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A Framework for Designing Interactivity into Web-Based Instruction

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Interactivity—engagement in learning—is crucial for success in Web-based learning. This article discusses five attributes of interactivity and presents a framework for instructional design to promote those forms of interactivity.

Interactivity has been defined in several contexts for Web-based learning. Hillman, Willis, and Gunawardena (1994) put it very simply as *engagement in learning*. Most can agree that interactivity is two-way communications among two or more persons. Garrison (1993) further suggests that the purpose of interaction is to promote explanation and challenging perspectives among two or more learners. The interaction itself is categorized within a *learning context* with the purpose of task/instructional completion or social relationship building (Berge, 1999; Gilbert and Moore, 1998), with a mixture of both types of interaction being common.

Moore (1989) classifies interaction as engagement in learning through (1) interaction between participants and learning materials, (2) interaction between participants and tutors/experts, and (3) interaction among participants. Northrup and Rasmussen (2000) take a similar approach in classifying interaction as (1) student to student, (2) student to instructor, (3) student to instructional materials, and (4) student to management [feedback]. The notion of adding management/feedback as one of the interaction strategies arose due to the need to close the communications loop on areas of instructional content, but also on general social communications.

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Until students receive a "reply" in some form verifying that what they sent was accurate, they typically are uncomfortable. Additionally, students may not be conceptualizing concepts in the manner intended. Interestingly, Yacci (2000) defines interaction through the lens of a student. Students must perceive that the message loop is complete, rather than the instructor assuming that it is complete. There must be mutual coherence for the message loop to be closed.

The idea of feedback as the indicator of completed communications is mentioned in several places (Berge, 1999; Liaw and Huang, 2000; Weller, 1988). Weller suggests that feedback occurs when learners actively adapt to the information presented through the technology, which the technology, in turn, adapts to the learner. Kulhavy and Wager (1993) suggest that feedback on incorrect responses assists in furthering individual learners' understanding of specific concepts.

Sorting out the instructional and social interactions that occur in a Web-based course, coupled with the types of interactions (student to student, student to instructor, student to content, and student to management/feedback), presents a challenge to designers of Web-based instruction. This article provides a framework of interaction attributes that can be used to select strategies and tactics to facilitate interaction on the Web. The framework encompasses five interaction attributes: (1) interaction with content, (2) collaboration, (3) conversation, (4) intrapersonal interaction, and (5) performance support. Each will be discussed, and multiple examples of how each fits within both a theoretical and a pedagogical context will be provided.

Types of Interactions

All interactions should involve complex activity by learners to include engaging and reflecting, annotating, questioning, answering, pacing, elaborating, discussing, inquiring, problem-solving, linking, constructing, analyzing, evaluating, and synthesizing (Liaw and Huang, 2000). The levels of interactivity include interaction between participants and learning materials, interaction between participants and instructors/experts, interaction among participants; management/ feedback communications (Moore, 1989; Northrup and Rasmussen, 2000) are embedded within both content and social interaction (Gilbert and Moore, 1998). Although content and social interaction are interwoven into highly interactive Web-based courses, each will be discussed independently to further explain the role of both forms of interaction in a Web-based course.

Content interaction is based on the theory of learning that is most appropriate to achieve educational outcomes within the course itself. In many Web-based courses, multiple layers of learning outcomes exist, thus suggesting that multiple strategies may be incorporated into the course. Some courses may include an intensive case study, while maintaining a weekly schedule of online lectures and discussion sessions. Other courses may adhere more loosely to a semester-long

simulation, with its outcome being an explanation of findings and events. It is difficult to prescribe one "best fit" for content interaction, given the wide range of possibilities available on the World Wide Web. It is important, however, to ground the design of the learning environment in solid theory and pedagogy, as distance learning has been criticized for having very little, if any, theoretical context (Moore, 1993). Hannafin, Hannafin, Land, and Oliver (1997) discuss *grounded design* as a context for dealing with the range of design decisions that best facilitate learning outcomes. Grounded design is defined as "the systematic implementation of processes and procedures that are rooted in established theory and research in human learning" (p. 102). Grounded design does not presume that one belief system is superior over another; it merely suggests alignment among the foundations, assumptions, and methods selected.

Social interaction is a key element in online learning. Given that the nature of online learning is *"anytime ... anywhere,"* the potential for isolation and frustration exists. The social interaction of the course must, at least initially, be designed into the course. Through collaboration and communication, the opportunity for learning more about peers and connecting with them in non-task specific conversation is more likely to occur. Although social interaction may have very little to do with a course, it is still valued as the primary vehicle for student communications in a Web-based learning environment. Non-task/content-specific social interaction may include conversation in a chat room, inquiries about used textbook purchases, or questions about using a new version of a piece of software.

Many aspects of social interaction, however, are directly related to the instructional outcomes of a course. For example, when collaborative teams of students work toward project completion, there is still the need for relationship building in the learning community. Relationship building is a necessary component of collaboration and communication and the perceptions of the efficacy of this type of social interaction can impact the learning outcomes of the course. By the very nature of social interaction, learners are directly able to foster content interaction (Liaw and Huang, 2000).

A Framework for Online Interaction

Interaction doesn't just happen. It must be *designed intentionally* into the Web-based course. Oftentimes, when Web-based instruction fails, it is because it was not designed well, not because the technology itself was inherently "bad."

It can be assumed that the more interaction, the better. However, the overuse or misuse of interaction strategies can lead to boredom, overload, and frustration (Berge, 1999). Additionally, it lessens the likelihood that students will be able to surmise what is "important," and once again, frustration may occur when students perceive interaction as online busywork. Gilbert and Moore (1998) suggest that the

more interactive the Web-based course becomes, the more complex it is to use. For novice distance learners, complexity may very well lead to more frustration and isolation. Future Web-based tools hopefully will promote collaboration and interaction online in a much easier to use format (Liaw and Huang, 2000). For now, designers of Web-based courses should weigh the *frequency* and the *quality* of interactions required that best facilitate the learning outcomes to be achieved, where frequency does not always equal quality.

A framework for online interaction is included below that provides five interaction attributes of an online course: (1) interaction with content, (2) collaboration, (3) conversation, (4) intrapersonal interaction, and (5) performance support. Embedded within each attribute are possible strategies and tactics that can be used to facilitate both content and social interactivity. The attributes of Web-based instruction should be filtered through the philosophy and pedagogy that is presumed appropriate for the course, preferably adhering to the grounded design approach suggested by Hannafin *et al.* (1997).

Oftentimes, lists of strategies and tactics are provided as design suggestions for Web-based courses. When suggested out of context, it is difficult to surmise how the online experience may be structured. For example, in a list that suggests threaded discussions be used, there is still little detail as to how they are to be used within the learning experience itself. In a more behaviorist notion, threaded discussion may be used to elicit responses to given questions. In a situated learning environment, threaded discussions may be used to discuss influences on the environment with a scientist in an attempt to determine why native plants are not surviving. Each interaction attribute will be discussed in relation to content and social interaction, bearing in mind that both interaction strategies are woven throughout a successful Web-based course.

Instructional Content and Interactivity

The instructional content is the central component of a Web-based course, as this is where new knowledge, skills, and abilities are presented. Whether students learn declarative knowledge or participate in a large-scale simulation, the way in which knowledge is shared sets the stage for all interactivity within the Web-based course. When given a choice, instructors many times will select [and design] instructional methods and techniques that are consistent with their theoretical and philosophical views.

Categorically, instruction is presented either through an instructor-centered approach [direct, formal instruction] or through a more student-centered approach. There are times when one style of instruction is better than the other. When the outcomes of instruction are to analyze, synthesize, or evaluate, or when ill-defined authentic problems are the focus, a more student-centered approach would best facilitate the learning outcomes. An instructor-centered approach

would work well for instruction that is procedural, declarative, or well-defined in role and definition.

Instructor-Centered Approach. Much of what exists online as Web-based courses appears to have a strong instructor-centered influence. In much of the instruction, *information* is presented, *examples* are provided, *practice* exists, and, in many cases, *feedback* is available through mentors and instructors. Examples of instructor-centered instruction include lectures presented via text and graphics online, through PowerPoint, and through audio-narrated PowerPoint lectures with note-taking guides.

Student-Centered Approach. Student-centered learning is appropriate for outcomes of instruction that are focused on analysis, synthesis, and evaluation (Berge, 1999). Land and Hannafin (1997) further suggest that student-centered learning provides "interactive, complementary activities that enable individuals to address unique learning interests and needs, study multiple levels of complexity, and deepen understanding" (p. 168). Using open-ended strategies for learning, such as situated learning, learners will actively construct meaning to determine how to proceed. This student-centered approach fosters a greater responsibility for learning and requires students to be more self-regulated in their approaches to learning. In some cases, scaffolding is provided that will facilitate self-regulation, thus providing strategies that students can use to create unique approaches to complex problems (Jonassen and Land, 2000).

Examples of student-centered learning in a Web-based environment include demonstrations, debates, simulations, role-plays, case studies, and discussion groups (Berge, 1999; Liaw and Huang, 2000; Paulsen, 1995). Rasmussen and Northrup (1999) propose that Online Internet Expeditions provide an optimal situated learning experience for students. In *Camp Habitat [http://mentor.coe.uwf.edu/camphabitat/]*, side-by-side with experts, students can explore native Florida habitats both virtually and locally to analyze the effects of humans on the environment (see Figure 1). While ongoing guidance is available through multiple sources to promote self-regulation, students actively participate in the expedition by posing problems faced within their environments, conducting investigations using various tools and communications equipment, and solving novel problems posed by their habitat. The Web-based expedition provides a framework that students can use as a model or as a source of comparative data for their own investigations.

In another example of student-centered learning, a Web-based Online Professional Development, *The Making of a Technology-Rich Classroom [http://mentor.coe.uwf.edu/onlinepd/mainpage.htm]*, provides a context for classroom teachers to use information and site-based examples of "model" teachers using technology effectively in their classrooms while filtering the models and examples according to their own classroom needs (see Figure 2). A framework is

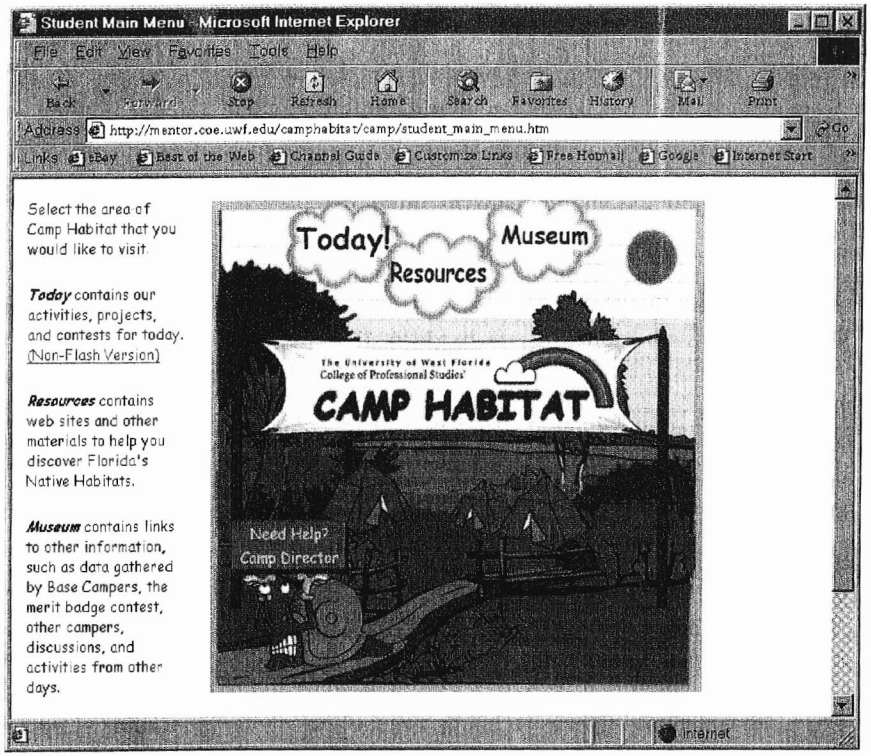

Figure 1. *Camp Habitat*

provided for assessing technology readiness, another framework is provided in planning for a technology-rich classroom, and much opportunity exists for conversation and collaboration with peers and expert technology-users. As a result of the professional development, teachers integrate technologies that are available to them in their classroom.

Collaboration and Interactivity

Designing collaborative online learning environments is an obvious strategy for promoting interactivity. Many of the same factors that exist for campus-based students in collaborative groups parallel collaboration on the Web. Topics such as group size, group role definition, group assignment, and shared grading all are issues as well on the Web. A collaborative group's members should be committed to the "group goal" and to maximizing each other's learning. Johnson and Johnson (1994) suggest very strongly that groups do not become collaborative just because

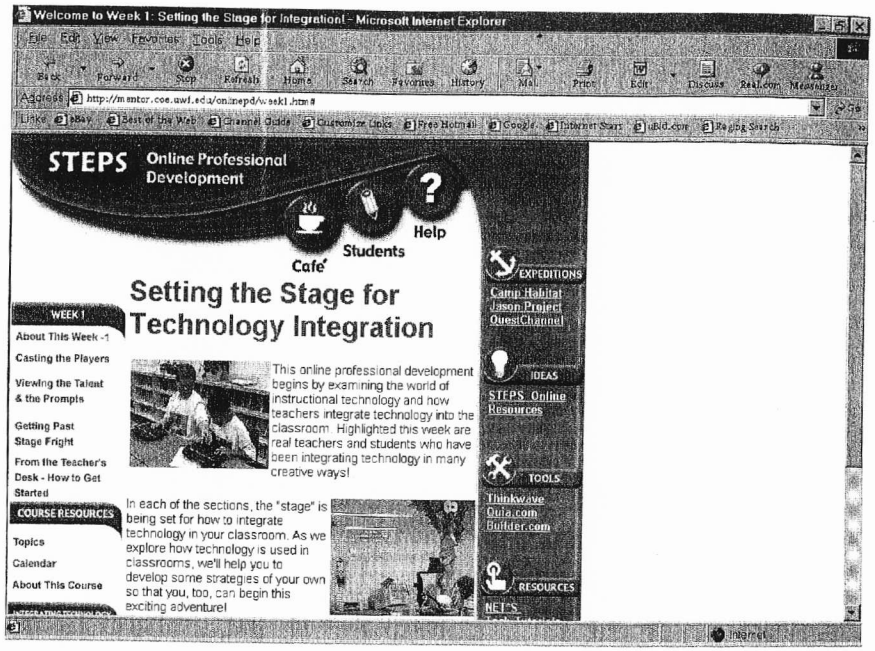

Figure 2. *The making of a technology-rich classroom*

someone assigns them together as a group. An effective collaborative group requires positive interdependence, group and individual accountability, promotive interaction, and interpersonal skills (Johnson and Johnson, 1994; Slavin, 1990, as cited in Frank, 1999).

Trentin (2000) proposes that quality can be obtained through highly interactive courses. Occasionally, however, a strong collaboration component in the course may hinder some students' participation. If, for whatever reason, some students are unable to participate in collaborative, group building exercises, those students may be left to communicate with only the instructor or mentor. Courses relying heavily on collaboration must indicate the collaboration requirement prior to class or alternative accommodations must be made for students unable to participate fully.

Conversation

Communicating online requires much clarification about the goals and objectives of e-discussion. Otherwise, students may not gain from the experience and the learning community will not form as intended. Many students complain about getting too much information online, not being able to follow concurrent threads in

a threaded discussion, and not being about to keep up with multiple conversations occurring in chat sessions. Despite some of the negative student comments, much can be said about conversation and e-discussion. Written communication seems to be more reflective, as students have more time to compose their thoughts and articulate in the manner intended online (Berge, 1997; Sherry, 2000).

To facilitate successful online conversation, Chism (1998, pp. 7-8) suggests six strategies (as cited in Sherry, 2000):

- *Building group coherence* by getting to know one another online. This form of social interaction will go far in establishing a comfortable environment and in establishing the community of learners.
- *Sharing information* by assigning collaborative groups to become resident experts in specific areas—then requiring the collaborative group to share its knowledge with others online.
- *Processing ideas* by elaborating on discussions, sharing cases, and asking questions of one another through listservs.
- *Online tutoring* as a tool for asking peers questions in preparation for an upcoming test.
- *Refining communication skills* by framing arguments and leading e-discussions.
- *Providing feedback to students* through peer critique and instructor critique online.

Engaging in both synchronous and asynchronous forms of conversation can extend learning online while motivating the online learner and extending the social interaction of the course (Sherry, 2000).

Intrapersonal Interaction

Monitoring one's own learning is essential for survival in a Web-based environment, even more so than in a traditional environment. Oftentimes, this element of Web-based design is not included, yet it is essential that learners work independently and can self-regulate their own learning. Many cognitive strategies can be embedded within a Web-based course, along with tips and ideas for time management and independent learning.

For example, a notetaking guide can be included in Web-based courses to assist learners in determining what is important. The intent of this notetaking guide is to be used as a companion to the RealAudio PowerPoint lectures provided weekly in a graduate instructional technology course. Additional cognitive strategies embedded within the context of this Web-based course are self-questioning, summaries, explanation of to-be-learned content, and standard times for completion of each of the weekly assignments.

Performance Support

Performance support is recognized as "... an electronic system that provides integrated access to information, advice, learning experiences, and tools to help someone perform a task with the minimum of support by other people" (Gery, 1991; Raybould, 1995). A review of the literature on EPSS suggests a series of goals and benefits of performance support, in prompting day-one performance. The basic premise of this just-in-time tool is to generate performance and learning at the moment of need, while assisting in building the knowledge infrastructure for-work that will be done in the future. Karat (1997) suggests four benefits of performance support: (1) enhanced productivity, (2) reduced training costs, (3) increased worker autonomy, and (4) increased quality due to uniform work practices. EPSS provides *cognitive training wheels* that can be progressively removed, as the performer no longer requires guidance and assistance.

In a Web-based course, retention will suffer if students are not supported throughout the course. Using the framework of EPSS, student support may include tools, information, advice, and learning experiences required to be successful online. When students are engaged in an online program and are truly "distance" students, there will be additional needs of financial aid, registration, library access, and more that must be woven into the Web-based structure. Many online providers encourage students to complete a pre-course tutorial on "How to Be a Distance Learner," while others provide online quizzes to determine if distance learning is "right" for the individual learner. However, in most cases, that is the extent of support provided to students, other than the heroic efforts provided by professors of disciplines like History and Accounting as they attempt to train students how to use chat rooms and reformat their computers. Yet their role should be to provide a rich experience for students in their content area, not to serve as the help desk. Distance learning *support* should be available "anytime ... anyplace," just as the advertisements suggest.

Supporting performance for the technical and even motivational components of the course is important and must be considered when a Web-based course is designed and presented. On university campuses, in industry, and in the military, Offices of Distance Learning may have educational materials for students, tutorials on how to use chat rooms, and Distance Learner student guides.

In addition to supporting entire programs at a distance, performance support can also provide in-course assistance. In Figure 3, SID, or Support for Instructional Designers, is included in a Principles of Instructional Design graduate course as a tool to guide first-semester designers in the design and development of their first instructional materials (Northrup and Rasmussen, 2000). SID provides advice in three areas: (1) Teach Me, (2) Show Me, and (3) Guide Me. In *Teach* Me, SID provides brief five- to 10-minute tutorials on each aspect of the Instructional Systems process (at a novice level). *Show Me* provides several completed examples of each

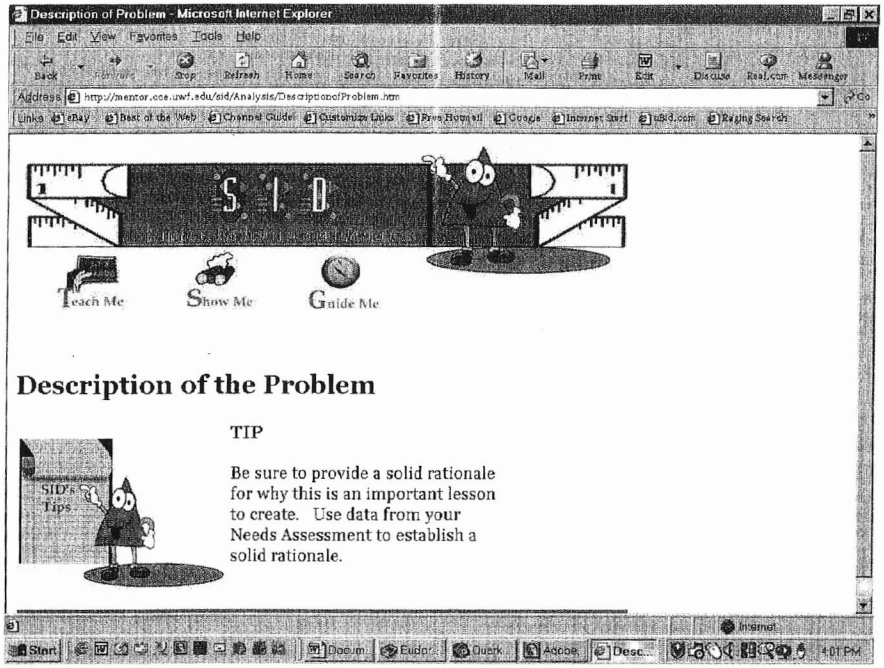

Figure 3. Support for instructional designers (SID)

step. *Guide* Me walks students through the process of creating three component objectives or conducting a learner analysis.

Conclusion

It is a given that interaction is valued as an important variable in Web-based learning environments. The design of interaction into a Web-based learning environment can present challenges, as too much interaction is perceived as busywork, while too little interaction is viewed as isolation. Both are frustrating to the online learner. The trick is to provide levels of interaction appropriate to the learning outcomes of the course, while constantly ensuring that the communications loop is perceived by the online learner to be "complete."

Within the context of social and instructional interaction, this article has presented a framework of interaction attributes that should be considered in the design of Web-based instruction. Attributes include (1) interaction with content, (2) collaboration, (3) conversation, (4) intrapersonal interaction, and (5) performance support. Performance support that provides information, advice, learning experiences, and tools to support learners "just in time" may alleviate many initial fears expressed by online learners. Once the initial fears are lessened, collaboration and conversation will begin to emerge.

Whether the course suggests a student-centered or instructor-centered approach, the quality of online interactions can promote successful learning outcomes. It is the responsibility of the instructor and even the institution to provide a learning environment in which the learner has the opportunity for appropriate interactions with content, the instructor, and other students (Berge, 1999; Moore, 1993). Additional consideration for feedback through interacting with a management/feedback tool should also be given.

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