WHITEPAPER

BLOOM'S TAXONOMY IN THE DIGITAL AGE

velsoft

DEVELOPING FORMATIVE ASSESSMENTS FOR ELEARNING

As trainers, how do we ensure that we are assessing for higher levels of learning in the e-Learning environment?

Formative assessments are tests or evaluations that take place throughout a course and provide feedback to the student in an ongoing loop, allowing them to build on their knowledge and improve. Examples are quizzes, assignments, or research papers.

There are three developments in cognition that are important to consider when looking at developing Formative Assessments for eLearning.

1. B.S. Bloom's Taxonomy (1956)
2. Andrew Churches Revised Bloom's Digital Taxonomy (2007)
3. J.P. Guilford's Convergent and Divergent Cognitions (1969)

BLOOM'S TAXONOMY

Benjamin Bloom was an educational psychologist who is best known for his 1956 book, Taxonomy of Educational Objectives, Handbook 1: Cognitive Domain. The book became the definitive guide for assessment in education because it provided a way to assess a student's ability to meet educational objectives. It became known as Bloom's Taxonomy.

Bloom felt that a person's learning fell into three domains: Affective (emotional), Psychomotor (physical) and Cognitive (thinking). He divided each of these domains into skills levels from lower order to higher order processes where each level was dependent on first achieving the skills from the level below it. The focus of this paper is on the Cognitive Domain.

Skills Level	Description of Level
Knowledge	Recall, or recognition of terms, ideas, procedure, theories, etc.
Comprehension	Translate, interpret, extrapolate, but not see full implications or transfer to other situations, closer to literal translation.
Application	Apply abstractions, general principles, or methods to specific concrete situations.
Analysis	Separation of a complex idea into its constituent parts and an understanding of organization and relationship between the parts. Includes realizing the distinction between hypothesis and fact as well as between relevant and extraneous variables.
Synthesis	Creative, mental construction of ideas and concepts from multiple sources to form complex ideas into a new, integrated, and meaningful pattern subject to given constraints.
Evaluation	To make a judgment of ideas or methods using external evidence or self-selected criteria substantiated by observations or informed rationalizations.

From: Bloom, B. S.; Engelhart, M. D.; Furst, E. J.; Hill, W. H.; Krathwohl, D. R. (1956).

BLOOM'S TAXONOMY IN THE DIGITAL AGE

Despite quickly becoming the definitive reference tool for educators and trainers, Bloom's Taxonomy was not without criticism. Some debated the ordering of the hierarchy, suggesting Evaluating should come before Analyzing. As the decades went on, others questioned if it was still relevant and updates were proposed. With the increase in digital technologies and the advent of eLearning, the most recent revision has been offered by Andrew Churches, who updated the taxonomy in 2007 to reflect these fundamental shifts in the learning environment. He called it Bloom's Digital Taxonomy.

CONVERGENT AND DIVERGENT COGNITION

Another important concept that can enrich our understanding of the types of thinking in Bloom's Taxonomy (and what we need to assess for) is Convergent and Divergent Cognition (J.P. Guilford, 1969).

Convergent thinking applies when there are pre-existing correct answers. The person is working with knowledge and concepts that have been covered in the course material or are generally known to exist. For example, a 'remembering' question to name the parts of a trumpet.

On the other hand, divergent thinking is cognition that happens when there are no pre-existing correct answers. The thinking creates new knowledge from existing knowledge. For example, a 'creating' question to compose a Trumpet Prelude from their knowledge of trumpet music.

If we were to combine this with the revised Bloom's Taxonomy, it looks like this:

Convergent

Remembering
Understanding
Applying
Analyzing

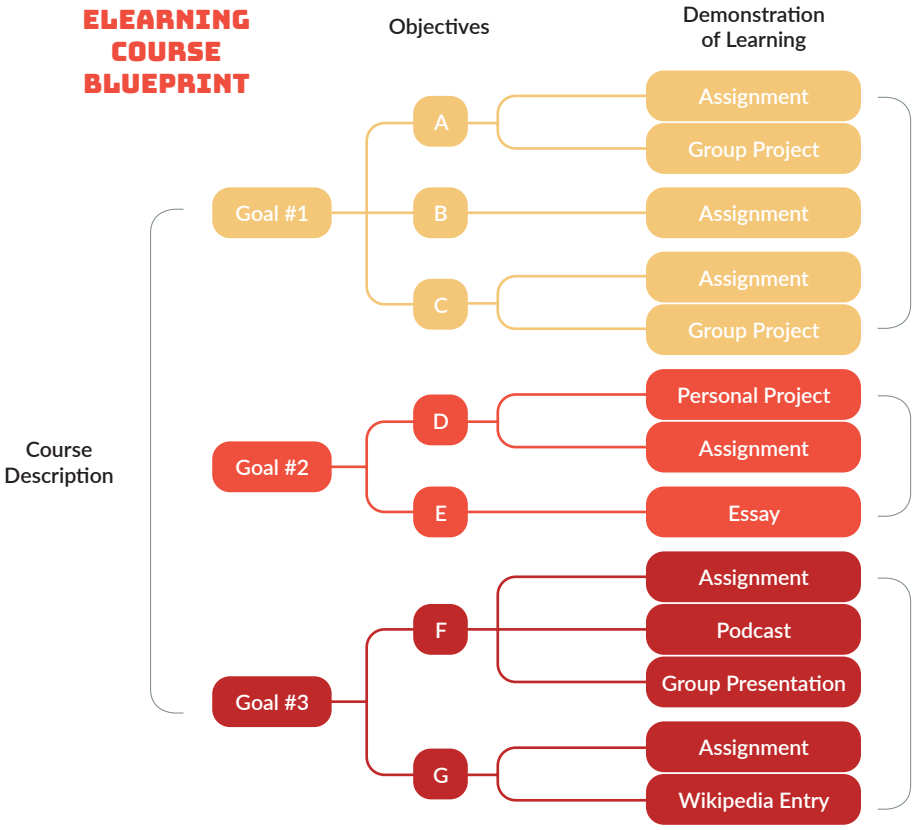
Divergent

Evaluating
Creating

DEVELOPING ELEARNING FORMATIVE ASSESSMENTS

How do we use these concepts to create effective assessments in the eLearning environment?

The following diagram shows the blueprint of an eLearning course and the relationship of "Objectives" to "Demonstration of Learning".



Formative assessments are mapped to the Enabling Objectives or Demonstration of Learning sections of an eLearning program. By doing so, the instructor ensures that the student is learning the concepts set out in the planning of that module or course. When the student successfully completes the assessment, it provides both the learner and trainer with feedback, showing knowledge they have gained, skills developed, and any areas that need to be further developed in that learning objective. Each successful demonstration of learning builds toward the overall learning for that student.

Formative assessment must take into consideration the level of proficiency that needs to be demonstrated. For example, if students are required to demonstrate knowledge-level proficiency of, for example, the capital cities in the European Union, an appropriate assessment might be a quick quiz asking them to list the capitals. On the other hand, if students need to demonstrate synthesis level proficiency of identifying the risk of food borne illness in a restaurant, the assessment would require students to access a number of sources of information to complete the assignment.

Examples of eLearning Formative Assessments

The following examples show how we can assess for proficiency at all levels of cognition.

CONVERGENT COGNITION
(WHEN THERE IS A PRE-EXISTING CORRECT ANSWER)

REMEMBERING

Retrieving: Learners demonstrate knowledge from memory by finding the answer in reference material.

Example
Instructor Led
Open book quiz, identifying items on map/visual reference.
eLearning
Bookmarking sites in internet searches, searching internet, searching Google to find concepts.

Recall: Learners demonstrate knowledge from memory by remembering the knowledge.

Example
Instructor Led
Fill-in-the-blank, short answer, essay, oral test, crossword puzzle.
eLearning
Social networking, visual identification, fill-in-the-blank, crossword puzzle, video followed by questions.

Recognition: Learner demonstrates knowledge from memory through identifying an answer.

Example
Instructor Led
Multiple choice, true or false, matching, highlighting answers, sorting.
eLearning
Bookmarking, drag & drop, matching, multiple choice, true or false, sorting game.

UNDERSTANDING

Contextual: Learners can not only recall knowledge, but can explain it - in context - to someone else.

Example
Instructor Led
Fill-in-the-blank, short answer, essay, oral test, computational questions, answer and reason, ordering.
eLearning
Blog journaling, commenting on social media, video presentation.

APPLYING

Training: Learners are starting to practice tasks, apply new skills, and correct mistakes

Example
Instructor Led
Problem solving questions.
eLearning
Uploading their own content, editing others' content, problem solving.

ANALYZING

Differentiating: Learners distinguish relevant material from irrelevant material / important information from unimportant information.

Example
Instructor Led
Compare and contrast, summarizing texts.
eLearning
Participating in simulations, linking, tagging, validating.

Organizing: Learners determine how elements fit or function within a structure.

Example
Instructor Led
Organizing lists/items, outlining, solving problems.
eLearning
Gaming, participating in simulations.

Attributing: Learners determine a point of view, bias, values, or underlying intent within presented material.

Example
Instructor Led
Critical response, fact vs. opinion, short answer, essay.
eLearning
Linking and tagging.

DIVERGENT COGNITION
(WHEN THERE ARE NO PRE-EXISTING CORRECT ANSWERS)

EVALUATING

Checking: Learners detect inconsistencies within a process; detect the effectiveness of a procedure.

Example
Instructor Led
Experimenting, testing, finding the error.
eLearning
Moderating discussions, testing ideas/created work.

Critiquing: Learners detect the appropriateness of a procedure for a given problem.

Example
Instructor Led
Critiquing, judging.
eLearning
Research and recommendations, participating in discussion boards, blogs/vlogs.

CREATING

Generating: Learners come up with alternative hypotheses based on criteria.

Example
Instructor Led
Designing, filming
eLearning
Creating videos, wikis, podcasts, blogs and vlogs, directing, producing.

Planning: Learners devise a procedure for accomplishing a task.

Example
Instructor Led
Project planning, proposal writing.
eLearning
Planning videos, wikis, podcasts, blogs and vlogs.

Producing: Learners invent a product.

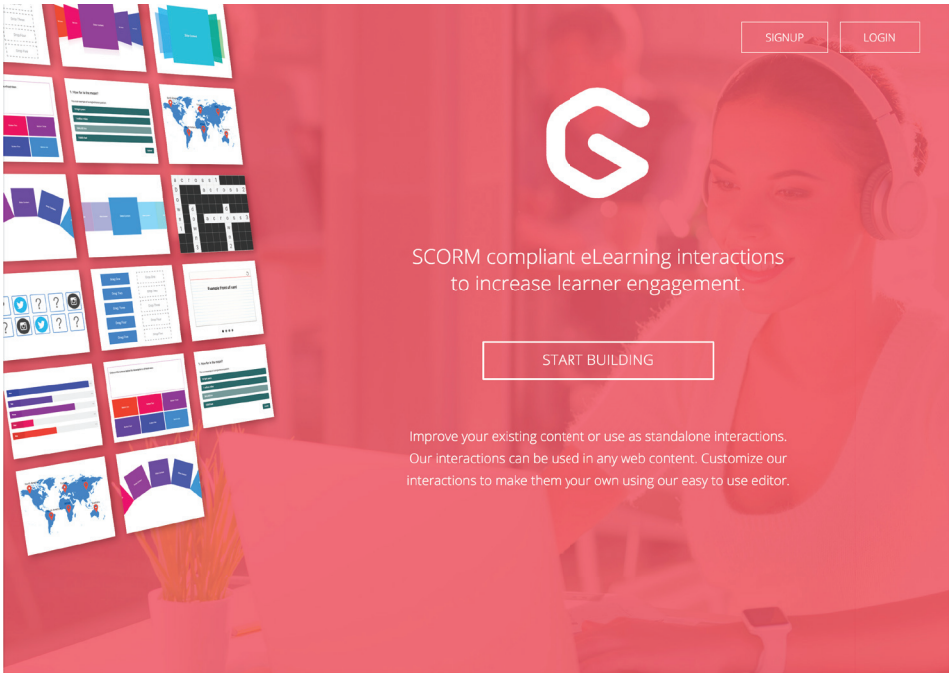
Example
Instructor Led
Constructing, inventing.
eLearning
Creating videos, wikis, podcasts, blogs and vlogs.

Adapted from: Anderson, L. W. & Krathwohl, D. R. (2001).

USING INTERACTIVE TECHNOLOGY TO COMPLEMENT YOUR ASSESSMENT PROGRAM

Games are a great way to enhance and deepen learning. They can be configured in many ways and used as assessments at all levels of learning.

Gameo (**www.gameo.io**) is a free site that allows you to customize SCORM-compliant eLearning interactions to increase learner engagement. It was developed by Velsoft to help you deliver training that achieves your objectives for your learners.



References

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Churches, A. 2007, Educational Origami, Bloom's and ICT Tools (http://edorigami.wikispaces.com/Bloom%27s+Digital+Taxonomy)