AN EVALUATION STRATEGY FOR THE MOODLE LEARNING ENVIRONMENT BASED ON BLOOMS TAXONOMY

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Abstract: Learning environments are based on core foundations, describing how knowledge is acquired and used, the underlying pedagogical philosophy, the supported learning process, the role of technique and culture, and related pragmatics. Bloom's Digital Taxonomy (BDT) describes the various thinking skills, ranging from low to high order thinking skills. We relate the learning environment Moodle to BDT by relating the core foundations with the thinking skills. We evaluate Moodle from different points of views: - methods, effectiveness and comparison with the existing learning environments.

1 INTRODUCTION

A Learning Environment (LE) is the setting where learning occurs, and maybe virtual or physical. Modular Object-Oriented Dynamic Learning Environment (Moodle) is an open source e-learning platform, using sound pedagogical principles, to help educators create effective online learning communities with a focus on interaction and collaboration content construction (Dougiamas, 2004). The creator believes that a LE should be created by an educator (Dougiamas and Taylor, 2002). Moodle presents a platform for resources and communication tools with basic features of a filtering system, tools for creating resources and activities, which provide various options for the tutor. It contains tools and techniques distilled from the educators' experiences to make the processes easy, flexible and provide a variety of activity modules like forums, chat rooms, assignments, quizzes, surveys, workshops, lessons, glossary, database, choice, SCORM, and the wiki.

In this paper we evaluate Moodle based on BDT. This paper is organized as follows. In section 1 we discuss the presentation of the information. Section 2 focuses on Blooms Taxonomy. In section 3 we discuss the effect of ICTs on Higher Order Cognitive Skills (HOCS) attainment. In section 4 we discuss the effectiveness of Moodle in relation to BDT. Finally, section 5 derives some conclusions and future research.

2 BLOOM'S TAXONOMY

Bloom, (1956) developed the taxonomy of Educational Objectives, a key tool in structuring and understanding the learning process. The taxonomy is a classification for different objectives and skills that are necessary for learners in various curricula (Bloom, 1956; Forehand, 2005). Bloom's Taxonomy identifies a hierarchical progression to categorize lower to higher order levels of cognitive processing. The main objective of the learning process is to create a holistic learner. The elements of the original domain cover many classroom activities and objectives; however they do not make use of the new objectives presented by the emergence and integration of ICTs into the classroom and the lives of students. Bloom identified three overlapping domains, each with various levels to be addressed,

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and proposed that learning fits into one of three psychological domains.

- Cognitive domain: 'what we know ' – processing information, knowledge and mental skills (knowledge)
- Psychomotor domain: 'how we do' – manipulative, manual or physical skills (Skills)
- Affective domain: 'how we feel' – attitudes and feelings, growth in feelings or emotional areas.

3 IMPACT OF ICT ON HOCS

Ball and Garton, (2005) show the concept of Higher Order Cognitive Skills (HOCS) was derived from Blooms Taxonomy. Bagarukayo and Mbarika, (2008) highlight the search by educators for new approaches to enhance HOCS. The authors further acknowledge the need to create active customized LEs for learner motivation and continuous learning desire. ICT provides better options to present learning material and enables effective communication between those involved in the learning process, thereby promoting collaborative learning.

3.1 Cognitive Domain: BDT

BDT is an update to BRT to account for the new behaviors, actions and learning opportunities emerging as technology advances and includes digital technologies and digital cognitive objectives (Anderson and Krathwol, 2001). BDT aims at addressing the advances in technology, insights and their applications in the field of academia. In order to let the learning process benefit from modern technology and new insights, BDT uses tools to facilitate learning.

Table 1: Cognitive Domain in a Digital Context.

Cognitive Domain		
Level	Definition	Digital Support
Creating	designing, constructing, planning, producing, inventing, devising, making, programming, filming, animating, Blogging,	voicethread, wikispaces blogs, mind maps, podcasts
Evaluating	checking, hypothesising, critiquing, experimenting, judging, testing commenting, reviewing, posting, moderating, collaborating, networking,	wikipedia, google alerts, forums, chat rooms,blogs, journals, vlog
Analysing	Comparing, organizing, deconstructing, attributing, outline, finding, structuring, integrating,	google docs, CC mindomo, remix, blogs, glossary,
Application	implementing,u sing, executing, running, loading, playing, operating, hacking, uploading, sharing, editing.	go2web2.0, voki, picasa, SCORM,video podcasts, flash games,
Understanding	Interpreting, Summarizing, inferring, paraphrasing, classifying, comparing, explaining, exemplifying Advanced searching,	Ted, skype, twitter, journal, blog, glossary, database, RSS feeder
Remembering	Recognising, listing, describing, identifying, retrieving, naming, Bullet pointing, highlighting, bookmarking, social networking, searching	youtube, yahoo, google, blogs, wikis, quizzes, lesson (flash card)

3.2 Affective Domain in a Digital Context

The various skill levels of the affective domain may also benefit from modern ICTs, as summarized in table 2:

Table 2: Affective Domain in a Digital Context.

Affective Domain		
Level	Definition	Digital Support
Receiving	The lowest level where students passively pay attention.	presentation tools, Notice boards, Discussion boards
Responding	Attending to stimulus, leading to some type of reaction from them.	interactive communication tools- email chat
Valuing	Assign some value to an object, phenomenon or piece of information.	White boards, editting tools
Organizing	putting together different values, information, ideas accommodating them with own knowledge	Graphical tools / figures, calenders
Characterizing	have a particular value or belief that now influences their behavior becomes a characteristics.	Personalised content presentation tools

3.3 Psychomotor Domain in a Digital Context

The digital techniques provide better options for monitoring the acquiring of skills in the psychomotor domain. ICT techniques as shown in table 3 are less prominent, since skill development requires specialized techniques to support the training of the skill under consideration.

Table 3: Psychomotor Domain in a Digital Context.

Psychomotor Domain		
Level	Definition	Digital support
1. Observing	Active mental attending of a physical event.	software agents
2. Imitating	Attempted copying of a physical behavior.	Virtualization, simulation
3. Practicing	Trying a specific physical activity over and over.	Multimedia, video games,
4. Adapting	Fine tuning. Making minor adjustments in the physical activity in order to perfect it.	video games

4 MOODLE EVALUATION

4.1 Methodological Evaluation

An analysis of Moodle was conducted using a framework developed by (Land and Hannafin, 2000), designed as a guide for developing constructivist LEs. According to (Land and Hannafin, 1997), "LEs, directed as well as constructivist, are rooted in five core foundations: psychological, pedagogical, technological, cultural, and pragmatic". We introduce a methodology framework as systems of aspect for characterizing and comparing methodologies (Proper, 1994), based on a model of Seligmann (Figure 4.1). The figure illustrates the aspects:

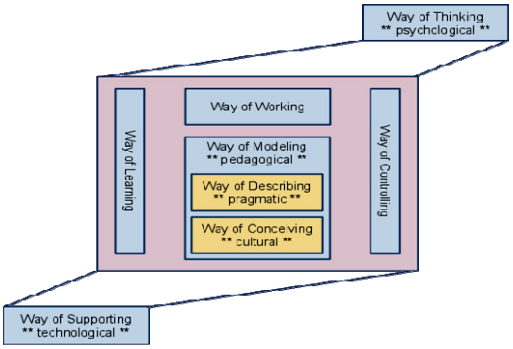

Figure 1: Matching Core Foundations to Methodology.

We interpret the core foundations of LEs within this methodology framework. The psychological foundations are all LEs, which explicitly or tacitly, reflect underlying beliefs about how knowledge is acquired and used. Psychological foundations reflect views about how individuals acquire, organize, and deploy knowledge and skills.

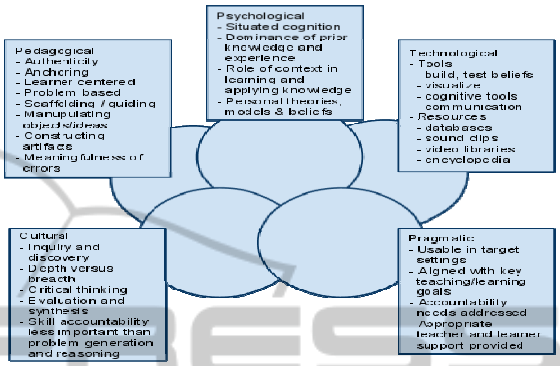

Figure 2: Core Foundations of Moodle.

The pedagogical foundation influences focus on the activities, methods, and structures of the LE, and emphasizes how an environment is designed. The technological foundation is related to the way of supporting and represents how the capabilities and limitations of technologies can be optimized. Technological capabilities suggest what is possible through advances in technology. The cultural foundation reflects prevailing beliefs about education, values of a culture, and roles of individuals in society. The pragmatic foundation bridges the gap between theory and reality by emphasizing the practical reasons an approach can or cannot be used in a given LE. This foundation is related to the way of conceiving and working. The core foundations for LEs benefit by two extra core foundations of the way of learning and controlling.

4.2 Moodle Effectiveness based on BRT

We discuss the effectiveness of the Moodle LE in terms of BDT. If we focus at the way of supporting aspect of Moodle, then we see that each skill level has a number of techniques to allow effective support for the activities at that level. The activities highly supported by Web 2.0 applications available in Moodle are summarized in table 4 (Dougiamas, 2004).

Table 4: Moodle and BDT Relationship.

Cognitive Level	Moodle Support
Creating	Collaborative wikis, blogs, workshop, assignment based uploads, mind maps, upload video, pod casts, publish documents, lesson plan
Evaluating	Discussion forums, collaborative wikis, blogs, chat rooms, forum with peer evaluation, assignment based uploads, journal for reviewing own learning, assessment viewing
Analysing	Survey & choices within moodle, database, glossary creation, wikis, blogs, assignment uploads (MS word, Excel)
Applying	Use of SCORM e.g. NLN, upload screen capture, upload slide share, audio / video podcasts, play embedded flash games, collaborative moodle wikis (editing), assignment upload
Understanding	blogs, journal, collaborative wiki, glossary, database, RSS feeder (masgables e.g. voice threads)
Remembering	Moodle glossary, blogs, wikis, moodle quizzes, moodle lesson (flash card), complete search activity

4.3 Evaluation of Moodle Functionality

Putting into perspective what Moodle can offer in relation to the Bloom's Revised Taxonomy (BRT), an evaluation of Moodle functionality was done with a randomly selected students' group that accessed it. The information was analyzed (figure 4) and presents Moodle as the central technology that can uphold the BRT levels through its functionality associations. The six functionalities (Camilleri, 2009) Moodle presents in perspective of the BRT for evaluating LEs include Tutor support, Peer Support, Interpretation, Relevance, Reflection and interactivity. The functionalities are embedded in Moodle tools and closely linked to the BRT. From the figure, we note that there is association between the functionalities and BRT:

- Tutor Support looks at adequately supporting the entire learning process by the tutors. It is observed that there is an association between creating, applying, remembering and evaluating levels of BRT. The tools that are associated with these levels aid in providing effective Tutor Support.
- The Peer Support looks at how peers within the learning technology support each other to achieve learning objectives. It associates with applying, remembering and evaluating levels of BRT. Through the tools peers can effectively evaluate what support to provide after remembering, and then applying what they know through peer support.
- Interpretation is closely linked to Moodle's ability to allow users interpret information before using it. BRT levels that closely associate with this functionality include analyzing, understanding and applying. Users first analyze information, understand and apply what is relevant in different contexts.
- Relevance focuses on the ability to select a tool that adheres to the appropriate learning style to undertake an effective learning process. Relevance associates with the analyzing, understanding and evaluation BRT levels. Being able to use the appropriate tool involves the user analyzing what works best for them in their state and having good understanding of the learning process. If learning occurs the tool can be evaluated for effectiveness. Moodle is relevant coz it enables students to use critical thinking, on the highest level of BRT

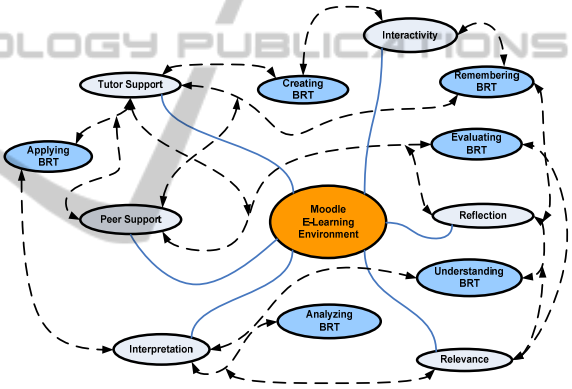

Figure 3: Moodle Functionality Benchmark in Relation to BRT.

- Reflection addresses the users' ability to think and understand what is presented to them. After reflection they can use their understanding to carry out other learning activities. The BRT levels associated with this functionality include evaluation, understanding and remembering. When a user interacts with the functionality, they are interested in evaluating what will lead to understanding and storing that knowledge.
- Interactivity allows the use of Moodle in different ways depending on the different learning styles. This contributes to the biggest percentage of usage and is associated with the creating and remembering BRT levels. Users can utilize the available tools to create learning activities through which they can have a good understanding of the entire learning process.

These skills are relevant to the students' professional practices because they prepare them for the work force where they are part of discussions before problem solving, decision making, and critical reflection for improving their HOCS.

4.4 Moodle & Learning Environments

Moodle is free, can be modified anytime, designed to take large numbers of students and has a vast array of interactive tools (Camilleri, 2009). He suggests that Moodle does not time out when not in use, is not limited to a whiteboard tool, and has more than one type of forum depending on particular needs. With Blackboard, one is immediately notified of any announcements and an icon, indicating what new material is available. First Class Navigation is simple to use, emails, features a Bulletin Board System and online conferencing, and allows for synchronous and asynchronous communication. However, new content or mail have to be searched for manually in the various folders on the home page and it has a very outdated welcome screen which contains a clutter of folders, not suitable to use with large groups simultaneously. Moodle's shortcoming is that it lacks modern Synchronous e-learning features like hosting virtual classrooms (Lalos *et al*., 2009). The authors emphasize the need to provide synchronous learning features for successful e-learning program implementation. We conclude that Moodle offers an impressive set of tools to support a DPL environment as compared to other LEs.

5 CONCLUSIONS AND FUTURE WORK

We discussed Moodle in terms of the methodological framework, and its effectiveness based on BRT. Furthermore we discussed Moodle in comparison to other LEs. Our main conclusion is that a recursive approach can be beneficial, leading to an unbounded depth in its approach. We would expect and propose a two-dimensional support approach in which the development of learning material is seen as the creative process to disclose a knowledge domain, that requires the core dimensions to be offered as a basic part of the LE. We acknowledge that the revised taxonomy is not a cumulative hierarchy as the original. The revised taxonomy also identifies four general types of knowledge: factual, conceptual, procedural and meta cognitve which make up knowledge dimension. We shall integrate these into our evaluation for future research.

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