Three Dimensional Model of Interaction: combining interactivity's three primary elements into a singular concept.

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Introduction

Interaction or rather interactivity in education has been discussed in great length, but no two authors see eye to eye on what should be a relatively straight forward process. Many authors have addressed interaction in the past and depending on their point of view and/or definition of interaction determined what interactivity is and how it should be used. Previous arguments made by the author (Interaction in Distance Education: the importance of pairing communication tools with learning objectives) have pushed the concept of responsibly designing interactivity into the educational curriculum. In a traditional classroom model interactivity is *assumed*. Most teachers are unaware that when they plan lessons and activities, hands on activities, essays, group discussions, even Q&A with the instructor that all of these elements are interactive. In fact, very little of what happens in traditional classrooms is NOT interactive. But when distance education courseware is designed only small parts or cross-sections of interactivity are *permitted* by the system therefore limiting the successful use of interaction. Douglas Harvey discusses this idea and points to a new "technology first" pedagogy that must be developed before designers can fully implement the objectives in an equal and quality way (Harvey, 2002). Simonson argues the need for a grounding theory (Equivalency) that will support an environment that will enable distance education to create and design for these new ideas (Simonson, 1999). It cannot be overemphasized the need for an underlying theory to guide and control the creation of educational curricula. But just using the theory of Equivalency and utilizing a "technology first" approach will not be enough. A proper understanding of interaction and its importance in the learning process must be gained to fully realize these goals.

This paper will discuss interactivity and how it truly is dynamic and that there is no 'one' way to build or design interactivity in the courseware. More to the point, once a true understanding of interactivity is developed an instructional designer, course developer, or instructor can integrate a proper level of interactivity into the courseware. This paper will present three elements of interaction, henceforth described as 'dimensions,' and demonstrate how each dimension can have levels that are not dependent on the other dimensions.

1. Time
    - Asynchronous – delayed communication.
    - Synchronous – instant communication.
    - Collaboration – can be both asynchronous and synchronous
2. Type
    - Student to Student
    - Student to Instructor
    - Student to AI or Media
    - Collaboration (three types)
3. Cognate
    - Declarative knowledge skills
    - Rule Following
    - Problem Solving skills
    - Expert Simulation and Demonstration.

Figure 1 – Three Dimensions of Interactivity.

Each of these types of interactions have been defined separately and in some cases in combination one with another. This paper will demonstrate that not only are all three dimensions a part of interaction but that each dimension is imperative to the success of the other two. The course designer must take into account all three dimensions of interactivity to fully utilize the benefits of interaction. The method in which a course designer/instructor would do this would be to start with an appropriate theoretical base or theory. Although there are numerous theories of Distance Education one theory, Equivalency, stands out from the rest and will be used for this discussion.

Theory of Equivalency

The Theory of Equivalency states that "distance education's appropriate application should provide equivalent learning experiences for all students – distant and local – in order for there to be expectations of equivalent outcomes of the educational experience (Simonson, 1999)." The Theory of Equivalency compares Distance Education and Traditional "On Site" Education and states that they should be fundamentally equal. According to Simonson, "Students should have learning experiences designed and made available to them that are tailored for the environment and situation in which they find themselves." He argues that we do not need to develop a new model for education but we need to provide the student with an equivalent education no matter what their location (Simonson, Schlosser, & Hanson, 1999).

Regardless of time or place of the learner "the goal of bringing about a change in student behavior" remains the same (Hoffman, Martin, & Jackson, 2000). Equivalency consists of five primary concepts: equivalency, learning experience, appropriate application, students, and outcomes. Equivalency aligns the learning experiences of online learners with those of on-site with the expectation that they will have the same resultant outcomes. The goal of learning experience is that even though different students, learning at different times, in different places the resultant outcome must again be the same. Appropriate application simply states that the learning experiences be suitable to the learner and that its availability be consistent with the needs of the learners. Students should simply be defined by the course that they sign up for, and not their physical location. Lastly, there are two categories of outcomes: first, instructor determined outcomes are usually goals and objectives that benchmark what the learner should be able to do at the beginning and at the conclusion of the learning experience.

Secondly, learner specified outcomes are generally more personal and are a reflection of what the learner feels they should have accomplished during the length of the course. One of the best ways to monitor learner specified outcomes is through attrition, how many student's move on to subsequent courses? Do they begin to apply the learning into their lives and work? "The more equivalent the learning experiences of distant learners are to those of local learners, the more equivalent will be the outcomes of the educational experiences for all learners" (Simonson et al., 1999).

A teacher in an on-site classroom selects appropriate discussion tools, such and Q & A and group work to help deliver the learning objective of the day. Sometimes the learning objective is also met through the appropriate use of lecture, video, the internet, or some other multimedia event. In every case the instructor chooses an appropriate medium or delivery system. In the case of Distance Education the instructor is often handed a delivery system such as WebCT, Blackboard, or sometimes none at all, and the has to make due with the available system whether or not that system accommodates the needs of the specific learning objectives. But if instead of examining current "delivery systems" and trying to recreate the "virtual university" using pedagogical rules created for traditional education, we design for the technology first. This would help produce a "new framework that would allow for design [of] online learning that begins with the nature of technology as its central assumption (Harvey, 2002)." Also, by utilizing the ideas and principles outlined in the Theory of Equivalency the instructor/course designer can examine the learning objectives and with proper knowledge of the use and practice of the aforementioned communication techniques to adequately deliver the message. One of

the fundamental properties of the Theory of Equivalency is the use of technology to enhance and make available interaction among learners and instructors.

The Need for Interaction

Interaction, whether student-student or teacher-student, is seen as one of the fundamental aspects of distance education (Juler, 1990). It is also essential to student learning and to the overall success of distance education (Hodgson, 1999). And it is considered to be a "great advantage" to the student because they can participate in a very flexible manner and even in real time conversations with their groups, each other, and even with the instructor. This increased level of interaction can help in developing a sense of "collegial interaction, immediate resolution to questions posed, and possibly a strong contribution to team building (Garrison, 1990)." Studies have shown that there is a connection between interaction and student learning and attitude. "Information must be shared, critically analyzed, and applied in order to become knowledge" (Garrison, 1990) Which in turn will help in retaining students for future interactions (Carr-Chellman & Duchastel, 2000). Some studies have shown that interaction in a distance learning environment lead to increased academic achievement (Lenning, 1999) as well as greater retention rates in distance education programs (Lenning, 1999). Geary (1998) found that in study after study, researchers continually found that interaction between the instructor and student was a key factor contributing to student persistence in Distance Education (39). Geary also states that interaction is a major factor in "positive course outcomes" as well as "persistence" therefore recent technological advancements that overcome time and place restraints should be investigated (41-42). Iinteraction is essential to Education whether or not it is Distance or Traditional Education (Flottemesch, 2000).

It is then essential that the instructor design interaction into the learning environment because "Quality distance education is dependent upon the interaction and participation of the learner, similarly as in face to face instruction" (Kruh & Murphy, 1990). This design must be intentional and should not just "happen" because certain technologies exist, but rather a certain type of interaction is needed to better achieve the learning goals of the instructor and a technology is used to meet a designed need. Online technologies have the ability to fully utilize interaction but it is rarely used because course designers are simply trying to 'recreate' the virtual university. With a "technology first" pedagogy course designers will be able to fully realize the "potential for online technologies to distribute knowledge and control as opposed to being mere media delivery mechanisms (Harvey, 2002)." It is critical that instructors in distance education settings utilize the technology and generally prepare and plan for interaction, since the very nature of the technology serves to influence interaction (Flottemesch, 2000). The goal then is to not just to inform the student or deliver content to them via the web, but to draw out opinions, knowledge, and problem solutions thus helping them to generate new knowledge (Berg, 1999). Interaction also leads to increased levels of participation and involvement on the part of the student (Whitworth, 1998). The advantages of interaction include a "more direct sense of collegial interaction, immediate resolution to questions posed, and possibly a strong contribution to the team building required to sustain future student interactions (Carr-Chellman & Duchastel, 2000) ." Therefore interaction is an important and inseparable part of the learning experience. It should also be fully understood so that it can be properly planned for in distance education. The Three

Dimensional Model of Interaction is an examination of the different aspects of interaction and how they influence one another.

Time

The dimensional element 'time' is divided into two parts: synchronous and asynchronous. Synchronous communication is two way communication and usually occurs in real or near real time. Common occurrences are face-to-face meetings, phone conversations, group meetings, telephone calls, chat, and audio conferencing. The great problem with synchronous communication is that in the distance education program it is often extremely expensive and laborious to implement. Two way television and Audio-conferencing are difficult to setup and maintain and usually still require the learner to travel to the site of the class instruction or monitoring station. Asynchronous communication is different in that it simply relies on mediated dispersal of information. Email, Bulletin Boards, etc are the most common forms of asynchronous communication and are widely used in distance education today.

A recent study comparing synchronous and asynchronous communication in ESL found that the results present in "synchronous discussions were similar to the types of interactional modifications found in face-to-face conversations." They also found that asynchronous communication were "more restrained" and closely resembled the "question-response-evaluation sequence of the traditional language classroom"(Sotillo, 2000). Their conclusions were that asynchronous and synchronous computer mediated communication (CMC) were fundamentally different and that they should be integrated to fulfill differing pedagogical purposes. The benefits of synchronous discussion encourage the students to "construct knowledge collaboratively", as well as increase

participation by people in subordinate positions, women, minorities, shy students, and the physically challenged. Proponents of CMC have also claimed that it encourages greater student empowerment, autonomy, equality, and enhanced critical thinking skills (Sotillo, 2000).

Because communicating with other people is a central part of education synchronous/asynchronous communication can help lead to deeper discussions, increased levels of participants, as well as continuity over time. One study demonstrated significant amounts of study to the technological abilities to help them achieve their goal of using CMC in the language learning classroom. They eventually found several CMC technologies that did work and were able to apply it to their learning environment successfully (Lee, 1999). Synchronous/asynchronous communication also will provide an environment that encourages role playing, conversation, and collaboration (Moller, 1998). Lastly, it cannot be understated that the instructor must take care to use and implement tasks, groups, moderation, and any other variables that will lead to heightened levels of quality discussion. "Merely instructing students to discuss a topic is likely to result in short superficial conversations with little educational value (Ingram, Hathorn, & Evans, 2000).

Collaboration

Collaboration is one of the essential social parts in the whole educational process (Palloff, 30) and it is a prime example of utilizing both synchronous and asynchronous models of interaction. It is also one of the foundational aspects of how we as a people communicate and it leads to and facilitates learning and retention (Lenning, 6). Our heritage in higher education is rooted in the traditions of the colonial colleges and is also

a direct descendant of the ancient Greek learning systems (Lenning, 9). But as "traditional instruction" changed to facilitate larger class sizes etc. our teaching methods came to be dominated by the lecture format. In some recent studies, the use of a collaborative environment in an onsite class at the University of Tennessee actually improved the quality of education according to the teacher (Burke, 2002). Collaboration has proved itself in numerous studies that it is valuable learning and to have "meaningful learning requires the learner to be actively engaged in cognitive manipulation of the instructional content" and that is best facilitated by a collaborative environment. Learners are more likely to take risks as well as enlarge their beliefs when supported by a community of learners (Moller, 2000). Our students will have these responsibilities in the workplace and in virtually every situation that they are in, and therefore it should be a required skill that is a fundamental part of any curriculum (Spector, 2000). The community in Distance Education has two primary functions (a) to provide social reinforcement and (b) information exchange. "Significant learning occurs when learners establish connection between the presented content and individual prior knowledge, and transfer it to new and relevant situations" (Moller, 1998). The review of the literature has shown that this type of interaction is not just "noise" or interaction for the sake of interaction but that it is "essential to the cognitive development of the students" (Moller, 1988).

Type

The second dimensional element is 'type' and it consists of following three parts: student to student, student to instructor, student to A.I. or system. Previously we have seen interaction commonly defined by the use of time. In type, the nature of interaction

that occurs while the learner is participating in the course is defined by the way the learner interacts with the curricula. Whether it be student to student, student to instructor, or student to system. The instructor or course designer must take into account the kind of interaction that will be taking place.

Student to student interaction describes a learning objective where the students are asked to communicate one with another. This could include, but is not limited too, students sharing thoughts in a 'clearing house' bulletin board or getting help one from another via email or chat (note email=asynchronous, chat=synchronous). Student to student could also be utilized by setting up communities where the students work with one another or as groups to accomplish specific tasks or objectives (note group=collaborative).

Student to teacher interaction describes interaction from feedback from a lecture or reading directly to the instructor, or taking a quiz on previously studied material. It would be safe to say that the bulk of our educational system is based off of student to teacher interaction at some level. It can also be argued that at some point in the education process their must be some sort of student to instructor interaction if only to demonstrate that learning has indeed taken place.

Student to artificial intelligence or student to system interaction is an enigmatic term that refers to the student's interaction with a system that is 'closed' and is independent of direct input from the instructor. This is illustrated not by common Distance Learning tools like WebCT or Blackboard but by a system that handles the feedback from the learner and properly guides the learner in the acquisition of new knowledge. It is possible to have a 'expert system' that so well duplicates the instructor

the student is unaware they are communicating with the system and not an expert. The best example of student to A.I. is full simulation. Major airlines use simulations to train airline pilots using equipment so realistic that it is possible to become certified to fly an airplane that the pilot when he/she has never been physically in that plane. On the other end of the spectrum is simulation 'games' such as Microsoft's Flight Simulator© that allows for a simulated experience but is not a full simulation of flying.

Cognate

The last dimension, Cognate, refers to the level of cognitive ability that is designed into the curricula. What is the end purpose of the interaction? What kind of knowledge is being sought after by the instructor, what are the end goals for instruction? In some cases declarative knowledge is all that is required; in others an in-depth analysis of the content is needed. Below is listed the four levels of cognitive ability.

1. Declarative knowledge skills
2. Rule Following
3. Problem Solving skills
4. Expert Simulation and Demonstration

Each of these is seen as stages and the logical progression is to advance from one to the other and it is not possible to skip any stage, therefore each has its place in the educational curricula. But each stage requires a different usage of interaction. If an instructor wished to use problem solving to develop cognitive skills, their must be considered the types of interactions that must be met to facilitate that. In a traditional classroom, an instructor can just rearrange the classroom and have a debate, this is more difficult in a distance education format. The interactive environment necessary to facilitate the objectives is present *by default* in the traditional classroom, but must be designed into the distance education environment.

The Model In Summary

The Three Dimensional Model of Interaction combines time, type, and cognate and states that they are all equal in importance. Each instructor must take into consideration all three parts of interaction. Can the learning objective be met by collaborating with fellow students, or does it require student to instructor? Should it be synchronous and require live communication of some sort, or can it be done asynchronously, and if so does it need to be email or bulletin board, etc.? What level of cognitive ability will it require, is the instructor wishing to have the students simulate a committee problem solving solution or just gather information for future use? In each and every learning objective all three dimensions need to be addressed. Once this happens the instructor then has a singular interactive formula that is unique to that learning objective. Each dimension is dependent on the other for success in the distance education world.

One concluding thought about the use of interaction in distance education. It would be unwise to just drop interaction in any form on a course and expect it too work. The instructor needs to understand the medium as well as the delivery method and seek sound training and advice. One study noted that most collaboration and thus interaction failed because of difficulty in using the tools that the course was utilizing. Not enough prior training was in place and therefore valuable cognitive energy and training efforts were spent on problems dealing with software rather than productive lessons (Maara and Jonassen, 2001). Another problem with Interaction is the temptation to use Interaction improperly or forcing its use when it is not necessary. Too much emphasis was placed on the amount of interaction and not on the quality of the interaction (Terwel, 1999).

Therefore it is extremely important that research into the different technologies be done so that proper application and integration can take place. It is not wise to just drop new demands onto an instructor and expect that they be able to use it in Distance Education.

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