An Online Social Constructivist Course: Toward a Framework for Usability Evaluations

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Abstract

There is a need for a holistic usability evaluation framework that accommodates social constructivist online courses. Social knowledge construction is at the core of such courses. These features may not be adequately evaluated using current frameworks. This qualitative research study examined the usability needs of a social constructivist online course. The intent was to identify elements of a usability evaluation framework specific to online social constructivist courses. Data was collected from an online course with 20 students and analyzed using phenomenography. The resulting analysis was compared to an existing framework for usability evaluations. One recommendation coming from the study was to classify usability concerns as either challenge or hindrance stress in order to eliminate hindrance stress and to appropriately select and pace challenge stress. Hindrance stress identified in this study arose from working across time zones, scheduling difficulties among collaborators, students dropping the course, and confusion of terminology. Challenge stress arose from interaction and collaboration with classmates, learning to navigate collaborative tools, and lack of examples of completed projects. Notably, the synchronous meetings were beneficial and effective at managing stress for some students.

Introduction

Usability evaluations are important for examining the flow and effectiveness of a course environment. Although traditional usability evaluations examine aspects like the ease of use and the look and feel of the course, it has been argued that instructional design features as well as the motivation to learn can, to a degree, be assessed using a usability evaluation framework (Zaharias, 2009). This paper examines the application of such a framework.
to a social constructivist course and offers suggestions for courses that hinge on synchronous and asynchronous interpersonal interactions.

**Objectives**

Usability evaluation is an integral part of the course design process (Cennamo & Kalk, 2005; Piskurich, 2006). However, the process of improving design through usability evaluation occurs more frequently in software and other consumer product development than in online course development (Fisher & Wright, 2010). Some usability evaluations for online courses may not address all aspects of the learners’ needs appropriately. When usability evaluation is applied to online courses, the learners’ pedagogical needs are not always addressed (Zaharias & Poylymenakou, 2009).

The following research question guided the study: How can a usability evaluation framework designed for constructivist online courses be used to support the needs of social constructivist online courses? The framework that guided this qualitative study was based on Zaharias’s (2005) usability framework for online learning, which combined Web design, instructional design, and Keller's (1983) motivation to learn.

**Theoretical Framework**

Zaharias (2005, 2009) presented a usability evaluation for constructivist online courses with asynchronous interactions. This usability framework went beyond traditional usability evaluations to include not just usability, but constructs to measure the instructional design and motivation to learn. Within this framework, the parameters and attributes are as follows:

- **Usability**: navigation, learnability, accessibility, consistency, and visual design
- **Instructional design**: interactivity/engagement, content and resources, media use, learning strategies design, feedback, instructional assessment, and learner guidance and support
- **Motivation to learn**: attention, relevance, confidence, and satisfaction.

Zaharias referred to these as functional connections, cognitive (learning) connections, and affective (learning) connections (Zaharias, 2009). This framework goes beyond task completion to review application of key principles of pedagogy and learning theory (Zaharias & Poylymenakou, 2009).

Zaharias (2009) offered the framework as a foundation from which to build. Alterations and adaptations were welcomed: “As Heller and Martin assert, this framework and the respective criteria can be ‘the floor not a ceiling for a series of guidelines that can be used to generate evaluation questions’ about an e-learning application” (Zaharias, 2009, p. 50).

In a social constructivist course, as opposed to a constructivist course, it is recommended that the usability evaluation take into consideration the social context of the course (Blandin, 2003). “A convergence appears between cognitive approaches and sociological approaches which advocates the importance of cultural and sociological context for determining ‘usability’ of tools, in both its restricted and broad acceptances” (Blandin, 2003, p. 317).

Social Constructivism

Social constructivism refers to the Vygotskian version of constructivism that includes collaboration with others as a key component. The zone of proximal development (ZPD) “is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers” (Vygotsky, 1978, p. 87). At its core, the philosophy behind a social constructivist course is that knowledge is created when it is shared. “Many versions of [social constructivism] maintain that objects exist only after they enter communicative space” (Keaton & Bodie, 2011, p. 192).

Additionally, in a social constructivist course, designers and instructors do not want to tell the students exactly what to do. Tam (2000) explained that the constructivist perspective “summons instructional designers to make a radical shift in their thinking and to develop rich learning environments that help to translate the philosophy of constructivism into actual practice” (p. 54). Students are often given a level of control over their own assignments while the instructor provides structure and scaffolding support (Tam, 2000). Assessment in a social constructivist course provides additional opportunities for student involvement. Students can work with their peers to evaluate one another’s work, which is expected to help the students foster a refined understanding of the content. This perspective means the designer and instructor relinquish some control of the course.
Usability and Stress

While in an online class and using a learning management system (LMS), students deal with both computers and communications (Brown, Fuller, & Vician, 2004), which can be challenging and contain uncertainty on their own. Individuals may experience computer anxiety, communication apprehension or a combination of both. Brown et al., (2004) proposed that different types of computer applications may cause different types of anxiety.

Anxiety has been shown to have a positive correlation with stress (Mughal, Walsh, & Wilding, 1996). Anxiety is the concept or feeling; stress is a stimulus (Sarason, 1984). Stress can be defined as “a physical, chemical, or emotional factor that causes bodily or mental tension” (Stress, 1999, p. 1164). Low usability can be a factor in causing anxiety (stress) and impact on motivation, but not all stress is bad. Stress is considered helpful for individuals to learn (Joëls, Pu, Wiegert, Oitzl, & Krugers, 2006).

In learning, LePine, LePine, and Jackson (2004) divided stress into two categories: challenge stress and hindrance stress. Using terms from a work-related stress study, challenge stress includes “demands or circumstances that, although potentially stressful, have associated potential gains for individuals [while hindrance stress can] tend to constrain or interfere with an individual’s work achievement, and which do not tend to be associated with potential gains for the individual” (Cavanaugh, Boswell, Roehling, & Boudreau, 2000, p. 68).

Examples of challenge stress included the number of projects, the level of difficulty and the amount of time needed to complete the work. Examples of hindrance stress included inability to understand class expectations, amount of time spent on “busy work”, perceptions that favoritism rather than performance affected final grades, and unnecessary obstacles encountered before completing a project (LePine et al., 2004).

Mendoza and Novick (2005) conducted a longitudinal study of instructors as they learned to build websites and found their frustration level decreased as they progressed from novice learners to experienced users. The researchers recommended studying usability past the initial stages of a course startup. At the beginning of the study, most frustration was as a result of user error. As the course progressed, causes of frustration shifted to users having difficulty finding advanced features in the software application (Mendoza & Novick, 2005). The more they learned, the more they wanted to learn. A social constructivist course may lend itself to inherently having a certain level of frustration in users as they interact with one another and with the course to progress towards mastery and expert achievement. Course designers may need to identify usability items as related to either hindrance stress or challenge stress when evaluating such a course. Totally eliminating stress in a course is not desirable, as it would indicate the learners are no longer learning.

Phenomenography

Phenomenography is a qualitative method that is "more interested in the content of thinking than is traditional psychology" (Marton, 1986, p. 32). Meaning, the process of cognition is not as important as the meaning of the thoughts. Phenomenography deals with people's perceptions of the world, rather than explaining the world itself. It is not based on an objectivist epistemology, but rather on a phenomenological epistemology (Sandbergh, 1997). "An effort is made to uncover all the understandings people have of specific phenomena and to sort them into conceptual categories" (Marton, 1986, p. 32). Briefly, the steps of the phenomenography method include:

- Semi-structured interviews or equivalent data
- Analysis of interview transcripts
- Categorization of description based on the meaning of the text
- Analysis of categories for hierarchical relationships (Marton & Booth, 1997).

According to Marton and Booth (1997), "In principle, there is no impediment to using published documents as data, or even artifacts of other kinds that in some way serve as an expression of the ways in which people experience some part of their worlds" (p. 132).

Phenomenographic analysis of student interviews was an important addition to content analysis by an expert (McCracken, 2002). Researchers showed that students in geology courses tended to have difficulty grasping the visualization and interpretation of three-dimensional maps (Edwards, 1986). McCracken (2002) examined how the learners in her study perceived this concept. The study found there was a disconnect between the instruction students needed in order to adequately comprehend the material and what experts thought the students needed; the lecturers involved in the study found students had not learned what instructors intended to teach them.

Based on these results, McCracken modified course objectives and sequencing of instruction. Results in the subsequent course offering showed an increase from pre- and post-test scores of 30% ($n=22$), with the four students who had the lowest pre-test scores showing the most gain.
Methods and Data Sources

Study Context

As stated above, this qualitative research study was designed to examine the usability evaluation needs of a social constructivist course. An online social constructivist course aimed to help teachers improve their basic online teaching and instructional design skills was selected as the context for the study.

The rich environments for active learning (REAL) instructional design model (Grabinger, Dunlap, & Duffield, 1997) guided the course design and grounded the course activities in social constructivist principles. Some argue that the REAL model supports social constructivist online instructional design (Robinson, Phillips, Moore, & Sheffield, 2014). The REAL model encourages meaningful student learning through five key attributes:

- Student responsibility and initiative
- Generative learning activities
- Authentic learning contexts
- Authentic assessment strategies
- Collaborative learning (Grabinger et al., 1997).

Participants in a usability study should be real users performing real tasks (Dumas & Reddish, 1999; Genov, 2009; Rubin, 1994). "The closer that the scenarios represent reality, the more reliable the test results" (Rubin, 1994, p. 179). The course was designed around two major projects in which the students worked in teams to design online learning units that each team would deliver to their peers. The authentic and collaborative nature of these assignments highlights the social constructivist aspects of the course. The course content, activities, and interactions were based largely in the Moodle LMS. Weekly synchronous meetings were also held through the web conferencing software Adobe Connect.

Rubin (1994) encouraged the use of rewards to motivate users. Motivation was a concern of the course designers because this initial offering of the course was free for volunteer participants. Attrition rates in such courses are especially high (Zaharias & Poylymenakou, 2009). Digital badges were awarded to students after the completion of certain tasks or challenges in an attempt to maintain or stimulate student motivation. These badges included metadata describing the evidence of the achievement, the skills or knowledge the learner needed in order to earn the badge, and the organization offering the badge. The badges functioned as a certification of achievement of certain benchmarks reached in the course.

Participants

Research indicated that usability testing works best when performed on four or five users (Nielsen & Landauer, 1993; Virzi, 1992), for both cost and results. However, the course design called for six student teams. In order to evaluate collaboration, community building, and social knowledge construction in the course, as well as to offer a cushion against attrition, 20 class members were recruited for the online course in this study.

Faulkner (2003) offered support for larger groups of participants in qualitative usability evaluations. She challenged the use of modeling to arrive at the recommended number of four or five users. She demonstrated with users instead of models the inadequacy of that number, showing that ten to twenty users found a higher percentage of usability problems.

The course was offered for free and without formal credits. Participants were recruited through Moodle forums, conferences, and the researchers’ social networks. All participants joined the course voluntarily. Participants were aware that they were joining a newly created course and that their participation in the course’s first offering would help to refine the course for future use. Participants also knew that the course and their participation in the course would be studied.

Participants in this study were adult professionals in the field of education. Some were teachers, some consultants, others worked for educational firms. Participants ranged in experience with online learning. Some were highly experienced and had taken and taught many online courses in the past. Whereas, others were taking their first online course.

Data Sources

Sources of data from the course included weekly feedback from the participants, discussion forums, and activities (e.g., quizzes, surveys, and assignments). These data offered a glimpse into the natural workings of the online learning environment as well as direct comments and questions from the users about the usability of the environment.
Data Analysis

A phenomenographic approach was selected to analyze the data. The categories of description and hierarchical relationships resulting from the phenomenographic analysis were compared and contrasted with the Zaharias (2009) framework for usability evaluation. First, the data from the course was exported and compiled into a spreadsheet in preparation for coding. Utilizing a computer program to randomly determine pseudonyms, all names of students in the course were replaced with pseudonyms to anonymize the data. The data were divided into thirds and coded individually by three researchers. The Zaharias framework containing 16 usability parameters was utilized as the basis for this first round of analysis. Each student question or comment was analyzed for placement into one of the 16 parameters. If stress was identified, an additional classification was applied: hindrance stress or challenge stress. These classifications comprised this first round of coding.

A second round of coding was undertaken in order to establish inter-rater agreement. The three researchers exchanged coded sections of the data. The initial codes and classifications were reviewed a second time. When disagreements arose, the researcher made comments on the codes and instances in questioned and suggested changes to the coding classifications as needed. Several meetings occurred during this time in which the researchers discussed various placements of categories and subcategories. This process allowed for consistency in categorical placements. The three sections of coded data were then combined for analysis.

Results

The parameters within the cognitive (learning) connections category contained the majority of instances overall, specifically within the sub parameters of interactivity, content and resources, and learning strategies design. The references and instances of both hindrance and challenge stress were highest within the learning strategies design parameter. This parameter offers a way to measure fundamental principles of learning theories and pedagogies (Zaharias, 2009). Among other things, the learning strategies design parameter allows for measurement of peer-to-peer interactions. Two of the descriptors under this parameter emphasizing peer-to-peer interactions are: 1) “The courses provide opportunities and support for learning through interaction with others (discussion or other collaborative activities)”, and 2) “The courses include activities that are both individual-based and group-based” (Zaharias, 2009, p. 52).

Likely due to the social constructivist nature of the course, the peer-to-peer interactions within the learning strategies design parameter featured prominently in the data set. The course offered opportunities throughout the 16 weeks for learning through interaction with peers and the instructor with the use of discussion threads and individual activities (asynchronous) and weekly online meetings in Adobe Connect (synchronous). Various authentic collaborative learning activities were developed for the students, including one extensive group project. Students expressed concern with:

- Working across numerous time zones due to the global nature of the group (hindrance stress),
- Scheduling difficulties (hindrance stress),
- Team members dropping out (hindrance stress),
- Inefficiencies of working collaboratively (challenge stress), and
- Lack of concrete examples of projects (challenge stress).

In this course, students were allowed to self-select their groups. Instructors did not control for the time zone differences and allowed participants from around the world to enroll. The challenges that this brought to the group activity may have been a hindrance for some students to complete the course.

Some of the student statements referencing interpersonal interactions could have been classified under more than one framework classification. For example, one student described anxiety about working in a group. This statement could have been placed under learning strategies design (cognitive connection) or satisfaction (affective connection). Similarly, one student requested an earlier deadline for choosing collaborative partners. The interpersonal interaction aspect of this comment aligned with learning strategies design (cognitive connection) while the procedural side of this comment aligned well with content and resources (cognitive connection): “Content is organized in an appropriate sequence and in small modules for flexible learning” (Zaharias, 2009, p. 52). In another example, a student suggested the enabling of emoticons in the discussion forums to assist in conveying tone and intention behind comments. The interpersonal interaction aspect of this suggestion fit in learning strategies design (cognitive connection) and, at the same time, the technical recommendation fell under visual design (functional connection).

The parameter with the second highest coding instances was content and resources. This parameter measures the quality of written and otherwise represented ideas in the course using “criteria such as credibility,
accuracy, objectivity, coverage and currency” (Zaharias, 2009, p. 47). In this course, content was organized in weekly modules and resources were contained within online books. Learning objectives were provided for the students at the beginning of each online book. Links to readings and assignment instructions were also included in the books.

One area of importance noted by students within the content and resources category was the terminology used by the course designers. Confusion of terms was considered by the researchers as a hindrance stress. There was confusion over the terms assessment, evaluation, peer review, and rubric. Students from different parts of the world had different understandings of these terms. The instructors and students worked together within the discussion forums and synchronous meetings to clarify the terminology and to come to a common understanding of definitions.

Another prominent theme in the data was the challenge stress of learning to effectively use new technology tools incorporated into the course. This challenge stress fell under several framework parameters including learning strategies design, navigation, and visual design. The technology tools discussed in the data were the breakout activity in a synchronous meeting using Adobe Connect and the discussion forums, database activity, and workshop activity in the Moodle LMS.

Positive feedback

The amount of positive feedback noted by students throughout the 16 weeks emerged in the analysis of data. In particular, the students expressed positive feedback for the synchronous sessions and found value in these meetings for tying the activities together and clarifying expectations. One student explained that these meetings were grounding and helped the student remain accountable and connected with the teacher and peers. It was also noted that the synchronous meetings were excellent for collaborating and allowed students to talk through things in voice rather than text. A smaller number of comments described the synchronous meetings as a waste of time. Presumably, those without questions benefited less than those in need of clarification. Additionally, students were pleased that the instructors emphasized pedagogy over technology. Students also appreciated the amount, level of, and promptness of feedback.

Discussion and Conclusions

Usability evaluations may benefit from the identification of hindrance and challenge stress (see Figure 1). Usability concerns that result in hindrance stress should be mitigated while those resulting in challenge stress should be appropriately supported and paced.

![Usability Evaluation Framework](image)

**Figure 1.** Classification scheme for analysis of student experiences.
Hindrance stress detracts from the learning experience. It prohibits the learner from progressing efficiently. The concept of hindrance stress is well aligned with traditional usability evaluations. Hindrance stressors build barriers to achievement of the goals and objectives of a course. These stressors should be identified and reduced whenever possible. As this study indicated, hindrance stressors might include working across different time zones, scheduling difficulties among collaborators, students dropping the course, and confusion of terminology. Course designers should be sensitive to students’ geographical locations and make accommodations so that students can work without excessive stress from geographical barriers. Course designers should also be aware of differences in language usage. A course glossary might be included to alleviate conflicting interpretations of terms and to raise awareness of the different uses of terms. Course designers should make a plan for adjusting or reallocating collaborative work in the event that students quit the course prematurely.

Further, course designers should not underestimate the energy and time required to build relationships among classmates to the degree that students can satisfactorily and effectively collaborate. For some students, limiting the number of people in a collaborative group may be beneficial. They may benefit from working in an online synchronous meeting setting where voice and video options can enhance the collaboration. Other students may prefer and benefit most from working independently. Likewise, Zaharias and Poulymenakou (2007) noted that “catering for cultural diversity seems imperative in the design of e-learning courses or technologies for international use” (p. 748). The approach to grouping students is something to consider for course designers and instructors.

At the same time, usability evaluation should examine and evaluate the intensity of challenge stress. Pacing challenges could be thought of as scaffolding: giving learners manageable challenges that increase in difficulty. As the challenges become more difficult, the learners gain more understanding, skills, and the confidence that allows them to tackle larger challenges with a tolerable stress level. The challenge stress experienced by the learner should remain more or less constant as the challenges increase. Carefully paced challenge stresses may balance feelings of frustration with motivation to overcome challenges.

The concept of challenge stress is perhaps better associated with learning theories and pedagogy than traditional usability evaluation. Zaharias (2009), however, argues that the assessment of pedagogy implementation should be incorporated in a usability evaluation framework. The implications of this study indicate that instructors should consider limiting and pacing the challenge stressors they introduce to the class. Students who are new to online learning may experience excessive stress due to the challenge of learning in a new environment. Many tools exist to support social constructivist collaboration; however, students may feel overwhelmed by the technology and learning how to effectively use a large number of different tools. These students may not benefit from a myriad of tools for collaboration (e.g., wikis, databases, discussion forums). Instead, frustration and dissatisfaction may result from such a high learning curve. Adequately training students to use the tools is expected to improve students’ success and satisfaction in an online course. Thus, the best teaching tools for the job are only the best if their use does not overly stress students. Reducing the variety of tools along with heavily supporting the collaborative learning activities in a social constructivist course may improve the pacing of challenge stressors. The results of this study suggest limiting and pacing the amount of social interaction and collaboration tools in an online course.

Additionally, the findings of this study suggest that synchronous meetings may be beneficial in supporting students as they are introduced to assignments and as they collaborate. Synchronous meetings allow students to voice their thoughts and concerns and receive immediate feedback. Additionally, instructors and more experienced peers are on hand to help students having technical difficulties. Incorporating synchronous meetings may help instructors manage stress experienced by students.

Further research towards a framework of usability attributes to evaluate a social constructivist online course may help instructors meet evaluation needs in ways that better support the nature of social constructivist courses. Examining usability through the lens of challenge and hindrance stress sheds light on the type and import of problems and struggles that students experience in an online course. Identifying hindrance stress in order to eliminate barriers to learning fulfills the traditional role of usability evaluation. Identifying challenge stress in order to understand the foundation and nature of the anxiety experienced by students, so the pace and context of information can be most effective and efficient under the circumstances, helps to bring learning theories and pedagogy into the realm of usability evaluation.
References


