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Interaction Equivalency in an OER, MOOCS and Informal Learning Era

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Abstract: This theoretical paper attempts to clarify design issues that the field of education has encountered in the context of OER (Open Educational Resources), Massive Open Online Courses (MOOCs) and increased emphasis on informal learning, as examined through the lens of the Interaction Equivalency Theorem. An overview of the core concepts of the Interaction Equivalency Theorem (the EQuiv) is provided and an explanation of how the EQuiv framework can be used to analyze interaction designs for online and distance education. The paper applies EQuiv ideas to categorize three variants of MOOCs (xMOOCs, sMOOCs and cMOOCs), from the perspective of interaction design so as to elucidate the major design differences. In conclusion, this paper explores the changing role of formal education in an era of learning opportunity where online educational resources and opportunities are readily accessible and in many cases completely free of cost to the learner.

Keywords: OER, Open Educational Resources, MOOC, interaction design

Introduction

If, as the New York Times declared, 2012 was the "year of the MOOC," 2013 has become the year to talk and worry about the MOOC! The largest MOOC provider, Coursera, reported registering 2.8 million students in March 2013, partnerships with 62, high prestige Universities and courses in Spanish, Italian and Chinese, thus showing evidence of strong user demand (TechCrunch 2013). Despite the media frenzy and claims for MOOC novelty, the issues related to designing, producing, marketing, assessing students work and evaluating quality have long been dealt with in research on distance education and most recently in online education. This theoretical paper attempts to clarify design issues that the field of education has encountered in the context of OER (Open Educational Resources), Massive Open Online Courses (MOOCs) and increased emphasis on informal learning (Eraut 1994), as examined through the lens of the Interaction Equivalency Theorem (Anderson 2003).

We first provide an overview of the core concepts of the Interaction Equivalency Theorem (the EQuiv). Next, we explain how the EQuiv framework can be used to

analyze interaction designs for online and distance education. Furthermore, the paper applies EQuiv ideas to categorize three variants of MOOCs (xMOOCs, sMOOCs and cMOOCs), from the perspective of interaction design so as to elucidate the major design differences. In conclusion, this paper explores the changing role of formal education in an era of learning opportunity where online educational resources and opportunities are readily accessible and in many cases completely free of cost to the learner.

Interaction Equivalency Theorem

Definitions and Concepts

Student interaction with content, with teachers and with other students has long been associated with persistence, learning outcomes and student enjoyment (Johnson, Johnson 1996, Shale 1990, Swan 2002). Indeed Dewey (1938) argued that all education experience is a "transaction taking place between an individual and what, at the time, constitutes his environment…" (p. 43). Wagner (1994) defined interaction as "reciprocal events that require at least two objects and two actions. Interactions occur when these objects and events mutually influence each other" (p. 8). Note that this definition does not apply only to interaction amongst human actors, but leaves open the possibility of interactions between humans and a variety of media objects.

Michael Moore's "Three Types of Interaction" model (Moore 1989) was the first systematic use of interaction as a defining quality and characteristic of distance education. This model defines critical interaction in educational contexts as having three components: learner-content, learner-instructor, and learner-learner interaction. Moore notes the value of each component, but provides no rationale for systematically enhancing, reducing or prioritizing one mode over another, thus leaving designers with only a fuzzy notion that "interaction" is good, but little guidance as to which to build into effective and efficient courses. As an extension of Moore's model, the EQuiv theory (Anderson 2003) was created with the purpose of providing "a theoretical basis for judging the appropriate amounts of each of the various forms of possible interaction." For a detailed history of interaction theory, please refer to Miyazoe (2012).

The main features of the EQuiv are condensed into two theses:

- **Thesis 1.** Deep and meaningful formal learning is supported as long as one of the three forms of interaction (student-teacher; student-student; student-content) is at a high level. The other two may be offered at minimal levels, or even eliminated, without degrading the educational experience.
- **Thesis 2.** High levels of more than one of these three modes will likely provide a more satisfying educational experience, although these experiences may not be as cost- or time-effective as less interactive learning sequences.

In accordance with the EQuiv formulation, Author has expanded Moore's interaction model to all possible six components: student-content, student-teacher, student-student interaction, plus teacher-content, teacher-teacher, and content-content interaction (Anderson, Garrison 1998). A new relation of the student-centric trio of student-student; student-content and student-teacher interactions and the more teacher-centric trio of teacher-content, teacher-teacher, and content-content interaction will be further discussed as a predominant feature of the OER and MOOC era of leaning.

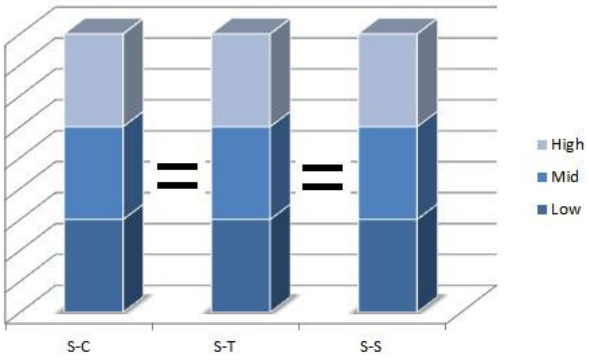
Figure 1 is an attempt to visualize the two EQuiv theses. The figure on the left represents Thesis 1 and its two main points: 1) in its extreme, a high level of one of the interactions (i.e., student-teacher, student-student, and student-

content) provides a context which can achieve insightful, meaningful formal learning, and 2) each interaction has the same potential value (equivalency = equal + value), which is denoted by using the equal sign. Additionally, the colored shading highlights the difference in the various intensity levels (high, middle, and low) of interactions: a lighter hue with a higher number signifies a higher level of interaction intensity. The figure on the right represents Thesis 2: more than one type of high-level interaction is desirable in order to increase learner satisfaction, but at a cost. The component of cost/time efficiency will be detailed in the next section.

It is important to emphasize that the main point of Thesis 1 is concerned with the effectiveness of learning (that is, the qualitative aspect of the educational interaction). By contrast, Thesis 2 is concerned with learner satisfaction and cost/time efficiency (quantitative in that interaction quantity makes a difference in the educational experience). In addition, the cost/time implications are relevant to both program providers (including institutions and tutors) who create and deliver programs and for learners who choose the type of learning that meets individual time and financial constraints and that matches learning and subject matter preferences.

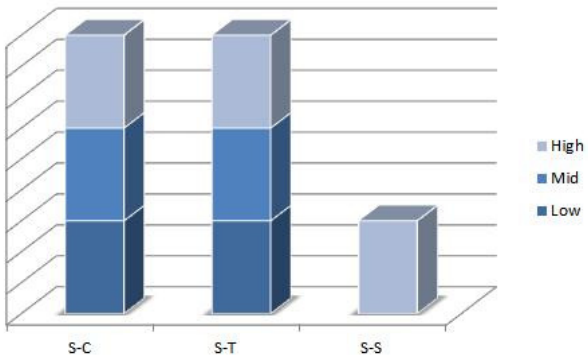
Figure 1: The EQuiv Visualization

Thesis 1: Quality



If any one is at a high level and quality, it will suffice for effective learning.

Thesis 2: Quantity



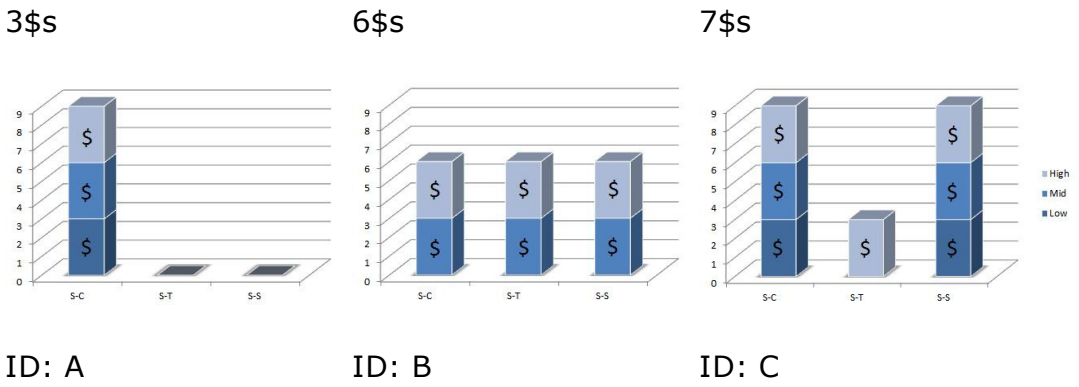
Increased interaction leads to higher satisfaction, but is it costly and time efficient?

Key - SC: Student-Content, ST: Student-Teacher, SS: Student-Student

EQuiv and Cost/Time Issues

Interaction is expensive in any format and has time, financial and opportunity costs for learners, teachers and institutions. Instructional design as systems theory refers to the entire process of achieving educational outcomes (Siemens 2002) and thus includes consideration of interaction costs. By contrast, interaction design (ID) is focused on the specific course/curriculum design for learning. When we plan for an increased amount of interaction in an educational course (for example, a higher frequency of Q&A between teacher and students using an online forum or a higher frequency of socialization among students using web conferencing), additional cost/time is required. This increase may be affordable, preferable or even mandated, but it will come with increased costs.

Figure 2: Cost/Time Issues in Interaction Design



In Figure 2, let us suppose that ID: A is the most efficient design (it has achieved a high level of learning with the least cost/time), and ID: C is equally effective (it achieves the same high level of learning) and satisfactory (due to the variation of high-level interaction) for a specific purpose in a particular context. In many cases, the ID used could be ID: B, in which a moderate level of all the three interactions is implemented with the hope that the ID will satisfy the needs and expectations of the highest number of stakeholders. It is important that the EQuiv considers that the optimal ID will likely be different, depending on the numerous variables in a specific context (Miyazoe, Anderson 2010, Miyazoe, Anderson 2012). However, ID: B and C could be less desirable if both effectiveness and efficiency are demanded.

The EQuiv in the Contexts of OER, MOOCs and Informal Learning

The idea of opening of learning opportunities in the EQuiv had been noted by the authors (Miyazoe, Anderson 2011) when we discussed closed versus open systems in educational resource provisions:

The conceptualization of the theorem clarifies further dimensions that need to be considered in the interaction design. One of these dimensions is the diversity of educational delivery contexts (i.e., closed vs. open systems). In a closed system, due to the limitations of cost and other resources, the designer may have to choose which possible interaction is the most important. In an open system, positive and accidental interaction surpluses (e.g., a course teacher voluntarily adding new online resources or inviting a guest lecturer to energize the course or students creating content) are possible. The cost and time issues are relative to the system chosen as the framework of the course design (p. 2).

The availability of ever-growing amounts of OER and the consequent informal learning opportunities fuel this "opening" of the traditional education systems. These free and open opportunities for both interpersonal and student-content interaction create an interaction surplus that can be used to augment and enhance formal educational curricula and systems. The educational institutions are important nodes in networks of information and knowledge aggregation where partially or fully open educational systems are digitally connected to each other. The Modes of Interaction model posited by Anderson & Garrison (1998) is used in the next section to analyze the various types of interaction, noting the informal opportunities alongside formal learning:

- **Student-Content interaction**: Increasingly, students are being asked and challenged to discover, use create and share content as OERs that can enhance and augment the content supplied by the course creators. Further, Dynamic interfaces are now being deployed that use student profile and behavioural data to dynamically construct individual learner paths amongst

content options (Farrell, Liburd et al. 2004)

- **Student-Teacher interaction**: Students have opportunities to gain a teacher-like presence from a variety of sources (for example, recordings of other teachers and automatic marking of quizzes and even essays), other than the formal teacher assigned to the class. However, issues of responsibility, morality, integrity, cultural maladaptation, accuracy, bias etc. can be confusing and/or time wasting to students.
- **Student-Student interaction**: Numerous online platforms and campus classrooms are being used for socialization, interpersonal support, peer tutoring and cooperative learning as students work through OERs or MOOC content. These interactions can extend to professionals, retired persons or external peers, thus providing international and diversified input to enhance the learning potential of peer-peer interaction (Zhao, Kuh 2004)
- **Teacher-Content interaction**: Teachers (or course developers) are able to collaboratively create and use content through tools such as wikis and cloud based course authoring systems (Schnieder 2012). In addition the normal licensing of OERs allows teachers to modify, mash or augment them so as to adapt to their particular educational needs.
- **Teacher-Teacher interaction**: Numerous online resources and platforms allow teachers to interact and learn within networked communities of practice.
- **Content-Content interaction**: On digital networks, content can be interactive and can be designed to update and augment dynamically other content (Farrell, Liburd et al. 2004).

The current issues and challenges that formal education systems have/will face amid expansion of OER, MOOCs and informal learning will next be examined using the EQuiv framework of learning outcomes (Thesis 1), learner satisfaction and cost/time issues (Thesis 2).

Learning Outcomes

In the formal learning environment, students can rely on high-level interaction of many kinds from various resources without major limitation. In this context, Thesis 1 remains valid because its primary focus is on quality; the difference in material location (inside/outside of school) and learning mode (formal and informal) are peripheral to the issue. This also signifies that quality learning can occur even if formal education fails to provide the necessary intensity of interaction as the learner is increasingly aware that he/she has opportunity to access external means to supplement to an expected level of interaction. For example, a student in a formal course may access content from iTunes University, a MOOC, Khan Academy, a Tedtalk or an international network of students studying in the discipline. In this sense, the realization of quality learning has become equally dependent on the individual learner's ability, which begins with choosing the best formal program that fits his/her needs, and extends to creative augmentation of the best available OER, MOOCs and informal learning opportunities.

As is too often the case in education, hard empirical evidence measuring learning outcomes is difficult and expensive to gather. However, in a meta-analysis (Bernard, Abrami et al. 2009) aggregated the results from 77 distance education studies in which different levels and types of interactions were classified. These studies yielded 74 achievement effects and 44 attitude effects. The study concludes that "when the actual categories of strength were investigated through analysis of variance ANOVA tests, we found strong support for Anderson's (2003a) hypothesis about achievement" (p.1265).

Learner Satisfaction

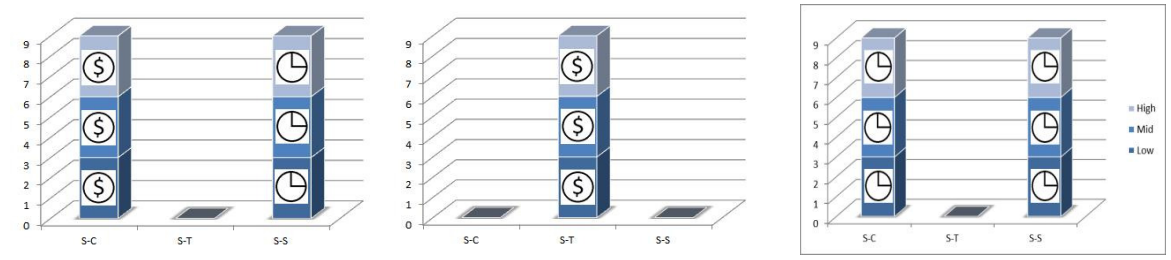
As we saw above, Thesis 2 suggests that having more than one kind of high-level interaction is likely to be associated with higher learner satisfaction. With OER, MOOCs and informal learning opportunities, when a program provides only one kind of high-level interaction, students can gain a higher level of satisfaction by using other kinds of high-level interactions from outside sources. Take, for example, the "flipped classroom" in which students acquire knowledge input through searching for content from OER in order to complete tasks or assignments outside of scheduled class time and then use the formal course time for topical discussion or high quality collaborative learning. Hypothetically, the student's satisfaction level would be quite high and this was shown in a recent Australian study (Butt 2013). Therefore, like learning outcomes, if an individual learner gains high satisfaction from any formal or fixed learning design, the outcome continues to depend to some degree on learning design created by others but now and increasingly depends upon his/her ability to obtain and effectively utilize an additional "surplus." This could further be facilitated if the provider (course tutor, content designer, etc.) provides training and recommendation of outer educational resources selection.

Cost/Time Issues

Cost/Time issues warrant an in-depth, analysis, particularly when OER, MOOCs and informal variables are involved. The clock-dollar sign symbol (a dollar mark in a circle) represents cost; whereas the clock symbol represents the time spent during an interaction.

Figure 3: EQuiv in OER and Informal Learning

3$s 3$s 0$s



ID: D ID: E ID: F

The figures in Figure 3 represent three hypothetical cases of high-level interaction:

- **ID: D** (the left side) - The formal program provides high-level interaction student-content, and high level student-student is provided in some way (by the program or through learner initiative). This model is practiced in many commercial MOOCs. Currently MOOCs are offered under no-cost financial models but will likely focus on advertising and sale of learner behavior data and auxiliary products (Daniel 2012). Thus the cost to the student may be free, but there are real costs for the delivery institution.
- **ID: E** (the middle) - The formal program provides a high-level interaction of one kind, and the learner is committed only to this format. This format is offered, for example, by purchase of a training package delivered via video, computer-assisted instruction (CAI) or text.
- **ID: F** (the right side) - High-level quasi-cost-free interaction of two kinds are used at the learner's initiative as for example, by engagement in http://learni.st/ cluster or supplemented by a study group (online or local).

Following the EQuiv theses, ID: E is the design in which the classic online or distance educational institution is concerned and tasked with creating high quality; whereas, ID: D is the design that is focused on maintaining an equal level of quality learning, but provided by the institution creating high quality content and encouraging the student to find their own S-T and S-S support. However, we should note that a higher level of satisfaction is not cost-free: it may consume more time of the learner, which is not free but precious: "opportunity cost" - time spent studying - precludes engaging in other activities. In other words, in terms of time efficiency, with ID: E, students spend only 3 dollar-time for one kind of high-level interaction to complete the formal requirements; whereas with ID: D, students spend 3 dollar-time for high-level S-C interaction to fulfill the formal course requirements plus 3 clock-time for high-level S-S interaction outside but paying 3 dollars for the formal part only; with the ID: F design, although it may be inexpensive for the active use of OER and others, the learner may have spent twice as much time, that is, 6 clock-time, though they may pay quasi-zero dollars in reality, to gain a level of learning similar to ID: E.

In sum, there are *visible* and *invisible* costs and the learner could spend more (of either of these scarce resources) to gain the same, or worse less. These invisible time-costs have always existed but the OER, MOOCs and informal learning opportunities make the extent of this invisibility more pervasive. It is worth noting that the same argument also applies to the teacher experience. With no or low cost for additional interaction for the educational providers, those "surplus" interactions are more likely to be suggested as options rather than requirements. That is, the surpluses may appear to be cost-free, but in actuality, they are volunteer activities that consume the teacher's time.

When we go back to Thesis 2, more than one form of high-level interaction will likely increase the level of satisfaction. On the other hand, the level of satisfaction also depends on the time-cost efficiency, whose satisfaction level differs learner to learner: for those who value time, even if ID: D and ID: E cost the same, ID: E may be more satisfactory. In the same way, those who value time may prefer choosing ID: D over ID: F even if he/she has to pay more because ID: D saves valuable time. In other words, in the OER and informal era, time-cost efficiency becomes even more critical in choosing the best learning than before. The quality-time-accessibility triangle posited by Daniel (November 2003), in reference to the external vectors of education and mega-universities, may now be re-phrased as both institutional vectors and the individual learner vectors of *quality-time-cost* especially in the places where the issue of accessibility is more attenuated by the Internet.

The EQuiv in the MOOCs

MOOCs are threatening and disruptive to higher education on a number of levels. Perhaps most fundamentally, is the intrusion of Silicon Valley based venture capitalism and innovation into a world that has long resisted commercialization. The lack of early revenue model, the potential to further de-skill professoriate and the slow speed of change at universities have conspired to make many institutions slow at developing scalable models of development and delivery.

At the eye of the disruptive storm is the issue of accreditation. In an attempt to add value to their MOOCs, the MOOC companies are experimenting with a variety of accreditation tools including certificates for successful completion of courses, badges, partnerships with testing centers for local invigilated examinations and attempts to convince accredited institutions to award their own credit for successful MOOC completion.

Though both OERs and MOOCs acronyms contain the word "Open," the nature of "openness" significantly differs. In the case of MOOCs, students may purchase

auxiliary products such as textbooks or certificates of completion and advertisers may pay for student data produced during MOOC study, but costs for students is by definition gratis. Note that unlike OERs, in which the content is licensed for use and re-use, the commercial MOOC providers are planning on developing revenue streams by selling their courses to educational, training and other organizations - thus the content is not open.

As per our previous discussion, there are certainly time and opportunity costs to both institutions and to the students involved in MOOCs. These costs help explain the "funnel of participation" (Clow 2013) noted by a number of researchers that shows that there are at least four different types of MOOC registrants (Hill 2013): the curious observers who register to see what the course or the content is all about; the auditors or passive participants, who listen to most of the lectures and may follow any discussions, but do not expend the time to complete assignments and write exams; the drop-ins, who complete some portion of the course, but do not complete the full requirements; and the active participants, who complete all of the activities and assessments. This later group is usually less than 10% of enrollments (Jordon 2013). As we have argued earlier, each of these types of MOOC participants are strategically using their time and financial resources to participate at a wide variety of levels within the MOOC.

MOOC Pedagogy and Interaction

If we examine the pedagogy of MOOCs, we see some quite different pedagogical types: xMOOCs (named by Stephen Downes after MiTx courses), cMOOCs for connectivist and later we add a model sMOOCs, which attempts to mirror and expand the social constructivist learning environment of typical LMS-based online courses. For each model, we look at the amount and costs of the three major types of student-centric interaction itemized in the EQuiv theories.

xMOOCs

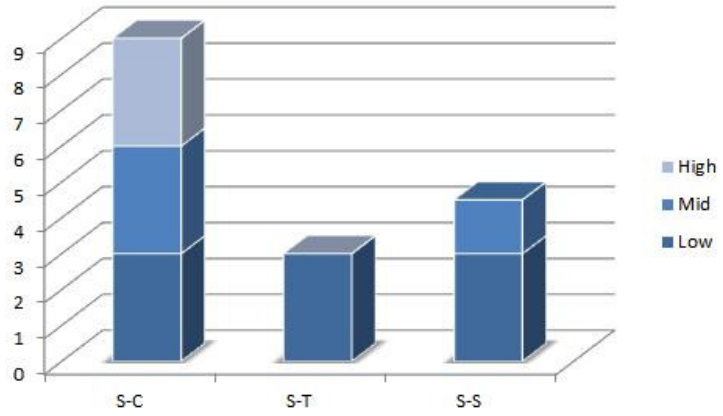
Most of the commercial MOOCs use a cognitive behavioral pedagogical model (Anderson, Dron 2011). This pedagogical model is marked by clear objectives, teacher direction and measure behavioral and cognitive psychology and learning theory. It has spawned a teaching and learning theory and practice that is often referred to as Instructional Systems Design (ISD) (see http://www.nwlink.com/~donclark/hrd/sat.html). This system has evolved and been molded by years of study and research on time and effectiveness of a variety of means to achieve measurable learning outcomes.

- **Student-Content interaction:** High. We see that the normal student–teacher interaction from the classroom has been transformed into student–content (the videos and quiz) interaction. A common design features a high prestige and experienced researcher/teacher who records video teaching sequences. These are often slide presentations that are annotated by the instructor, but can also include examples of "talk aloud" problem solving, interviews, video clips or other teaching techniques. The costs for production of this content has dropped to a level that recording video and creating quizzes can have as small or as great production skills and accompanying product expenses, as a provider can afford. Thus, the xMOOC can expand to "massive" sizes because student–content interaction is scalable and once created has very low delivery cost.
- **Student-Teacher interaction:** Low. xMOOCs may add student–teacher interaction to the design but the costs and lack of scalability present both technical and economic challenges. Massive Skype, or real time text, immersive or web conferencing are being explored, but scaling to 'massive' sizes creates vicarious interaction (Kawachi 2003, Sutton 2001) opportunities such as seen in a national call-in radio shows. In formal

education the student–teacher interaction over assessment and grading is highly valued, but again not very saleable. Thus, xMOOCs often use machine scored quizzes *(robo-grading)* to enhance engagement in the lectures or to help students assess their understanding of student content.

- **Student-Student interaction:** Low to Medium. The xMOOC providers are developing low cost ways to develop and support student–student interaction. Either or both asynchronous and synchronous interactions in text, audio, video and immersion can be used during scheduled learning sessions. However our experience has shown that much depends on the motivation of learners and inducement from the learning design to interact. The goal is to create "compelling but not compulsory" learning activities (Paulsen 2008). A critical mass of learners moving through a learning event together is necessary - and not easily achieved. xMOOCs with continuous enrollment courses (i.e. Audacity) can be problematic especially if numbers are less than massive. Besides machine assessed multiple choice and essay type assignments, there is great hope for student–student interaction that focuses on peer assessment. There is a great deal of evidence to support the learning value to both creator and the student–assessor of peer assessment. However, the logistics of building and maintaining the necessary level of encouragement and support (given full range of networking tools) remain challenges.

Figure 4: Cognitive Behavioural xMOOC Model



Social Constructivist sMOOCs

How massive must a MOOC be to provide effective and efficient learning? sMOOCs, an acronym either for Small Massive Open Online Courses or for Social Massive Open Online Courses, use a similar social constructivism pedagogy as developed in campus classrooms. Social constructivism stresses group interactions, team work, discussion, debate and collaborative creation of knowledge (Jonassen, Mayes et al. 1993). Attempts to scale this by increasing the size of a classroom or the number of enrollees in an online course have not been particularly cost-effective and thus, most of today's online courses rarely exceed 50 students per course. The model however may be particularly effective when soft skills, or learning to work effectively with others, is itself a major learning objective of the curriculum.

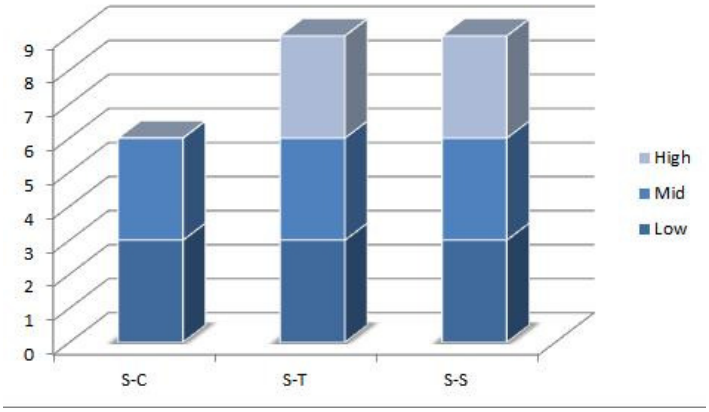
- **Student-Content interaction:** Medium. sMOOCs often are designed around, textbooks or a pre-set list of OERs, journal articles creating an online reading package. More recently use of videos is increasing, thus the cost and effect of student-content interaction is at a medium high level.
- **Student-Teacher interaction:** High. Learner expectation is for a high degree of teaching presence - both as a subject matter expert and as a facilitator of cMOOC experience. Thus teachers tend to find that teaching

sMOOCs is challenging and time-consuming.

- **Student-Student interaction:** High. Since the creation of trust within a learning community is highly valued in sMOOCs, there is a great deal of emphasis on opportunity and requirement for student-student interaction. Most sMOOCs are paced with defined start and completion dates. In many cases a cohort develops, which has been associated with higher completion rates as students learn to support each other.

sMOOCs are not as disruptive as their two other cousins partially because they have not been shown to scale easily and the pedagogical model from the classroom transfers relatively easily to these online courses - whether they be for credit and at a cost or as open MOOCs. They may be used as marketing, or service functions by universities, but there is a great deal of work needed to evolve sustainable revenue models for relatively high cost, low enrollment sMOOCs.

Figure 5: Social Constructivist or Small sMOOC Model



Connectivist Pedagogy cMOOCs

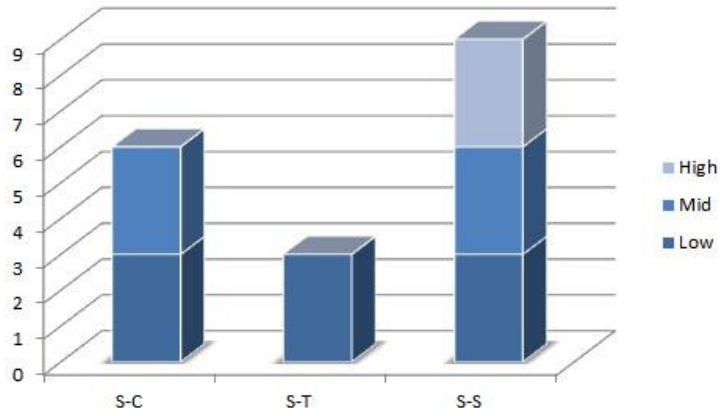
The original MOOCs were developed by Canadian researchers interested in developing new ways to teach and to learn on the Internet. George Siemens (Siemens 2005b) and Stephen Downes (Downes 2007) defined a new pedagogy based upon creating networked connections between and amongst students, teachers and content. Although not without its critics (see IRRODL special issue, edited by Siemens, 2011), Connectivism has emerged as a "pedagogy for the digital age" (Siemens 2005a) that focuses on network development, creation of persistent artifacts and emergence. cMOOCs achieve this by focusing on students creating and supporting their own personal computer environments, that are networked for learning.

- **Student-Content interaction:** Medium. Like sMOOCs, cMOOCs are often designed around textbooks or a pre-set list of OERs, journal articles, and multimedia, creating an online reading/learning package. Students are encouraged to add to this collection through referral or recommendation to other learners of networked resources that they have found useful and have built into their personal learning networks. Thus student-content interaction is at a medium high level.
- **Student-Teacher interaction:** Low. Student-teacher interaction is usually quite limited in a cMOOC. The teacher first is responsible for creating a variety of learning activities or events that learners are invited to travel upon, while constructing their own networks of resources, knowledge and relationships. These may be synchronous or asynchronous, but generally the teacher seeks to be co-traveler along a multifaceted path of knowledge construction. Learners are encouraged to become teachers themselves, sharing their constructed artifacts, publicly reflecting on their learning

journeys and building searchable paths through comments and critique of public and shared artifacts. Thus dedicated student-teacher interaction is minimal.

- **Student-Student interaction:** High. Since the creation of trust within a learning community is highly valued in cMOOCs, there is a great deal of emphasis upon opportunity and requirement for student-student interaction in the form of networked interaction. Most cMOOCs are paced with defined start and completion dates. In many cases a cohort of engaged learners develops (among again a minority of students) which has been associated with higher completion rates as students learn to support each other (Clarke, Erickson et al. 2005).

Figure 6: Connectivist, cMOOC model



EQuiv and MOOCs Summary

By examining these three models of MOOC through the lens of EQuiv interaction theory, we see that the xMOOC is most easily scaled up and the number of xMOOCs offerings and learners bears witness to the efficiency of this model. The sMOOC carriers much of the high cost of classroom or LMS supported e-learning models and promises to be a more expensive and likely time ineffective model - except when the development of group communications skill is a critical outcome. Finally, cMOOCs depend a great deal on student self-direction and motivation and allow little opportunity to delegate the organizational part of an education system to others. Thus, they may only appeal to that subset of the population who can and wants to play a very involved role in creating their own learning networks.

The diagrams above illustrate that all three models can produce high levels of quality interactive learning. However sMOOCs especially require more resources from delivery institution and cMOOCs require a great deal of student motivation and self-direction. These constraints may limit widespread adoption of these later models.

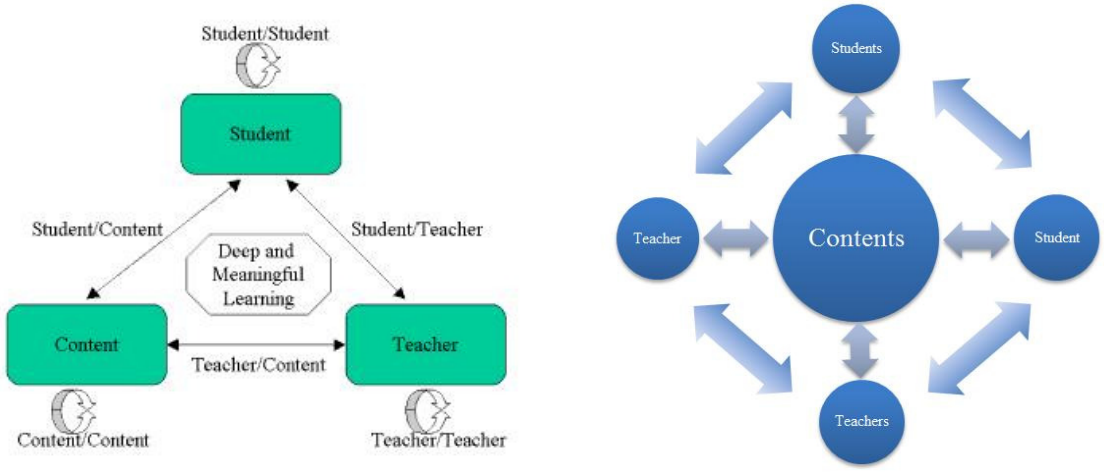
Discussion and Further Direction

From the EQuiv perspective, it seems apparent that "formal education" should and indeed must cost less if it hopes to survive in an era when alternative forms of free educational opportunities grow rapidly. However, "time is money" principle suggests that the time needed to achieve quality learning may remain consistent in the new era of learning. Additionally, this paper argues that there needs to be a higher level of a learner's control over his/her learning design by creating necessary *surpluses* as well as *reductions* in order to produce learning at the highest level of effectiveness and efficiency. For this to be achieved there needs to be a high quality of learning resources available and learner must be capable of highly skilled time management. In sum, the ability to *manage the cost and*

the time for learning is becoming extremely critical to formal students and lifelong learners in this emergent world of network enhanced learning.

What we witnessing in this digital era of learning is the concurrence of an ever-accelerating self-multiplication of the "content" for digital learning on one hand and the ever-growing feeling of powerlessness and unpredictability of "a teacher" for learning on the other. In this era of digital learning, the teacher and the student contact more and more indirectly via the digital content or platform. The "Modes of Interaction" (Anderson, Garrison 1998) in Figure 7 left may have captured and predicated is the transitional state of the "Three Types of Interaction" model (Moore 1989) to the progressive state of learning with the multiplication of students-content-teachers in Figure 7 right.

Figure 7: Modes of Interaction in Informal Learning Era



In this context of informal learning, how does formal education claim its raison d'être? The answer implied in this paper is to provide education that creates adaptable and affordable models of high-level interaction - but allows the learner to augment or choose adaptations that meet their constraints of time and money. Thus creating courses that are not only affordable, but can be individualized (Miyazoe 2008). In other words, use Thesis 1 and adhere to it. This minimalism seems to be a means for institutional survival in an ever-tightening world economy. Consequently, for learners who have acquired the skill of managing his/her learning, the formal educational system is losing its traditional status and authority as the only authentic education provider. It is time that we accept this challenge and recreate our institutions for service in a networked, lifelong learning context.

EQuiv Resource-Sharing

We have created an online portal that collects references and resources from studies relevant to the EQuiv (http://equivalencytheorem.info/) theory. We invite you to contact us for further information sharing and collaborative research projects regarding the development of the EQuiv.

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