tabassum, 011 131 086; Tanjina Afrin, 011 132 135; under the supervision of Suman Ahmmed, Assistant Professor, Department of Computer Science and Engineering, United International University, Dhaka, Bangladesh, Director, Center for Development of IT Professional (CDIP) and Center for Engineering & Scientific Research (CESR). The work was spread over eight months' courses in accordance with the course curriculum of the Department for the Bachelor of Science in Computer Science and Engineering program.

Examination held on December 09, 2017.

Supervisor

Suman Ahmmed
Assistant Professor,
Department of Computer Science and Engineering,
United International University, Dhaka, Bangladesh,
Director, Center for Development of IT Professional (CDIP) &
Center for Engineering & Scientific Research (CESR).

We would like to dedicate this thesis to our parents.

Statement of Originality

This work has not previously been submitted for a degree in any university. To the best of our knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

Al Maruf Hassan

Signature

Date:

Tanjum Tamanna

Signature

Date:

Tanjum Tabassum

Signature

Date:

Tanjina Afrin

Signature

Date:

Abstract

Pedagogy of ICT has great methodology in the interaction of the teachers teach, the students learn and the learning environment as well as the tasks. It helps expand the educational opportunities in different perspective, enhance the quality of teaching such as strategies, actions, judgements and learning process, sustain life-long learning, and improve efficiency. We considering the theories of learning in different phases, try to understanding of the students and their needs, realize the background and interests of individual students. We find and get some kind of model, architecture and process to increase the ability of that issue. We are generated a compact methodology that will build with the help of those existing recourses to manage the issues related to the pedagogy of ICT. The pedagogy of ICT is very important for the system of the current educational trend around the globe.

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1. Introduction

1.1 Background

Pedagogy of ICT is a very important thing in the learning environment of ICT. In our country, the ICT education is not the global standards. Day by day, ICT has play the major role in our society. By in this increase of role, our ICT education is not grow up with the change of world trend.

Pedagogy of ICT refers to the interactions between the teachers, students, and learning environment as well as the discipline that deals with the theory and practice of teaching strategies, actions, judgments, decisions and the understandings of students, their needs and the backgrounds and interests of individual students. ICT pedagogy abbreviation of basic elements such as pedagogy, social interaction and technology [1]. Learning design categorized into different focuses such as System-based, fact-based, deftness -based, nature-based and different learning outcomes such as Incident-based, the outcome is understanding procedures, prefaces and a caliber to apply the knowledge domain [2]. Some skeleton of ICT Skills is categorized different types such as Programming, Communicating, Creative Multimedia, Databases or Data Handling, Exchanging & Sharing information, and Modelling [5]. In the pedagogy of ICT, E-learning is a very important thing. The key things of E-learning environment are Interface, Mobility, Healthy user's habits and, the components of the architecture are Application layer, Transportation layer and User-Interface layer [8]. In a developed system or application should be keep in mind the following rules such as check the kid's attitude in day to day performance, grasp the strength and weakness in the past teaching arsenal, use a guide so that kids can realize the study activity and their current position and ultimate goal, apply a measurement scale to directly identify the rectification of the explanation or feedback, verify the viability of ICT pedagogy ingredients [11]. Learners make their thinking transversely the syllabus into the way of planning, developing and reflecting, building ICT where children reveal their ICT abilities through the curriculum by inventing, stimulating, forming, introducing information and ideas and by considering a specious variety of arsenal and ICT based system [12]. Learning standards in ICT such as meeting with the world, meeting with each other, inventing with ICT, interlarding with ICT, expectation in education, reaching out and surmount divides [13]. ICT build in consider to education is that it has the ability to completely change the environment of pedagogical

practice. The education system should include those elements such as spring, quantity, work strategies and ament's sheet, pulp and teachers object, feedback, power that function in both forthright and transcendental, way, progressively as well as virtually and cognizant in advance in terms of period, towards attaining the objective and activities within the school environment and early schooling system environment in the context of the pedagogy of ICT. Active-learning is an another part in the pedagogy of ICT. Active learning is a method whereof learners involve in performance, such as studying, scrawling, conversing, or problem analyzing that raise exploration, association and evaluation of class content or task as well as active learning based teaching process include four stages such as select, practice, judgement, conclusion and result [31] [32] [33].

In this paper, we get the right indicators and point of the compasses to originate Pedagogy of ICT that focusing in the local area of Bangladesh; after that, we inventing pedagogical learning environment in ICT with some kind of theories and practice of world trend in ICT education in the age base outcome basis.

1.2 Importance of our Research Area

Increase the interaction ability of teacher, student and learning environment in many perspectives. Opportunity to build up learning model in the basis of theory and practical basis. In the view of teachers and students both, ability refers that critical thinking, evaluating, creativity, designing, strategies, planning etc. In the view of learning environment, proper ICT based infrastructure, model, architecture and proper ICT tools is necessary for the pedagogy in ICT. It's very important to understanding and evaluating the students and teacher's ability. Identifying the backgrounds and interests of the individual students on the base of pedagogy in ICT. Learning task is an another crucial thing of the pedagogy in ICT. we will make the learning task is more enjoyable and interactive among the students. Learning task is related to the learning outcomes. It very important to identify the standard learning outcomes for the different learning stages of task. ICT based curriculum is also an important view of this research. There are not stay any standard curriculum for the pedagogy in ICT. it's very important to build up world recognize a common standard curriculum in the context of this field. So the pedagogy in ICT is not a single thing, it's a compact thing that related to each other.

1.3 State of the Art Review

Wang [1] claimed that educators do not generally consider sketch patterns of linear pedagogical when the authors are thinking for ICT integration. The author proposed a tribal pattern which included of three fundamental elements – pedagogical environment, social interaction between social elements and technological expand in positive ways. The author also suggested that educators need to pick the valid and tested ICT tools for especial learning objectives, building new learning pedagogical atmospheres to involve inelastic outfits of learners. The research assesses some kind of instructional design models such as “ASSURE model” (Analyses students; State purpose; Select media and components; Utilize media and ingredients; Require student involve; Evaluate) “ICARE model” (Introduce; Connect; Apply; Reflect; Extend) and “Systematic planning model”. Pedagogical environment, social interaction process and technological spread are critical components of a technology-ameliorate learning atmosphere. Wang considered some kind of relating to philosophy cornerstone that promote this pattern to elongate why these three elements are involved in this pattern. Those are constructivist approach knowledge ethos, Interactivity design and Usefulness (ibid).

Helen [2] discovered the , exorcism knowledge outcomes comes from ICT-based pedagogy architectures, from that, The author provided some fundamentals customized a learning aspects to characterize the necessary elements of a learning architecture with the dynamic to high-quality learning. Learner involvedness, Acknowledgement of the learning background, Learner requires and hedonism of culture as [3] in a framework for a learning architecture. The author indicated that learning design divided into different focuses such as regulation based, fact based, technique based and preamble based. Those have the different learning outcomes such as incident based, the outcome is understanding procedures, roles and an ability to apply the knowledge. The author alleged that the curriculum mapping will be

supporting classification between models for learning and their aimed goals and outcomes. Including this type of level with a constructivist pedagogical philosophy is the basis of constructive array that described by Biggs [4].

Donaldson [5] emphasized on the ICT Skills Framework which include the structure of the EAS (Education Achievement Service) ICT (Information and Communications Technology) Skills Framework, using this Framework in the classroom and the future of the EAS ICT Skills Framework. The framework of ICT Skills is divided into six types such as Coding, Communicating, Creative Multimedia, Databases or Data Handling, Exchanging & sharing information, and Modelling. Donaldson divided each section of following into two types of section, the first one is KS2 ICT Skills and the second one is Foundation Skills. The author inferred that each section has different type of contents that depend on that individual one and particular requirements.

Pavol et al. [6] discussed about the Modern ICT in the pre-school and basic school education systems, and technical approach of those. Dado [7] stated that one of the greater portion requirements for e-learning application of technologies is to create a positive prima facie; technologies must be logical and transparent, the authors must offer users appropriate human-computer interfaces and help, and the authors must stimulate primary interest. All these mechanisms help increase the success of e-learning activities. The author suggested that the design of the environment must always have in mind - the main specificities, such as children who can't read, children who cannot concentration their outlook to work for a long period, a relevance with updated ICT and need to lead kids to the proper handle of ICT and the main specific functionalities defining important features of e-learning atmosphere, especially the user interface to be visually attractiveness, education by role-play collaboration for individual and device dynamism etc. The author discovered that the key things of E-learning environment are the front end view, dynamism, strong user's habits and, the elements of the architecture are Application layer, Transport layer and User layer. [8]

Viswanadha et al. [9] stated that Outcome Based Education (OBE) umbilicus on the caliber that discovered by the kids. It indulges the improvement of children by building caliber, impacting exorcism, states of attention and vow, and propagating sagacity. Malan [10] observed that ICT in Outcome Based Education (OBE) provides benefit to the learners that the authors will ingress the intelligence if the authors will be finding delayed to the curriculum and knowledge out of the curriculum. Viswanadha inferred that organizing ICT in

OBE gives the successive phlegmatic outcomes of children's future and ICT can impact the pedagogy inspiration and reflect with more mass accessions.

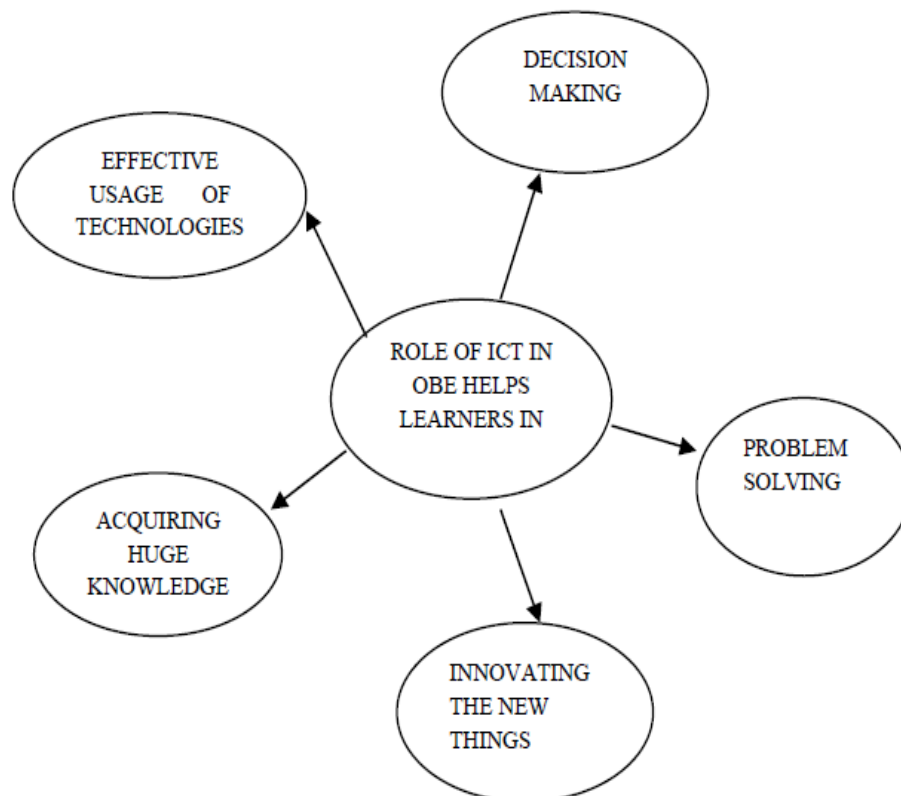


Figure 1: Preamble of ICT in OBE for children's [9].

Jing et al. [8] presented a well-connected architecture to precise the relevance by examining 40 identical exemplars, which include of seven elements: ICT direction, student caliber, enriching of teacher professional, teaching strategy, learning environment, curriculum processing and evaluation technique. Jing also assumed that the main vision for pedagogy of ICT is to enriching the learner's capability in learning structure. so in order to get this vision, the author suggested that it is better to enriching of professional development for teacher, optimize learning environment, modify the teaching process, modify the evaluation process and make syllabus processing.

Table- 1: - A posteriori conclusion for three case [8].

Framework Dimension	Intel-ICT Monitoring Benchmarks Draft	The Self- review Framework	e-Learning Road Map
Leadership in ICT	✓	✓	✓
Student ability	✓	✓	
Teacher professional development		✓	✓
Teaching practice	✓	✓	
ICT in curriculum		✓	✓
ICT infrastructure	✓		
Curriculum Resources	✓	✓	
e-Learning culture			✓

Table- 2: - Case for typical model statements[8].

Dimensions	Attributes
Leadership in ICT	• E-learning vision • Self-identity in society • Reform strategies
Student ability	• Student information literacy
Teacher professional development	• Teaching support • Teacher training • Teacher promotion
Teaching method	• Teaching mode innovation • Learning method transformation • Evaluation method transformation • ICT in teaching • Digital resources application • Evaluation the using of data • Instructional design
Learning Space	• ICT infrastructure • Virtual learning environment
Curriculum Resources	• Resource construction • Resources availability • Opening and sharing of resources
Evaluation Method	• Digital portfolio • Academic achievement • Graduation rate

Takahiro et al. [11] observed that individual type learners at the developmental phase of their cognitive educators. ICT teaching ingredients, the use of Extreme Programming process for Innovative Software Based on Systems Design (EPISODE), which has agile development and innovation techniques at its core that he proposed. The authors suggested that educator always impel their kids in the learning process that develop software (EPISODE) using to following guidelines such as repression kid's act in daily activities, understand the powers of and languishing in the past teaching ingredients, take the "retry" indicators so that kids can replication the concepts that they learned, use a guide so that kid can fathom the lesson activity and their current position or ultimate goal, imbed a function to instantly check the rightness of the answers, experiment the practicality of ICT teaching arsenal. The authors proposed a technique that comprising the things of comprehensive architecture and EPISODE. The author reported on the developmental phases of Otokana that is Japanese case study, used for kids with developmental inability. The author asserted that Otokana is recently being used in classes with special requirements as an ICT based teaching process. In fact, using Otokana, kids with developmental inabilities have reflect positive betterment.

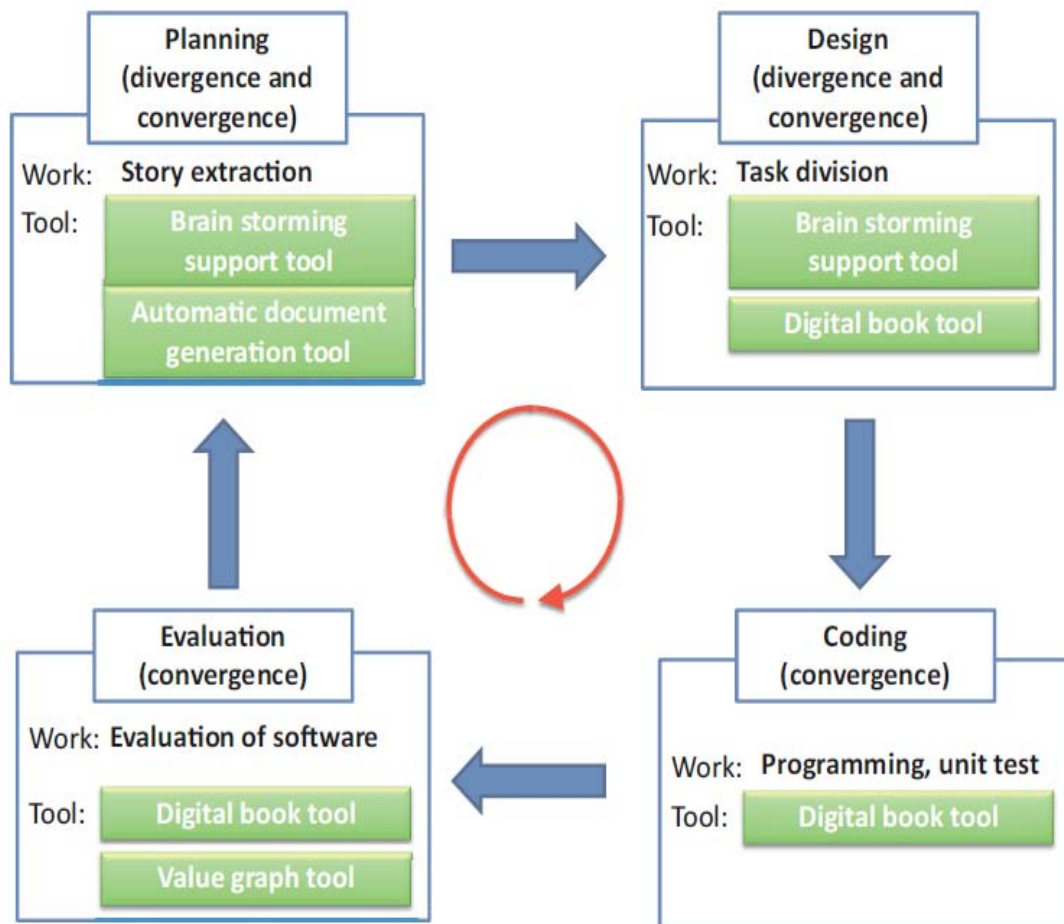


Figure 2: - Development cycle of EPISODE [11]

Adran [12] suggested that the place of education should pick ingredients that will provide a significance, pertinent and motivating curriculum for their students reach the specifics requirements of their kids and further their overall development. The author hypothesized about the critical thinking. The author discovered that students build their thinking over the syllabus through the method of dodge, building and ruminant. The author also hypothesized about the developing communication in software industry. In this phase he discovered students build their communication abilities over the curriculum through the skills of oratory, studying and extensive indication that the research indicated about the building ICT where students build their ICT skills over the syllabus by collecting, building, making and offering knowledge, ideas and by using a big amount of layout and software. In this research, thinking about the developing number where students build their number skills across the syllabus by using mathematical as ICT information, calculating, illustrating and representing the discovers. The author assumed that in ICT, learners use mathematical data that can be presented numerically, graphically, linearly in data-managing with the system.

Marg [13] described that there are six learning standards such as meeting with the earth, meeting with each other, building with ICT, Interacting with ICT, chances in education. The author proposed that this syllabus is recommended for the use with learners of ages between 11 to 18 according to our research. It should not be used at the primary phase that means ages between 6 to 11 according to our research. A configured ICT programmed model at the primary phase is not allowable and can counterproductive. The research states that ICT in school that progress for ICT knowledge into three levels such as basic, intermediate and advanced and the syllabus involve them (ibid).

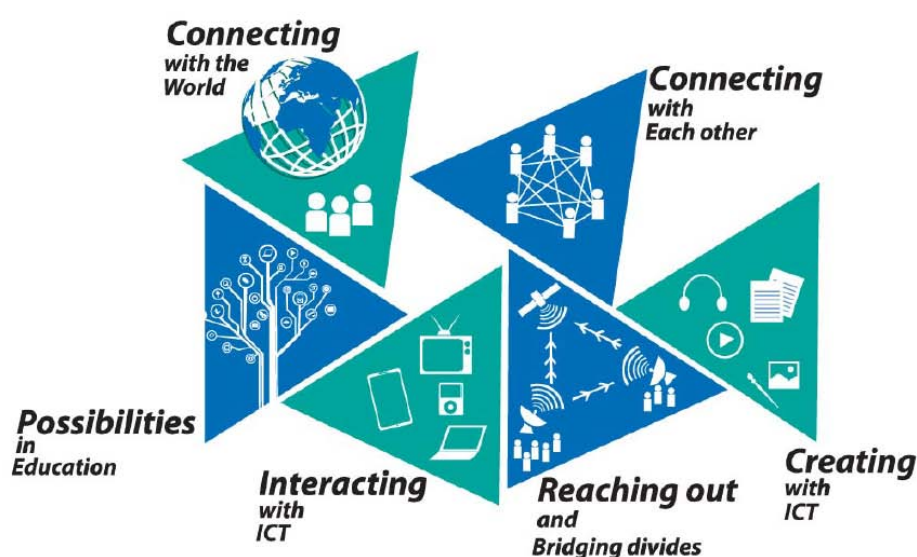


Figure 3: Six Learning Standards [13].

The research presented the earmarked of knowledge management software with the help of ICT as a free basis, which was accomplish on a Greek High School in the reason of European union. This extortion started because of his interest to saw the impression of the use of multimedia and Internet that are the things having e-learning content in a classroom environment (ibid). Pavlidis [14] stated that this entresol for distance learning should have the following indicators such as knowledge management, Interaction between educators and learners, self-assessment of learners, acclimatization to the requirements of any user. The research inferred that ASDL is a stage that fuses the functionality of a progressive database and the knack to store and project educational multimedia data. FLYNN [15] asserted that

connectivity between the stage and the educational way are multidimensional based on the require of educators and children to communicate in a virtual classroom atmosphere.

Nuangjamnong et al. [16] discussed and compared two dosage sib to expertness levels and embodiment veil. The authors are considered about the scenario of the use of deftness case in data center of business houses is largely fetterless of the proper content of any specific case. nomenclature, in such as "skill", "competence" and "competency" has been used in a variety of various ways in the learning, and offerings for their ignominy and interrelationship, have oft vary with each other (ibid). The research [17] states that a common defamation of skills case model is to synopsis knowledge, attributes, skills acting standards and knowledge requirements against a full set of preamble and standard class job specifications based on the practiced of well recognized standard class adeptness skeletons, which can be fruitful into the real IT ambience, yielded below: The Skills Framework for the Information Age (SFIA) and The Occupational Skills case Model (OSPM),

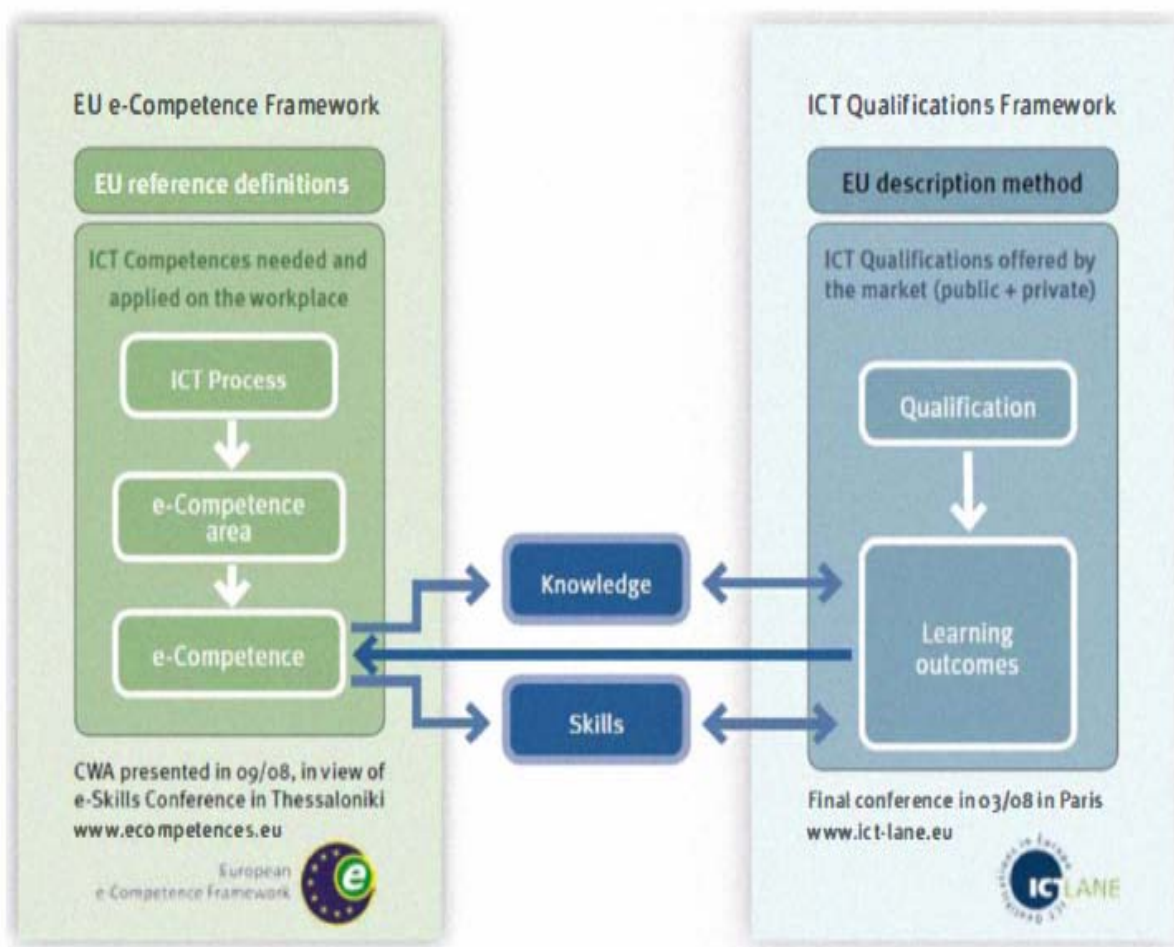


Figure 4: accosting e- deftness market and ICT exorcism issue cohesive knowledge outcomes to deftness[16].

Table- 3: - Characteristics of ICT Competency Framework [16].

Characteristics of ICT competency frameworks	SFIA	OSPM	e-CF	KIBNET
Clarification of Business Need and relevant ICT capability	✓	✓	✓	✓
Specification of skills requirements - Technical/functional skills - Business and management skills - Personal/Interpersonal skills - Software/IT Environments	✓	✓	-	✓
Installation/Implementation/Integrate/Commissioning of developed skills	✓	✓	✓	✓
Operational Management and Maintenance of HR activities	✓	✓	-	✓

Choy [18] focused that the three sets of actors those are educators, pioneers around the educational institution and support establishment in the background from technical section, interlude with each other to build a feasible working case for ICT embodiment. Fullan [19] stated that accomplish extended emendation, the feel to require pioneers who can make a fundamental metamorphosis in the knowledge cultures of the educational institution.

The author [18] asserted that the architecture has three diversity as shown above, of the three dimensions, two of them are Technogogy and Teachnology, are new terminologies, to more elegantly taking the abstract of the effectuation action. The author considered that the following proficiencies include the educator's authority such as to recognize the application of new technologies to classroom educating and learning norm, secondly, to trigger relevant technology that is advantage to children's, thirdly, to change lesson plans based on the feature of the technology, to exhibit pliancy in changing pointing in the session of technology

disaster. The author also discovered that the iTaCH shaping architecture has the potential to assist pioneers around the educational institution in building technological inroads in their educational institution's behavior of ICT in teaching method.

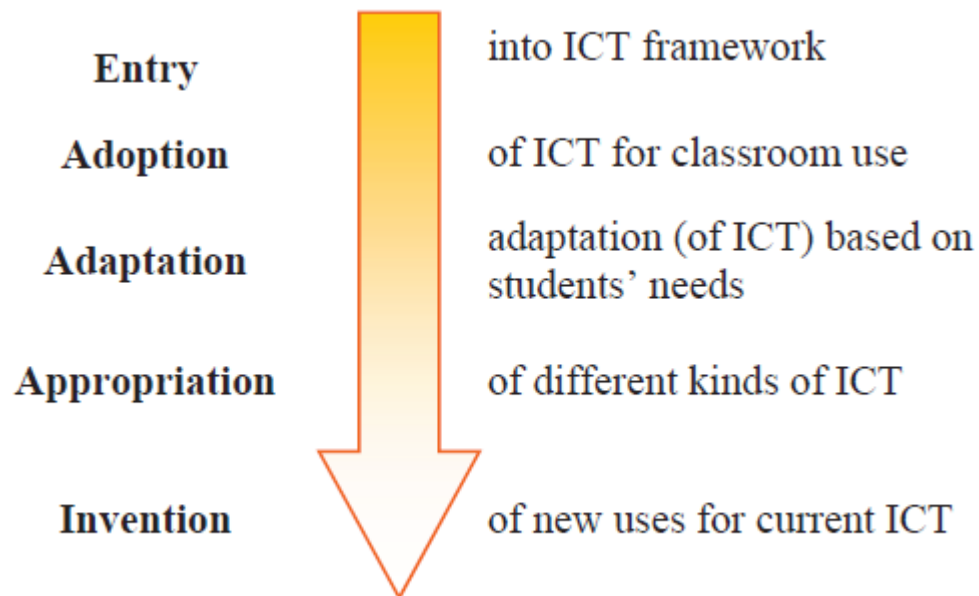


Figure 5: Improvement of a educators professional skills at merging ICT in the classroom environment based on Sandholtz et al. philosophy [20].

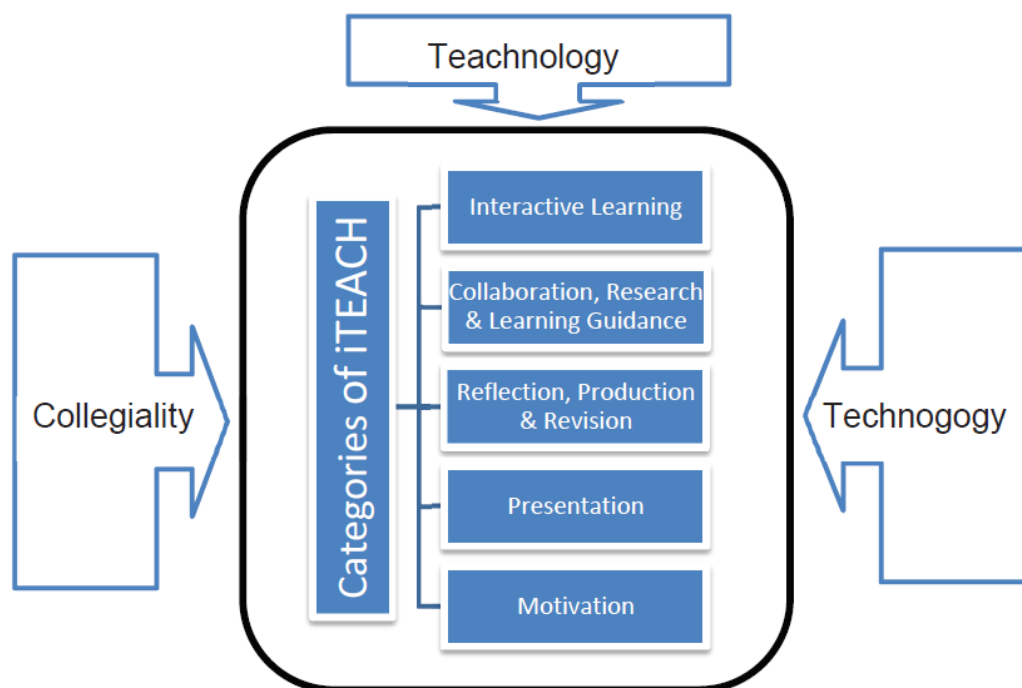


Figure 6: ICT Technology and Collegiality Holistic impersonation architecture [21].

Tsungjuang [22] stated that practice of ICT in the consideration of pedagogy is that it has the strength to completely remake culture of classroom environment. In the fundamental of this change is the concern between the educator and the children (ibid). McCormick & Scrimshaw [23] identified three phases of alternative that can be predicted from the index of ICT pedagogy: a raising in proficiency, prosperity of existing educative practices, and a total metamorphosis of the instructing and knowledge sagacity. The research inferred that according to these authors, ICT is a vicegerent of modifying doughty of proposing new pedagogical methodologies and inflict much greater input from learners into the knowledge action, much more assistance among learners and between learners and educators, and much abbreviation of physical and virtual pedagogical atmospheres. The author observed that the Western leaning culture is that the prevalent trailblazer of ICT in the classroom environment – is constructivist approach and children are focused and following to the invention of new learning, while Asian pacific pedagogical pattern is instructivist, educator focused, and adherent to the inspiration of inaugurated learning.

Jerko et al. [24] argued that the manner of ICT in knowledge is a principle artistic peculiarity of exorcism pedagogy such that improvement and possibilities of employment in a competitive fair economy perspective. The author indicated that all pedagogy process takes the challenges and needs of the information community, and practice of ICT in pedagogy to build learning, intelligence, and education more get-at-able, as well as to shift life-long

learning and pedagogy also. Primary education is the foundation of the entire pedagogical process. Its nature will gleam on the proficiency of life-long education (ibid). The research revealed that the pedagogical of ICT system that is, the system of compliance and pedagogical surround all those elements such as spring, content materials, institution, work techniques and evaluation forms, arsenal and educators that play in both direct and indirect side, progressively and known in enhancement in terms of period, unto attain objective and activities within the school system environment and all its patterns with the intention of providing education for young generations at different phases. The authors indicated that ascertained of the pedagogy system can be developed as order of reciprocally associated, proviso and contingent ingredients that play a role intentionally on the part of the set objective. The authors can be divided in four groups such as technological, elements and economical prerequisites; programmed and content prerequisite; individual prerequisites; regulatory, systematizing and directing prerequisites.

Jared [25] stated that e-learning is defined as: any type of learning that improves a network for adjustment and interaction.

The author alleged that ICT implement has been the backbone of e-learning and other indication services. The author believed that ICT's direct to handle the information that enacting by different e-learning atmospheres. The research proposed to modifying the appropriate knowledge preparation architecture for resort ICT into e-learning based on the cockiness from past perusal that were discussed before in Figure 11. The author proposed a knowledge prescription architecture that may help to provide benefits in different perspective, namely, (I) to ameliorate learner's acting in learning environment. ICT can greatly set to increase learning by allowing for more interesting, interactive, more complete than other, and dynamic processes as well, (II) to aid applying shared learning bases such as stowage and data, (III) to improve interaction among all the educators of the society, (IV) to improve services in terms of children ingress into the learning resources environment, (V) to improve the usefulness of leading procedures, and (VI) to concern the administration procedures

knowing the management of possessing and of children's position in the e-learning environment area.

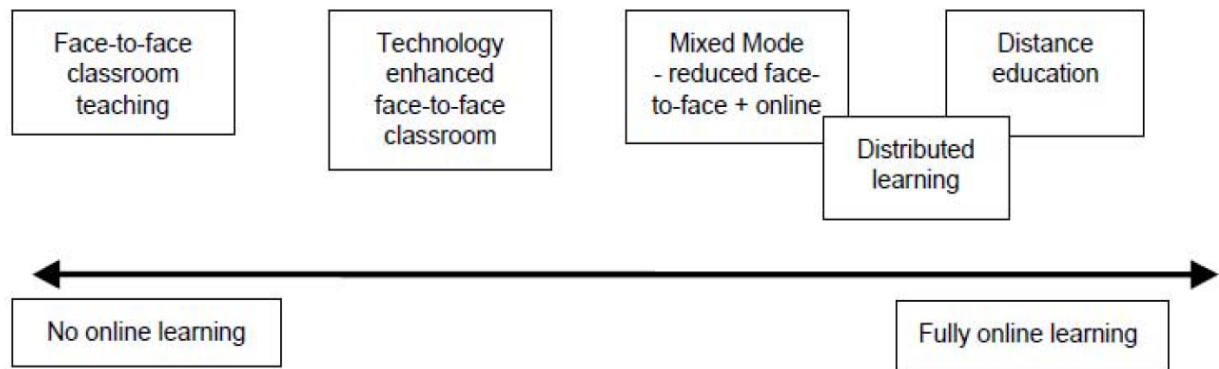


Figure 7: E-learning Continuum [26].

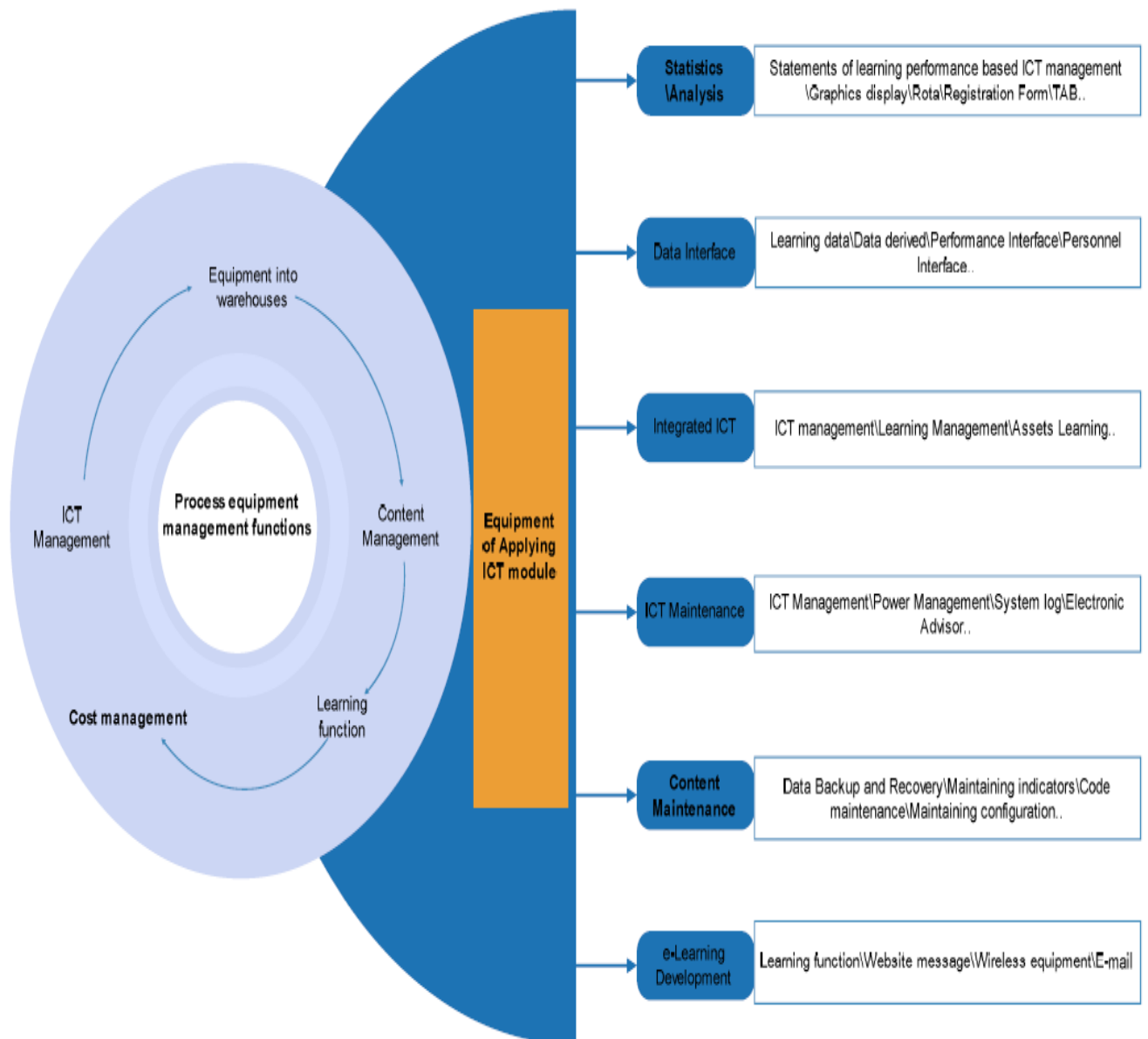


Figure 8: Proposed Learning Management Model [27].

Joshi [28] observed that most of the scholars are investigate the thought of Adaptive Educational Hypermedia Systems that called AEHS to realize personalization, in particular the distance form of e-learning system. The author proposed that the taxonomy of e-learning specially for distance mode continuity and investigated the process of educating and knowledge process and learning approaches. The author defined in the taxonomy of figure-12 that it will see practice of technology in Face to Face that means classroom teaching as well as technology enables learners to learn with or without educator in geographically extensive propagation area for example it's called distance mode. The research indicated that there are three types of knowledge approaches such as coincidental that means educator-led learning, asynchronous that means self-learning and adaptive that means personalized education. The author inferred that delivery of knowledge content is based on learner architecture, which is executed from the children's benefit, background knowledge, knowledge style and many other indicators. The author asserted that every individual learner architecture is different than other and hence learners must be take steps the contents according to their learning architecture. The author point out that there are several of personalization of learning such as course phase, knowledge aim phase.

Nungki et al. [29] discussed the matters while developing and implementing the e-learning software overrunning the primary cost exposure. The authors proposed a feedback for these matters by taking cloud technology and thought of public pedagogical possessing to implement the e-learning and expected become a cloud based open learning system. The term public learning is used in order to stimulant the improvement of the opinion of Indonesia Open Educational Resources that is called IOER and as well as the taking thought of cloud computing. There are many phases that authors conducted in this research such as exploration, sketch, execution, checking, and amends phase. The plan of the proposed model includes of six layers such as infrastructure, stage, system, service, entrance and user. As a result of the depicted from this model is a prototype of Indonesian Virtual Open Learning System (IVOLS) (ibid).

Edward [30] presented an effectuation of active learning based educating architecture for educating a matter on programming techniques in computer science background pedagogical course, in that programming object is very crucial for building long-life proficiencies in problem-solving and critical thinking proficiencies. proficiencies that are of eventual significance in the walks of life of computing as well as computer science learners (ibid).The research stated that active learning is a method whereby learners involve in activities, such as reading, writing, conversation and problem solving activity that develop exploration,

association and judgement of class content as well as task [31] [32] [33]. Hazzan [33] explained that the active learning based educating architecture includes of four phases such as select, action, conversation, and conclusion.

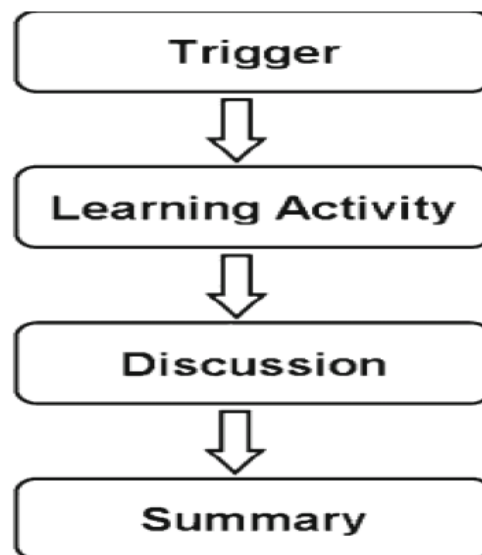


Figure 9: Active-Learning Teaching Model from Harzan [33].

Syslo [34] stated that in educating informatics such as computer science, an algorithmic problem solving and analysis obtainment is suggested for the methodical development of a computer solution for a specific problem which includes the entire process of architecting and performance the solution. The author [35] inferred that the methodology includes of six phases such as exploration of a problem circumstance, development of a specification of the matter, architecting a computer solution of the problem, coding, testing and presentation with conversation. The research alleged that these six phases of the algorithmic accession are functionally very resembling to the phases in the operational explanation of computational thinking which invented recently [36] [37]. The author assumed that such actions promote inventing, problem solving proficiencies and aid in groups for the computer science background.

Peter et al. [38] indicated that the inconvenience to get the same considering for all these terms is showed by their asymmetrical synonymic system, figure 15 displays some of the

ideas as nodes and their synonymic usage in some countries as one side. The edges are marked with the states where these ideas are used synonymously (ibid).

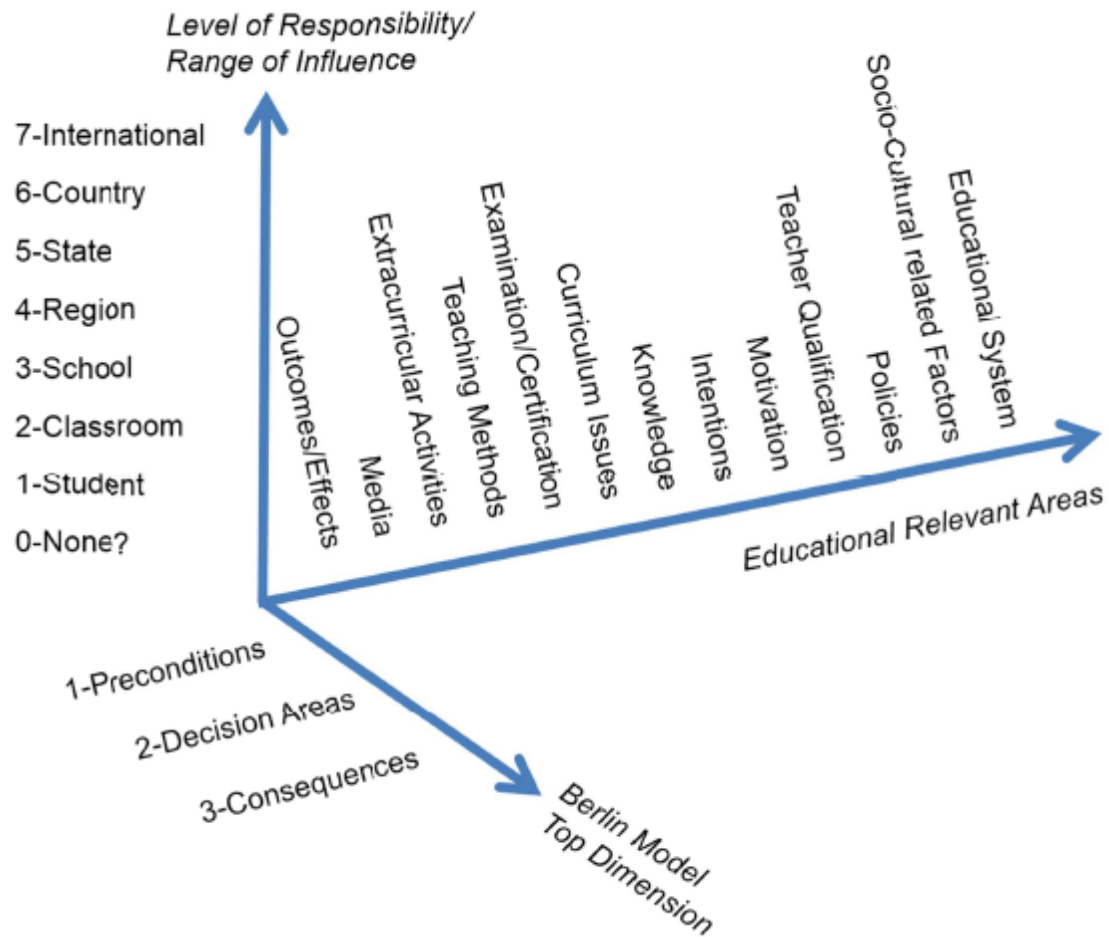


Figure 10: The Damsstadt Model [38].

Lessner [39] examined that the computer science (CS) education on high schools from the curricular point of philosophy. The author provided in the introduction (information, algorithm, efficiency), The author counts the most of this into CS on high schools. The author claimed that the main drawback, he will see in the current concept is that it mixes together basic computer usage skills with basics of information and computer science. This results into

an incoherent subject, difficult to teach and unpleasant to learn, as its nature is so ambiguous (ibid).

Moller [40] noted that Information and Communications Technology (ICT) has begotten into IT knowledge's with characteristic on digital elementary knowledge. Doyle [41] observed that a big amount of academic institution learners learning the fundamentals of programming in a syllabus which included a different of expletive topics such as hardware, software, Boolean logic and binary number representation. Crick [42] inferred that ICT is typically presented by educational institutions as their computing accessorial, learners who might in a different way enjoy studying computer science is effectively put-off from what the authors are amiss but innocuously guided to believe is computer science. Voogt [43] observed that the twenty-first century indicates balanced emphasize the following pedagogical outcomes for students such as liaison, innovative in knowledge generation, assistance, Critical thinking proficiency, ICT literacy and proficiency of life.

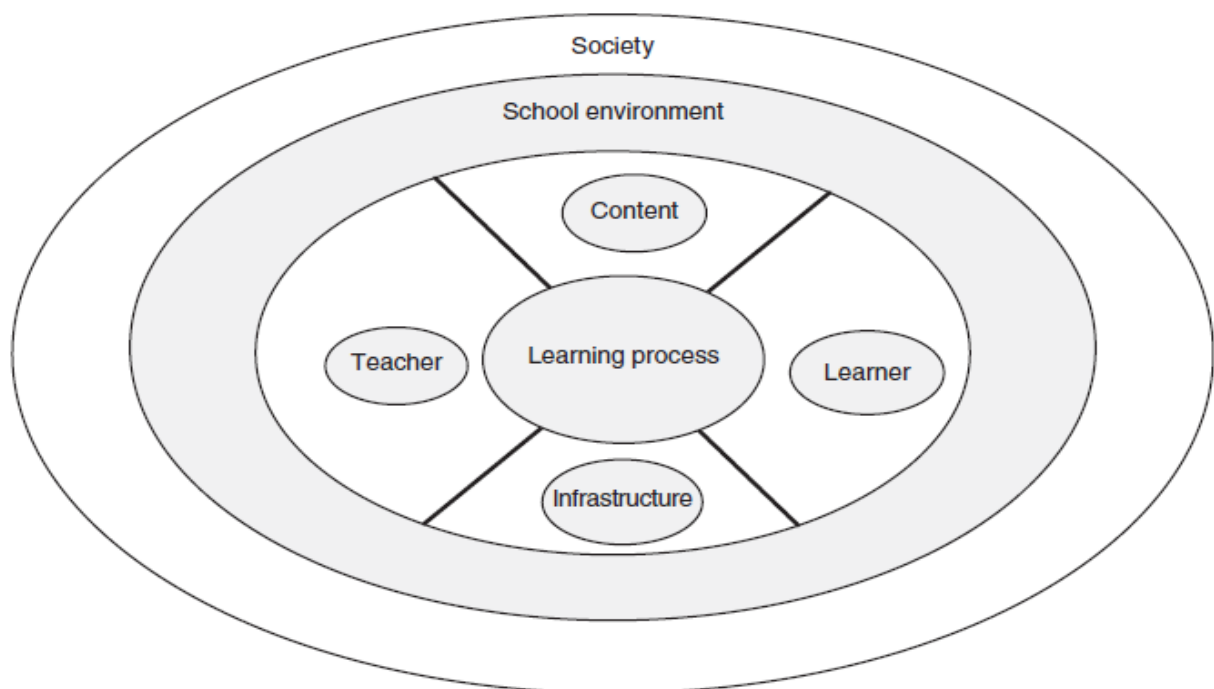


Figure 11: The educational knowledge process: fundamental components and touching producer [43] [44].

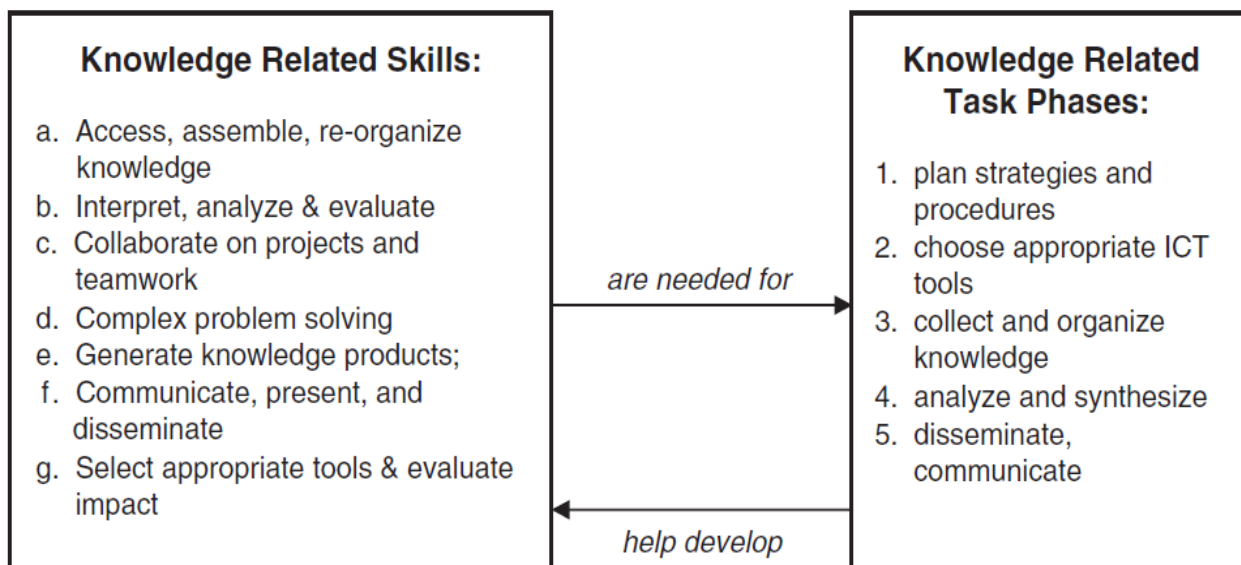


Figure 12: Relevance between knowledge respecting proficiency and knowledge respecting task method considering or without considering ICT [43].

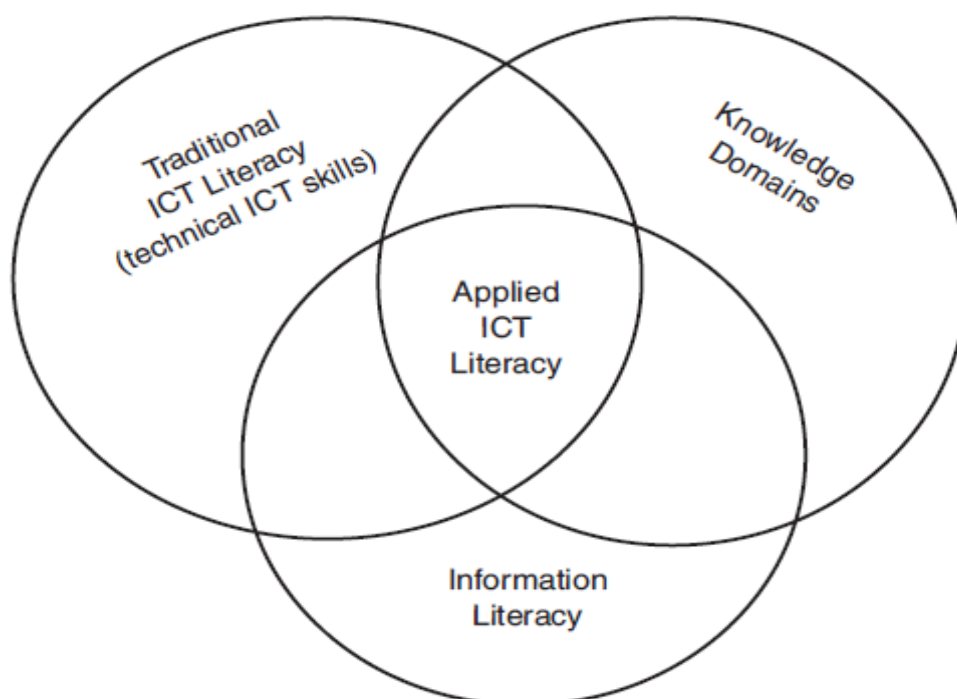


Figure 13: The Venn model of practical ICT elementary fundamental knowledge [43]

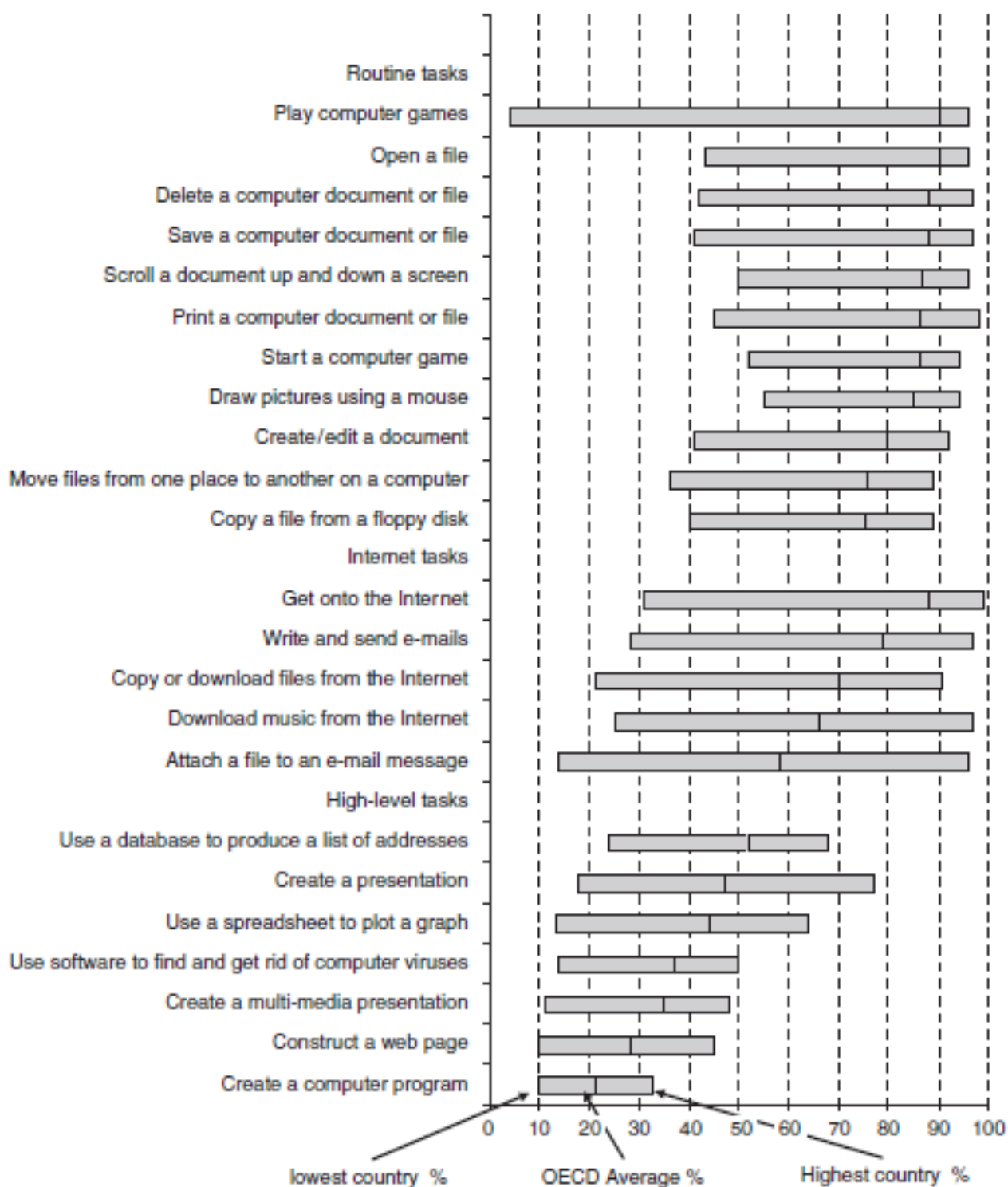


Figure 14: Children's carry through different ICT activity by themselves as percentage basis [45].

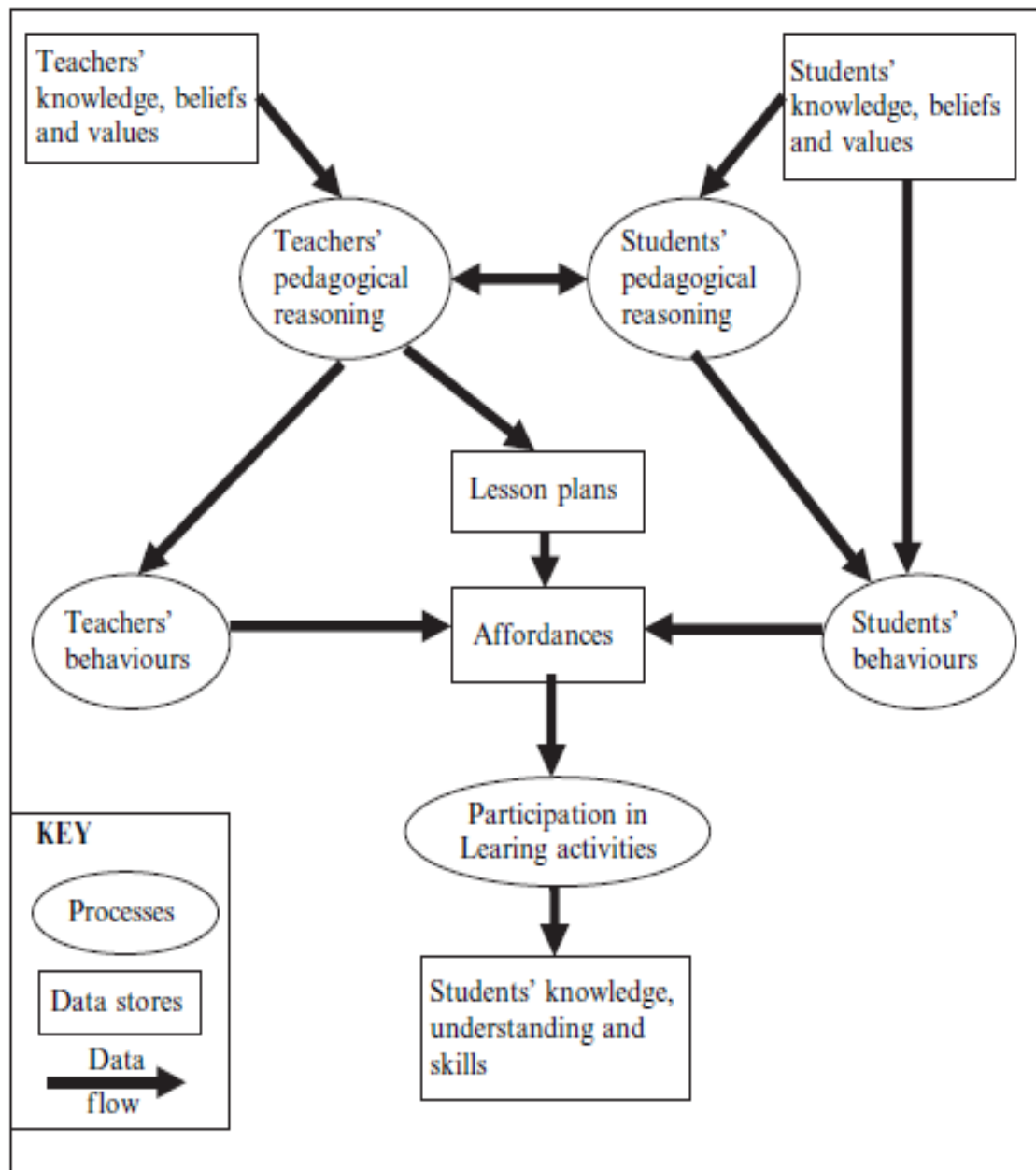


Figure 15: Modified case for pedagogical learning culture relevance of ICT base [46].

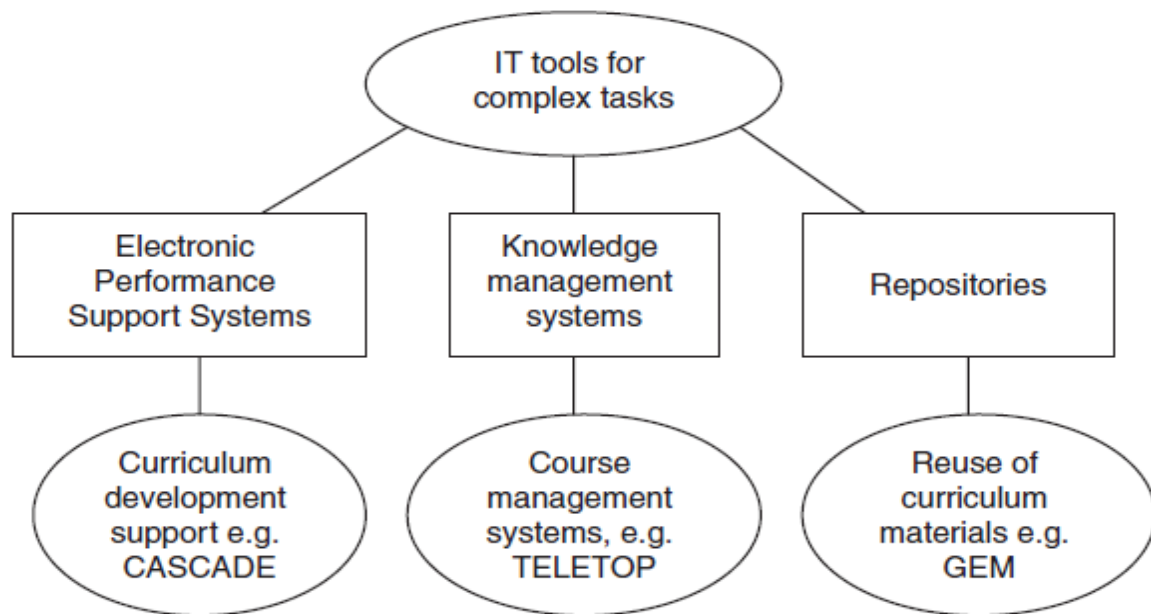


Figure 16: Different ICT instrument used to corroborate the tangled persuasive of curriculum development in the pedagogy of ICT [43].

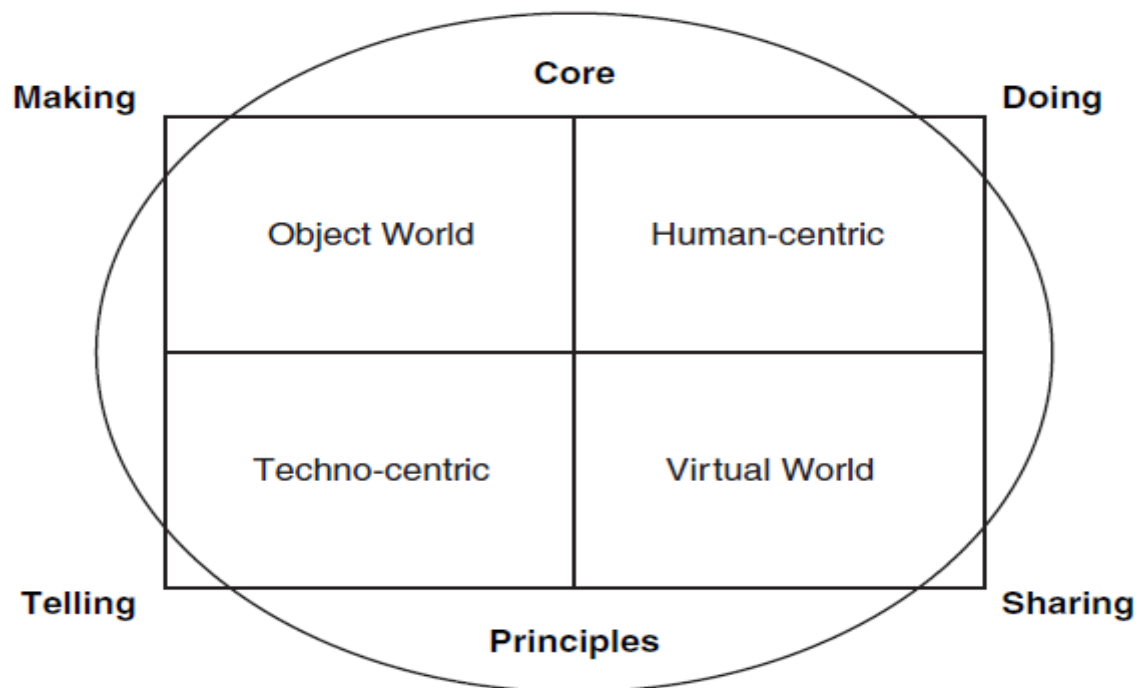


Figure 17: Domain of interactive learning environments [43]

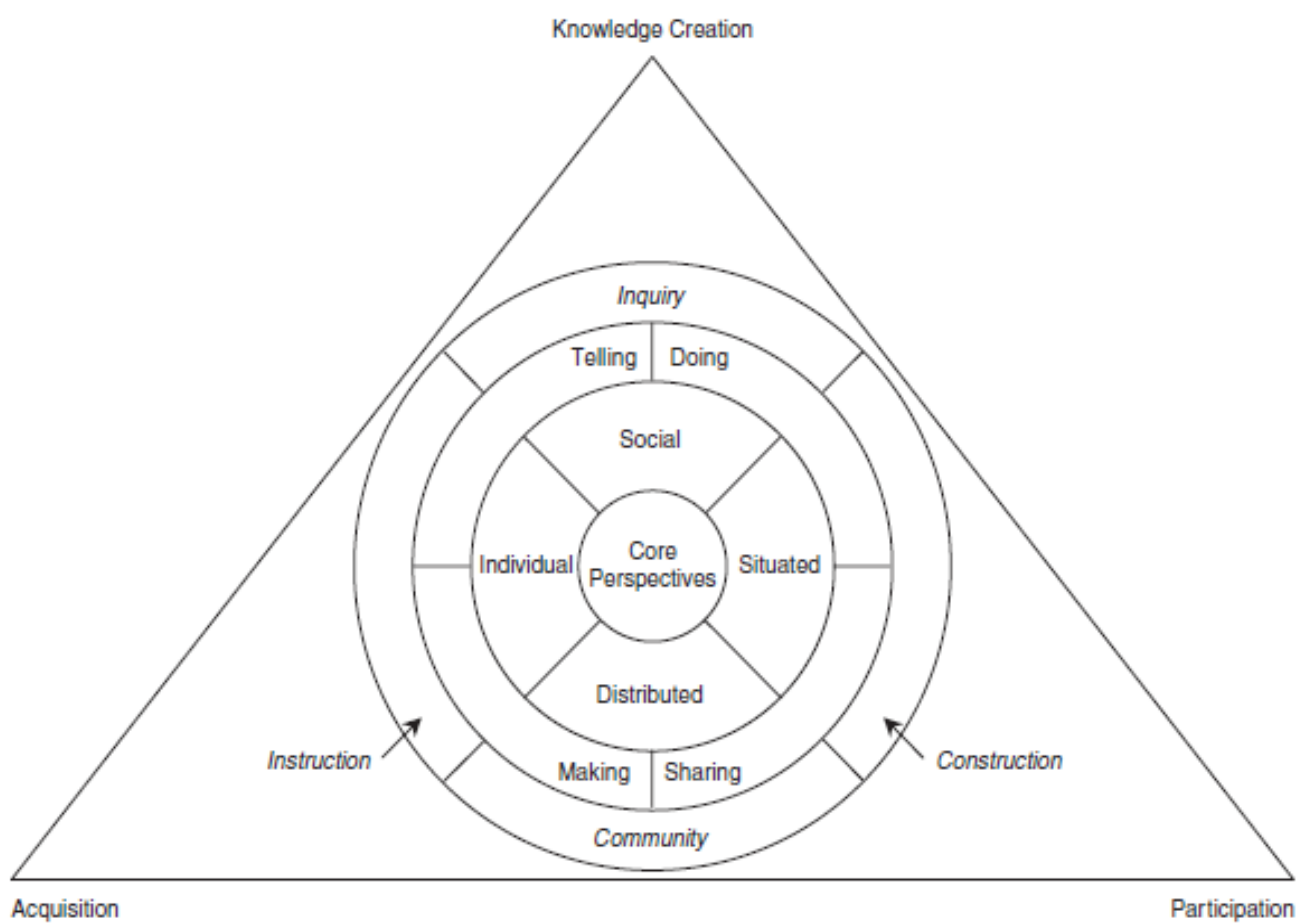


Figure 18: Spinning the metaphors of learning [43].

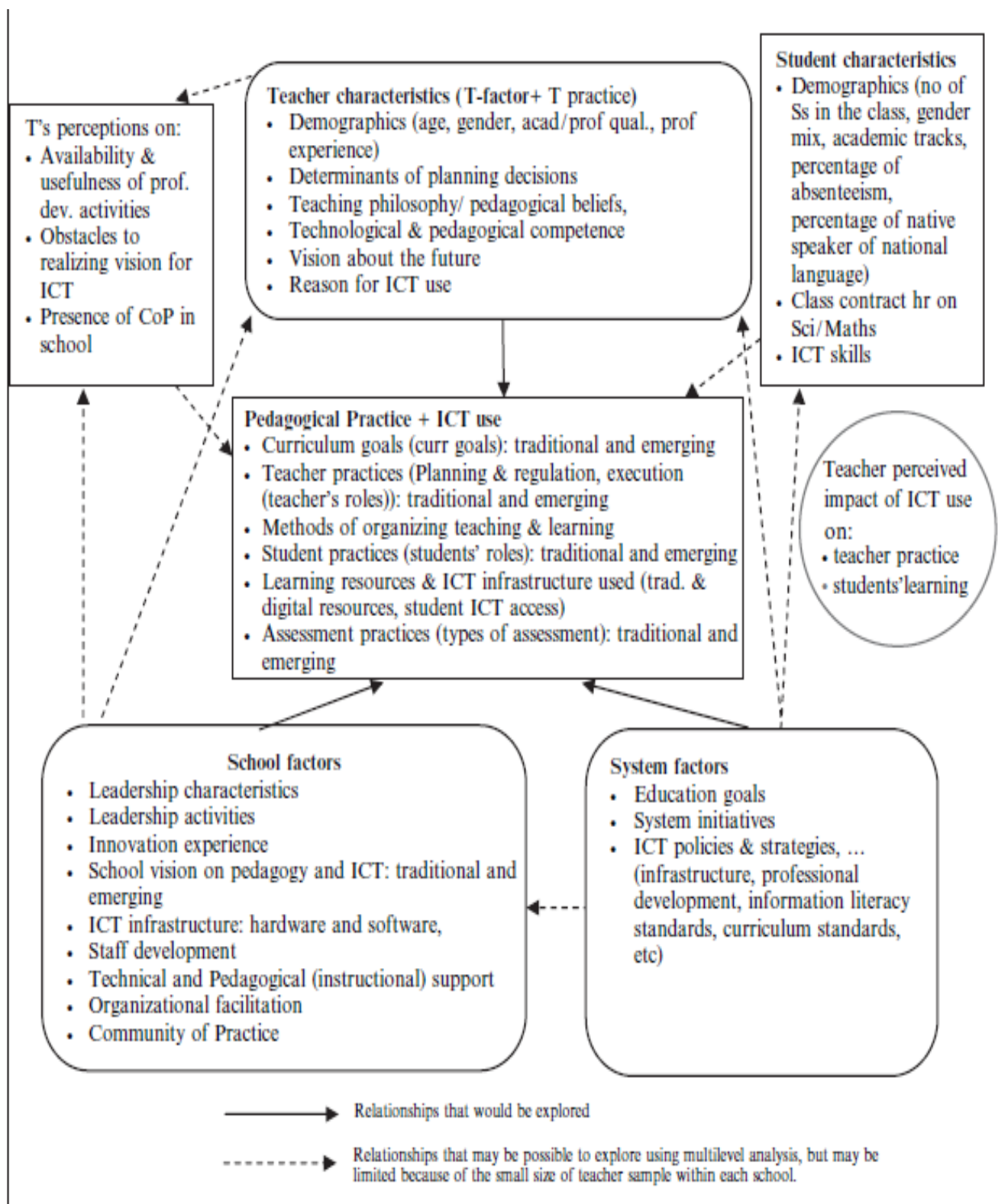


Figure 19: SITES theoretical case [47].

Note that, T=teacher, Cop – Community of practice for the above figure.

Smeets [48] stated that ICT may witness to building powerful learning atmospheres in various ways. ICT provides amenities to penetration an affluence of information using many information possessing and observing information from multiple aspects, thus maintaining the authenticity of learning ambience. ICT may also make perplexing methods easier to understand through simulations that, again, pay subscription to authentic knowledge environments (ibid). Alexander and Jonassen inferred that Thus, ICT may operation as a facilitator of active learning and higher-order thinking [49] [50]. Mooij and Smeets assumed that ICT may distribute as an instrument to syllabus differentiation, providing amenities for accommodating the learning content and tasks to the requirements and abilities of each individual student and by taking steps tailored feedback [51] [52]. Marco [53] claimed that an philosophy for Computer Science can be turned out as a side-result from the work made by an ACM committee on computer science syllabus.

Erik et al. [54] inferred that CS (different alternative terms are in use to reveal the base discipline or school subject called CS, for example Informatics and Computing.) ‘spread students’ computational and critical thinking skills and viewed them how to build, not simply use and new technologies. Deborah [55] observed that the CSTA has developed the CSTA K-12 CS Standards. These standards contain five strands such as computational thinking, assistance, computing culture and programming, computers and communication devices, and community, catholic and ethical influence. Goode [56] discovered that the Exploring CS model curriculum covers six areas such as human-computer interaction, problem solving, web model, introduction to programming, computing and data analysis, and robotics.

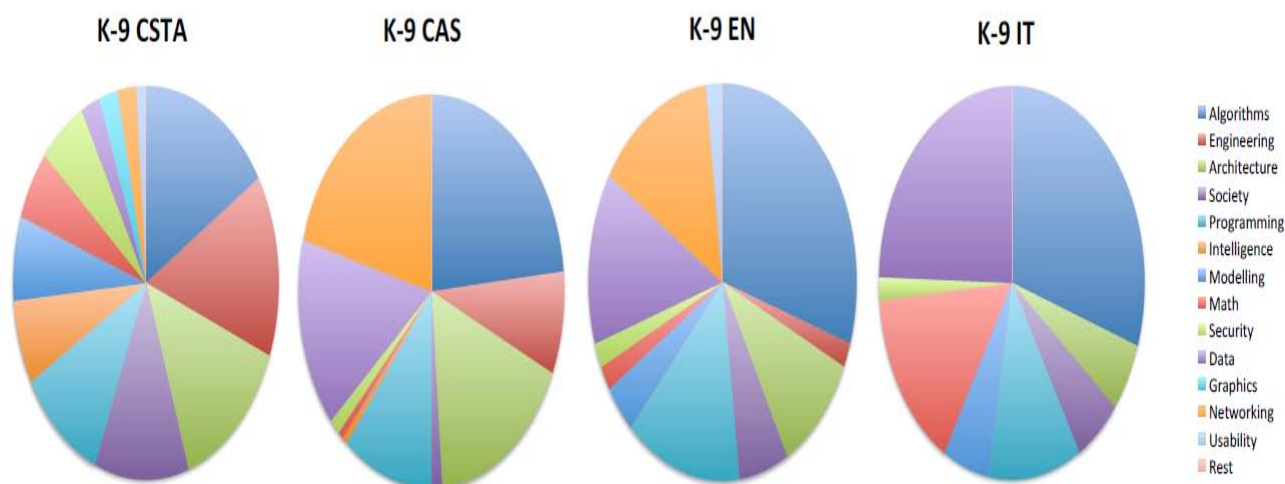


Figure 20: Visualization of concept distributions [54].

Davis et al. [57] examined the location and preamble of Computer Science in curriculum in the light of recent calls for syllabus change. The authors observed that, major anxieties have been mentioned about this expiry of Computer Science leading to calls for all learners to build key considering, skills and thinking obtainments that go away from Computer Science before graduating from secondary schools and probably in primary school also. The authors are used pedagogically a spiral approach based on three elements such as problem circumstance, associative games, and puzzles that use concrete cabalistic aims –innovative concepts, computational thinking about the objects and concepts – algorithms, solutions, Programming--The emphasis on each of these three elements modifying as the students' progress.

Torsten [58] assumed that the value will importantly dominance the next revisions of the federal countries CS educational institutional curriculum and thus pay subscription on the one hand to better match able learning outcomes in the CS pedagogical field and on the other to a more realistic image of all students about what CS is all about.

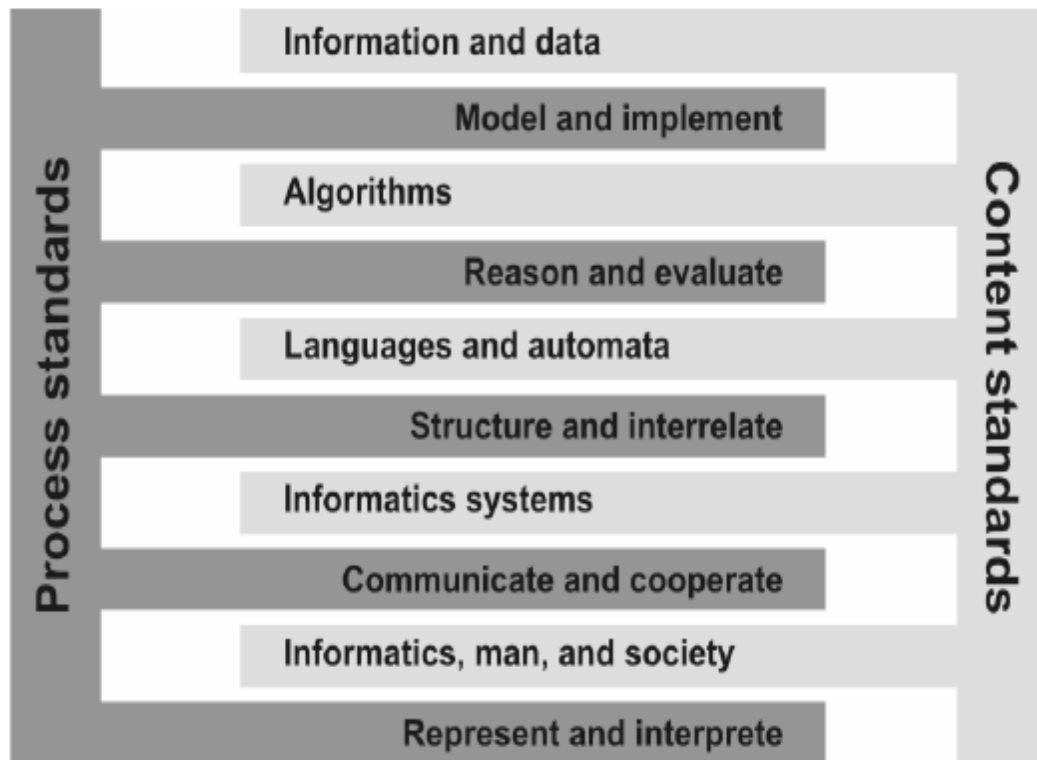


Figure 21: Content/process standards ([59] p.11).

Jonathan [60] stated that most significant is the require to accomplish ICT cabalistic throughout all educational institutional subjects. The author inferred that Information and communication technology, or ICT, is defined as the alliance of informatics technology with other, related technologies, specifically communication technology.



Figure 22: Delimitate architecture of a continuum way to ICT development in educational institution [60].

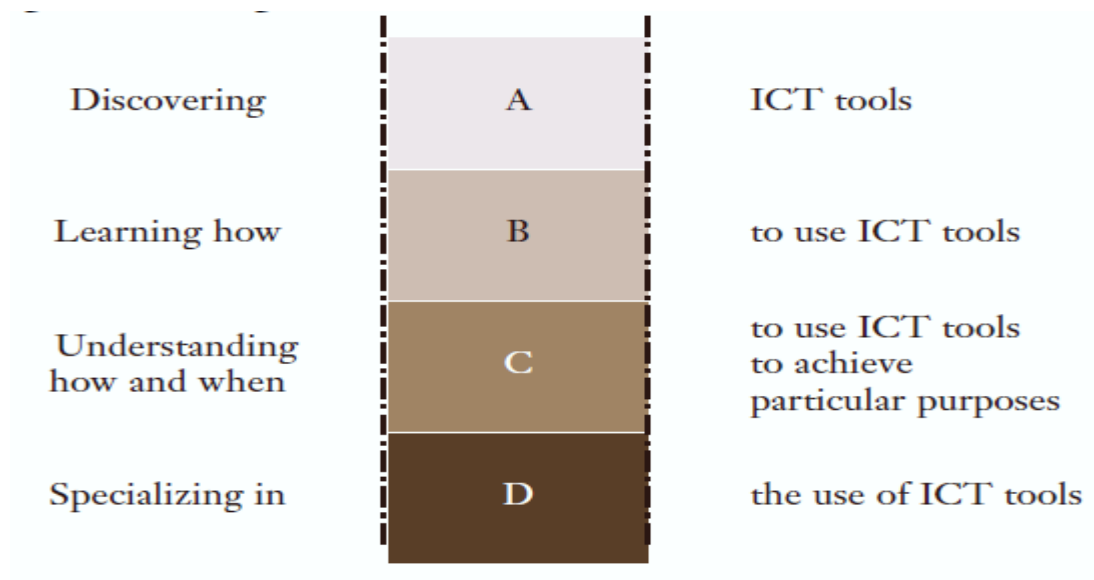


Figure 23: Echelon architecture of educating and knowledge in the pedagogy of ICT [60].

Table 4. Sample ICT curriculum for secondary educational institution by *UNESCO* [60].

ICT Literacy	Application of ICT in Subject Areas	Infusing ICT across the Curriculum	ICT Specialization
<i>Units</i>	<i>Units</i>	<i>Units</i>	<i>Units</i>
A1 Basic Concepts of ICT	S1 ICT in Languages	C1 Encouragement to reading	<i>Specialization Preparation</i>
A2 Using the Computer and Managing Files	S2 ICT in Natural Sciences	C2 Are we becoming genetically modified?	SP1 Introduction to Programming
A3 Word Processing	S3 ICT in Mathematics	C3 Antarctica 2000	SP2 Top-Down Program Design
A4 Working with a Spreadsheet	S4 ICT in Social Sciences	C4 Multimedia and languages	<i>General Specialization</i>
A5 Working with a Database	S5 ICT in Art	C5 The parking garage problem	GS1 Foundations of Programming and Software Development
A6 Composing Documents and Presentations	B1 Measurement	C6 The 1920s and its excesses	GS2 Advanced Elements of Programming
A7 Information and Communication	B2 Modelling and Simulation	C7 Le village prologue	<i>Vocational Specialization</i>
A8 Social and Ethical Issues	B3 Robots and Feedback Devices	C8 Society's problems	VS1 Business Information Systems
A9 Jobs and/or with ICT	B4 Statistics		VS2 Process Control Systems
	B5 Creating Graphics		VS3 Project Management
	B6 Music		
	E1 Spreadsheet Design		
	E2 Database Design		

The research [61] states that the ICT framework offers schools a structured approach to using ICT in curriculum and assessment by identifying the types of learning with ICT (including knowledge, skills and attitudes) appropriate for students during the period of compulsory education.

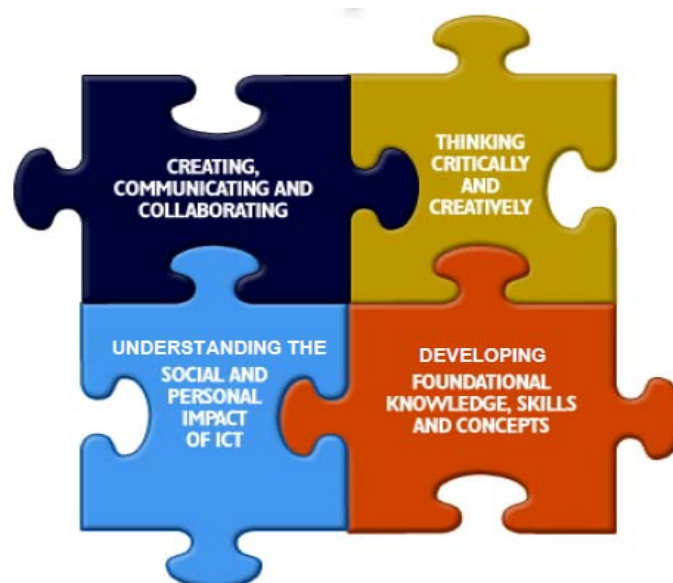


Figure 24: ICT case object in the base of pedagogy of ICT [61].

Table 5. ICT Framework Learning Outcomes [61].

Area C	Creating, communicating and collaborating
The student should be enabled to	
C1	draft, format and revise text using ICT
C2	create, manipulate and insert information in a variety of different formats (images, sound, video) using ICT
C3	gather, organise, manipulate and analyse data using ICT
C4	communicate and collaborate locally and globally using ICT
C5	plan, design, create and present information using ICT
Area F	Developing foundational knowledge, skills and concepts
The student should be enabled to	
F1	demonstrate and apply functional knowledge and understanding of ICT
F2	develop skills for maintaining and optimising ICT
F3	understand and practice healthy and safe uses of ICT
Area T	Thinking critically and creatively
The student should be enabled to	
T1	research, access and retrieve information using ICT
T2	evaluate, organise and synthesise information using ICT
T3	express creativity and construct new knowledge and artefacts using ICT
T4	explore and develop problem-solving strategies using ICT
Area S	Understanding the social and personal impact of ICT
The student should be enabled to	
S1	demonstrate understanding and critical awareness of the contribution of ICT to the individual and to our society
S2	develop independent and collaborative learning and language skills using ICT
S3	demonstrate an awareness of, and comply with, responsible and ethical use of ICT

1.4 Aims and Objectives

We want to design and implement a dynamic and virtual interaction model between the teachers, students, learning environment, learning task in the pedagogy of ICT. Want to generate a challenging theory, and practice of Teaching Strategies, Action, Judgement and Curriculum development in the context of the pedagogy of ICT. Want to made a construct and outcome based decision of the learning, understanding, needs, background, as well as interest of individual learners in the context of the pedagogy of the ICT. Want to build a proper standard ICT instruments for particular knowledge context, changing standing resources or develop new learning atmosphere. Want to provide some standard common guideline of the ICT-based thinking or critical thinking skills for the Students and Teachers. We want to make learning outcomes of the different phase of Planning, Design, Coding and Evaluation for the Development life cycle. Want to define the clear role among the components such as innovative, problem solving proficiencies and assistance in groups of the computational thinking proficiencies in the context of the pedagogy of ICT. Want to specified a role and implement about the Active Learning Based teaching model for teaching a topic of the pedagogy of ICT in computer science education course from preschool to higher secondary school.

Students and teachers should properly utilize the ICT material such as curriculum, contents and other tools. Establish good communication skills, productivity, critical thinking, problem solving skills and creativity for students by help of ICT. Increase the confidence of teachers to use the ICT tools in education. Establish use of variety ICT based educational services for teaching, learning and research. ICT based education must bridge the gaps in existing educational system.

2. Benchmark Analysis

Australian Capital Territory (ACT) and Tasmania (TAS) curriculum has built to considering in the outcome basis of those focusing area.

Focusing Area:

- Inquisitive with ICT
- Building with ICT
- Expressing with ICT
- Leading with ICT

Table 6. Year Calculation (Hybrid Model for ICT Development program) [62] [63].

Year Calculation:

Australia (Australian Capital Territory (ACT) and Tasmania (TAS))		Bangladesh	
Year	Ages	Class	Ages
Pre-Kindergarten	3-5	Pre-Primary	4-5+
Kindergarten	5-6	Class 1	6+
Grade/Year 1	6-7	Class 2	7+
Grade/Year 2	7-8	Class 3	8+
Grade/Year 3	8-9	Class 4	9+
Grade/Year 4	9-10	Class 5	10+
Grade/Year 5	10-11	Class 6	11+
Grade/Year 6	11-12	Class 7	12+
Year 7	12-13	Class 8	13+
Year 8	13-14	Class 9	14+
Year 9	14-15	Class 10	15+
Year 10	15-16	Class 11	16+
Year 11	16-17	Class 12	17+
Year 12	17-18		

In syllabus structure, each of the following section has different performance criteria for different kind of stages. For example, In Inquiring with ICT has there are two performance

criteria. First one is the “Inquire and become critical information consumers” and the last one is “Inquire using appropriate strategies and tools”. Each performance criteria contain three different stages in a particular age or class.

3. Problem Statements

- An appropriate infrastructure is needed to identify for the early stage of schooling.
- Lack of Integration through ICT into classrooms.
- Unavailable of Proper ICT-based learning design as well as ICT Skills Framework that promote quality learning outcomes.
- Not practice Active-learning-based learning & teaching model through ICT.

4. Research Questions

- What type of ICT based tools available on the context of the Pedagogy in ICT?
- What are the types of learning environments in standard grade of primary pedagogy?
- How ICT integration enhance student’s seeking and critical thinking power as well as in the active learning?
- What are the challenges to implement ICT in education?

5. Working Procedure with Pedagogy

5.1 Interactions between learning elements in learning environment

- Teachers
- Students
- Learning Environment (ICT enable Infrastructure)

- Learning Tasks (Digitalized Content)

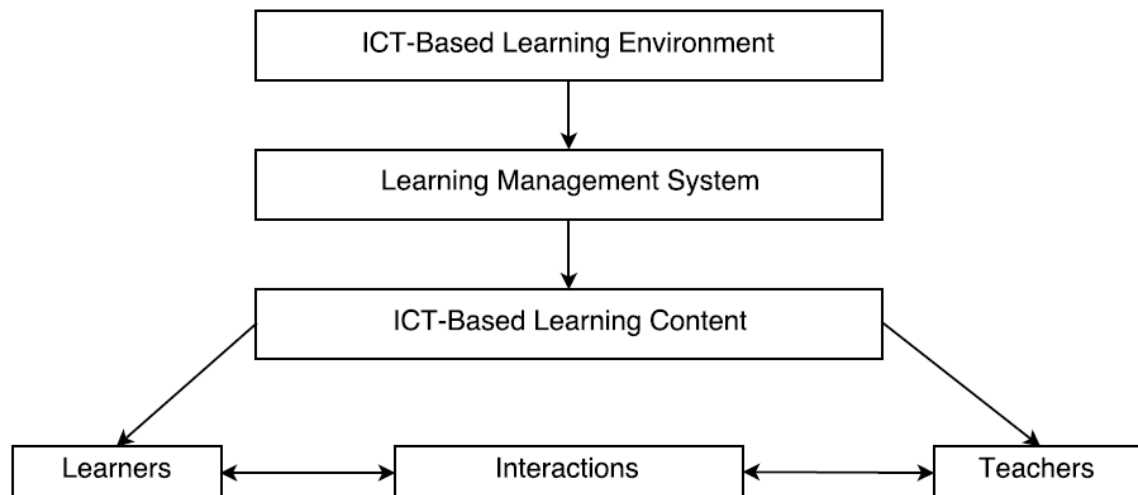


Figure 25: Graphical representation of Interactions between learning elements in learning environment.

In learning environment, Interactions between the learning elements are very important. The elements such as students, teachers, learning environment that means infrastructure and learning tasks that means content. For students and teachers, active learning based interaction will very helpful for understanding in both side as well as infrastructure will ICT capable and content will have digitalized. In our building graphical representation, here, we are considering the Learning Management System to manage the ICT-Based Learning Environment and ICT-Based Learning Content as well as the interactions happened between the learners and teachers.

5.2 Theory & Practice of Teaching

- Teaching Strategies
- Curriculum Development
- Teacher Actions
- Teacher Judgements

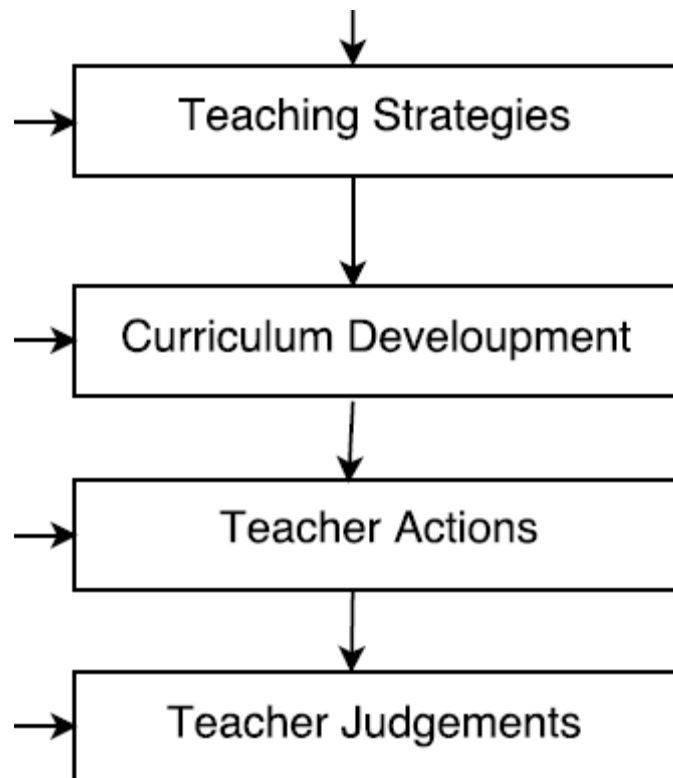


Figure 26: Graphical representation of Theory & Practice of Teaching.

Theory & Practice of Teaching is a very important thing in the pedagogy of ICT. The key elements in this phase are Teaching Strategies, Curriculum Development, Teacher Actions, Teacher Judgements. We can take the theories from our state of art study or can build a new hybrid theory through the combination of multiple theories as well as in the case of practice of teaching. Practice of teaching is like a culture. We can learn the teaching culture from the western country and modify it in basis of our culture.

5.3 Decision by the different elements

- Knowledge of Learning
- Understanding of learners & their requirements
- Background and self-interest of Individual learners

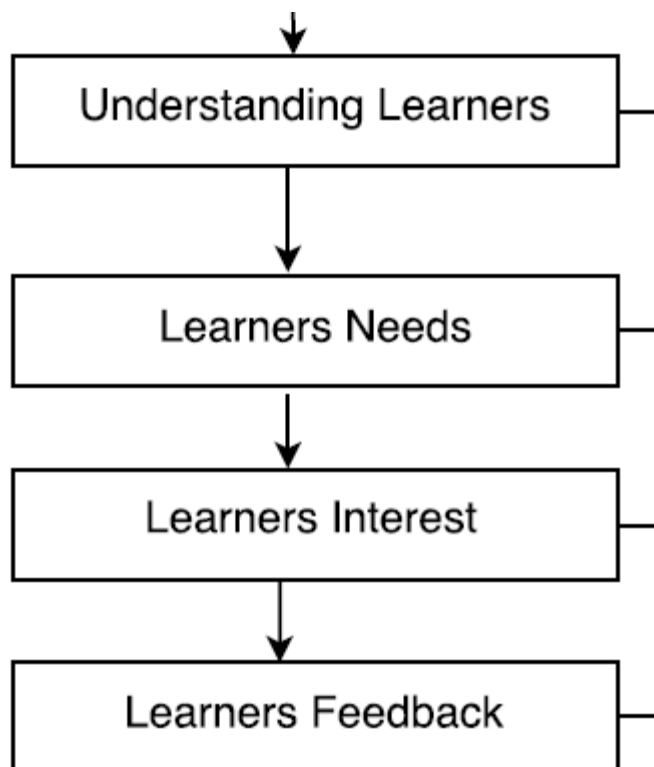


Figure 27: Graphical representation of Decision by the different elements.

Decision by the different elements phase is another an important part in the pedagogy of ICT. The key elements of this phase are Theories of Learning, Understanding of Students & their needs, Background & Interests of Individual Students. Here, all the elements are related to the learners. The most important thing in this phase are Knowledge of Learning, Understanding of learners & their requirements, Background and self-interest of Individual learners. We are thinking for the individual learners and looking for the solution for particular student according to their ability.

6. Proposed Model

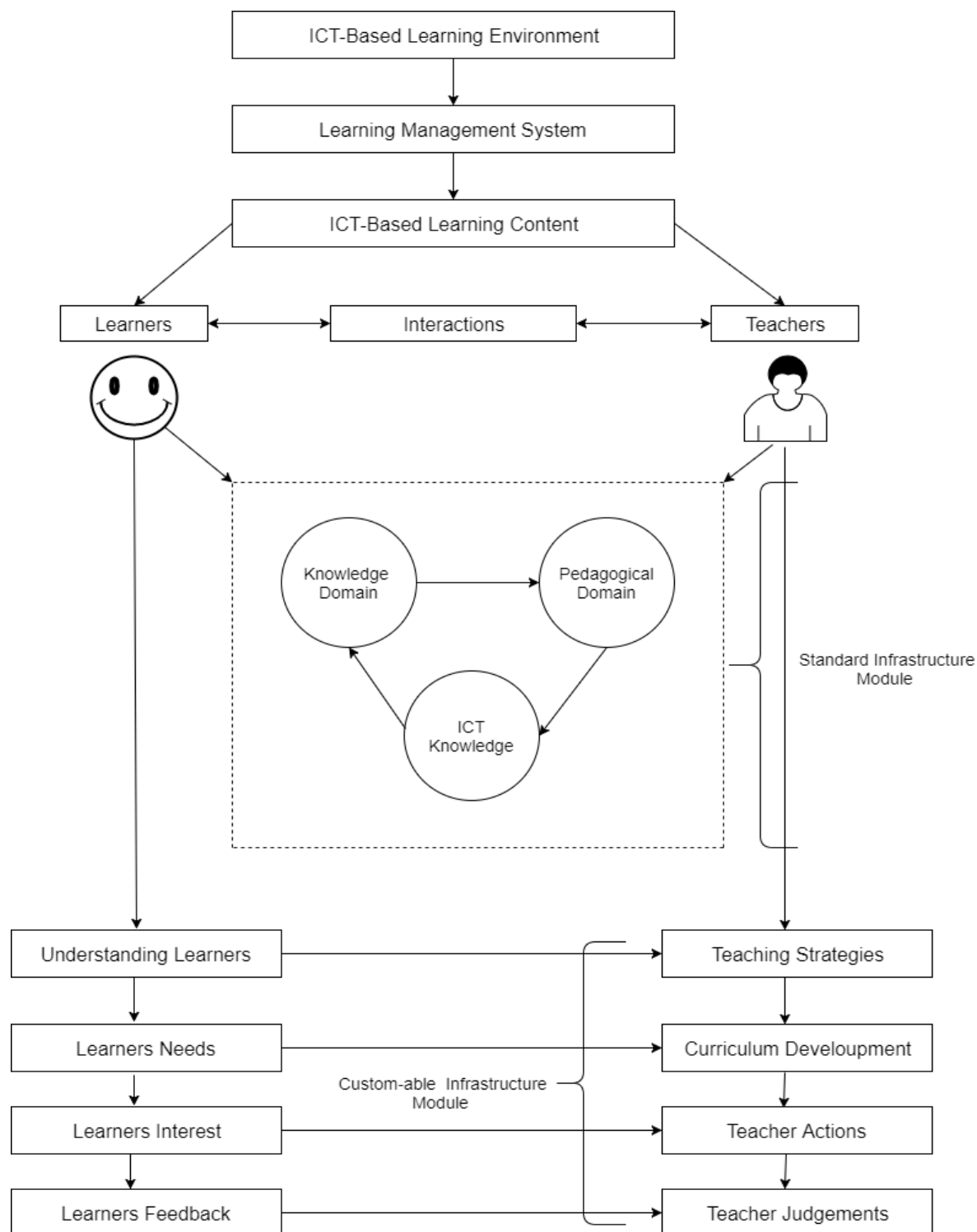


Figure 28: Designing pedagogical learning environment in ICT (Proposed).

In our proposed model, there are two major things, first one is standard infrastructure module and second one is customizable infrastructure module.

In standard infrastructure module contain three elements such as knowledge domain, pedagogical domain and ICT knowledge. The working process of this module like a loop. Loop due to the reason of purification the knowledge in the context of ICT. standard infrastructure module is unique that means it's not changeable, always remain same both for the learners and teacher.

In customizable infrastructure module contain mainly four elements and combination of total eight elements. The main elements are Teaching Strategies, Curriculum Development, Teacher Actions, Teacher Judgements and other elements are Understanding learners, Learners need, Learners interest and learner's feedback. This module is customizable automatically according to the individual learners needs and interests.

Table 7. Combination of Standard, Stages, Year Level and Class Level (Proposed) (Hybrid Model for ICT Development program).

Standard	Standard 1			Standard 2			Standard 3			Standard 4			Standard 5		
Stage	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Age Range (Each Box = 10 Months)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Year Level (Kinder to Year 10)	Kinder - Prep														
			Year 1 and Year 2												
					Year 3 and Year 4										
							Year 5 and Year 6								
									Year 7 and Year 8						
											Year 9 and Year 10				
Stage	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Class Level (Pre-primary to Class 9)	Pre-School, Class 1, Class 2														
				Class 3											
					Class 4										
							Class 5								
								Class 6							
										Class 7					
											Class 8				
													Class 9		
														Class 10	

This is the hybrid model among the curriculum structure of Australian Capital Territory (ACT), Tasmania (TAS) and Bangladeshi context. Here, we are trying merge the structures and bring into one umbrella. In the base our work is age base that means we are considering the age to construct the model. This model is merge the elements of standard, stages, year level and class level. to mapping this model, here, occur some overlapping.

In standards, here cover the standard of one to five, stage of one to fifteen, age range three to seventeen, year level of kindergarten to year ten, class of pre-primary to class 10.

7. Conclusion and Future Works

In this paper, we have tried to observe, identify existing problems and proposed a pedagogical learning environment in ICT with the global standards.

In future, we will directly work with the

- field school,
- apply our proposed curriculum,
- get the feedback from students,
- Identify the flaws and
- finally customize if needed.

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