Student Centered E-Learning Leveraged Through the Revised Bloom's Taxonomy

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Abstract

Our Institutions of learning are formal structures created within societies for its progress. So it follows that the educands must be equipped with skills relevant to the present and the forecasted future. Students in the third decade of the 21stcentury ought to possess 12 global skills namely; Critical thinking, Creativity, Collaboration, Communication, Information literacy, Media literacy, Technology literacy, Flexibility, Leadership, Initiative, Productivity and Social skills to succeed in a Knowledge driven 4th Industrial Age. The best way forward in through education as an instrument accelerating student learning in student centered learning environments in cyber space. This paper deliberates on the Revised Bloom's Taxonomy and suggests a methodology to construct learning experiences which can be executed in virtual spaces by the teacher. The author also suggests that the learning experiences could be developed by the teacher, or by the teacher and students or by the student themselves. The ultimate goal is to help the learner develop higher order faculties.

Introduction

Digital technologies are rapidly changing the landscape and practice of education and recent years particularly show a rapid proliferation of online courses and higher education degree courses (Bawab, 2014; Kasar, 2014; Nico, 2014). Murphy &Manzanares(2008) study in an attempt to understand Teachers' Beliefs about Learner-Centred E-learning shows that, the Internet offers an opening of the world and unlimited learning wherein learners sense technology as a powerful vehicle whichengages and support authentic purposeful learning.

Designing effective learning experiences for a 21st century learner is crucial in student centered e-learning and leans heavily on a robust framework for designing teaching, learning and assessment. The Revised Bloom's Taxonomy is used as a framework to illustrate design of learning experiences in this paper. Experiences planned through such a framework can be executed through different learning platforms, Web 2.0 and Web 3.0tools.

Student Centered e- Learning – Developing the Learner's Learning Ability

E-learning is gaining popularity since a few years and particularly with the outbreak of COVID-19vis-à-vis the more established form of offline learning. Theonline learning environment is seen to be more than just dispensing information or teaching skills. It is seen as an educational approach that enables a learner to think for themselves, reflect, observe,

question, formulate tentative explanations, test them, make decisions, alter decisions etc. There are several research views expressed in relation to offline student centered learning but lesserempirical evidences in relation to the online form of student centered learning. Let us conceive the process of student centered, and student directed online learning from the following perspectives.

1. Interaction with content and the world outside

Student centered E-learning brings flexibility in terms of time, space and pace which is often ably supported by the educator/tutor in real time or through an asynchronous mode. Learning tasks presented to the learneror co-decided by the teacher and learners have a real world orientationas they allow learners to connect past experiences tothe presentin a safe learning environment leading to enhanced comprehension and knowledge retention. Thus, leaners not only connect knowledge but also construct knowledge and skill acquisition which can be applied across domains. Learners have control over what they learn and how they learn as they direct their own learning as responsible seekers of truth.

The learner besides Interacting with a variety of learning materials made available by the teacher also hasaccessto other virtual spaces which would otherwise go unexplored. Looking beyond and outside the prescribed work by the teacherbrings into focus multimedia materials parked on different learning portals by way of OER's, videos indexed in YouTube or Vimeo, animations, virtual field trips,films, webinars, discussion, diverse views/ideas, and even conflicting data. So the learner has access to rich and wide information which they can process, connect to and reflect on. Such a deliberate interaction helps learners to acquire self-directed learning skills such as; ascertaining the credibility of a variety of resources, being open to new perspectives, planning and managing the desire to learn etc.

2. Interaction with Peers and higher order skill development

A variety of learning experiences (tasks) allows learners to reflect, develop, test and analyse their ideas, create something novel, brainstorm, discuss, organise, disagree, compromise, deliberate,be at crossroads and even melt into consensusvia consultation with each other. Activities can be on a continuum from very simple to complex. When students interact with each other in cyber spacefor peer reviews, group presentations, or even small virtual cooperativegroup discussions etc. they feel like they are a part of a virtual learning community and such interactionshelp students engage in higher-order thinking. Tasks like Problem Based Learning (PBL) necessitates that students explore real-world problemstogether andhaveconsistently shown increase in academic performance in science related programmes which enhances science content knowledge, as well as improve critical thinking, student dispositions, student behaviour and attitudes towards learning (Burris and Garton 2007; Gordon et al. 2001). Similarly, project based learning (PjBL) also leads to gain in student motivation, critical thinking, and academic skills.

3. Supportsto various learning stylesand intelligences.

Technology breaks down barriers that separate learners in the domain of learning. It ensuresthat students across denominations feel that they can learn no matter what their background is. A world of variety opens to address their learning styles. Intelligence is not a measure of the traditional IQ, but in terms of a spatial expression, a linguistic piece of work, an artistic creation, a mathematical puzzle that is created or a tough problem solved.E-learning taps into their creativity enabling learn to explore, wriggle out of their closets and become more expressive and engaged.

Learning should not be limited to mere acquisition of basic knowledge and concepts or for that matterpreparation for exams, but its practical application must be emphasised. Students need to develop the ability to extrapolate simple knowledge gained to a wide range of daily life situations. For this to occur, learning experiences ought to be linked to outside of school situations and authentic environments (Scardamalia&Bereiter, 1994). Hence, the need to design learning frameworks that will hone higher order skills through a sound pedagogymediated through suitable technological platforms.

The Revised Bloom's Taxonomy

Cognitive processes also known as mental processes are the channels through which knowledge is acquired and understood by exercising thought, experience, and the various senses. Cognitive processes can be simple or complex. The Taxonomy for Learning, Teaching, and Assessing (Anderson &Krathwohl, 2001) was proposed to monitor, assess, and understand complex cognitive processes.The taxonomy according to its creators is more dynamic in structure and flexible in function vis-à-vis the original.

The Revised Blooms Taxonomy is a 2 dimensional framework thatinterrelates the Cognitive Processes Dimension along the horizontal axis i.e. X-axis and the Knowledge Dimension along the vertical axis i.e. Y-axis.

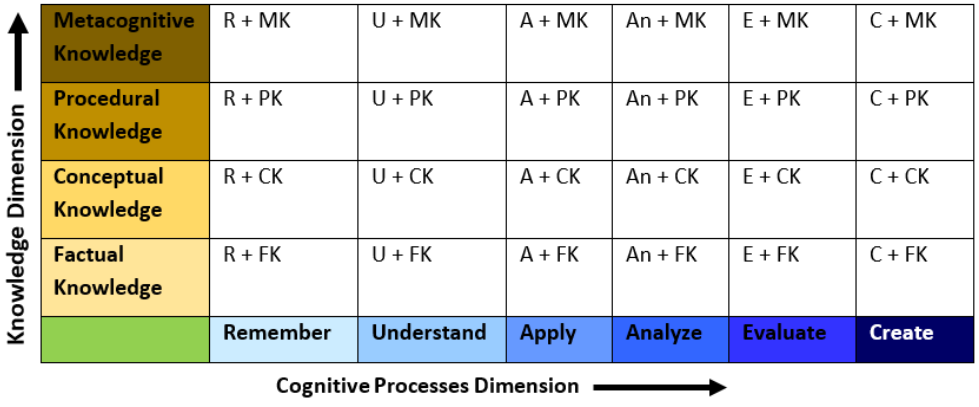


Figure 1. Revised Bloom's Taxonomy

Figure 1. Presented below shows the interrelationship between the two dimensions diagrammatically.

The cognitive processes dimension indicates a continuum of **six**cognitive processes or categoriesin the increasing order of complexity as shown in Figure 1 from Remember (which is the lowest level of thinking) to Create (which is the highest level of thinking).Remember, understand and apply are the lower order thinking skills LOTS which focus on acquisition of basic facts, knowing theories and processes, understanding procedures, applying the skills or content learnt in a new context.While analyze, evaluate and create are higher order thinking skills and are labelled as **HOTS.**Higherorder thinking skills are necessary 21st century skills and particularly important for a learner in the third decade of this century. HOTS indicate the ability of a learner to analyze, critic, evaluate, synthesise, be innovative, create something new, spot errors, and be insightfuletc.These skills which learners are expected to hone can be placed under three broad skill areas namely; critical thinking, creative thinking and problem solving.

According to Anderson et.al, 2001, there are 19 specific cognitive processes that are listed under **six**different cognitive processes as illustrated below.
Remember: *recognizing*, *recalling* relevant knowledge from memory
Understand: *interpreting*, *exemplifying*, *classifying*, *summarizing*, *inferring*, *comparing*, and *explaining*
Apply: *executing* or *implementing* a procedure
Analyse: *differentiating*, *organizing*, and *attributing*refers to chunking materialsand studying how they are connected.
Evaluate: *checking* and *critiquing* based on criteria and standards that are drawn-up.
Create: *generating*, *planning*, and *producing*refers to putting elements together, or designing something new or different.

On the other hand, the Knowledge Dimension comprises **four** levels as shown in Figure 1 arranged in the vertical hierarchy beginning with Factual Knowledge (concrete knowledge) to Metacognitive Knowledge (abstract knowledge). According to the creators of the revised taxonomy, "metacognitive knowledge is one's own personal knowledge"The taxonomy distinguishes between the knowledge levels as illustrated below.
Factual Knowledge: Focusses on knowledge of terminology,specific details and specific elements
Conceptual Knowledge: Focusses onclassifying orcategorizing,graspingprinciples and theories, drawing generalizationsetc.
Procedural Knowledge: Focusses on skills specific to a variety of subjects, techniques and method besides knowing what procedure to use when and where.
Metacognitive Knowledge: focus is on what an individual knows about himself/herself and in relation to what they have learnt.Metacognition
The intersection of the cognitive processes dimension and the knowledge dimension creates a matrix of 24 cells. To illustrate; the intersection of Remember (R) and Factual Knowledge

(FK) gives the cell R + FK. So ***Remember*** is the cognitive process that the student engages in at the level of ***Factual Knowledge***.

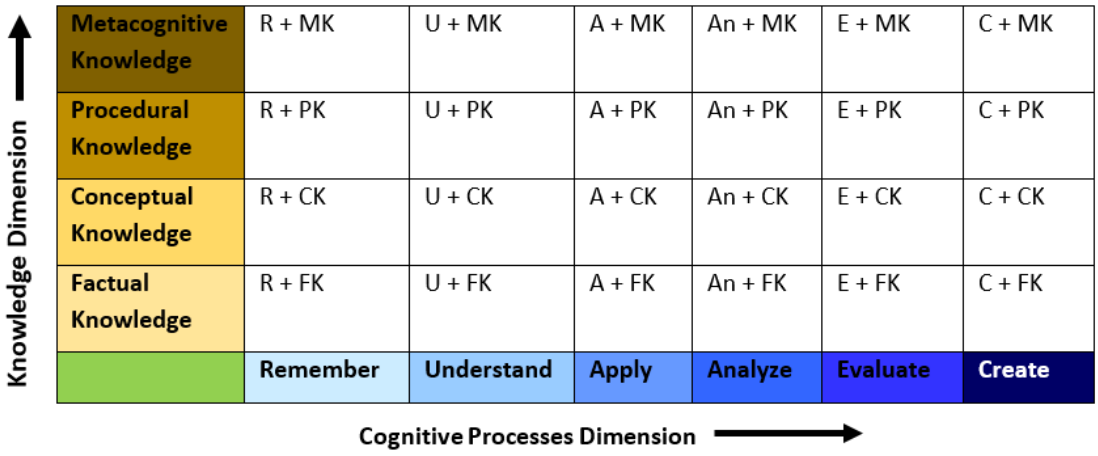
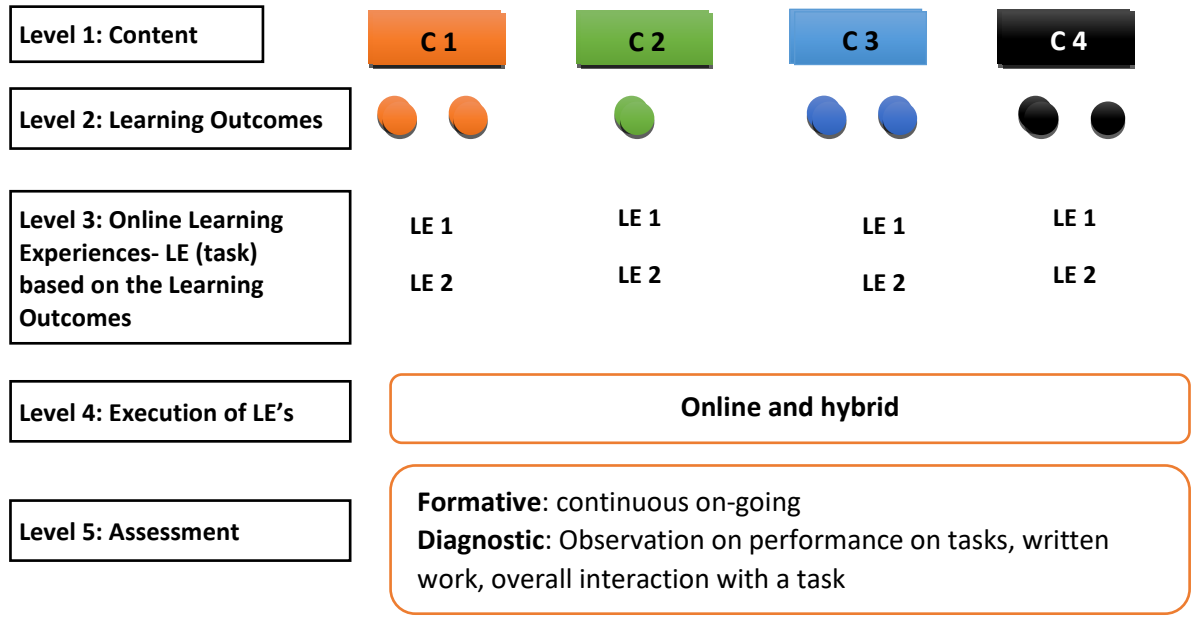


Figure 2. Revised Bloom's Taxonomy Dimensions Matrix

Workflow in a StudentCentered eLearning Environment



To engineer systematic and effective acquisition of student learning, there is a need to specify learning outcomes that specify what students are expected to demonstrate at the end of learning. Structuredlearning outcomes not only help in planning learning experiences but also guideformulationof suitable measures for testing acquisition of learning.

To understand the workflow let us consider an example.

1. **Content**: 'Environmental Damages not related to Emissions'
2. **Learning Outcomes**: if you don't write them scientifically, then all efforts including the teachers and students are lost.While framing learning outcomes, sufficient attention to be given toFigure 2 in terms of determining;

- The cognitive level at which the student are expected to operate, and;
- The corresponding level of knowledge that the learner engagesin duringthe process of learning.

Ensure that the learning outcome reflects two parts; the verb and the object. The verb describes the cognitive process whereas the *object* deals with the content/knowledge part. Let us construct learning outcomes for the content area stated overleaf.

- Identify*non-emission based damages to the environment*[Understand (U) + Conceptual Knowledge (CK)]. Learning here is pitched as the level of Understand (cognitive process) and Conceptual knowledge at the level of Knowledge.
- Examine the *extent to which such activities have damaged the environment*[Analysis(An) + Procedural Knowledge (PK)].
- Formulate strategies to reduce *non-emission based activities*[Conceptual(C) + Conceptual Knowledge (CK)]

3. Learning Experiences (HOTS) in a Student Centered e-learning environment

Traditional education favoured *LOTS* addressed through regular tests, exams, assignments, projects or any other appropriate forms. But, progressive and reform oriented education looks beyond the acquisition of mere information and encompass*higher order skills*acquisition such as; problem solving, critical thinking, creative thinking, communication, information processing, leadership, social skillsetc. so that a student can compete with their inherent learning potential. An important consideration in the learning process is to engage students not only in simple cognitive processes but also in more complex cognitive processes (Hwang &Shadiev, 2014).

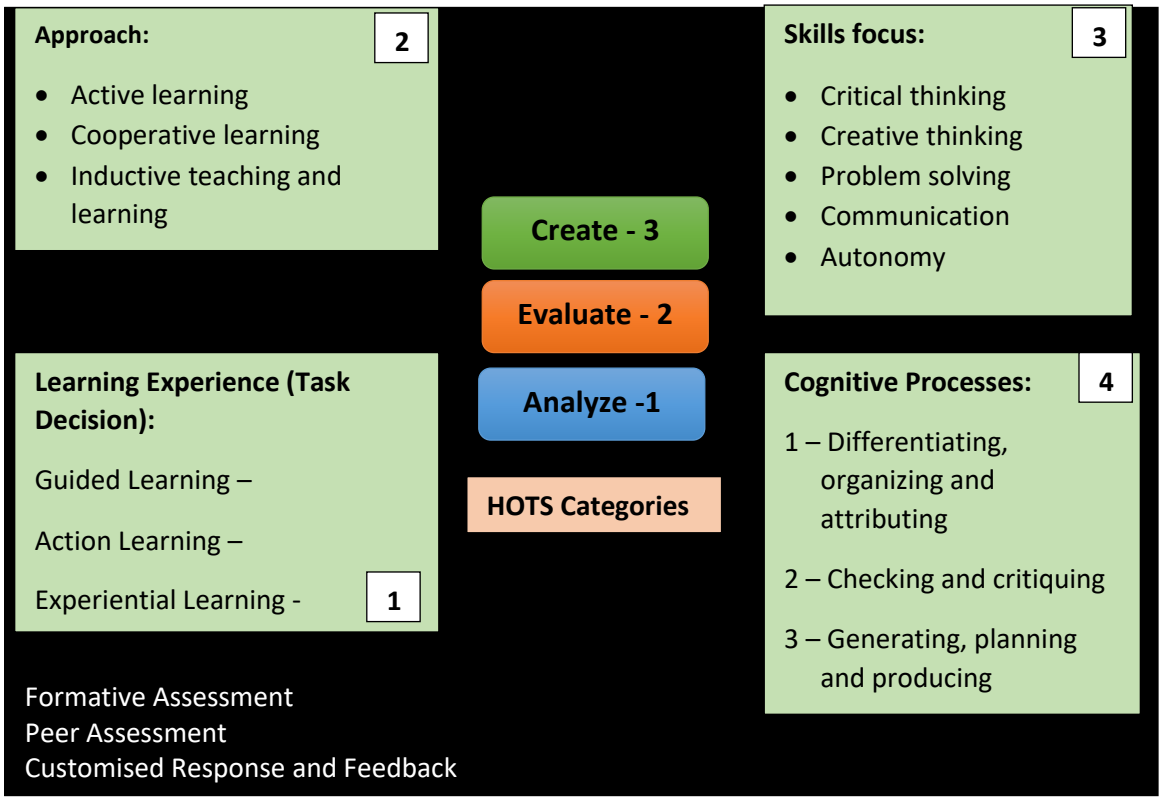
Learning experiences can be designed on a continuum from easy to difficult and across types of outcomes. Knowing that classrooms are heterogeneous entities learning experiences (task)are to be appropriately constructed. The aim of every learning experience is to shift **action** from the **teacher** to the **student**.

Some of the prominent student centered learning approaches that facilitate higher order cognition are;

- **Active learning**: in which students encounter and deal with problems, react to stimuli such as questions, devisestimuli of their own by way of questions, doubts, suggestions, discuss in small cooperative groups,elucidate, expound, brainstorm, formulate tentative solutions, communicate with peers.

- **Cooperative learning**: in which students work in teacher constructed cooperative teams (mix of below average, average and high performing learners) on various stimuli such as;inquiry questions, writing a dialogue, problems or projects usingPIES

- **Inductive approach to teaching and learning**: in which students are first presented with challenges. Inductive methods include higher order learning approaches such as; inquiry learning, instruction that is case-based, learning through problem solving, learning through creative and constructivist projects etc.



There are two mechanisms that can be followed. The Forward 1-2-3-4and Backward4-3-2-1.

In the 1-2-3-4 mechanism, the teacher, teacher and students or students would determine the learning experience, decide on the approach, and identify the skills that would be needed or utilized resulting in the acquisition of the HOTS cognitive processes.

Whereas the 4-3-2-1 mechanism would begin with the HOTS cognitive processes that should be developed leading to identifying the specific skills that would help in its attainment though a particular approach which is decided by the teacher, teacher and students or students.

The selected mechanism can be executed through a variety of platforms presented earlier in the paper.

4. Execution of the Learning Experience (task)

Student centered e-learning can be executed through a plethora of platforms namely;

- Student centered e learning platforms,

- Learner Centric MOOCS Model (LCM),
- Flipped online class using videoconference portals,
- Institutional LMS etc.
- Gaming platforms like Kahoot!, Quizlet, Brainshark etc
- Nearpod (student engagement platform)

An article by Silvia (2012) says that curiosity as a crucial source of intrinsic motivation leads to learning and exploring thereby reducing negative feelings and states such as; uncertainty, drive, or information gaps. Learners do need facilitator support when working on high-stakes tasks since a sizeable number of learners in any given class may not assume full responsibility for their learning leading to collapse of motivation resulting in poor performance. Therefore, the teacher must be aware of classroom diversity and the complexity of the task.

Let us apply the Yerkes-Dodson Law as seen in Figure 3 to understand the relationship between arousal and performance when the task is either easy (simple task) or difficult (difficult task). This law expounds how anxiety affects performance.

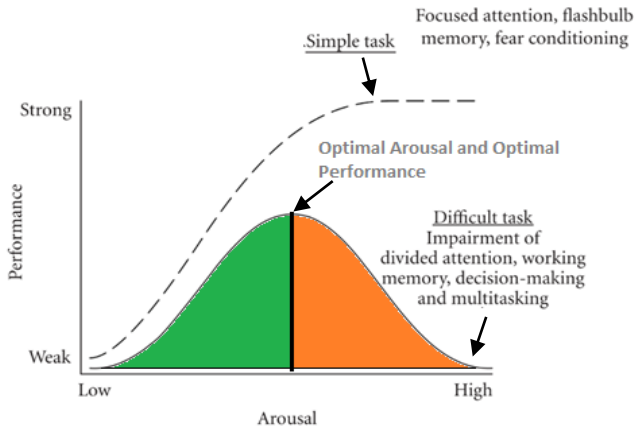


Figure 3. Yerkes-Dodson Law

The Yerkes-Dodson lawdescribes the relationship between arousal and performance which is expressed through a bell shaped curve as shown in Figure 3.For a difficult or complex task, performance increases with physiological or mental arousal (stress) but only up to a point (end of the green region). When the level of stress becomes too high (orange region), performance decreases.The black vertical line separating the green and orange region indicates optimal arousal and optimal performance.

Whereas, when the task is simple, the point of optimal arousal is pushed ahead and performance increases steadily. So we see that there is focussed attention along with steady progress. The shape of the curve varies based on the complexity and familiarity of the task. Different tasks require different levels of arousal for optimal performance. The tasks designed for learners should encourage optimal arousal which will facilitate optimal

performance.Customization of learning experiences (tasks) could be on-going depending on emerging student needs.

5. Assessment

A good assessment method be it a test, exam, projector assignment should test the knowledge and skills that you want students to learn/acquire. A variety of assessment formats can be used depending on the nature of the specified learning outcomes. Some examples are; developmental portfolios, infographics, concept maps, outlines, critiques, case analysis, dialogues, letters to persons in high office, synopsis of regulations, laws and rules, narratives, documentationof ethnographic realities, writing papers, debates, discussion for a, collaboration with international students etc.Teacher as well as peer feedback would raise the bar of learning. A good practice is to design rubrics to grade and interpret students' work against defined criteria and standards.

Conclusion

Student centered learning empowers the learner in the journey of learning. It secures a strong foothold when teachers re-align their practice and become open from directing to facilitating from saying "do what and how I tell you' to 'let's do it the way you can do, based on your needs and ability'.

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