# Perspectives on learning and technology: A review of theoretical perspectives Mohd Nihra Haruzuan Mohamad Said<sup>a</sup>, Noraffandy Yahya<sup>b</sup>, Mohamad Bilal Ali<sup>c</sup>, Mohd Salleh Abu<sup>d</sup>,

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#### Abstract

This paper provides a review of literature pertaining to theoretical references on educational practice and technology from perspectives of learning theories of the 20<sup>th</sup> and 21<sup>st</sup> centuries. In addition, socio-cultural historical views for guiding educational research and technology are also presented. It is suggested that the incorporation of educational practice and technology as a particular case of socio-cultural views in designing and supporting the implementation of learning technology may help students' learning.

# 1. Introduction

The aim of a learning theory (or theories) is to help understand how people learn, thereby assisting researchers or educators reflect on their educational practices, reshape, refine and improve upon their work, and their contribution to the educational field (Harasim, 2012; West-Burnham & Coates, 2005). Many learning theories emerged in the 20th century; they can be categorised as three major prominent learning theories known as behaviourist, cognitivist and constructivist. These three major learning theories are shaping the study of learning, providing educators with insights for teaching and learning with associated pedagogies and technologies (Harasim, 2012; Jonassen, Peck, & Wilson, 1998). Harasim (2012) argues that educational researchers should not consider these learning theories

(behaviourist, cognitivist and constructivist) as "distinct silos - independent or autonomous of one another" but that they may reflect different theoretical perspectives, some of the old and some of the new (p.10). She further argues that learning theory should not be viewed as something detached from how humans work or their practices (e.g. teaching) (p.4). However, not all practitioners or educators have addressed learning theories as integral to practice or vice versa (Harasim, 2012; Wenger, 2009) as they are seen to be unproblematic. This particular view of educational practice is consistent with the traditional notion of learning as the acquisition of knowledge, skills and values based on memorization and replication of information, which literature indicates as narrow, instrumentalist and reductionist of learning processes (West-Burnham & Coates, 2005). Indeed, humans are an evolved species and are capable of learning on their own (implicit) and in response to teaching (explicit). Understanding learning theories gives knowledge of how they were shaped, and how they were shaped by, technologies and educational practices and informed teaching and learning.

This paper aims to provide a review of literature pertaining to theoretical references on educational practice and technology for designing and supporting the implementation of learning technology that may help students' learning. Therefore, in order to achieve this aim, the objective of this paper is to:

- discuss learning theories (behaviourist, cognitivist and constructivist), including the pedagogies and technologies associated with each; and
- provide socio-cultural theoretical references in designing and supporting the implementation of educational research and technology

#### 2. Behaviourist learning theory

In the early 20th century, behaviourism was introduced as a learning theory that was empirical, observable and measureable. Much of the approach of the theory focuses on how people behave or change particular behaviours on the basis of a stimulus-response principle through the manipulation of external stimuli of the environment. Behaviourists argue that certain behaviours can be enhanced by repeated stimuli (Schunk, 2012). In other words, learning with this view of theory in mind is conditioning students to respond to environmental stimuli in order to enhance the observable behaviours. In behaviourist learning, the mind is viewed as a black box that is not accessible and relevant to educational practice. Behaviourist theory emphasizes two types of conditioning: classical and operant. In classical conditioning, behaviour becomes a reflex response to a stimulus as indicated in Pavlov's dog experiments, and operant conditioning as the reinforcement of behaviour by reward or punishment as indicated in Skinner's rat experiments (Harasim, 2012; Pritchard, 2008, 2009; Schunk, 2012). The prominent key figures of behaviourist learning theory were Pavlov (1849-1936), Watson (1878-1958), Thorndike (1874-1949) and Skinner (1904-1990) (Harasim, 2012; Schunk, 2012). Behaviourist learning pedagogy consists of reward and punishment, behavioural instructional design and taxonomies of learning (Harasim, 2012). The most commonly used technique of behaviourist pedagogy is reward (positive reinforcement) and punishment (negative reinforcement).

The main purpose of the behaviourist learning pedagogy is to accomplish the correct behaviour which focuses on achievable learning objectives; the link between a stimulus and the response must be consistent, automatic and replicable (Harasim, 2012; Pritchard, 2009). The behaviourist learning pedagogy has been relevant in the context where learning objectives are clearly stated and achievable according to a set of agreed evaluation criteria based on task or examination oriented learning. Some others examples of educational practice based on behaviourist learning techniques are known as memorization, repetition, rote-learning, reinforcement of correct answer, examinations, organization of the curriculum content into specific behavioural objectives, and behavioural instructions (Pritchard, 2009; Schunk, 2012).

Learning technologies that are designed and developed based on behaviourist learning theory are known as computer-assisted instructions (CAI), teaching machines and programmed instruction (Harasim, 2012). These learning technologies are intended to support practice and reinforcement of specific tasks. In the context of online learning based on the behaviourist theory the focus is on delivering learning content with clear intended behavioural objectives, and drill and practice and 'electronic page turning' (Harasim, 2012). These approaches were reflected as limitations in behaviourist learning theory as it was unable to explain social behaviours that cannot be measured based 'only on seeing'. However, educational researchers began to realize the limitations of this theoretical approach and behaviourism's rigid focus on behaviour and its extreme rejection of the human mind (Harasim, 2012, p.45). Furthermore, there have been many critiques towards the online programmes based on behaviourism such as "long sequences of 'page-turner' content, and, point and click quizzes" (Singh, 2004, p. 51). Limitations in the behaviourist learning theory in teaching and learning eventually led to the next wave of views of learning which recognised the power of the human mind to influence that are not directly related to an external stimulus.

#### **3.** Cognitivist learning theory

Cognitivism emerged as a response to behaviourism. Cognitivist views of learning recognize the importance of the human mind in making sense of the material with which it is presented (Harasim, 2012; Schunk, 2012). Cognitivists sought to understand what was inside the black box of the human mind and tried to emulate it computationally. In other words, cognitivists were seeking to understand the processes of the mind that behaviourists viewed as the black box, revealing the box by modelling the mental structures of the human mind as a central computer processor in order to understand behaviour (Harasim, 2012). The rise of cognitivists' learning theory was related to the development of technology, particularly the

invention of the computer. In educational practice, the terms 'mind as a computer' and 'human information processing' refers to cognitivist theory. Its key proponents were Ausubel, Piaget and Gagne (Pritchard, 2009).

Cognitivism viewed learning as similar to computer information processing, where information from the real world is processed as input, and transformed into a form of representation that can be manipulated, stored, and retrieved as output. Cognitivist learning pedagogy comprises cognitivist instructional design (e.g. Gagne's nine events of instruction), schema techniques, and cognitive information processing (Harasim, 2012). In a cognitivist approach, teaching and learning was designed to be prescriptive, based on certain learning outcomes and strategies to ensure mastery of the skill. Computers were the main technological component of cognitivists and there were attempts to replicate the human mind through the computer whereby cognitivists developed educational technologies such as intelligent tutoring systems (ITS) and artificial intelligent (AI) (Harasim, 2012, p.53). In addition, online learning based on a cognitivist approach is focused on a learner's working memory and sensory system. This is done through utilising different multimedia modality (e.g. audio, visuals, animations, or video), the proper location of information on screen, screen attributes (e.g. colour, size of text, or graphics), the pacing of the information, and information chunks to avoid information overload. In order to avoid overload, learning content or information is presented on screen as items sized between five or nine chunks, together with the use of concept maps, intrinsic and extrinsic motivational strategies, learning reflection and metacognitive, so as to enhance learning based on the cognitivist approaches (Ally, 2008; Harasim, 2012).

Eventually, cognitivist views of learning were being criticised for failing to address the role of the learner in respect of active knowledge construction. Fundamentally, the cognitivist approach to learning still depicted learning as the transmission of knowledge from teacher (or

computer software) to learner; this approach was also called instructor or teacher-centred. Cognitivism advocates that the primary role of the learner is to assimilate what the teacher or computer software presents on screen. This concept of the didactic model of teaching and learning held until the late 1970s when social reform movements began to penetrate education in the United States. Also at this time, new perspectives on learning began to surface focusing on active learning and student-centred learning models. These are discussed next.

# 4. Constructivist learning theory

In educational research, constructivism surfaced around the 1970s during a period of educational reform in the United States and Europe that recognized the role of the individual learner in making sense of the world (Harasim, 2012). It was based on the argument that humans could not be programmed as robots to always respond in the same way to a stimulus (Harasim, 2012). The constructivist learning theory advocates an active joint endeavour between teacher, students and their peers in constructing meaning. The philosophical view of constructivism is knowledge constructed through interactions with one another including the community and environment and the result of the interaction is not always absolute (Harasim, 2012, p.12). Harasim (2012) further argues that constructivist learning theory is not one unified entity. Rather, it is an umbrella term representing a range of perspectives on learning. Educational practices adopted the constructivist approach including situated and active learning, learning by doing, problem-based learning, inquiry-based learning, cooperative learning, collaborative learning, personalised learning, the learning community, active participatory learning, activity and dialogical processes, anchored instruction, cognitive apprenticeship, discovery learning, and scaffolded learning (Ally, 2008; Harasim, 2012; Pritchard, 2009; Schunk, 2012). Two key theorists associated with constructivist approaches were Jean Piaget (1896-1980), known as a key theorist for 'cognitive constructivism'

emphasizing individual learner knowledge construction in terms of biological developmental stages; and Lev Semyonovich Vygotsky (1896-1934), who advocated a 'social constructivism' emphasis on social knowledge construction.

# 4.1. Cognitive Constructivism

Cognitive constructivism posits human learning through the construction of progressively complex biological structures from infancy through adulthood, and the complexity of knowledge is moved from one stage to another stage of development: Sensorimotor, birth to 2 years, reflex based and known through the senses; Preoperational, 2-7 years, acting on objects, words and thoughts, self-oriented; Concrete Operational, 7-11 years, problem solving and more than one view point; Formal Operational, 12 years and above, abstract thinking and theoretical reasoning (Harasim, 2012; Pritchard, 2009; Schunk, 2012). Related to the developmental stages is how humans internalize knowledge through experience and make sense of it through adaptation, assimilation, accommodation and equilibration, or disequilibration. Piaget (1969) believes that through these processes humans learn, grow and outgrow ideas, and create new ones. Assimilation involves applying a pre-existing mental structure to human sensory data; equilibration or disequilibration occurs when new cognitive structures are constructed which can lead into disequilibration when it cannot be assimilate; while accommodation compels the constructed structure to be modified in order to reassimilate.

## 4.2. Social Constructivism

Social constructivism advocates the social process of human interaction rather than individual context in active knowledge construction. The focus of social constructivism is on the relationship between the student's cognitive process and his or her social activities. The essence of social constructivism is the social context of human development and learning in contrast to the individual development context as proposed in cognitive constructivism (Harasim, 2012, p.66). The human mind is regarded as situated in the social and cultural context, and does not exist in isolation. The essential concept of social constructivism as proposed by Vygotsky (1978) is Zone of Proximal Development (or ZPD). According to ZPD, learning takes place when learners solve problems beyond their actual developmental level but within their level of potential development under adult guidance or in collaboration with more capable peers. In other words, within ZPD a learner's learning is observed in terms of what a learner can do without help and what she or he can do with help. As result of this approach, the term of scaffolding is coined as a metaphor to reflect guided or supported learning, in which the peer or adult supports the learner in constructing meaning. In the classroom context, a scaffold is a set of activities designed by the teacher to assist the student's progress in accomplishing difficult tasks or to master a new skill.

The constructivist learning technologies are often associated with learning environments (e.g. Construction Kits, Microworlds, Scaffolded Intentional Learning Environment, Learning Network or Telecollaboration and Learning Management Systems such as BlackBoard, WebCT or Moodle) with characteristics including the following: providing multiple representations of reality to prevent oversimplification; represent the natural complexity of the real world; emphasize knowledge construction instead of knowledge reproduction; emphasize authentic tasks in a meaningful context rather than abstraction out of context; provide learning environments such as real-world settings or case-based learning instead of a predetermined sequence of instruction; foster reflection on learning experiences; enable context and content dependent knowledge construction; and support collaborative construction of knowledge through social negotiation and not through competition among learners for recognition (Harasim, 2012, p.73). In addition, online learning based on a constructivist approach including learning should be an active process; learners should construct their own knowledge; learners should make use of collaborative and cooperative

learning; learners should be given control of the learning process; there should be an opportunity for reflection; and learning should be meaningful and interactive in order to enhance learning based on the constructivist approaches (Ally, 2008).

#### 5. Socio-cultural theoretical references

As discussed previously, constructivist learning theory viewed learning as a process by which a student constructs knowledge thorough interacting with more knowledgeable others. However, constructivist learning theory also ignores some other important aspects potentially contributing to the success or failure of learning including the role of cultural artefacts, the nature of the learner, the nature of the environment, and their relations within a cultural context (Gunawardena, Wilson, & Nolla, 2003; Tu, 2007). This led to the emergence of a view of learning that recognizes the importance of social and culture influences. Sociocultural theory views learning and educational practice as a social activity focusing on the relationship between social interaction and individual cognitive change within a cultural context (Tu, 2007). It explains the educational practice and learning as a process of participating in cultural and social activity in which knowledge is constructed in a joint activity within a social and cultural context. Vygotsky (1978) argues that it is difficult to understand individual cognitive development without reference to the social and cultural context in which such development is promoted, and further asserts that higher mental processes can be understood only if we understand the cultural tools and signs that mediate them. Cultural artefacts or tools emerge and change as the culture develops and socio-cultural views of learning stress the importance of historical and cultural perspectives in understanding human mental functions (Gunawardena, Wilson, & Nolla, 2003; Ravenscroft, 2005; Vygotsky, 1978). According to Wertsch (1998), "the task of a socio-cultural approach is to explicate the relationships between human action, on the one hand, and the cultural, institutional, and historical contexts in which this action occurs, on the other" (p.24).

Furthermore, Cole (1998, p.291) proposes several principles of cultural psychology for guiding educational practice and learning, namely, mediated action (Cole, 1998; Cole & Engeström, 1993), distributed cognition (Salomon, 1993), situated activity (Lave & Wenger, 1991) and goal-directed (Engeström, 2001; Yamagata-Lynch, 2010) that are of value to be considered in research and technology.

## 5.1. Mediated action

Mediated action refers to an interaction between the individual and mediating artefacts or tools or signs, a semiotically produced cognitive tool that resulted from the interaction (Yamagata-Lynch, 2010). The mediating artefacts can include artefacts or tools (e.g. physical, technical, psychological or symbolic tools), social others and prior knowledge that contribute to the subject's mediated action experiences within the activity (Wertsch, 1998; Yamagata-Lynch, 2010). Wertsch (1998) argues that human action employs the cultural artefacts as meditational means to accomplish a task or objectives. The human action can be externalised and internalised or executed by groups or by individuals. In fact, groups and group activities are just as real as individuals because they are abstract, analytic units rather than concrete entities (Sawyer, 2006; Tu, 2007; Yamagata-Lynch, 2010). The importance of the humans and the cultural tools they use to achieve goals are irreducible in the context of the individual's mental functioning (Wertsch, 1998). These cultural tools act as an intermediate agency between the mental processing of the individual and the object of the mental processing. A mediated action view on learning also signified Vygotsky's ideas such as mediation by tools (e.g. symbols, texts, signs, language) and its role in bridging the learner's cultural development. Vygotsky (1978) argues that every function in the learner's cultural development occurs twice: initially on the social level (between people, interpsychological), and later, on the individual level (inside the individual, intra-psychological). According to Yamagata-Lynch (2010) individuals as learners are not passive participants

waiting for "the environment to instigate a meaning-making process for them but, through their interactions, individuals make meaning of the world while they modify and create activities that trigger transformations of artefacts, tools, and people in the environment" (p.16). The important characteristics of mediated action as prescribed by socio-cultural theorists (e.g. Cole & Engeström, 1993; Wertsch, 1995, 1998; Yamagata-Lynch, 2010) are of importance to educational research and technology: mediated action as an active process occurs when the individuals use it in the process; the introduction of cultural tools has an influential impact on the transformation of human action; the introduction of cultural tools in the process has limitations (constraints) as well as an enhancement affect on human action; and mediated action can also have unanticipated benefits (or spin-offs) by which the same cultural tools can facilitate actions other than specifically original actions.

#### 5.2. Distributed cognition

The notion of distributed cognition suggests that learning is distributed across the members of a social group (Salomon, 1993) and the person-plus, the individual student, and the environment (Perkins, 1993). Cognition is located outside the individual learner's brain and occurs in the interactions among many individual learners' brains, and cultural tools (or environment) (Halverson, 2002; Salomon, 1993). Salomon (1993) states that distribution or distributed is a term intended to mean sharing including sharing authority, language, experiences, tasks and a cultural heritage (p.111). Distributed cognition occurs within social interactions and communications of cultural activities. Cognition is distributed in a learning community (between and among students, peers, teachers and tools to achieve particular goals) and is not merely something that occurs inside a learner. According to Salomon (1993), the distribution of cognition across a learning community is seen as being stretched over, rather than solely focussed on the inside of the individual. Cognition is seen "residing in between and as jointly composed in a system that comprises an individual and peers, teachers, or culturally provided tools" (p.112). Salomon (1993) argues that knowledge has the potential to be off-loaded on to a device like a calculator or computer with cognitive functions placed on the machine. Cognition or knowledge is communicated into external representations in physical or virtual which embodied experience through the sensory systems and mental filters of individual learners interacting with learning artefacts, environmental elements, and other people (Halverson, 2002; Salomon, 1993; Pea, 1993). In the literature of computer supported collaborative learning (CSCL) and computer supported collaborative work (CSCW), distributed cognition has been considered in terms of how collaborative spaces are designed and used (Harasim, 2012). In this research, the distributed cognition on learning online is considered with less radical views. The participants become enculturated into the social and cultural activities embedded in the online learning environment in which they are provided with access to the learning resources, knowledge and understanding that are distributed across their discipline within the community based on the affordances of the online learning environment. Educational research and technology therefore would need to take into account what and how the students are learning as they participate in the distributory processes of learning and the construction of knowledge.

# 5.3. Situated activity

Viewing learning as situated within cultural activities is the central focus of the situated activity approach. Fundamentally, situated activity represents a range of perspectives on learning including situated learning (Lave & Wenger, 1991) and situated cognition (Brown, Collins, & Duguid, 1989). The situated approaches view learning as situated and embedded in a system of activity, communications, culture and context. The unit of analysis involves not only the individual learner or the tools, setting and environment but also the relationship between the two (Barab & Plucker, 2002). From this perspective, separating the learner, the material to be learned, and the context in which learning occurs is impossible and irrelevant

because learning and activity are irreducible into separate processes (Barab, Schatz, & Scheckler, 2004). Barab and Plucker (2002) argue that knowledge is more aptly phrased 'knowing about', and 'knowing' is a perceptual activity that always occurs within a context only after the event (or in anticipation thereof) can be known about and can be discussed as a thing. Barab and Duffy (2000) describe the central tenet of situated activity perspective including 'knowing about' as:

Knowing about refers to an activity—not a thing; knowing about is always contextualized—not abstract; knowing about is reciprocally constructed within the individual- environment interaction—not objectively defined or subjectively created; and knowing about is a functional stance on the interaction—not a "truth." (p. 28)

In situated learning, learners go through a kind of cognitive apprenticeship in a community of practice within an applied learning environment of various levels of expertise, the learners move from the periphery to the centre of the practice (Lave & Wenger, 1991). In other words, the newcomer learner moves from novice to an expert through developmental phases of learning and through interacting and engaging in authentic learning works (e.g. real-world problem solving, problem-based learning, project-based learning, and creative work) within the community of practice. Educational research and technology need to consider learning activity through the creation of authentic situated activity that affords learners with the opportunities to be engaged in authentic problems situated in the cultural context in collaboration with peers in developing knowledge and understanding.

#### 5.4. Goal-directed

A goal-directed perspective on learning emphasizes the embeddedness of goals within cultural activities in accomplishing desirable learning. The notion of learning as goal-directed is seen to be highlighted in Activity Theory which refers to goal-directed actions anchored with other related activities, the goal and the motives for participating in an activity and material product that participants try to gain in an activity (Yamagata-Lynch, 2010, p.17). Kaptelinin (2005) argues that an object or goal is the reason why individuals and groups of individuals choose to participate in activity, and it is also what holds together the elements in activity (cited in Yamagata-Lynch, 2010). In an object-orientedness and goal-directed action, the individuals and groups of individuals' participation are motivated by their goals and motives which may potentially lead to the creation of new artefacts that can make the activity robust (Yamagata-Lynch, 2010). Consequently, people as human beings are normally considered to respond when "an environment consists of entities that combine all kinds of objective features, including the culturally determined ones, which, in turn, determine the way people act on these entities" (Kaptelinin, 1996, p.103). Viewing learning as goal-directed in the educational practice requires the structuring of goal-directed learning activities when teaching in the classroom. Through these goals, the students are supported in their way to attain the goals through meaningful social activities (Häkkinen, Arvaja, & Mäkitalo, 2004). Educational research and technology need to consider different types of goals embedded within the designed situated activities to foster students' participation and collaborative interaction in understanding learning and constructing knowledge.

# 6. Conclusion

This paper has highlighted several useful ideas of learning technology and educational from the perspectives of learning theories for designing and supporting the implementation of learning technology may help students' learning. Several important theoretical perspectives on learning such as the behaviourist learning theory which highlighted the important of external stimulus in accomplishing desirable goals followed by the cognitivist learning theory with the recognition of the human mind as similar to information processing and the constructivist learning theory that addressed the role of the learner in respect of active knowledge construction. Whilst, several important principles of socio-cultural perspectives in

guiding the educational research and technology such as mediated action through learners' interactions and mediating artefacts or tools; distributed cognition through learners' participation in the distributory processes of learning; situated activity where learners have the opportunities to be engaged in authentic problems situated in the cultural context; and goal-directed where learners are supported to attain the goals of learning activities are presented and elaborated.

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