

# Applying Research to Design Online Learning Environments

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## **Abstract**

*Online learning environments (OLEs) are at a stage where research in online learning and pedagogy can be used to influence the design and technical feature-sets of these software platforms. To date, most OLEs are technical modifications of existing discussion software, and not platforms built specifically with the on-line learner and facilitator in mind. Concentrating on the development of a text-based asynchronous learning network (ALN), we seek to harvest a number of best practices in on-line learning, supported by research; examine the technological and learner-centered affordances and caveats concerning OLEs; building an analytical framework with which to measure our progress in terms of creating social, cognitive, and teaching presences; and finally proposing a number of recommendations for the design and implementation of OLEs.*

## **1. Introduction**

Currently, most online learning environments (OLEs) have been technologies built for general discussions, but not explicitly for learning. We see technology integrations of “message bulletin boards” or “discussion forums” but very few tools focusing on practical inquiry, reasoned discourse, community building, and online pedagogical methods for asynchronous learning. Because of this, pedagogy has focused on teaching “around the technology,” rather than “with the technology.” With this in mind, we ask the

questions: Why not build technology for teaching and learning, rather than fit teaching and learning into technology? Moreover, why not take full advantage of the affordances, while being wary of the caveats, of technology to make teaching and learning online the most effective experience possible? Then, lastly, how can we align the design of an OLE with research on online teaching and learning?

To these questions, we first start by synthesizing the most effective contexts and methods of online learning, focusing on adult learning within a Teaching for Understanding framework, where we are also limiting our definition of OLEs to asynchronous learning networks, or ALNs. Secondly, we summarize the affordances and caveats of OLEs, looking to current research to explain in what cases online learning is most effective and how the technology can match and improve upon face-to-face learning. Next, we build an analytical framework with which to examine OLEs and guide the design of a new OLE that capitalizes upon research in teaching and learning online. Lastly, we will make concrete recommendations on how technology can be designed with the teaching and learning process at the core.

We are limiting our definition of OLEs to online platforms for asynchronous learning networks, or ALNs (cf. Hilitz and Goldman, 2005). ALNs are most commonly known as “bulletin boards” or “discussion forums,” where users can post their writing online, at any time, from any place, with no immediate time constraints (as would be the

case with synchronous communication such as “chat” or instant messaging (IM)). While there is much discussion regarding course management software (CMS)—which usually incorporates multiple course-management for individual students, classroom management tools, access to gradebooks, syllabus-building tools, and more—our angle is to concentrate on an essential but narrower tool within online learning. Due to their breadth of tools, CMSs also typically suffer from bloat and complexity—while the argument is outside of the scope of this paper, we feel that good design allows the selection of tools by the individual and not the “one-stop shopping” context of most CMSs. *OLEs should be tools, rather than toolboxes.* Also, while one of the affordances of online learning is the usage of multimedia, we are focusing on the text- and icon-based affordances within design, as we are not quite at the stage where rich, broadband multimedia is accessible for download and (especially) upload by the average learner. We also feel that quality teaching and learning can occur without “pushing the envelope” of technology—text- and icon-based OLEs are simply sufficient (cf. Garrison and Anderson, 2004).

## 2. Affordances and Caveats of OLEs

Mason (2002) summarized the “facilities” of online learning, framing the “new paradigm for learning”:

1. Multi-way communication among learners and between learners and experts.
2. Hypertextual rather than linear presentation of material.
3. Integrated access to resources both inside and outside the learning package.
4. Multimedia forms of interaction and presentation of material.

Expanding on each of these broad areas allows us to catalogue the affordances of

OLEs in creating educational experiences for a variety of learners.

### *The Affordances of Communication*

The ability for learners to communicate—at any time, at any distance—with other learners, with instructors, and with experts is one of the greatest affordances of OLEs. Learners are accommodated regardless of geography or schedule, especially with asynchronous communication. Furthermore, with this ability to communicate with others, either actively (e.g., message board postings, e-mail) or passively (e.g., profile information, demographics, transcripts of previous conversations), learners can create communities with other learners for social or on-going learning purposes. Various technologies to facilitate “social networking,” such as matching users based upon profile information, stated interests, or the content of their posts can bring users together for non-formal learning situations.

### *The Affordances of Organic Organization*

Learning within OLEs, as we will later discuss regarding the Teaching for Understanding and Community of Inquiry frameworks (Wiske, 1998; Garrison and Anderson, 2004), should be constructivist and generative through inquiry. In this sense, the learning is hypertextual in its organization, i.e., organic, where threads of inquiry and discovery sprout out along webs, instead of a purely linear, single-threaded direction. This organic organization allows adult learners to weave in their own variety of lifelong experiences and to make interdisciplinary connections with other subjects and classes.

### *The Affordances of Access to Information*

Being in an online environment, learners have access to the wealth of information on the Internet to supplement their learning. Beyond this, there is the access to the

information within the OLE, with functionalities such as search and navigation, guided by design usability. Deeper into the OLE, there is also the ability to embed assessment and monitoring of learning progress, feedback, and evaluation (Mason, 2002; Champagne, 2004). Teachers and students can provide immediate feedback and grading into the learning process. Monitoring of student participation and the organization of the posts for scanning, browsing, and printing can be streamlined. Rubric and evaluation criteria can be made public and easily accessible. Even the usage and performance of the technology can be tracked regarding the administration of the software and online services.

#### *The Affordances of Multimedia*

Though the text-based nature of OLEs, on the surface, seems to limit the media richness of learning, especially in comparison to face-to-face interaction, there is support that current students prefer the text-heavy interactions and that facilitation pedagogy can overcome these apparent deficiencies (Hilitz and Goldman, 2005; Collison, et. al., 2000). Beyond this, teachers and students have the ability to supplement their OLE experiences with multimedia from other platforms and applications. File-sharing (either via file-sharing networks, e-mail, or download/upload functionalities) of multimedia presentations or video conferencing are examples of how multimedia can engage and enrich the learning experience. As deliberated above and further below, the affordances of multimedia should be approached with caution to the limited accessibility and availability to the constantly burgeoning arena of multimedia applications.

#### *Caveats of OLEs*

Given the affordances explored above (and those not yet delved into or discovered), there are a number of caveats with which to

approach OLEs. Teachers must be aware of the ease with which students can—consciously or not—be prey to cheating and plagiarism in online writing (Mason, 2002). This can be countered by requiring students to use their own experiences in composing responses, apply their ideas to personal or otherwise real-world contexts, collaborate with peers within the class, or to actively negotiate the assessment process with the instructor (Mason, 2002). The Teaching for Understanding framework (Wiske, 1998), requiring the construction of knowledge through generative and formative processes with on-going authentic assessment, also helps control the temptation to cheat.

Since OLEs are at the moment heavily text-based, teachers and students must be facile in their ability to write effectively and demonstrate understanding through the written word. Furthermore, participants should be aware that the process of learning via written communication can be at times more demanding and time-consuming than physical face-to-face interaction (Garrison and Anderson, 2003). In the same manner, text-based learning can also be more generative, constructivist, and engaging to the individual learner (Garrison and Anderson, 2003; Hilitz and Goldman, 2005).

Lastly, while there are great temptations to take advantage of the multimedia affordances of technology, many of these functionalities are not yet widely available or accessible to many learners. Personal computer power, bandwidth considerations, software availability (due to purchasing and licensing requirements, as well as the ability to install and use a variety of cutting-edge applications), and access to multimedia hardware peripherals limit the current usefulness of multimedia.

### **3. Theoretical and Analytical Frameworks**

General pedagogy should embrace the recommendations of Teaching for Understanding (TfU), where learning

consists of:

- **Generative topics** that are relevant to teachers and students, and connectable across experiences and disciplines;
- **Understanding goals** that are explicit, relevant, and practical;
- **Performances of understanding** that allow “messing about” (i.e., open and risk-free), guided, practical inquiry, and culminating performances that demonstrate understanding in a holistic, differentiated manner; and
- **Ongoing assessment** that relates to understanding goals, values understanding, allows students and teachers to gauge their learning progress, with explicit criteria, and that is frequent (Wiske, 1998).

On top of it all, teaching and learning should be constantly assessed such that its nature is knowledge-, learner-, assessment-, and community-centered (Wiske, 2002).

Within each of these recommendations from TfU, online learning should be encouraged and monitored via Garrison’s and Anderson’s Community of Inquiry where three presences are developed amongst teachers and learners: social, cognitive, and teaching presences (2003). The characteristics and processes of building these presences will then guide us in evaluating design and usability issues amongst OLEs to narrow in on a set of recommendations based upon best practices.

#### *Social Presence*

The development of social presence is the conduit through which teachers and learners construct open, risk-free environments to explore and resolve their thoughts for generative understanding as a community (Garrison and Anderson, 2003). Social presence can be evaluated by examining indicators of affective communicative response that encourages learning amongst all the participants—the

usage of expression, language (especially for humor and play), and the inclusive nature of community conversations.

#### *Cognitive Presence*

Cognitive presence is more individually grounded, where learners walk through processes of practical inquiry, or “sustained critical discourse and higher-order knowledge acquisition and application” (Garrison and Anderson, 2003). This process of practical inquiry should be guided along four stages: a triggering event, exploration, integration, and resolution. An OLE should be designed to facilitate this progress in learning.

Beyond these stages of guiding practical inquiry, cognitive presence should be facilitated by the usability of an OLE: issues of access to the content regarding readability and scannability, navigation, and cognitive design (cf. Tufte, 2004). Issues of organizing content as a community also (browsing, categorization, community moderation) aid in fostering cognitive presence and generative learning.

#### *Teaching Presence*

Teaching presence is the design, facilitation, and direct instruction of cognitive and social processes for learning (Garrison and Anderson, 2003). The design and organization of the learning experience includes setting the curriculum and publishing the syllabus, communicating expectations and norms to learners. Perhaps the most important aspect of the online learning experience is the facilitation of discourse, which we will go into in depth below. Lastly, direct instruction—especially in the form of providing scaffolding for learning and at times in the form of expertise and direct guidance—is necessary for learners to construct the most effective learning experiences possible.

Implementation of the facilitation component benefits immensely from the

research of Collison, et. al., of the Concord Consortium, most notably with their manual, *Facilitating Online Learning* (2000). Through the process of Negotiating Space, i.e., experimenting with and negotiating “meanings and expectations in [the participants’] new virtual discussion area(s),” learners can develop voice and reasoned discourse through the guidance and moderation of the facilitator (Collison, et. al., 2000). With the goal of building a community with a culture of respect that engages in reasoned discourse, Collison, et. al., describe three phases that permeate through online learning experiences (which overlap and descriptively supplement Garrison’s and Anderson’s stages of practical inquiry): ice-breaking, “wallowing in the shallows,” and reasoned discourse. An OLE should be shaped to allow the progression and timing of these stages in its design.

- But beyond identifying another subset of stages in online learning, Collison, et. al., have provided techniques of manipulating “voice” to guide and encourage critical thinking, from social and argumentative dialogues to pragmatic dialogue, along the way to reasoned discourse and resolution (2000). To this, Collison, et. al., have outlined a number of voices to support facilitators fulfilling the role of the “Guide on the Side” (as opposed to the pedantic “Sage on the Stage”), which also serve to inform design of OLEs, such as understanding the role and technical ability to communicate voices such as that of a “generative guide,” “conceptual facilitator,” or “reflective muse.”

These three frameworks for presences can then be tweaked apart, then brought together and used as specific guidance towards developing and integrating technical features into OLEs.

#### 4. Recommendations for Design

Synthesizing the three above frameworks, we have settled upon the following major recommendations to scaffold design:

- Providing Proper Tools and Design for Cognitive Presence.
- Developing Social Presence and Community.
- Tools for Facilitation and Assessment.

##### *Providing Proper Tools and Design for Cognitive Presence*

For learners to develop cognitive presence, the text-based OLE must first be readable, scannable, and navigable.

- **Require subject lines for posts – also allow users to preface their longer posts with summaries.** Subject lines are essential for scanning, browsing, and navigating posts in a conversation. Furthermore, as writing is often a formative process for ideas, it may be useful to provide writers a chance—upon completing the main body of their post—to summarize their thoughts more succinctly and display this new writing as an excerpt or preamble to the longer, original response.
- **Use readable fonts and text-sizes – 12-point serif fonts.** Studies show that while 10-point Tahoma and Verdana were perceived as the most legible and preferred, respectively, 12-point Times New Roman offered the fastest reading times, and there is some evidence to show that Georgia (and serif fonts in general) may promote better comprehension (Bernard, 2003).
- **Use optimal line lengths for readability – 40-60 characters or about 11 words.** Shorter line lengths are easier to read than longer ones, as longer lateral eye movements provide more opportunity for users to lose their place in texts (Bernard, 2003).

- **Pay attention to color – use dark text on plain, light backgrounds.** Also, note that 8% of males and approximately 0.5% of females are color-blind—avoid using reds, greens, browns, and purples to distinctly differentiate text (Bernard, 2003).
- **Provide a Printer-Friendly layout option.** Many participants (facilitators and learners) prefer reading and scanning print-outs of conversations—provide a printer-friendly layout option that allows them to simply print out the text as whole, without graphics and navigation.
- **Use in-line expansion of conversations – a la Google’s Gmail webmail service.** When navigating discussions, it may be useful to see a list of respondents, subjects, and excerpts from the text and allow users to “click and choose” which posts to expand and collapse as they scan a discussion.
- **Provide constantly accessible, simple search – a Google site-search may be sufficient.** Participants desire and use search to find conversations that are useful to them (Nielsen, 2005).
- **Float prompts alongside conversations and posting areas.** Since the prompt is the “triggering event” that guides conversations, it should be visible as much as possible and easily referred to when learners are reading and writing within the OLE.
- **Use meaningful, proportional navigation.** Use font size and colors to code links to conversations based upon popularity (number of responses), age (how long ago was the topic started), and freshness (how recent was the last response). For example, larger fonts denote more popular topics; darker font colors denote more recently started topics; lighter backgrounds denote conversations with more recent

responses. 43Things (<http://43things.com/>), an online community based upon peoples’ goals, implements proportional navigation on its homepage.

- **Allow participants to “bookmark” conversations and posts.** Many times readers want to refer back to or “keep tabs on” certain conversations or posts. Allow participants to keep a record of “bookmarks” to refer back to in the future. Also, it may be useful to allow the “organic tagging” of posts—self-defined single-word descriptions so that learners can categorize posts according to their own, personal mental models. An example of organic tagging and bookmarking can be seen at the social bookmarking web site del.icio.us (<http://del.icio.us/>).

#### *Developing Social Presence and Community*

Social presence can be encouraged by the usage of tools to communicate emotions and moderate posts, creating robust and relevant profiles, and by encouraging social networking around ideas.

- **Allow participants to effectively communicate emotion and emphasis – provide access to emoticons and rich-text formatting (RTF) or HTML (font sizes, weights, and colors).** Many online message boards, such as PHPBB (<http://phpbb.com/>), allow RTF of posts via a toolbar.
- **Allow authors and community members to categorize and moderate posts.** When scanning a conversation, it is sometimes helpful to know the context and subjective quality of a post. Online communities such as Slashdot (<http://slashdot.org/>) allow moderators to score and categorize posts based upon content. In an OLE, community scoring should be discouraged, but moderation with pre-defined tags such as Insightful, Funny, Playful,

Informative, Interesting, or Tangential could be used.

- **Allow learners and teachers to color-code their roles.** As Collison, et. al., (2000) outlined six voices to negotiate online space, writers should have the option to clearly identify to other classmates what role they are playing in the conversation. For example, a student's name may be color-coded in gray for a generative voice, light blue for a conceptual facilitator, or pink if the student is acting as a muse. The same can be done for facilitators as well.
- **Participants should be able to create robust and relevant profiles with different "views" for their facilitator, classmates, and the public to see.** Profiles should contain biographical, personal, and contact information—protected by "views" where access is limited based upon the relationship to the user. Profiles should also display pictures—whether the pictures are headshots or other pictures representative of each participant. Profiles are useful to create community within classes, but also to meet other like-minded learners outside of the classroom—either by users' browsing through other member profiles or through technology that tries to make social connections between learners. Privacy must also be highly valued in all of these situations.
- **Create anonymous "water cooler" areas where ideas can be floated and questions can be pondered without constraint or risk.** Sometimes learning is a risk-taking endeavor; reduce the threat of risk or embarrassment by allowing learners to post anonymously in specific, non-assessed areas of the OLE. Also, allow users to create purely social places where informal learning

and community-building can take place (cf. Hilitz and Goldman, 2005).

#### *Tools for Facilitation and Assessment.*

One of the greatest sets of affordances for OLEs describes the ease of embedding facilitator-specific tools and assessments into the technology. We indulge these affordances and make the following recommendations for designing OLEs based upon our frameworks:

- **"Guide on the Side" facilitator posting – place facilitator comments directly to the side of learners' posts so that both can easily reference comments.** Learners should be able to constantly be able to reference prompts with ease, so the prompt should be "floated" beside posting and conversation areas. Furthermore, allow facilitator comments (and perhaps grades—viewable only by the logged in learner) to appear to the side of the posts in question.
- **Create a "facilitator's view" of conversations.** Examining what tools are desired by facilitators for understanding and assessing learners' comments, a facilitator's view should leave space where they can enter grades and make private notes in-line with the posts. A simple grading view could also be beneficial to create summaries of grades by individual.
- **Embed monitoring tools for facilitators – provide statistics of user posting patterns and summaries of individuals' participation.** It may be useful for facilitators to gauge when users are posting, as well as other statistics, such as average length of post or average time spent on the site, browsing, or writing comments. Also, summary statistics for individuals should be available for assessment and participation monitoring.

- **Create syllabus upload and creation tools.** For clear understanding of the course goals, as well as stronger teaching presence, facilitators should be able to upload course syllabi and, optionally, be able to create syllabi within the OLE. These syllabi should be constantly available, perhaps linked from top-level navigation according to which course a conversation is linked to.
- **Provide tools for uploading documents and links to external sources.** While it may be beneficial to provide uploading functionality for all users of an OLE, it is especially important that facilitators are able to easily upload documents from word processing or multimedia applications for learners to access. Also, there should be a section where facilitators can easily link to external resources for the benefit and convenience of the students.
- **Create areas for “office hours.”** When face-to-face opportunities are limited or non-existent, semi-synchronous “office hours” may be necessary. Synchronous communication may be desired, but there are software compatibility issues involved, and there tends to be a lack of deliberation in conversation when compared to asynchronous methods. Instead, by creating an “office hours” conversation during a limited time frame, learners can post questions and facilitators can respond to them under time constraints. Furthermore, in this manner, transcripts are available for learners who may not be able to attend these “office hours” sessions. If synchronous communication is required, third-party applications (IM) or web sites can be employed to fulfill the need.

## 5. Conclusion

*We must first rethink our educational approaches and begin to appreciate the powerful communication capabilities and potential to support the development of quality learning outcomes—not simply accessing and attempting to recall increasingly fragmented bits of information (Garrison and Anderson, 2004).*

Hilitz and Goldman, in their book *Learning Together Online* (2005), state “ALN software must be improved.” This study has been an effort to meet this request, by using frameworks for general learning and pedagogy as well as for online education, specifically, to guide the design of an OLE. By undergoing a process integrating WIDE World’s Design-based Research and by couching recommendations within the combined frameworks of Wiske’s Teaching for Understanding, Garrison’s and Anderson’s Community of Inquiry, and Collison’s, et. al., Negotiating Space and “Voice,” we hope to guide future designs of OLEs to the social, cognitive, and teaching benefits of online learners and educators.

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