Developing an Online Learning Community for Engineering, Cooperative-Education Students: A Design-Based Research Study

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Abstract

Cooperative education is a learning model that integrates theory and practice by having students alternate work and school terms. Limited research has been done to assess or enhance learning through cooperative education. Technical engagement of students at work might be one method to enhance learning. The purpose of this study was to create a theory-informed design of an online learning community for engineering cooperative-education students and to refine the underlying learning theories on which the design was based. A design for an online community was developed and is ready to be assessed for its affect on student learning through work.

Keywords: Work-integrated learning, technology, community, reflection.

Work-integrated learning is an important educational model that has been utilized for many years. Apprenticeships, internships, practica, and cooperative education are common models of work-integrated learning. These models typically require students to participate in full-time, career-related work experiences for one or more terms as part of their formal education. The experience gained is valuable to the students' education, but as Dewey (1938) noted, experience alone is not an education. The problem with many work-integrated learning programs is that the work experience is an autonomous entity that is not thoughtfully integrated into the students' overall education (Marsh & Triseliotis, 1996). Many studies have found that students feel isolated, disengaged, and disconnected from their peers or their institution (Casey, Bloom, & Moan, 1994; Cohen, 2000; Mayer, 2002, Scherff & Paulus, 2006; Schlagal, Trathen, & Blanton, 1996). Even as its own entity, the work component is not fully realized as a learning mechanism. Eames (2000) noted that

the inability to place cooperative education on a sound educational basis has prevented the recognition of work-experience components as learning opportunities. Johnston, Angerelli, and Gajdamaschko (2004) believe that the field of experiential education risks becoming "nothing more than a job placement mechanism with limited intentional and mediated educational value — nonessential to the goals and objectives of the institution in which we reside" (p. 158) if it continues to ignore the pedagogical aspects of work-integrated learning. This begs the question of how educators can enhance the value of work-integrated learning.

One possible method to enhance student learning through work is through technical engagement by developing an online community. Current technology makes student engagement a viable task whether students are working locally or remotely. Many technologies are available to engage students in a variety of ways. Three studies found that technical engagement showed some student-perceived effect on practical knowledge (Canale & Duwart, 1999; Witmer, 1998) or perceived learning through collaboration and reflection (Canale & Duwart, 1999; Hayward, DiMarco, Kranz & Evans, 2001; Witmer, 1998).

A closer examination of literature about technical engagement of students at work revealed several gaps. For example, although different types of technology, such as e-mail, discussion boards, blogs, course management systems, and virtual communities were examined (e.g., Hatton & Smith, 1995; Paulus & Scherff, 2008; Roberts-DeGennaro, Brown, Min, & Siegel, 2005), none of these studies used an informed-design process to develop or enhance the use of the technology. The majority of the studies only considered one technology (e.g. email, discussion board, blog) and not an environment that incorporated multiple technologies. The research was not grounded in a theoretical framework. The research samples tended to be female-dominated, non-technical majors (e.g., Goos & Bennison, 2004, 2005; Hough, Smithey, & Evertson, 2004; Keegan, 2007). Only one study by Canale and Duwart (1999) was completed with engineering and computer science students.

Purpose and Research Questions

Based on the gaps in the literature, the purpose of this study was to create a theory-informed design of an online learning community for engineering, cooperative-education students, and to refine the underlying learning theories on which the design was based. The research questions posed were:

1. How can students', employers', faculty, and field experts' prior knowledge and experience be considered in the online community design?
2. How can students', employers', faculty, and field experts' design ideas and experiences using the online community influence the design of the community and the underlying community design theories?

Theoretical Framework

The theoretical framework used to develop and assess the online learning community was the model for community-based online learning developed by Palloff and Pratt (2007). The community-based online learning model brings elements from communities of practice theory (Lave & Wenger, 1991) together with elements specific to virtual communities with an emphasis on social collaboration and reflection. The development of community and social presence in a distance-learning course is the key to successful delivery of an online course (Picciano, 2002). Preece (2000) indicated that purpose, policies, and computer systems are needed to develop an online community. Building on this model, Palloff and Pratt (2003) believe that additional elements are needed to form an online *learning* community. The model has evolved over the years and currently includes the elements of people, purpose, and process with the outcome of reflective/transformative learning.

People. Social presence and interaction/communication are key factors (Palloff & Pratt, 2007). Social presence is the degree to which a person is considered "real" based on their behavior online (Polhemus, Shih, & Swan, 2000). The degree of social presence positively correlates to the degree of social interaction among participants (Stein & Wanstreet, 2003). Social presence supported by social interaction also reduces the possibility of learner isolation (Palloff & Pratt, 2007).

Purpose. The purpose element encompasses the ideas that an online community must have goals/purpose, and include the framework that allows students to focus on the purpose. This framework encompasses the practical considerations of the design and delivery of the online community, such as the amount of time students are involved, the sense of safety and security, and the rules and guidelines that govern their behavior.

Process. The process category includes the elements that drive reflective/transformative learning and social/constructivist learning (Palloff & Pratt, 2007). For example, an online community for learning must include features to promote social interaction and collaboration to support knowledge construction. In addition, reflection is needed to help students recognize learning or development needs. Reflection may lead to transformative learning, which is the interpretation of experiences, ideas, and assumptions gained through prior learning (Mezirow, 1990).

Method

Methodological framework. A design-based research methodology was used to create an informed design for the online community. This methodology stems from the works of Brown (1992) and Collins (1992). According to the Design-based Research Collaborative (2003), design-based research should take place in an authentic setting, result in the development and refinement of a learning environment, and lead to sharable theoretical frameworks and practices for instructional design.

Research design. Over a 9-month period, participants engaged in an iterative development-and-evaluation process of an online learning community for engineering, cooperative-education students. Throughout the cycles, the researchers examined how the development of this community for this unique educational setting (i.e., work-integrated learning) and its learner needs may affect the underlying theoretical model of community-based online learning.

Sample. The convenience sample was comprised of engineering students, departmental, and co-op faculty at a large urban Midwestern research university, employers who oversee an engineering cooperative-education program or supervise engineering students at their company, and field experts (faculty and staff from different colleges and universities who advise co-op and internship students across a variety of majors) (see Table 1). Ninety-three participants were recruited for Cycle 1, 52 were retained for Cycle 2.

Table 1. *Sample – Cycle 1 and Cycle 2*

Sample	Cycle 1	Cycle 2
Students	30	16
Faculty	14	9
Employers	39	20
Field Experts	10	7
Total	93	52

Data sources. The two main data sources were focus groups and surveys. For Cycle 1, focus groups were used only for faculty and field experts. Students, employers and a few faculty members completed a survey in lieu of participating in a focus group. The survey was posted online. The focus groups and the survey used the same questions with slight grammatical variations to better suit a survey format or a focus group (see Appendix A). For the Cycle 2, all participants answered an online survey (see Appendix B).

Procedure. For Cycle 1, all field experts participated in an hour-long focus group during a national co-op and internship conference. Most faculty members participated in an hour-long focus group in a university conference room. Students, employers, and additional faculty members completed an online survey. For Cycle 2, the first step was to build a prototype online community. Next the participants logged into the online community with a visitor account, reviewed and tested the prototype community, and completed a survey about its design and objectives.

Analysis. For Cycle 1, the focus group discussions were transcribed and compiled with the survey data. For Cycle 2, the survey data were downloaded and compiled. Content analysis was used to analyze the written and oral-communication data (Fraenkel & Wallen, 2003). This process involved determining coding categories based on the theoretical framework, categorizing the data, and using both frequency counts and themes to organize and synthesize the data.

All responses were assigned an alphanumeric identifier that indicated the participant status (e.g., faculty, student, field expert or employer) and gender. All comments were compiled into the theoretical model categories of people, purpose, and process (see Table 2 and Table 3). Two additional categories were created: "other relevant" and "other irrelevant" (see Table 2 and Table 3). Comments in each category were sorted into reoccurring themes.

Findings cycle 1. Cycle 1 addressed the first research questions of how students', employers', faculty, and field experts' prior knowledge and experience could be considered in the online community design. Table 2 shows the results of this analysis.

Table 2. *Cycle 1 Focus Group: Rank Order and Number of Comments for Each Model Category*

Category of Comments	Number of Comments	Rank
	Total	Total
Process	442	1
Purpose	321	2
People	297	3
Other Relevant	53	4
Other Irrelevant	107	
Total	1220	

Process. The greatest number of comments from participants was in the area of process. Participants suggested design ideas to enhance or incorporate professional collaboration and reflection in the online community such as synchronous and asynchronous discussions, event posting, internal messaging, e-mentoring, creating shared knowledge such as a wiki or a file share, networking or developing networks, and group projects and more social features such as posting birthdays.

Purpose. Surprisingly, only a few participants, primarily faculty, indicated the importance of having a purpose, value, or goal for the community to get students interested. For example, one faculty member noted "if those courses do not provide some kind of values to students back here on campus then there would not be much interest on the part of students in doing it."

The largest category of comments in purpose was the practical considerations for the design of the community. Participants noted privacy/security and the ability to customize these, time needed or allotted for participation, including when during the day community access should be granted (since students are at work), the issue of spam or unwanted contact or content, and the need for the community to be easy to use. For example, a female employer noted, "It would be nice to have a reminder on the site that students should not access it during work hours."

The last category of comments was about the protection of employer intellectual property and student information as related to the Family Educational Rights and Privacy Act (FERPA).

People. The people category was dominated by comments of being connected or making connections and wanting to be "in the know." It was a theme of defining oneself through connections, networks, fan groups, photographs, and getting event/insider information through these connections. Participants also noted that the site could provide connection to the university or to peers as a way to alleviate isolation.

One reoccurring theme not mentioned in the model for community-based online learning was the concern about over-sharing: Sharing too much inappropriate information. For example, one female faculty member commented, "sometimes you see things you don't want to know or people really wouldn't share in another venue."

Other relevant. Two categories of comments emerged that did not fall into other categories: Concerns about student communication skills and concerns that there are too many networking sites.

Only faculty and employers commented about student communication skills, specifically how this community may not benefit students with social anxiety or oral-communication issues as it provides another avenue to keep students physically disconnected. For example, a male employer commented:

> *I personally think that today's youth, and many adults, hide behind texting, e-mails, MySpace, etc. No one picks up a phone or talks face-to-face. This is a VERY important part of the working world and we need to stimulate that by making them communicate at work and school verbally. We don't want them to sound like idiots when they open their mouths. The more verbal communication they do, the easier it becomes and teaches them how to deal with the "butterflies" of speaking in front of groups. Technology is great, but we can't let it consume our lives.*

Findings cycle 2. Cycle 2 addressed the second research question of how participants' design ideas and experiences using the community influence the community design. More than 800 comments were collected from the participants in the second cycle. The summary of comments by category is shown in Table 3.

Table 3. *Phase 2 Survey: Rank Order and Number of Comments for Each Model Category*

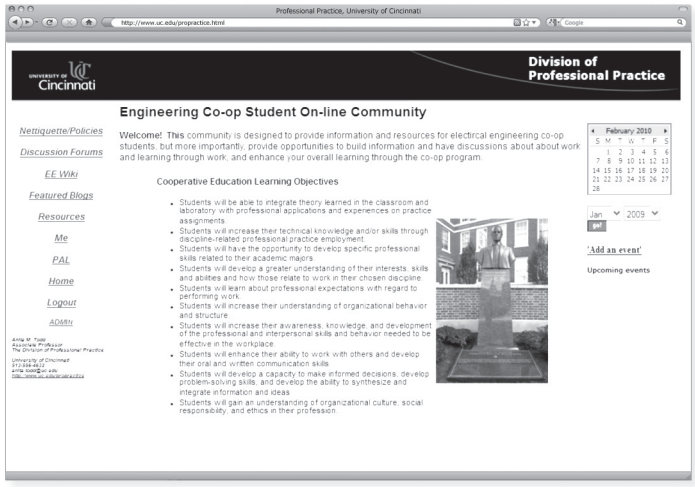
Category of Comments	Number of Comments	Rank
	Total	Total
Purpose	302	1
Process	169	2
People	101	3
Other Relevant	8	4
Other Irrelevant	228	
Total	808	

Purpose. In Cycle 2, the practical consideration comments focused on the look and flow of the community. Pages had too much text and not enough graphics (see Figure 1.), the menu was confusing in its order and labeling, and the site was not as consistent in appearance from page to page.

Participants indicated the need for moderation and oversight. Employers were concerned it could become a place to vent or criticize their company.

Participants were still concerned about the specific community purpose and if students would participate. Some participants suggested making it mandatory or making some level of participation mandatory. Participants again indicated that the community needed to be professional and not social in nature.

Figure 1. *Initial design of the home page of the online prototype community*



People. The resources section was designed to provide information for students to be "in the know" and the strength of the resource section was the most common comment from the entire survey. Participants also liked the calendar, but suggested that it be downloadable. Participants also suggested adding RSS feed capability so students could get updates and a dashboard that indicated the most recent updates (similar to Facebook).

Process. The majority of comments in the process category indicated that the interactive components of the community (e.g. wiki, blog, forums) were of value. Some participants indicated a concern over the depth of reflection possible within these elements.

Other Relevant. Once again, participants raised the issue of too many social networks. Participants questioned if there was an existing platform in which to build the community, such as Blackboard or Facebook.

Discussion

The community design. The initial community design evolved from the researchers' ideas for an online community design based on university cooperative-education learning objectives combined with ideas from the first cycle of focus groups and surveys. The findings highlight the influence of social networking through Facebook. Through the data collection and analysis, the researchers confirmed, changed or added features as follows:

People:

- Students can create a student profile including a picture and personal/professional information they choose to share.
- Student may post anonymously to the discussion forums.
- Students can access an events calendar to which the moderator and participants can post (see Figure 2).
- The resources section was better organized and included more items.
- Students can subscribe to RSS feed to follow changes within the community.

Purpose:

- Learning objectives and the value of the community were clearly posted on the main page (see Figure 2).
- The comprehensive netiquette section remained. Over-sharing of inappropriate content and cautions about sharing intellectual property/confidential company information was added.
- Learning objective and netiquette were added across the website in small reminders (see Figure 2).
- More pictures and graphics were added (see Figure 2). The font size, page layout, and design were made consistent across the community.
- The main menu was re-organized (see Figure 2).
- Participation was made mandatory for cooperative-education students.
- The community will be monitored by the cooperative-education faculty member.

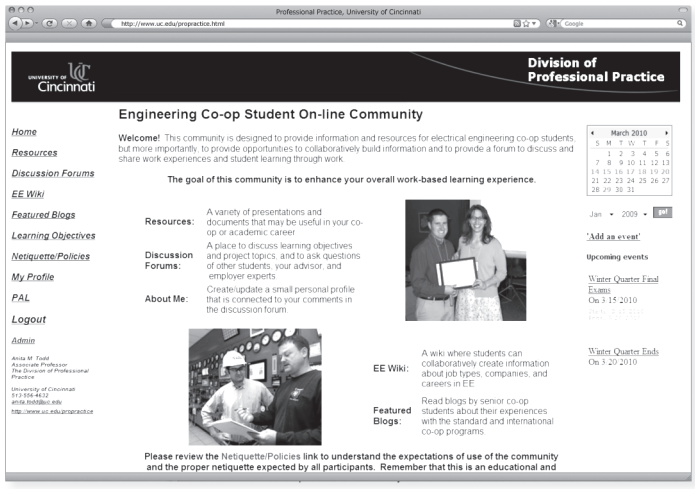
Process:

- The wiki, blogs, discussion forums, calendar and internal messaging remained.
- A chat feature to allow for real-time communication and vodcasting (i.e., posting videos) and podcasting capabilities was added.

Other Relevant Features

- The community was fully incorporated into the current cooperative-education assessment system.

Figure 2. *Revised home page*



Enhancements to the Model of Community-based Online Learning. In most cases, participant responses fell into existing categories in the community-based online learning model. One issue that was not specifically addressed in the category of people was the issue of over-sharing. When building a community, the social aspect is important in creating online identity; however, participants must be protected from inappropriate content. Sharing of company information or intellectual property is a unique issue of over-sharing specific for students at work. Palloff and Pratt (2007) suggested that sharing of inappropriate content could be addressed through defined netiquette and community moderation. With the ubiquity of social networking, over-sharing will continue to be an issue that may warrant greater emphasis in the model.

In previous online community models, technology had significant emphasis (e.g. Preece, 2000). In the model for community-based online learning, the purpose element encompasses the practical considerations in the design of the community, which can include the technology or computer systems used. However, the technology element is not explicit as a category in the model, similar to people, process, and purpose. It is recommended that a more specific emphasis on technology be included in the model.

Limitations

There were several limitations to this research study including the use of a convenience sample of engineering students, the relationship of the first author with the participants, and potential biases of the first author who was developing this community for her own use as a teaching tool within her division. Therefore, the analysis was filtered through the first author's lens (Merriam, 2001). This perspective has the benefit of providing an insider perspective and more in-depth analysis of the data; however, a certain level of objectivity was most likely sacrificed in order to gain this perspective. Given these limitations, the research is not generalizable to other populations; however, other researchers may benefit from the lessons learned and the process of how this community was designed.

Future Research

This design-based research study was the first phase of a multi-phase study to develop a tool to enhance engineering student learning through cooperative education. Once the community is finalized, future studies will address its effectiveness in increasing student interaction and reflection and their affect on student learning.

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Appendix A

Cycle 1 Survey – *Student/Employer/Faculty/Field Expert*

- What other social networking have you heard of or your friends may participate in? EX: Facebook, MySpace, LinkedIn, Others?
- Why do you participate in these communities?
- What are some of the best features of these communities? Why?
- What features work particularly well in these communities or do you think are particularly cool or clever?
- What features or activities draw you to these communities?
- What are some features that you do not like or do not work well? Why?
- What are some positive experiences you have had from participating in these communities?
- What are some negative experiences you have had participating in these communities?
- Do you think there are too many social networking sites?
- Does anyone not participate in some type of social networking site? Why not?
- While students are on co-op with your company, do you think they feel disengaged from the university? Why or why not?
- Do you think an online community for students specifically on co-op would be beneficial? Why or why not?
- What might be some of the benefits that you could see from this type of community?
- What might be some of the negatives of having a community like this?
- Would you be concerned if students were participating in this during work hours?
- What type of features would be beneficial to students — think about seeking work students, job changing students, first-time co-ops, last time co-ops, international co-op, and other groups of students?
- As we get started — do you have any ideas or suggestions to make the community engaging?
- Any other comments or suggestions?

Appendix B

Cycle 2 Survey – *Student/Faculty/Employer/Field Expert*

The purpose of this survey is to gather your opinion about the initial version of the Virtual Community for Co-op Students. You may want to have the community open in another window so you may refer to it if needed to answer questions.

- Did you have any technical problems accessing the community or using any features in the community?
- Please explain the problem(s) and where it (they) occurred.
- Did the explanations/text in the site make sense? If not, please explain?
- Was the site easy to navigate? If not, what suggestions do you have?
- Were you able to find the features desired? If not, what suggestions do you have?
- Was the site aesthetically pleasing (nice looking)? If not, what suggestions do you have?
- What features did you like most? Were most useful? Why?
- What features did you not like? Were not useful? Why?
- Based on you participation in the first focus group, do you think the site was developed in response to your ideas and suggestions? If not, what is missing?
- What are your suggestions for improvements or changes?
- Were co-op resources obvious to you?
- Do you think the community can meet the purpose of increasing social interaction among co-op students?
- Why/Why not?
- Do you think the community can meet the purpose of increasing social collaboration (working/learning together) among co-op students?
- Why/why not?
- Do you think the community can meet the purpose of increasing reflection about the co-op work term?
- Why/Why not?
- In your opinion, does the community serve any other educational / assistive purposes for co-op students?
- Do you think participation requires too great a time commitment vs. the potential benefit?
- Would you like to see this implemented as an educational tool for students at all levels from seeking work through your senior year?
- Other thoughts, comments, suggestions?

Thank you so much for your time.