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THE COGNITIVE-TECHNOLOGY ENHANCEMENT LEARNING THEORY (C-TELT)

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The Cognitive-Technology Enhancement Learning Theory (C-TELT) germinates in response to the weaknesses of the cognitive theory. The major tenet of C-TELT holds that all meaningful learning, from simple to complex, takes place when the cognitive ability of an individual is enhanced by artefacts in the environment, through experience or practice. These artefacts are collectively called technology. The theory maintains that when the brain is enhanced by technology, it is the sharpest and most effective structure that exists. The focus of this theory brings the core elements of cognitive, constructivism, empiricism and rationalism together. The meaning of the term learning, as used here, is adopted from Kimble's modified definition as "a relatively permanent change in behaviour or behaviour potentiality that results from experience and cannot be attributed to temporary body states such as those induced by illness, fatigue or drugs" (Olson & Hergenhahn, 2013, p. 6). Consequently, the intent of this theory is not to reinvent the wheels or restate what is already stated. It intends to stand on the shoulders of pioneers and unearth how teaching and curriculum can be improved so that students learn better in a dynamic globalized 21th century environment.

This theory holds that cognitive states are representations and sees the mind as processing complex representations with the aid of semantics, that is, technology. Meaningful learning, as is used here, is taken to mean the construction of connected tissues between symbols, artefacts and the mental faculties. Therefore, it calls into play the processes involved in concept formation and problem solving (Ausubel, 1976). However, this theory goes beyond the hierarchical nature of knowledge and the epistemological stance that the process of reading is the key to think and learn about the world. This theory echoes the call of Prensky (2013, par.2) for "educators to think of technology in the same way they've long view dreading. That is, as a key to thinking about and knowing about the world. To equip the 21st century learners to achieve their fullest potential, technology is the new skill, the key and foundation to thinking about and learning about our world (Prensky, 2013).We have long depended on external enhancers of our brains such as writing. As powerful as our brains are, we have outgrown its competence due to the rapid changes that occur around us. We must see technology as the solution to our unique context of diversity, variability, uncertainty, complexity, and ambiguity, to enhance the capabilities of our brains symbiotically (Prensky, 2013).

THEORETICAL CONCEPTS

The foundation of the Cognitive-Technology Enhancement Learning Theory (C-TELT) is builton the key concepts of the cognitive theory, but expands on these concepts by postulating technology as an appendage of our brains.

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The C-TELT accepts the key concepts of cognitivism as building blocks that are central to its success, but it goes further. These building blocks are: schema; Three-Stage Information Processing Model; Sensory Register; Short-Term Memory (STM); Long-Term Memory and Storage (LTM); Meaningful Effects(Cofer, as cited in Good & Brophy, 1990); Wittrock, Marks, & Doctorow (as cited in Good and Brophy, 1990); Serial Position Effects; Practice Effects; Transfer Effects; Interference Effects; Organization Effects; Levels of Processing Effects (Craik & Lockhart), as cited in Good and Brophy (1990); State Dependent Effects; Mnemonic Effects; Schema Effects, and Advance Organizers (Ausebel). However, the essence of this theory is that learning is not just about memory, motivation and thinking, of which reflection plays a major part. It is about the new role of elongating our brains that technology is now playing.

Clark and Chalmers (as cited in Prensky, 2013, p.1) pointed out that "extended cognition is a core cognitive process, not an add-on extra." They further state that the brain is continually integrating useful components from the external world such parts of our bodies for counting; “pen and paper for writing; and, more recently, slide rules; calculators; and computers” (Prensky, 2013, p.1). The cognitive-technology enhancement learning theory extends beyond the mind as a processing center that formulates mental models of reality and uses them to command the body's behaviour. This theory also extends beyond the field of extended cognition and the processes involved in the creation of mental processes. It simply attributes these mechanisms to constituents of consciousness generated through interaction with the technology in the environment. In building on key concepts of cognitivism and extended cognition, this theory accepts that cognitive processes are involved at 'low' level such as motor learning and haptic perception (Morasso, 2005). However, Ratner (2011) and Marek, Hanne & Ezequiel (2013) stated that there is a 'high' level where cultural factors play a role, that is, ‘enaction’.

This theory goes further than the interplay between the organism, its environment, the feedback processes involved in developing an awareness of, and reformation of the environment (Stewart, Gapenne & DiPaolo, 2014). It postulates that technology should now be viewed as part of our mental activities and capabilities that we have become so dependent on such as calculations and simulations that machines can do much better than the brain (Prensky, 2013). These should include multimodal tasks that will improve our intelligences. This should also include principles such as novelty, challenge, creativity, doing things the complex way and networking. This should also improve memory through data input and output tools, enhance judgement, moral and ethical choices. C-TELT does not only view mental processes and the mind beyond the body and the emergence of order and structure evolving from active engagement with the world, it also extends embedded functioning, enacted and extended.

RATIONALE

Like their predecessors, cognitivism and constructivism have come under serious criticisms for their apparent weaknesses, and rightly so because as knowledge increases, we able to examine issues from different vantage points. In cognitivism, a weakness is that the learner learns only one way to accomplish a task, but this may not be the most appropriate way, or suited to the learner or situation. Thus, while concerning with how knowledge is acquired, processed, stored, retrieved, and activated, knowledge itself is given and absolute. Therefore, this input-process-output model is viewed as mechanistic and deterministic, does not account enough for individuality and places little emphasis on affective characteristics that humans are so good at.

Constructivism on the other hand, suggests that knowledge is neither given nor absolute, and is often seen as less rigorous than traditional approaches to instruction. As well, while entrusting the responsibility of actively constructing knowledge on the learner, by searching for meaning through contextualized, inherently social activity that are dialogic and recursive, it does not fit well with traditional age grouping and rigid terms or semesters. More so, it appears that in an environment of high stakes standardize tests as we now operate; most educators are forced to resort to the traditional ways in which they were taught.

Thus, the cognitive-technology enhancement learning theory goes beyond the cognitivism paradigm, whose central core holds that the "black box" of the individual mind should be opened and understood, and the constructivism paradigm which states that what someone knows is grounded in perception of the physical and social experiences which are comprehended by the mind." (Jonasson, 1991).This theory seeks to foster students' skills in how to synergize in situations where conformity is essential to ensure that divergent thinking and actions do not pose problems.

This pragmatic theory views the learner not through the lens of the computer metaphor as an information processor, but through their ability to meaningfully utilize all artifacts provided by their environment to accomplish a task. This theory build on the claim of cognitive psychology that learning involves the use of memory, motivation, and thinking, and that reflection plays an important part in learning. However, it differs in that learning is seen as more than an internal process. Therefore, this theory is different as it contends that the amount learned by students should not only depend on the processing capacity of the learners, the amount of effort expended during the learning process and the depth of the processing (Craik & Lockhart, 1972; Craik & Tulving (1975), and the learner's existing knowledge structure (Ausubel, 1974; Winston, Kolb & Kolb, 1974).

The cognitive-technology enhancement learning theory also views learning from more than an information processing vintage point, but agrees that the learner uses different types of memory during learning (Mödritscher, 2006).The cognitive-technology enhancement theory recognizes the importance of individual differences, and of including a diversity of learning strategies and artifacts in instruction, learning and assessment, to accommodate the unique manner in which the learner perceives, interacts with, and responds to the learning environment as a measure of their individual differences (Mödritscher, 2006).

APPROACHES TO INSTRUCTIONAL DESIGN

The approaches to instructional design of the evolving and powerful C-TELT theorydemands that we flip the classroom and redesign our curriculum. The aim of this model is to symbiotically synchronize human strengths with the most powerful technological strengths through its focus, syntax, and principle of retention, social system, support system, application and nurturant effects. In this approach, instead of focusing on the Math, English, Science and Social Studies, the focus should be on three major crucial areas proposed by Prensky (2013).

These areas include Effective Thinking, such creative and critical thinking and portions of math, science, logic, persuasion, and arts; Effective Action, such as entrepreneurship, goal setting, planning, persistence, project management, and feedback; Effective Relationships, such as emotional intelligence, teamwork, ethics, and other contextual attributes (Prensky, 2013). Prensky suggest that the remainder of the curriculum should be centred on Effective Accomplishment or relevant content

which would be project-based and real-world oriented and would be differentiated based on the needs of the student. These areas curriculum approach are delineated below:

EFFECTIVE THINKING

Prensky (2013) proposes that in the early grades, this subject begins with simple mathematical and logical thinking and a focus on obvious flaws. At this stage, illustrative stories and well-designed games are also used as a basis for learning strategic and logical thinking. He suggested that technology be introduced throughout as a "thinking extender" using tools such simulation that show students the consequences of their actions in a variety of contexts and circumstances. From as early as elementary school, he suggests that kids uses pread sheets and other analytics as parts of projects, many of which are web-based.

Also, Prensky (2013) believes that from the earliest grades students should learn how to involve world databases, knowledge, sources, and teams in their thinking processes by creating and analyzing their own surveys of worldwide student opinion on current topics. As the years progress, students would learn about mindfulness and historical elements of human thinking such as tool creation, logic, deduction, induction, calculus. In addition, Prensky believes that students should learn about dangerous flaws inhuman thinking, critical analysis, scientific thinking, mathematical thinking, systematic skills for problem solving, and ways to obtain self-knowledge of one's strengths and passions. Teachers would teach the seskills, with both reading and technology as deep foundations.

The relevance of this subject in the 21st century cannot be over emphasized. The skills outlined in this subject would set up students to be flexible, allowing them to 'understand and to handle a variety of content. Pogrow (2005) found that in studies contrasting the efficacy of teaching higher-order thinking skills with teaching enhanced content instruction, the benefits of effective thinking far outweigh those of enhanced content instruction. This is highly student-centred and involves entails activities that cater to all intelligences.

In addition, student motivation increases when teachers hold them accountable for higher-order thinking. This is so as teaching students higher-order thinking tasks forces them to engage in thinking about particular things, and undertaking assessment that requires intellectual work and critical thinking. While memorizing is useful in some cases, it does not increase students' autonomy and, to a large extent, does not contribute to mastery. Also, it should be noted that 'knowing things' for immediate recall is a relatively unimportant skill in the 21st century. In most things we do today, it is not the facts that are important but how we apply knowledge. Thus, Prensky (3013) suggest that instead of today's focus on pre-established subject matter, with thinking skills presented randomly, haphazardly, and inconsistently, the student and teacher should always focus would on thinking in its various forms and on being an effective thinker, using examples from math, science, social studies, and language arts.

EFFECTIVE ACTION

Prensky (2013) believe that this subject should begin by fostering Covey's (1989) seven habits of highly effective people and should include increasingly complex challenges in persistence, entrepreneurship, and project management and focus on creative ways to break down barriers and get things done. Students at all grade levels would learn how to start and manage real-life projects, start companies, both for-profit (designing websites or devising social media strategies for local businesses) and not-for-profit (meeting asocial need), and they would learn the difference between the two. The emphasis would be on continual improvement and on how to do

each task more effectively next time (Prensky, 2013). To achieve all these skills, students should use as "mind extenders" all the latest technological tools: simulations, CAD/CAM, and other software, as well as the best writing on project management (Prensky, 2013). This curriculum is relevant in the 21st century as it should focus on getting students to be proactive, to initiate positive actions and programs to improve their communities, their country, and the world by exploring and undertake such actions as mobilizing citizens for lobbying; building local Internet infrastructure; designing new schools and school additions; and, in places that need it, improving public health and the water supply. (Prensky, 2013). Effective action is relevant in the 21st century because it gives students real world situation to solve and make best incomes out of problem through hands on activities. This subject seeks to help the society and to cater for the less fortunate (Prensky, 2014). Also, this helps to make students better citizens, critical thinkers, and responsible agents of society and great leaders (Prensky, 2013).

EFFECTIVE RELATIONSHIPS

This subject would be geared at fostering students' high-level communication skills and focus on relationships in both the real and virtual worlds and teach students to negotiate modern world in which both real and virtual are equally important. (Prensky, 2013). This subject would also include ethics, citizenship, and politics. This experience should help students to learn how to maximize the irown communication strengths and mitigate their weaknesses. They would also learn how to best fit their own personality with all the communication possibilities offered in today's and tomorrow's world and how to succeed in both the face-to-face world of visual prejudgments and the online world of easy deception (Prensky, 2014) In this quest, students would read and analyze great works of lite rapture that focus on human relations and relationships, study languages and translation, and explore material from the social studies with a focus on helping students relate better in awide variety of situations (Prensky, 2013).

Effective relationship is relevant in the 21st century because when students can communicate or relate effectively to each other and to different situations, it will help them to solve problems and also will help them to get work done (Prensky, 2013). These activities will benefit both the teachers and students to communicate information and ideas effectively. Quite often, it is through effective relationship of communication that work are adequately done and on time by students (Prensky, 2013).

SUMMARY

Although technology has been evident in education for decades, it is evident that we are in the very earliest stages of exploring how it might be used effectively to enhance the teaching of our students while they are independently utilizing the capabilities of technologies without our assistance. Thus, technology is fast becoming a part of our students thinking, writing, reading and living. Many students cannot function today if they lose their phones, computers and many other technological gadgets that they have become so dependent on. Therefore, the evolving and powerful C-TELT suggests an approach to instructional design that demands that we flip the classroom and redesign our curriculum to meet the needs of our students and the global market. The aim of this model therefore, is to symbiotically synchronize human strengths with the most powerful technological strengths through its focus, syntax, and principle of retention, social system, support system, application and nurturing effects.

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