Process Education and Constructive Alignment: The Challenge of Student Assessment Online

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Abstract

Student assessment is of increased concern for educators and stakeholders in education. In this paper, we will review the basic concepts of constructivism, which underlies Process Education, and the theory of constructive alignment. Connections among these theoretical foundations will be explored and then applied to the challenging issue of student assessment in an online environment. We end with some specific examples of how these principles can be combined to achieve quality student assessment in online environments.

Introduction

Online course development has reached a new level of maturity over the last decade. Improved multimedia and greater bandwidth have increased the richness of the presentation. YouTube itself has had a major impact on both opportunity for inserting video as well as a changed mindset about video and the home computer. In addition, improved animation and web programming techniques have made interactivity on the web an expected reality.

These technological improvements have certainly supported improved online environments for learning. But, have online course development approaches also matured to coincide with the technological advances? A quick review of some online offerings may indicate that there is a wide range of quality of pedagogical approach in online curricula.

An area of increased concern in all segments of education is that of student assessment. Assessment presents additional challenges in an online learning environment. Because of the high dependence of attaining information through reading course content, assessment of skills beyond reading skills requires assumptions about those reading skills. Also, assessment should evaluate deep learning, rather than superficial completion of trivial, unconnected tasks. Students should find their assessment supportive and the evaluation of their work fair. And, timing is critical, providing necessary feedback that enhances learning at critical learning moments. A hasty evaluation may prematurely end a learning opportunity.

Many theories have informed the development of effective environments for learning and the assessment of learning. Constructivism focuses on the importance of the learner at the center of the learning, as a constructor of one's own learning. Building on constructivism, Process Education, also placing the learner at the center, proposes ways to improve learner effectiveness by identifying methodologies for the learner to follow and helping the facilitator of learning (aka the instructor) develop rich environments for learning through self-assessment and the providing of clear learning objectives. Constructive alignment, put forward first by Gibbs (1996) also focuses on creating environments that align clear learning objectives to learner activities. For both Process Education and constructive alignment, formative assessment is an essential component focusing on helping the learner improve.

In this paper, we will discuss the aspects of constructivism and Process Education that could be applied to online course development, especially in the area of student assessment. We will then discuss how constructive alignment influences online course development and online assessment tools for formative assessment. The connections among these approaches will be explored. We will end with some specific examples of how these principles can be combined to achieve quality student assessment in online environments.

Constructivism

Mahoney (2004) gives a thorough definition of constructivism. He provides five basic themes that pervade the diversity of theories expressing constructivism. These themes are (1) active agency, (2) order, (3) self, (4) social-symbolic relatedness, and (5) lifespan development. He explains,

> With different language and terminological preferences, constructivists have proposed, first, that human experiencing involves continuous active agency. This distinguishes constructivism from forms of determinism that cast humans as passive pawns in the play of larger forces. Second comes the contention that much human activity is devoted to ordering processes – the organizational patterning of experience by means of tacit, emotional meaning-making processes. In a third common contention, construc-

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> tivists argue that the organization of personal activity is fundamentally self-referent or recursive. This makes the body a fulcrum of experiencing, and it honors a deep phenomenological sense of selfhood or personal identity. But the self is not an isolated island of Cartesian mentation. Persons exist and grow in living webs of relationships. The fourth common theme of constructivism is that individuals cannot be understood apart from their organic embeddedness in social and symbolic systems. Finally, all of this active, meaningful, and socially-embedded self-organization reflects an ongoing developmental flow in which dynamic dialectical tensions are essential. Order and disorder co-exist in lifelong quests for a dynamic balance that is never quite achieved. The existential tone here is unmistakable. Together, then, these five themes convey a constructive view of human experience as one that emphasizes meaningful action by a developing self in complex and unfolding relationships. One can easily see the spectrum of contributions that have constructed constructivism. They range from Taoism and the process philosophy of Heraclitus to the personal, social, and narrative emphases of contemporary constructivists like Bandura, Bruner, and Gergen. (Mahoney, 2004)

In the next few sections of this paper, we will describe how theorists and practitioners have adopted segments of constructivism to develop strategies for learning environments.

Process Education Principles

Process educators base their ideas on constructivism. They believe, first and foremost, that learners can improve their learning through conscious attention to their performance. A comprehensive set of learning skills is used to help learners and facilitators of learning identify what skill development will support achievement in a specific area. As a facilitator of the learning environment, the process educator clearly identifies learning objectives for the activity as well as measurable criteria for determining the level at which those objectives have been met. Learners engage in continuous improvement through self-assessment.

Implementations of Process Education are based on a performance model, where the factors affecting performance, such as levels of skill and knowledge, are identified. Bloom's taxonomy is then used as a foundation for identifying levels of performance. Bloom's Taxonomy, giving levels from low to high, and the corresponding levels in Process Education, are shown in Table 1 (Beyerlein, 2007).

Table 1 Levels of Performance according to Bloom's Taxonomy and Process Education

Bloom's Taxonomy Levels	Process Education Levels
Knowledge	Information
Comprehension	Conceptual Understanding
Application	Application
Analysis	Working Expertise
Synthesis	Working Expertise
Evaluation	Research

A primary goal of Process Education is to develop individuals into self-growers, who are challenged to increase their level of performance through activities that include collaborative learning, the use of critical thinking questions and self-assessment. To further assist these learners in their development, many methodologies have been developed that break the learning process into a series of steps. For example, there are methodologies for developing a presentation as well as for problem-solving.

A critical distinction is made by process educators between assessment and evaluation. Assessment is a process for improving quality and the focus of assessment is on growth rather than judgment. Others would label this type of assessment as formative assessment. Evaluation, on the other hand, is a process for determining quality, where the focus is on determining how objectives have been met at the end of the process.

A key strategy for assessment in Process Education is SII, that is, Strengths, Areas for Improvement, and Insights. Both learner and facilitator of that learning benefit from stepping back and assessing a learning experience through SII. Through SII, continuous improvement becomes a reality.

For assessment to be effective, criteria for performance need to be identified. The development of criteria based on clearly defined learning objectives is a key component of course design for process educators. Process Educators use a 21-step process for course development (see Table 2). Note how many steps are involved in preparing expected outcomes from the course, leading to the development of activities to achieve these outcomes. Once Process Educators complete these steps, they then develop means of providing assessment and evaluation of student work. The pages of preparatory work in this course development methodology are extensive.

Rubrics are used in Process Education for both assessment and evaluation. According to the module entitled, "Fundamentals of Rubrics" in the Faculty Guidebook (Bargainnier, 2007, pp. 76-78), the following are characteristics of quality rubrics:

- They are based on clear criteria
- They contain rich, descriptive language
- They focus on the attainment of the desired performance (in other words, they describe w h a t was accomplished, as opposed to what is missing in the performance.)
- They are easy for both instructors and students to interpret.

Table 2 Methodology for Course Design

Step	Task
1	Construct professional behaviors
2	Identify course intentions
3	Construct measurable learning outcomes
4	Construct a knowledge table
5	Choose themes
6	Create the appropriate methodologies
7	Identify a set of activities
8	Identify a set of specific learning skills for the course
9	Identify activity preference types
10	Match the activity types with the chosen activities
11	Choose the in-class and out-of-class activities
12	Allocate time across the themes
13	Sequence the activities across the term
14	Create individual activities from a prioritized list
15	Enhance activities by using technology
16	Ask peers to review the activities you create
17	Produce key performance criteria
18	Locate or build key performance measures
19	Design a course assessment system
20	Design a course evaluation system
21	Design a course syllabus

Faculty Guidebook, 4th edition (2007). Lisle, Illinois: Pacific Crest, p. 247

Constructive Alignment

The theory of constructive alignment (Biggs, 1996) represents a merging of constructivism and instructional design. Constructivism provides a framework for thinking about how people learn and how teachers can meet the challenge of finding ways to design instruction that puts constructivist principles into practice. The construction of this knowledge is therefore based not only on the types of teaching and learning activities, but on what a student brings to the learning environment, such as prior knowledge, experience, attitudes, and assumptions (Biggs, 2003).

When designing online instruction from a constructivist perspective the instructional designer works to translate curricular content and learning objectives into course materials and teaching/learning activities. This is done by aligning learning objectives, instructional strategies, and assessments of learning (Smith and Ragen, 2005). Biggs (1996) talks about the merging of constructivism and instructional design when he identifies the alignment of three components: (a) measurable, clearly-stated, curriculum or unit objectives, (b) learning activities that will help students gain and understand content knowledge, and (c) assessment tasks that utilize new knowledge to meet stated objectives (Biggs, 1999; Biggs, 2003, Harvey and Kamvounias, 2008).

While the theory and practice of constructive alignment has been around for quite some time its use in online teaching and learning is relatively new. Many online courses are offered using a learning management system (LMS) such as Angel or Blackboard. The LMS adds another dimension to the aligning of learning objectives, instructional strategies, and assessments. In the online environment the instructional designer must utilize constructive alignment within the confines of the computer mediated environment.

Deep Learning

Another concept we kept in mind while considering the development of assessment for online learning was the concept of deep learning. According to Houghton (2004), deep learning "...involves the critical analysis of new ideas, linking them to already known concepts and principles, and leads to understanding and long-term retention of concepts so that they can be used for problem-solving in unfamiliar contexts." Deep learning relates to the upper levels of both Bloom's Taxonomy (analysis, synthesis, and evaluation), and to Process Education (application, working expertise, and research). In practice, the instructional designer should be attentive to what level of learning each designed activity promotes and be aware of the possibility that an activity may only contribute to superficial learning.

For the authors, the concept of deep learning resonated well with their backgrounds in Process Education and constructive alignment. In the case study below, we will show how a focus on clear learning objectives led to the development of activities and assessments that promoted higher-level learning.

Connecting Theory to Practice

In many ways, the LMS provides an opportunity for implementing several main components advocated by Process Education and constructive alignment. For example, learning objectives are an expected feature in online courses. Because the learning activities are planned ahead, they can be constructed using the ideas of constructive alignment. Scaffolding activities to lead to higher order thinking can be part of the instructional design. Assessment is conscious, and a gradebook can make assessment transparent to the student.

However, the LMS does not automatically provide a good learning environment. Learning objectives are not always written well. If not, they will be ineffective and may even impair learning. While learning activities can enable deep learning, they can also allow for superficial learning. Assessment and evaluation can be opaque and act as a disincentive if not developed appropriately.

The gradebook presents an additional challenge for effective online learning. Students are often overly dependent on the gradebook reports and may read these reports differently from what was intended. For example, if contributions to discussion boards represent 10% of the final grade, will some students neglect discussion boards and focus on written assignments, which are usually "worth" more?

Instructor use of the gradebook can also be problematic. We have had instructors neglect to enter grades into the gradebook, which students find quite distressing. Other instructors put more weight to their own objectives, such as that of grammatical correctness, over other more critical objectives, such as the demonstration of improved analytical skills.

In the next section, we will explore how reflection on these connections and how a revision process based on constructive alignment improved the learning environment in an online computer course.

Case Study: Assessment and the Gradebook

In previous sections we have discussed some principles of Process Education and constructive alignment. The authors of this article recently began to work together on an online course revision (Computer Information Systems), both having backgrounds in education and therefore aware of the challenges of assessment. They realized that a core weakness of the course under revision lay in the lack of clearly defined objectives leading to a gradebook that gave unintended messages to students and instructors for the course.

These were the original objectives for the course:

- Understand and discuss the impact of information technology in today's world.
- Describe how major IT business initiatives (such as: Enterprise Resource Management, Customer Relationship Management) have provided competitive advantage opportunities.
- Describe the key characteristics and importance of databases.
- Define and discuss the use of Decision Support Systems.
- Describe the role of eCommerce, including basic models and impacts to businesses and consumers.
- Describe the four systems development methodologies.
- Define an enterprise system and four types of IT infrastructures.
- Define and discuss ethical and information safe-guard issues relevant to IT.

Note how all of these objectives are at the low level of knowledge (Bloom) or information (Process Education). Yet, a review of the activities for the course revealed a much higher expected level of learning. The students were being assessed on activities that had little relation to and were more demanding than the stated objectives for the course. In addition, the gradebook for the course was categorized by type of activity, thus placing the student's focus on activities rather than the learning objectives.

Before continuing with revision of the course, the revision team, composed of an instructional designer, a content specialist, and an area coordinator, reworked objectives to more accurately reflect the goals of the course. These are the revised objectives for the course:

Students completing this course are expected to demonstrate:

1. An understanding of the terminology in the area of information systems,
2. The ability to summarize what one has learned from the CIS text as well as other resources,
3. The ability to apply book knowledge to a specific example drawn from plausible situations in the IS environment,
4. Improved analytical skills, that is, the ability to explore relationships among different topics studied in the area of information systems,

5. The ability to formulate conclusions and/or recommendations regarding implementation of CIS from different sources of information by clearly defining an objective and moving logically from that objective to a solution, defining the steps taken to reach that conclusion (as applied to a challenge in the IS area),
6. The ability to work effectively in a collaborative environment to complete an IS-related project.

Several aspects of these revised objectives relate to the principles identified in the above sections:

- The focus is on what the student will measurably achieve, not on what the course is intended to achieve.
- A number of the objectives relate to higher level learning, according to Bloom's taxonomy and the levels of performance identified in Process Education.
- Objectives are performance-based with an emphasis on how the student will demonstrate whether they have met the learning objective.

Once the objectives had been identified, a table was developed to see how each objective was addressed through the activities in the course. The results of that work are given in Table 3. Please note that "P" in a cell means that it is the primary objective met by that assignment. An "S" indicates a supporting or secondary objective.

Table 3 Learning Objectives Table for Computer Information Systems

	Learning Objectives ®					
Assignments	**1. Understanding of the terminology**	**2. Ability to summarize**	**3. Ability to apply book knowledge**	**4. Improved analytical skills**	**5. Ability to formulate conclusions**	**6. Ability to work effectively (Teamwork)**
Quiz Results	P		S			
M1 Chap 1 Case Study 2 and Chap 2 Case Study 2	S	S	P			
M1 Discussion (Krispy Kreme)		S	P			
M2 Chap 3 Case Study 2 and Chap 4 Case Study 1	S	S	P			
M2 Discussion (Quality Data)	S	S		P		
M3 Team Assignments						P
M4 Team Work Plan						P
M4 Chap 5 E-Commerce Essay (Team)	S	S		P	S	S
M4 Project Proposal				P		
M5 Chap 6 Case Study 2	S	S	P			
M5 Chap 7 IT Infrastructure Essay		P	S	S	S	
M5 Team Activity - EPR Application	S	S		S	S	P
M6 Chap 8 Case Study 2	S	S	P			
M6 Discussion (Patriot Act)			S	S	P	
M7 Chap 9 RFID Essay		P	S		S	
M7 Discussion (SOA)	S	S		P	S	
M8 Final Project	S	S	S	S	P	

The creation of this table resulted in several immediate outcomes. Earlier, we defined the use of "P" and "S" in the table, where "P" indicated that the activity fully met that objective and "S" meant that the activity was supportive of the objective, but did not meet the objective as fully as an activity with a designation of "P". The revision team made sure to have at least one "P" per objective and often more than one. At least one "P" meant that the achievement of each objective could be measured by how the student completed that activity. Multiple "P"s in a column give the student more diversity of opportunities to meet that objective. And, as the student progresses through the course, his or her improvement in meeting a specific objective can be documented in the gradebook report.

The fluidity of the process identified below is also worth mentioning. As the revision progressed, frequent returns to the table helped refine the learning objectives. Some assignments were revised after noting that they did not meet stated objectives for the course. Rubrics were added for the final project and online discussions to better inform students about what would be considered a quality submission. The principles of constructive alignment informed our conversations regarding the learning objectives, instructional strategies, and assessment practices.

Revision of the gradebook to align objectives and categories completed our process with the result that each graded activity was linked to a category (objective.) The authors replaced the typical gradebook categories (i.e. quizzes, discussions, projects) with the objectives for the course. Working with the Angel gradebook function each assignment was linked to its primary objective, corresponding to the "P" on the matrix. This allows the instructor to view a student grade report that highlighted each objective, the assignments that were linked to that objective, the grade the student received, and any narrative comments that were associated with the assignment.

An immediate result of this change in gradebook is that the emphasis is moved from the assignments themselves to the learning objectives. Since our college does narrative evaluations, this approach to the gradebook will help the instructor also write a narrative evaluation based on how the learning objectives of the course are met. This change also addresses quite powerfully a concern stated earlier, that students viewing a gradebook categorized by activity would focus on the activity grade, rather than on what objectives they needed to address.

We have since completed this activity for a number of courses. The table for Math for the Inquiring Mind is given in Table 4.

Case Study: Use of Rubric

As mentioned earlier, once discussions and the final project were identified as key components of the course, we concluded that students needed clearer criteria for what constituted quality submissions. Tables 5 and 6 contain rubrics that were added to the course. These rubrics have the learning objectives of the course as their foundation, but provide further clarity for students on more complex activities.

Conclusion

In this paper, we have described an implementation that grew out of a blending of educational theories and pedagogies. The courses using this new approach will be piloted in the summer and fall terms. During those terms the team will be gathering feedback from instructors and students. Instructors will be asked to reflect on how the new approach has affected their facilitation of learning in the course. Students will be asked to identify how the focus on assessing learning objectives helped them to achieve their own learning outcomes.

Table 4 Learning Objectives Table for Math for the Inquiring Mind

Objectives

By the end of the course, students will:

1. Have self-assessment skills so that s/he is able to execute an SII (Strengths/Improvement/Insight) to any learning situation in order to improve.
2. Be able to communicate effectively about quantitative information and learning experiences.
3. Possess algebraic skills as well as critical thinking and spreadsheet analysis skills necessary to complete quantitative analysis.
4. Be able to move from a problem statement through a problem-solving process to a solution that is clear and appropriate.
5. Be aware of the limitations of any solution and reflective about how those limitations could be addressed.

Table 4 (continued)

Assignments	Learning Objectives ® 1. Perform self-assessment	2. Show effective communications	3. Possess skills for Analysis	4. Apply problem solving process	5. Address solution limitations
Math and Graphing Skills Modules		S	**P**		
Module Reflections	**P**	S			
Critical Thinking Blog	S	**P**	S		
M2 Self-assessment	**P**				
M3 Reading Log	**P**	S			
M3 Discussion (Crit. thinking skills)	S	**P**	S		
M4 Initial Application - PSP A and B			S	**P**	S
M4a Discussion (Use of PSP)		**P**	S		
M4b Discussion (Application to a current problem)		S	S	**P**	
M5 Using spreadsheet for math calculations		S	**P**	S	
M5 Data table analysis		S	**P**	S	
M5 Discussion (Data collection analysis)		S	**P**	S	
M6 Development of Graphs		S	**P**	S	
M6 Discussion (Analysis of graph used in media)		S	**P**		
M7 Team Project (Applied PS - Budgeting)			S	**P**	S
M7 Project Proposal		S	S	**P**	**P**
M7 Discussion (Benefits of PSP)			S	**P**	S
M8 Application of basic statistics			**P**	S	
M8 Discussion (Use of stats in media)		S	**P**		
M9 Book Review		S	S	**P**	
M9 Discussion (Book recommendation)		S		**P**	
M10 Final Project		S	S	**P**	**P**
M10 Discussion Item (Transfer of PSP skills)		S		**P**	

Norton (2004) discusses the disconnect between objectives and learning activities when considering the tendency of some students to use assessment criteria as a guide to obtain a good grade. By placing too much emphasis on assessment criteria an instructor runs the risk of having students place too much emphasis on how they will be assessed. While this concern is certainly valid, it can be mediated by reconceptualizing the notion of assessment criteria. This new view would change assessment criteria to performance-based learning objectives therefore inviting students to address those criteria. The authors believe their new approach applies Norton's proposed solution; however, more research is needed.

Table 5 Rubric for Final Project

Step/ Achievement	Does not meet expectations	Minimally meets expectations	Acceptable meeting of expectations	Excellent meeting of expectations
Develops clear outline for project	Does not provide outline	Provides outline, but with minimal information, making it difficult to get a sense of the project	Provides informative outline	Provides outline that clearly lays out intent, objectives and value of project, so that the expected outcomes are clear
Objectives defined clearly	Does not identify any objectives	Identifies some key objectives	Identifies most of the objectives clearly	Objectives are clear and demonstrate an excellent understanding of the expected scope of the project
Use of IT Concepts, Practices, Terms, and Illustrations (i.e., schematics)	Does not use concepts from the course and/or applies them incorrectly	Applies some of what was learned in the course, but in a limited way	Uses a number of concepts/practices from the course and applies them in a way that demonstrates good integration of these concepts	Extensive use of concepts from book, applied to a complex situation for which the application is not obvious
Analysis of project	Does not demonstrate any analytical approach to the project	Demonstrates some analysis of the proposed project, but superficially	Approaches project with good analytical skills, leading to interesting results	Approaches project from a multitude of directions, demonstrating excellent integrative abilities
Conclusion	Missing/inconclusive discussion of results	Provides brief conclusions with minimal insight.	Provides good insight into benefits of proposed solutions/ findings and some discussion of disadvantages and how findings could be improved upon	Discussion demonstrates a thorough understanding of the value of the solution/ findings as well as what further approaches may provide additional insight.
References	Does not provide references	Provides some references, but with some errors	Provides references when appropriate, using proper APA format	Provides references when appropriate, using proper APA format

Table 6 Rubric for Class Discussions

Characteristic/ Level	Unacceptable	Minimally Acceptable	Acceptable	Excellent
Quantity	Does not participate or submits at end of time period	Submits one response to original question	Submits a thoughtful response to original question and to at least one other student	Engages with questions and with other students in a way that their presence is apparent
Quality	If there is a response, it is brief and does not contribute to the discussion.	Response is given in a timely manner and moves the discussion forward.	Response to original question and to other students helps class interpret material in a novel way.	The response is one that heightens the interaction and leads group to a higher level of understanding.
Overall Impression	The student doesn't care about online discussions.	The student is perceived by others as "there" but not fully engaged.	Can be depended on for a helpful response.	When this student has contributed, others make sure they read the contribution because they know this person will make a worthwhile contribution.

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