Theories into Practices: Bloom’s Taxonomy, Comprehensive Learning Theories (CLT) and E-Assessments

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Abstract. The development of novel and innovative technologies to an extent has enriched the means of how assessments are done. Researchers and academics alike explore and leverage on the employment of an assemblage of technologies to design their assessments which are critical in gauging the students’ learning outcomes. However, the manifestation of technology in the context of teaching and learning necessitates reconceptualization of existential and fundamental theories which scaffold learning process. Thus, this paper provides a critical and contextualised exploration of the eminent Bloom’s Taxonomy, Comprehensive Learning Theories (CLT) and e-assessments with its underpinning and groundwork concepts, ensuing its feasibility and application in the blended learning environment.

Keywords: E-assessment, Blended Learning, Bloom’s Taxonomy, Comprehensive Learning Theories (CLT), Teaching and Learning.

INTRODUCTION

In the era where new generations are born amidst technological advances, their perception, attitude and expectation towards learning are vastly different than the generations before them. Educational researchers have commenced to further investigate specific learning styles of the current or the millennial generation to understand how these behavioral changes impact the existing teaching practices. In this context, the technological attributes as well as how they are aligned with teaching and learning theories have to be probed further; thus, pedagogical approaches employed for the millennials would not be deemed as obsolete or futile. In the similar light, how has this tremendous shift amended and altered the present notions of teaching and learning landscape. The prevalent growth of technology has definitely become one of the game changers, converting the traditional classroom learning to learning via means of technological advances, customized to accommodate the needs of recent learning styles. To determine the achievement of the intended learning outcomes, assessments are designed to be included as part of the teaching and learning process. A study was done to probe on the efficacy of online peer-assessment using Facebook in which the findings of the study yielded affirmative retorts; “the students were also certain that the online peer assessment process allowed them to provide appropriate and relevant feedbacks, enhance their assessment practices, as well as communicate with their respective group members in order to gain subject knowledge and ultimately obtain solution to a problem” (Mahmud & Wong, 2018, p. 111). At this juncture, many of the current studies have acknowledged the practical applications of technology integration; however, scarce resources are available on important discourses of how imperative concepts and theories scaffold this new pedagogical approach.

Predominantly, assessment is one of the imperative factors in understanding students’ learning and technology-supported assessments are becoming more common wherein programmed instruction and computer-based quizzes, to an array of interaction and content creations to scaffold virtual or online submission, peer / self-assessment as well as authenticity grading (Buckley & Cowap, 2013; Kulkarni et al., 2013; Tamim, et al. 2011). Likewise, online assessment offers a systematic structure to facilitate and support ongoing monitoring, provisioning timely and adequate formative feedback via continuous collaboration between students and instructor. In this case, disposition towards self-regulated learning can be developed or enhanced by which critical for an online environment to be integrated successfully. As noted by Selwyn’s (2010), the ‘state of the
actual researches in incorporating technology as part of the classroom instructions is "concerning what is actually taking place when a digital technology meets an educational setting" (p. 70). At the same time and despite its tremendous benefits as well as widespread, the employment of technology to facilitate assessment process is rather inconsistent and circumstantial (Warburton, 2009). Considering this, it necessitates for the existing pedagogical approaches to be re-evaluated so that the designs can be aligned with meaningful assessments.

Deliberating on current theory and practices contributes to the needed learning transformation. The assumption and conclusion of scientific application demand for precursory validity by which a scientific theory to a phenomenon is established to support the inquiry which would eventually lead to a discovery and understanding of new theory. The manifestation of theories and concepts in this study are based on the organization of concepts, conventions, potentials, philosophies, and ideas invoked by Bloom’s Taxonomy (1956) and the Comprehensive Learning Theories (CLT) that are frequently and synonymously used in numerous instructional settings. These three broad learning theories are (a) Behaviourism, (b) Cognitivism and (c) Constructivism, and are derived from the distinctive schools of thought which not only reinforce face-to-face instruction but also the design of online learning resources (Ally, 2004). At this juncture, these primary theories are able to assist in understanding the theory of the application of online assessment in the context of blended learning phenomena.

Bloom’s Taxonomy: Domains of Learning

The architecture of learning is synonymous with one of the key theoretical frameworks, for instance, Bloom’s Taxonomy developed by Benjamin Bloom where it is prevalently employed in the discipline of Instructional System Design (ISD). The utilisation of Bloom’s Taxonomy to assess students’ learning in a traditional environment is ubiquitous; however, there is still so much room for e-learning environment to be explored. There are several possible explanations to illustrate the variances and factors in using these two methods; physical distance which is to limited synchronous responses as well as assessments’ design which could pose some challenges in the process of evaluation. In factoring a well-designed course, the initial step is to determine and identify the course objectives. Bloom’s (1956) taxonomy is largely used to devise learning outcomes or objectives in the respective three domains: cognitive mental skills (knowledge), psychomotor; manual or physical skills (skills), and affective; growth in feelings or emotional areas (attitude or self) wherein each domain constitutes different levels of learning. For example, the higher order learning skills require application, analysis, synthesis, and evaluation to be evidently utilised and integrated as part of the learning outcomes or objectives. It is noteworthy to highlight that the essential premise in the application of Bloom’s Taxonomy is that the degree of difficulty is incrementally apparent to distinctly drive learning process and each domain is ideally should be thoroughly grasped before progressing into the next level which is quantifiable from the measurement of the knowledge obtained. Figure 1 below illustrates the nitty gritty of the three major domains; affective, cognitive and psychomotor and the concise depiction of levels of complexity to progressively capture students’ learning process.

![Figure 1: Domains of Learning by Bloom Taxonomy (1956)](image)

To exemplify specifically, in the Cognitive Domain, intellectual skills are predominantly established and it comprises six different levels of difficulties. Level 1: Knowledge. This is the level which constitutes recollection of memory and demonstration of what previously learnt that are commonly expressed through obtained knowledge in answering fundamental and basic concept questions. For instance, knowledge of specifics: terminology, specific facts, knowledge of methods to deal with specifics: conventions, trends and sequences, classifications and categories, criteria, methodology and knowledge of the things that are universally accepted in a field: principles and generalisations, theories and structures. Level 2: Comprehension. This is the level that students are required to understand a particular concept or key terms in which assessments are designed to possess these criteria; compare, organise, deduce, translate, provide descriptions and state main ideas which simultaneously be able to demonstrate interpreting, translating and extrapolating skills. Level 3: Application. This is the level in which the
comprehended knowledge is applied in relevant contexts to address and acknowledge concerning issues by incorporating acquired facts, knowledge, rules and techniques. **Level 4: Analysis.** This is the level which close scrutiny of acquired knowledge is exercised to further separate the learnt concepts or facts. Inferences are formulated to distinguish essential elements, relationships/correlations and principles involving structural means. **Level 5: Synthesis.** This is the level which data is colligated via different means of approaches to form an assembly of solutions, including manufacture of distinct communication and a proposed plan of procedures as well as cogent understanding of the how a concept is derived in a form of abstract link. And **Level 6: Evaluation.** This is the level which viewpoints are supported through critical means of analysis and evaluations in which elements of novelty is apparent to fulfill criteria such as employing acquired evaluative knowledge to exemplify both internal evidence and external criteria.

With the earlier illustrations on the levels in the cognitive domain, it is rather clear that even with the intricacies of these progressive levels, the emulation of systemic design and support can be executed via the incorporation of technology. The employment of scientific principles as a basis to create meaningful learning experiences with the amalgamation of Bloom’s Taxonomy and technology is used by instructional designers worldwide to define the required cognition level as well as to map the content type to the ideation or multimedia enablement of an eLearning course.

**Comprehensive Learning Theories: Behaviourism, Constructivism and Cognitivism**

![Figure 2: Comprehensive Learning Theories](image)

Figure 2 graphically illustrates how the intersecting learning theories and blended learning scaffold the conceptual framework of this study. The main proponents of Behaviourism, Skinner and Watson noted that learning is the result of variations in the setting or environment, and they pursued to attest that behaviour can be anticipated and even controlled (Skinner, 1974). Meanwhile, fervent proponents of Constructivism, Piaget and Vygotsky regarded learning as a process to seek for meaning, besides designating specific criteria which could aid in anticipating what students actually comprehend at a variety of phases in the developmental and learning processes (Rummel, 2008). The main focus on learning, according to the Behaviourists is how the process impacts changes in behaviour. They argued that “only observable, measurable, outward behaviour is worthy of scientific inquiry” (Bush, 2006, p. 14); hence, all learners obtain a uniformed understanding when exposed to the veracious environmental stimuli. However, the contrary belief of the Constructivists is that they regard learning as a search for active meaning created throughout the learning process. At this juncture, a Behaviourist would continue to examine the content as well as the impacts of the environment upon that learning process whilst a Constructivist would be more concerned with understanding the learners’ attempts to construct meaning (Bush, 2006). As for the Cognitivists, they underscore the learner’s schema as a systematized knowledge assembly (Bruner, 1990; Gagne, Yekovich, & Yekovich, 1993) where the learners themselves interpret knowledge and provide meaning to it. Hence, it can be deduced that the cognitive learning theory recognizes the human mind as an active recipient of knowledge. Under these circumstances, the learner synthesizes the newly acquired knowledge with prior knowledge. Deliberating the myriad of views and notions advocated by psychologists and educators on learning, educators are assigned the huge responsibility of determining the instructional design which will augment students’ learning digitally.

The latest trends involving technology as a cognitive tool have progressed tremendously in the last decades. Cognitive tools in this context are the types of technology that assist learners to be more engaged in the process of knowledge construction, which is inherent not physically but in the form of cognitive nature utilized as a catalyst to create knowledge (Jonassen, Peck, & Wilson, 1999). This would enable learners to think and solve problems better (Jonassen & Reeves, 1996). Jonassen (2002) further established that the role of cognitive tools are to facilitate critical thinking and higher-order learning, designed to trigger the learners’ capability as part of a mechanism to enhance learning (Kim and Reeves, 2007). Based on their study, Jonassen, Peck and Wilson (1999) stated that learners do not acquire knowledge directly from technology. However, the role of technology embedded in part
of the instruction would be able to involve learners more actively in the thinking process, which in turn benefits the learning process. Undoubtedly, thinking can nurture learning processes, and computers as well as technology play a vital role in mediating cognitive processes (Jonassen & Reeves, 1996) by offering a technological platform for the learners to be more creative and critical cognitively, allowing them to experience a better learning environment. With technology as part of the learning process, learners and technology become allies. For example, technology can assist learners in going beyond the limitations of their cognitive ability, such as computation of numbers, information storage and retrieval. Consequently, with this assistance in place, learners are able to cope with the content better, and engage in a more reflective process which is one of the foundations of higher-order thinking. Jonassen (1994) stated that when students are able to apply any cognitive tool effectively in their learning, it requires them to be actively involved with the thinking process to produce the output or knowledge. At this juncture, outdated and obsolete learning approaches like rote learning and memorization can be averted because with such technological opportunities, learners are more focused on the construction of knowledge rather than merely reproducing it.

The philosophy and beliefs behind the ideology of Constructivism are that learners create their own knowledge based on interactions with their environment, including their interaction with other people (Draper, 2002). The notion lies in the interpretation process created through the existing interaction with the physical and social contexts (Fosnot, 1996). Constructivism has been verified to be efficacious when it involves circumstances that correlate with learners' performance. In this context, the teacher takes on a facilitator's role, allowing learners to take on a more active role and to be responsible for their own learning (White-Clark, DiCarlo, & Gilchriest, 2008). With the emergence of technology, teachers or instructors who employ constructivist theories can support discovery learning and critical-thinking activities via synchronous discussions done online. The concept of synchronous discussion can directly invoke collaborative learning among learners as well as the teachers or instructors. Classrooms that practice Constructivist concepts and theories integrate real-life and complex issues for the learners to solve together. Herein, learners are able to work collaboratively to discover the best solution. “Cooperative learning, hands-on activities, discovery learning, differentiated instruction, technology, distributed practice, critical thinking, and manipulatives are elements that embrace the constructivist educational philosophy.” (White-Clark et al., 2008, p. 41). Constructivism allows learners to take on an active role and to be more responsible for their learning process where it emphasizes dialogue, reflection, and communication, not only between the learners and teachers/instructors but also among the learners, which is undoubtedly enhanced with technology. A virtually-simulated environment has tremendous potential to offer social interaction and collaboration that develops the construction of knowledge. In this circumstance, the Constructivist’s view that the construction of knowledge is based on an individual’s experiences, thus the philosophy behind this notion embraces the integration of technology in education and definitely in the learning process. Simina and Hamel (2005) noted that a learning process that involves technology allows its users to not only interact with learning materials, but to also network with other people, which is a combination of social and individual characteristics. According to Vygotsky, the expression of social constructivism can be optimized when language and culture are emphasized. To reiterate this view, Woo and Reeves (2007) and Wise and Quealy (2006) strongly endorse that the pedagogy of web-based learning has to synthesize the notion of the social constructivism learning theory. When learners share texts, audio and video resources online, the social interaction that exists between them would be able to assist the improvement of individuals’ and groups’ construction of knowledge.

The Behaviourism theory asserts that the framing of instructional goals is executed in a specific manner, driven and motivated by behavioural and observable conditions; meaning is gauged independently from personal experience. Utilizing such an approach, teachers/instructors are more oriented toward the dissemination of individual presentation and interaction. At this juncture, learners are expected to be fully engaged with the instructional presentation resources and to consequently utilize them to demonstrate their understanding. Typically, both formative and summative assessments are linked to the intended learning objectives. According to Sutton (2003), the various aspects of Behaviourism have directed the growth of important instructional technologies such as educational software and modules, which are computer-assisted instruction. The Conditions of Learning created by Gagne echoes the Behaviourist thought process in which five categories of learning are acknowledged. These categories are classified into (a) verbal information, (b) intellectual skills, (c) cognitive strategies, (d) attitudes, and (e) motor skills. Gagne also established that the internal and external conditions are needed for each type of learning. Counting and depending solely on the Behaviourism theory in designing web-based learning settings can create limited learner-content
interactions (Hirumi & Bermudez, 1996 cited in Woo & Reeves, 2007). However, present Behaviourists believe that students learn by memorizing information before they progress to higher-level problem-based or situational learning, and therefore the means and notions by which the Behaviourist operates are still pertinent in today’s digital and electronic context (Shield, 2000).

CONCLUSION AND SUGGESTION FOR FUTURE RESEARCHES

The theories of the Bloom Taxonomy (1956), Behaviourist, Cognitivist, and Constructivist have demonstrated how blended learning can be incorporated into learning environments where the design of the online resources, the pedagogical approaches, as well as the principles, underpin each theory. For instance, the employment of the learning domains to design assessments is also one of the essential aspects wherein the lesson’s outcomes/objectives are mapped against specifically designed assessments to scaffold the achievement of course outcomes/objectives. This can be accomplished with the use of either or both formative and summative assessments. To define, formative assessment affords timely and vital feedback on the attainment of content knowledge and learning objective. Based on the feedback which is yielded in a form of result or performance, instructors can modify pedagogical approaches to improve students’ learning experience whereas summative assessment garners final grades to provide complete and comprehensive deduction on the attainment of learning objective. Figure 2 below displays the comparison between formative and summative assessments, exemplifying the means of assessing students.

![Figure 2: Comparison of Formative and Summative Assessments](image)

Table 1 below illustrates the variety however non-exhaustive online assessment methods which can be potentially employed for either formative or summative assessment.

<table>
<thead>
<tr>
<th>Bloom’s Taxonomy</th>
<th>Online Assessment Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Multiple Choice, True/ False, Matching, Fill in the Blanks, Short Answer, Games, Quizzes</td>
</tr>
<tr>
<td>Comprehension</td>
<td>Online Simulations, Tutorials</td>
</tr>
<tr>
<td>Application</td>
<td>Essay, Case study</td>
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<tr>
<td>Analysis/ Synthesis/ Evaluation</td>
<td>Project, Portfolio, Presentation,</td>
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</tbody>
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With the preceding description, this paper has reviewed and expounded on domains of learning as well as three key aspects of theories associated with learning and reinforced and reviewed in detail how e-assessment is scaffolded by this major formulation of theories and concepts. Sketching an analogy of the dynamic and synergy between theory-application relationships, it is equilibrium of the roots and branches of a tree. Both are equally important, possessing unique characteristics and purposes, supporting and abetting each other. Discovery of theories leads to comprehension and applications and applications of existing theories leads to perhaps more novel, ground-breaking theories. Espousing the attributes of each theory, the notion of blended learning is indispensably imperative in enhancing learning among the millennial learners of the 21st century.

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REFERENCES


