Using Activity Theory to Examine Social Interaction of Online Learning

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Abstract. This study aims to build new knowledge about social interaction during online learning using perspectives of activity theory and social ability. Based upon a joint framework of activity theory and social ability, a set of serial interviews and final interviews were conducted with participants in online learning and the interview transcripts were analyzed via content analysis. The results include four themes: 1) Course design and task requirements interact with student biography and non-course needs to shape means and motives for course activity; 2) The social nature of online learning is important for accessing help and building motivation, and is partially shaped by available tools; 3) Awareness of social information influences learning behavior; and 4) Making work visible promotes social learning and satisfaction.

Keywords: Activity Theory, Social Ability, Social Interaction, Online Learning

Introduction

Online learning is an accessible and effective learning format that shows positive results and potential benefits (Talent-Runnels, et al., 2006; Allen & Seaman, 2007). Social interaction has been found to be a key factor impacting the success of online learning (Arbaugh, 2000), but many authors note concerns about the level of social interaction in online learning (Arbaugh, 2000; Carr, 2000; Bower, 2001; Hara & Kling, 2000). To better understand how social interaction can be supported in online learning environments researchers have investigated the relationships among social attributes during online learning (Chyung, 2001; Picciano, 2002; Laffey, Lin, & Lin, 2006; Tsai, Kim, Liu, Goggins, Kumalasari, Laffey, 2008). Utilizing Vygotsky's (1978) social learning theory and Wenger's (1998) social theory of learning Laffey et al. (2006) and Tsai et al. (2008) identified social ability as a significant predictor of students' sense of community and learning satisfaction, and a potentially important attribute for understanding how to support social interaction online. The purpose of current analysis was to apply activity theory as a lens to examine how learners' social ability is achieved, supported and maintained in an online learning environment as well as to better understand how social awareness information may influence learners' social ability in their pursuit of learning goals.

Theoretical Framework

Activity Theory

In describing and framing the social nature of online learning, we draw upon activity theory (AT) (Engeström, 1987; Engeström, 1999; Leont'ev, 1981; Vygotsky, 1978) to guide analysis of data from interviews with online learners. AT has been described as an analytical tool originally popularized and developed by Vygotsky (1978), expanded upon by Leontev (1981) and Engeström (1999), and subsequently applied to technology interaction design (Kaptelinin, Nardi & Macaulay, 1999; Kaptelinin, Nardi & others, 2006; Nardi, 1996) among others. AT enables us to organize information about mediated social activities in order to clarify the interconnected and inseparable relationships among the components of the activity system (Nardi, 1996). At its very core, AT states that an individual takes action with a purpose and an objective; in other words, the actions are object-oriented (Vygotsky, 1978). In addition, Vygotsky (1978) noted that the individual rarely takes action directly on an objective, but rather takes action on the objective through the interaction with others and through the use of mediating tools.

Engestom's (1987, 1999) well-known model of AT describes these main components within a social context (see Figure 1). To illustrate this model in an online learning context, a student (subject) uses a discussion board (mediating artifact) to communicate his understanding and seek help in solving a problem (object) with the help of others in his online community (community). There are various roles within the community (division of labor) as well as etiquette and expectations for how one should behave within this community and context (rules). By

working towards the goal (acting on the object), the object is, over time, transformed. In other words, what was once in the individual mind's eye is now externalized in the form of an outcome. All of these pieces are interconnected, inseparable, and may lose substantial aspects of their meaning when analyzed outside of the connection with the other elements (Cole & Engeström, 1993).

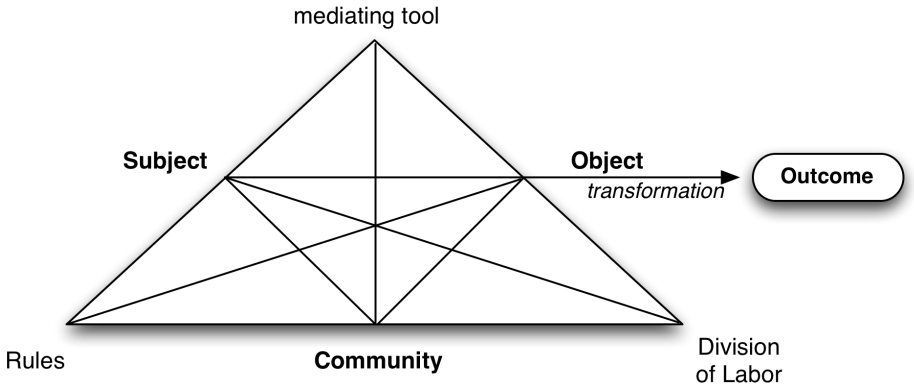

Figure 1. Engeström's model of the Activity System according to Activity Theory

Researchers have used AT to describe facets of educational technology, online communities, and computer-mediated communication. Barab, Schatz, Scheckler (2004) used AT as an analytical lens to describe the design and development processes over time of an online "socio-technical interaction network" (STIN). They found AT useful to both describe the activity within the online community and in informing and iterating the design of the STIN. Hew and Cheung (2003) used AT to evaluate asynchronous online learning discussions. They looked at subject-object-community triads and subject-community-role triads in order to inform their evaluation of the community. However, they did not consider mediating artifacts. Others have looked at web-mediated communication (Suh, Couchman, Park & Hasan, 2003), designing constructivist learning environments (Jonassen & Rohrer-Murphy, 1999), and various roles within a learning environment (Hedestig & Kaptelinin, 2005). While all of these studies inform facets of online learning and how AT can be applied to help understand mediated learning, the present study places a special focus on how AT can be used to explicate the social nature of online learning.

Nardi and Kaptelinin (2006) extended the AT model by considering poly-motivational activity (see Figure 2). The model shows a revised version of the subject-object-action relationship. Motives, which are based on needs, may be aligned or may conflict with one another. The social context as well as conditions and means influence how the motives may be compromised and prioritized, and how they may impact the subject's action on the object. Learning is a complex social activity for which learners may have multiple motives; taking into account the various and possibly conflicting internalizations can help explain the externalization of the learner's actions and behavior.

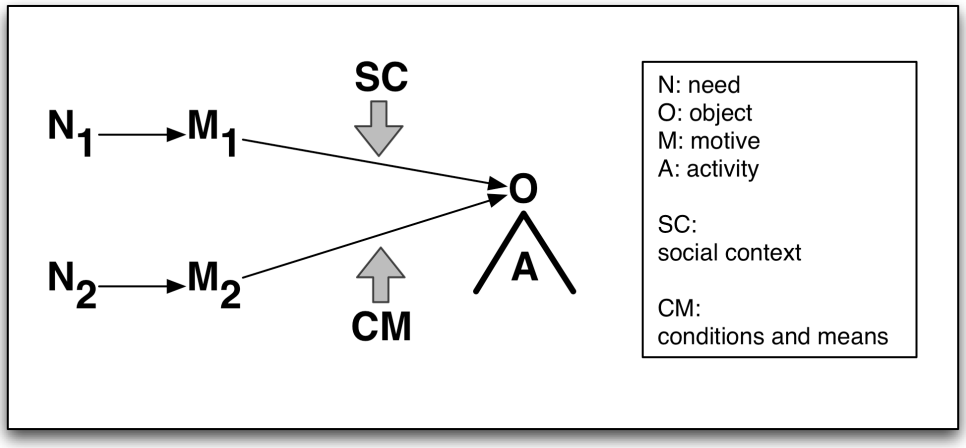

Figure 2. Nardi and Kaptelinin's model of polymotivational activity (2006, p. 149). Social context and conditions and means influence how the motives inform the subject's action on the object.

For the purposes of this paper, we will be using AT as a lens to explicate the social nature of online learning by applying it to a community of learners as they engage in a common objective of completion of their online course through various mediating artifacts and tools. Activity theory points us to a consideration of learning activity as having multiple and even conflicting motivations. In addition, while AT shows us that social activity is mediated in regular interaction by rules, expectations, and language that may change over time, in online learning the social nature of learning is further and substantially mediated through online tools, such as course management systems. Thus AT focuses our attention on the poly-motivational aspects of individual and community behavior as members strive towards their objectives, decide on tool and artifact use, and make choices for how various conflicting motives will be resolved.

Social ability

Laffey, Lin, and Lin (2006) identified social ability as a construct to represent how able are participants to use an online system and context to achieve their purposes. Social ability is measured through "the experience and perception of social interaction by members." They further pointed out that social ability is a relationship among individuals, environment (such as tools), and the nature of tasks. In other words, social ability is influenced by both internal attributes of individuals and external features of environment and tasks. For example, individuals vary in terms of their interpersonal skills and biography. Thus, they differ in their abilities to interact with others and use social information to achieve certain goals. However, their social ability is also be impacted by the external environment and the nature of task, such as the ease of use of a mediating tool and the complexity of coordination required by a task. Therefore, social ability is determined by how well the individuals, the environment, and the task fit with each other (Tsai, et al., 2008).

Students who perceive themselves to have higher social ability tend to experience more positive social interaction in online learning. Laffey et al (2006) developed a questionnaire to measure online learners' social ability and found that social ability is significantly correlated with learning satisfaction. In a subsequent study, five components of social ability were identified: written communication skills, peer social presence, instructor social presence, comfort with sharing personal information, and social navigation (Yang, Tsai, Cho, Kim, & Laffey, 2006). In other words, learners, who are more aware of peers and instructors' actions, more able to use information of others actions to guide their actions, more willing to share information about their personal actions, and more capable of communicating effectively in the written format (likely an artifact of using course management systems that rely heavily upon text communication), are assessed to have higher social ability and subsequently higher learning satisfaction in online learning (Tsai, et al., 2008).

Social presence in online learning includes the sense of "being there" and the sense of "being there with others" (Laffey et al, 2006). Tu and McIsaac (2002) further explicate social presence as the feeling of community that a learner experiences in an online learning environment. Studies have shown that social presence is a significant predictor of learning satisfaction. Hackman and Walker (1990) found that social presence significantly impacted student learning and satisfaction in a television classroom. Gunawardena and Zittle (1997) also found that social

presence measured by their instrument is a significant positive predictor of online learning satisfaction. Richardson and Swan (2003) found that students with higher perceptions of social presence also report higher perceived learning and satisfaction in online courses. Social navigation refers to the phenomena that people are guided in taking their next actions by knowing what others have done (Dourish, 1999). An example of social navigation is how Amazon.com keeps track of items that users have brought and viewed and then provides customers recommendations for items they may be interested in based on buying decisions of similar other customers. Cho et al (2002) used social network analysis to examine the relationship between social navigation and centrality, and found that resources recommended by central actors generate more responses than resources recommended by peripheral actors in a communication network.

Wenger (1998) characterized learning as a process of participation in a community of practice which includes sharing perspectives and resources. Thus, a willingness to share personal information may influence levels and types of participation in online learning. In addition, learners' ability to communicate effectively is the foundation of successful interaction with instructors and students in online learning environment. Currently, in most online learning environments, text-based communication tools, such as email, instant message tool, and discussion boards, are the primary ways that students communicate with each other. These text-based communications require students to have a certain level of reading, writing, and keyboard typing skills (Tu, 2001). Tu (2001) studied Chinese students understanding of social presence in online learning environment in US classroom and found they spend much effort on composing and reading messages because of English difficulties, which negatively influences their online interaction and degrades their level of social presence. In research conducted by Mandernach, Donnelli, and Dailey-Hebert (2006), reading comprehension, writing skills, and communication skills are indentified by instructors as important competencies which contribute to student success in online learning.

In summary, AT focuses our attention and gives us a lens to analyze how motives (potentially multiple and conflicting) shape actions in a context of social rules, expectations and collective action and how the path from motives to objects and outcomes is mediated by tools. The review of social ability suggests that, especially in online learning, the ability to be social and thus effectively use the social context has numerous factors that must be considered in making sense of how tools are appropriated and how tasks are accomplished.

Research Method

Research Questions

This study aims to build new knowledge about students' social interaction during online learning using the joint perspective of AT and social ability. The research questions of this study are:

(1) Do AT and social ability provide a framework for understanding students' social interaction in online learning?
(2) How do students' needs and motives influence the ways they appropriate the tools/resources to socially interact with others and participate in the class activities?

Research Context and Participants

A set of serial interviews conducted during the semester and a set of final (end of semester) interviews were conducted with students in 3 online courses at a mid-west University. These three courses with 15 students in each had similar course structures containing units with a set of learning tasks and were delivered fully online through the Sakai 2.0 course management system. The learning tasks in one of the courses included both individual and collaborative learning tasks while the other two courses, having the same instructor, had mostly individual learning tasks. All three courses used weekly discussion topics and frequently required peer review of other students' work. These courses primarily addressed how to use multimedia or to design learning systems. Social information (information about what others were doing in the course) was provided in 3 key forms: (1) A daily email digest reporting course members' posting activities (discussion boards, chats, and resources) was delivered to students every morning. (2) A "Presence box" (showing who was online) was always present within the Sakai system. And (3) course member activity could be observed as discussion board posts, resources uploaded, and chat messages. Table 1 shows the distribution across several characteristics of the students interviewed in each of the courses.

Table 1 *Demographic information for 123 cases*

Course/ Types of Learning Tasks	Interview Types	ID	Participation Level	Gender	Total
1 Weekly discussion topic, Individual, & Peer-review activities	*Serial*	*BC*	*High (H)*	*Female (F)*	*3*
		CC	*Low (L)*	*Male (M)*	
		SS	*H*	*F*	
	Final	*JF*	*Middle (M)*	*F*	*2*
		SL	*H*	*F*	
2 Weekly discussion topic, Individual, & Peer-review activities	*Serial*	*JH*	*H*	*M*	*2*
		AM	*H*	*M*	
	Final	*AH*	*H*	*F*	*1*
3 Weekly discussion topic, Peer-review, & Collaborative and individual activities	*Serial*	*LN*	*H*	*F*	*2*
		JW	*L*	*M*	
	Final	*DR*	*M*	*M*	*2*
		PS	*L*	*M*	
				Total:	*12*

Note: N=12; 7 serial interviewees (each serial interview participant had 3 interviews) and 5 final interviewees.

Data Collection and Analysis

At the beginning of the semester, invitations to participate in the serial and final interviews were emailed to all 45 students in these three courses. Seven out of 45 students agreed to participate in 3 serial interviews during the semester, while 5 out of 45 students participated in the final interviews at the end of the semester. These participants then were classified into 3 levels (high, moderate, & low) based on participation, or total post count in the discussion board relative to their course mates: top (30%), lowest (30%), and moderate (31% to 69%). The purpose of the serial interviews and final interviews was to explore how students socially interact with others via the tools and resources provided in the online learning environment. The serial interviews were used to characterize student experience with specific tools and tasks during the semester as well as changes in usage and perceptions. The final interviews were used to collect overall impressions of tool use and social interaction. The interviews were conducted with a semi-structured interview protocol developed based on issues of AT and social ability.

Content analysis was used to identify and explore themes for how students with different levels of participation experienced the social nature of their courses and appropriated the daily digest and other tools and resources to interact in the online learning environment. For the content analysis, a coding scheme developed by the research team based on AT (Kaptelinin & Nardi, 2006; Engeström, 1999; Leont'ev, 1981; Vygotsky, 1978) and social ability (Laffey et al., 2006; Tsai et al., 2008) was utilized to analyze both serial and final interview transcripts. A process was conducted to resolve different coding results and establish inter-rater reliability among three researchers. In the first stage of the coding, the researchers discussed their understanding of how to code the data based on the coding scheme. Later, researchers were assigned to review each others' coding results and resolved differences in coding results until 100% agreement was reached.

Results

The results presented below are a summary (to fit the page limits) of the findings from content analysis of the interviews. The four main themes are presented below.

1. Course design and task requirements interact with student biography and non-course needs to shape means and motives for course activity.

The nature of the course design and task requirements interacts with student biography and needs driven by other aspects of students' lives, such as demands from family or work. The interaction of requirements and needs influenced students' motives for what they were trying to accomplish and shaped the means by which they participated in activities to accomplish those motives. For example, students from course 1 and 2 (C1&2), which had individual and peer review activities that required correct answers to a limited number of questions in the weekly discussion, expressed their need to post their answers to the set of questions quickly before the questions were answered by others as well as to take advantage of the opportunity to get feedback on questions or issues by posting

early.

> F(final interview)-JF (C1&2)For the discussion activities I try to get out there as soon as possible because I wanted to answer the question right away, because I knew that there was a limited amount of questions and I wanted to be able to pick which question I responded to. So I tried to get out there right away. I would just go read the question figure out my answer post it and then leave, cause I'm usually out there early, and then I would come back later…see what other people had said…respond to get my points and then be done.

> S (serial interview)-SS (C1&2): I always feel like I can put my projects up there, or my weekly activities, and I can always ask for feedback. And I can say, like the instructor made it clear, if you want help with something you're working on, you can post it up there and other people will help you on it. And so with that information, just knowing that I can share that product before it's in its final form and get feedback on it is helpful.
> I read the message postings under the assignment and the instructor encourages us to post questions about things that we need help with there, and so a couple of postings were there and I read those.

A second example of how course design and requirements interact with aspects of individual needs and biography and shape means and motives is how the due dates for assignments may be inconsistent with expectations from prior experiences or felt needs from outside the class. For example the following quote from JW shows that the course due dates conflict with patterns established by forces out side the course in ways that are most likely unapparent to the instructor. One can also see how the expression by JW and the one above by JF show competing forces for when and how to do an assignment. Should the student hurry up so as to be efficient or can the student wait so as to fit with familiar patterns of working.

> S-JW (C3): I think it has been…I think most of the other online courses I have taken at the University have had more of a focus on the idea that most of the work should be done over the weekend. I am a full time teacher, I generally find it difficult…I mean generally I have done with it what I have done in every course I have taken here at the University, except for the courses I have taken over the summer, which is that I tend to do very little work over the work over the week and then I cram really hard and work over the weekend. That is when I have more time. In this course the deadlines have been Friday at noon, so I find I have had a harder time fitting in with that time schedule.

Course design and task requirements also shape the social nature of the course experience. Whereas the competition to act quickly shaped some of the activity of students in the C1 & 2 courses, students in course C3 expressed different needs for working in an efficient and effective ways within their teams. C3 students expressed needs to work outside the course management system so as to use tools that better matched the requirements of cooperation and collaboration of team-based activities. Thus the team-based activities introduced new motives for working effectively as a team as well as for submitting course assignments.

> F-PS (C3): Well the collaborative work we did over Sakai …we had to default to some phone conversations…the thing with Sakai was… that the chat room, you would have to leave your work area in order to talk over the chat room…And we found that to be kind of difficult. The…so we ended up talking over the phone together. The previous quarter in this class we had to default again to our conference calling in order to collaborate actually. We were able to do a voice to voice collaboration…And the other thing with Sakai that we found difficult was…and when we did try to coordinate through the chat room, we could never tell when the other person was there at the chat room, and the different abilities for typing quickly is how some other in the group would fall behind, and that was kind of tough.

2. The social nature of online learning is important for accessing help and building motivation, and is partially shaped by available tools.

Students seek social interaction in online learning to provide help, social navigation and feedback. Additionally, the opportunity for social interaction can motivate higher levels of participation in course activity. However, students criticized the limited functionality for social awareness and interaction in Sakai. It is clear from numerous comments that while task requirements set the stage for social interaction the way tools invite or constrain awareness and interaction shapes students access to social information, ways and levels of social behavior and the sense of the social nature of online learning. As an example, the social presence information available via the "presence box" influenced how students wanted to find help or knew who were available to help them.

> S-AM (C1&2): When you log into Sakai, you can see which users are... are present [via present box]. I guess that would be a way to check if there's someone there to help right there.

> S-JH (C1&2): I think knowing the kind of people who are online at a certain time. If I see there are eight people on when I'm on, I'm more likely to post a question…If they're online at the time, then that's my first resource, my first resource is to ask the others. But if they're not online, then I don't post because if they're not online I'm going to go to a third party resource like Google.

Most students indicated a high usage of the discussion board and a high level of attention to the presence box as part of the process of asking for help. However the presence box proved to be a substantial irritant to students because it allowed you to see who was online, but did not allow you to ping them or gain their attention. Students saw the potential of the social information, but also were frustrated by the implementation.

> F-JF (C1&2): I could see when people were online with me but I couldn't…there was really no… I knew there was a chat tool where we could go in and have a discussion synchronously but I could like invite someone and say hey could you meet me in the chat area, I have to just go and hang out there and hope that somebody would come in and talk with me if I…you know…if I wanted to get help right away…Otherwise I would just post a questions and wait until somebody answered it, and I had no idea when they were going to do that.

Students developed numerous strategies for seeking help and an active discussion board was the primary mechanism. Other students' posts to the discussion could provide suggestions for how to take on a problem. Sometimes others would actually ask a question similar to one's own and most students seemed comfortable asking questions and seeking help via the discussion board format. Having specific roles for providing feedback such as in the peer review process also facilitated students getting valuable feedback in a socially acceptable and timely manner.

> F-JF (C1&2): I could usually answer my own questions. I didn't really feel like waiting cause I knew I find the answer…In the end when it got really difficult I did post some questions but not a ton. Some people used it pretty heavily. But then we could also post our project for reviews. To get peer feedback but I always waited till the last minute to do my assignments so I didn't have enough time to do it…the peer review, however, I used a lot. The peer review …I posted my messages in terms of my peer review cause that is what I had to do. I asked questions of my classmates who reviewed my project to get clarification on what they had said. I read what other people had said in their peer reviews… just to see what kind of feedback they got to see if I could use it with the feedback on my own project. That was a really good discussion activity because it was valuable.

The student interviews provided numerous examples of students being resourceful in finding help, such as the textbook, personal resources, searches on the Internet, directly asking the instructor, or working with a few confederates rather than discussion with the whole class. The nature of the problem (ill-defined to simply seeking information), the urgency and time sensitive nature of getting an assist, as well as how active the topic was being discussed in class (such as a discussion topic that was active and current) all influenced how the students sought help.

> S-CC (C1&2): Well when I'm doing a project and I get lost then I just research through the discussion boards and see if the subject has already been brought up, and so far it has. Everyone seems to be kinda having the same difficulties. Usually with the problems though …usually with the problems like I really don't have…with the exercises or the assignments…I really don't have a lot of problems with it. The…the book is pretty straight-forward, it's a really good book…like I said there was a couple of different play loop questions on there…there is actually two play loop questions on there and I tried to follow both of them and the girl even provided the link and stuff and I still could not get either one to work. I don't know what I was doing wrong….I have no idea... I'll probably go to the instructor's office hours and just be like…or send her a private message, or just be like… Well usually when I feel like I need some help and I don't know like anyone personally that can help me, instead of posting the message I send a private message to the instructor.

> S-LN (C3): I just contacted people that I knew from working with them in the class or the people that I would trust with the set, kind of a gut feeling about people I'd worked with in other modules probably…
> I wouldn't say it's tremendously specific, but there's like certain key people that I think like are very knowledgeable and good at what they do and so I would always kind of touch base with them and gather comments or feedback or even look and see at how they had done something. And then see if the feedback that they gave me would help make mine better… I had a relationship with them through the class and so, I felt like I could ask them questions and stuff.

Students in C3 were required to do a team project. The instructor setup team discussion topics to support their collaborative work, but while the discussion boards were valuable places for sharing information within and across teams all students indicated the need to go beyond the discussion board and chat tools available in Sakai. Students indicated that one of the key values of the discussion boards was the ability to review other groups' discussion. This form of review helped them to know what and at what speed other group were working so as to help direct and calibrate their own activities. Perhaps because the challenges of coordinating work across team members usually left the teams behind schedule and needing to meet deadlines, the students in C3 seem to rely more upon email, phone or other direct contacts to get help than was shown in the reliance on the discussion boards for help in C1 and C2. When two members of C3 were asked what they would do when they needed help, they said:

> F-DR (C3): Well I would always communicate with my group members by email….. you know… I mean we would have things hammered out….. I mean it was mostly email communication…Well…. I contacted the person [the

instructor] that was in charge of the individual module… like you know… in some modules it was the second instructor ….. I would just email him if I did have any questions….

F-PS (C3): actually the…there's a couple of students in the class that I was able to… develop a relationship with and still have that if I e-mailed them on the school e-mail…that I work pretty close with and they always give me good feedback… The program overall and the students overall have been outstanding in really working with each other and whenever I had difficulties I could count on the students…feedback I needed to get an understanding of what was going on.

Lastly, students explained that when the resources or help provided by the instructor and peers were not sufficient or timely enough to meet learning needs (i.e. could not understand the instructor's explanation of an issue), they reached out to the most convenient resources around them with which they were familiar and could control (i.e. Internet resources, school labs, and colleagues). For example, SL and BC tried to use Internet examples to help complete projects, and CC, SS, LN, and JW liked to discuss ideas with or ask help from their co-workers, friends, and family.

3. Awareness of social information influences learning behavior

The implementation of an Email Digest was a special intervention in the Sakai course management system to impact social awareness by providing social information. More information about the implementation can be found at cansaware.com or see Laffey & Amelung (2010) and Laffey, Amelung & Goggins (2009). The Email Digest provided a list of when discussion board messages or resources in the course site were posted or read by class members or the instructor. The intent of the digest was to provide a daily reminder of activity on the course site so as to increase and shape appropriate student learning behavior. Students value knowing what the instructor is doing in a class, and appreciated the report of instructor activity via the email digest. Students also used the digest as a way to quickly gauge the level of activity in the course. If there was a lot of activity and they were not involved in it the digest could stimulate their participation.

S-AM (C1&2): Basically every time when someone posts something on the discussion board or is in the chat room, we get an e-mail [Email Digest] notifying us about that so every time I get the e-mail I just go to the website and check out what they have to say and what they asked and see if I can help them if they had any questions or just to see if someone else had answered their question, maybe that's the same question I had.

S-JH (C1&2): One thing is that it [Email Digest] comes in four pages like this [a lot of action entries], those four pages say…I'd say when…those four pages say something is due soon. If nothing is due for three weeks, there is not going to be this much activity…So if it is fairly short, I am going to assume that nothing is due for the next day. If I got this I would assume there is nothing due tomorrow.

The students were not used to having a digest of class activity so at first they expressed doubts about its value to them. But over time and as the courses started to have greater activity the digest became a filter for being aware of important course activity. For example, JF and DR stated that the email digest reminded them to check the course site either when they were away for few days or when they were interested in if someone had commented on their posts or work. Additionally, being more aware of social activity through the email digest promoted social interaction among students. For example, PS indicated that he would review the work from someone who reviewed his post or work. Having social information be more salient and accessible during the course work created social motives for action as is shown in this quote from PS:

F-PS (C3): when I went to [open] the digest I saw that they would look at my stuff and I would go look at their stuff too. So that was kind of a feedback that I was having my work viewed by my peers… it makes a difference how long they spend on the…well, two things…I can identify people that just browse through all the assignments based on very quick contact, and …remember I told you that there were a couple of students, I really liked their work and I knew that they were really working….I do look to see what the instructor is reading and how much time they spend reading… Certainly, that's [email digest] one of the ways that I was able to identify somebody who was really involved or somebody who was just doing mediocre work or just browsing through the course. Now at first I didn't really get a hold of that digest very well. And later…later on in the course quarter I was able to look at who was looking at what.

Students in C3 noted that they found value in the Email digest to the extent that it efficiently helped them keep track of the actions of their team members. This was especially true of team member who had low levels of participation. Students also found the digest to be a good indicator of impending due dates. When they saw a lot of activity in the digest it reminded them that they probably had a submission due. During online collaboration it is

hard to coordinate activity when you do not see the other members engaged in tasks. The team members collected this form of social information by talking to team members via private messages, email, or in the chat room, but when team members were slow or not participating well there was no social information through these tools. However, the Email Digest did provide a way to monitor activity or lack of activity and was recognized as an important tool for helping members make decisions to move forward rather than wait and be frustrated by a weak teammate. One additional aspect of the email digest was how the systematic reporting of activity helped the students feel a greater sense of presence with the instructor and fellow students, because even if they did not log into Sakai they could see activity and feel the presence of others on a daily basis.

4. Making work visible promotes social learning and satisfaction.
Whether working individually or on collaborative projects, students in all 3 courses identified the value of being able to review the work of others and knowing that others were reviewing your work. Part of the value of seeing other's work is a sense about whether you were on the right track and information to help you get back on track. The content of the discussion boards and Email Digests were helpful for seeing others' progress or performance on the assignments and projects. Students further expressed that grades were not the only way to gain a sense of success as they also could see how much they contributed, how often others referred to their contribution, growing reciprocality in relations to other students, and how their identity as a student was transformed through instructor's feedback as well as their own judgments of their work. The visibility of work efforts also encouraged increased participation.

> S-CC (C1&2): Well I look…when you look at other people's examples you can't just look at just one cause they could have done it wrong, so I take a pool and see what…either the consensus opinion seems about what the instructor…wants… I think it is important for me to know what other people are doing just so I don't feel like I am gonna get it wrong, you know, just so I can see what other people…just what they did, what they say, and then…so I feel comfortable with my…You see cause there's some people that like…I had one of the longest…I had one of the longest…umm…explanations in there. A lot of people cut through it real short and simple, and I don't know, just to make sure I'm putting the information that the instructor wants in there.
>
> S-JW (C3):
> How do I judge my own success? I judge my own success. If I get excited by my own…If I find that I'm excited to be logging in and excited about what I'm writing, then I feel that whether or not the teacher has …. Whether or not I write what the teacher is looking for, I feel like I've made life interesting for myself and gotten a new viewpoint. If I'm excited. If I find that I'm not logging in very often and I'm not very excited about what I'm writing or what I'm reading, then I would say that I'm not at the level of success that I'd like.

Conclusion

In online learning, as in most other forms of education, much of what is undertaken can be explained by the course design and task requirements set by the instructor. Using AT and social ability as an integrated framework for characterizing the experiences of students undertaking these tasks in an online environment shows that these requirements become real only in the context of students prior experience and other demands of work and family. Similarly these tasks requirements are undertaken in a social context which enables members to find help when needed as well as providing motivation for participation in the activities. Further the social context has requirements and motives that also come into play. Course designs which fit well with student biographies and other demands of work and family and which harness the positive aspects of social learning are important to student success. Making work visible and accessible to members of a course seems to positively impact social learning and we suggest that course designers consider how to beneficially include making student work visible in course activity. Additionally, online learning the tools for communication, interaction, and social awareness are also key to student learning. Tools such as the email digest have potential for improving access to social information which can impact social navigation, efficiency in learning and effectiveness in learning. We suggest that designers and instructors consider how to increase social awareness in online learning. This short paper provides only a brief, but hopefully provocative, view of the potential for jointly considering how the activity and social context of online learning are influenced by the tools available for communication, interaction and awareness, and how the lenses of AT and social ability can help improve course design and tool use in online learning.

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