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Learning Designs: An Analysis of Youth-Initiated Technology Use

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Abstract

Researchers espouse that youth are learning differently than any other generation. Many researchers believe that because youth are leading the way with technology, their technology practices impact the way that they connect with the world around them. As a result, educators examine how to successfully engage youth in learning by understanding how to tap their technology practices. This study utilizes a sociotechnical framework to bring to light emergent structures of participation during student-teacher instant messaging interactions to support learning. Analysis illuminates three emergent and fluid participation structures. These structures reflect both pedagogical models and the most current literature on how people learn. (Keywords: instant messaging, net-generation, sociotechnical, learning designs.)

TODAY'S LEARNER

Prevalent research suggests that today's youth learn differently as a result of their pervasive social interactions during technology-mediated activities. Statistical reports illustrate that these youth, often referred to as the Net-Generation (Tapscott, 2002), use the Internet, interactive simulations, Instant Messenger (IM) and text messaging as a natural part of their everyday lives (Lenhart, Madden, & Hitlin, 2005). The implication is that in technology-mediated participation, youth are decidedly engaged and are, more often than not, involved in enveloping, distributed, fluctuating, and emergent participation. The argument follows that if educators are to successfully motivate students to learn, then they need to craft learning designs that unite youth technology practices with effective learning practices.

Youth technology practices begin to reveal these espoused new forms of learning. For example, many researchers assert that youth figure out things for themselves, tinker with technology, work across people and in groups, multitask, learn through a variety of media and collaborate with others (Tapscott, 2002). In addition, these youth are good at context switching (Oblinger & Oblinger, 2005) and particularly savvy at developing relationships within interactional technology systems such as Instant Messaging (Jacobs, 2003; Lewis & Fabos, 2005), text messaging (Ito & Okabe, 2006), and social networking (Boyd & Heer, 2006). Through such unique interactions, students have a novel ability to read multiple "texts" (e.g., words, images, and video). Further, youth have a facility and a comfort with navigating complex "information spaces" (Seeley-Brown, 2000, p. 14). Finally, they learn through discovery which requires new forms of reasoning. Specifically, this reasoning encompasses using objects and tools, texts, codes, etc., and using them to create a product that is considered important to them (Seeley-Brown, 2000). As a result of these new interactions, youth access, absorb, interpret, process, and use information fundamentally differently than previous generations (Jukes & Dosaj, 2004).

When youth engage in these practices, their learning is both socially constructed and situated within the broader community of practice with their peers. Socially constructed learning assumes that knowledge is built through personal, situational, and social dimensions (Vygotsky, 1978). Further, social learning is contextual and distributed among human and material resources in the classroom (Cole & Engstrom, 1993). Communities of practices are an inherent part of social learning. They are defined as emergent ways in which "individuals develop and share the capacity to create and use knowledge" (Wenger, 1998, p. 2). Learning then is contextual and occurs within the given social and physical environment (Lave & Wenger, 1991). Many technology uses within learning reflect the ways that youth socially construct knowledge through their technology practices.

NET-GENERATION TECHNOLOGY PRACTICES IN LEARNING ENVIRONMENTS

CSILE (Computer Supported Intentional Learning Environments) is an early example that exemplifies the convergence of youth technology practices and socially situated learning. CSILE was designed to be a tool where students could interact with a communal database (with text and graphics capabilities) and with other students to collaboratively solve problems. This multi-window, networked learning environment affords students the opportunity work across resources (computer tools, textual and graphical resources, peers and teachers) in order to build understanding about a topic. As students work with their peers, receive guidance from the teacher, and access academic content, they are socially constructing knowledge (Scardamalia & Bereiter, 1993). The success of knowledge building is that students become a legitimate part of building knowledge together as they move in and out of core and peripheral participation (Lave & Wenger, 1991). CSILE showed its potential to "restructure the flow of information in the classroom, so that question ideas, criticisms, suggestions, and the like were contributed to a public space" by all participants (Scardamalia & Bereiter, 2006, p. 104).

More simple forms of technology-mediated learning opportunities have brought to light affective aspects of learning. For example, students indicate that they valued the informality and immediacy of tools such as Instant Messenger (IM). This interface afforded easy access to teachers, which resulted in quick responses from teachers (Jeong, 2007). IM's ease of use also facilitated academic communication with students (Nicholson, 2002). This informality and ease of use also helped to develop strong bonds with instructors, which in turn fostered positive attitudes towards their instructor (Rau, Gao, & Wu, 2008). Furthermore, IM has been shown to build social bonds with peers (Nardi, Whittaker, & Bradner, 2000).

The findings noted in more complex environments such as CSILE and more simplistic ones such as the use of IM are both valuable in providing insight into effective learning designs that tap youth technology practices. In terms of CSILE, technology is used to support problem solving that addresses real world situations. Designing learning environments in this way is particularly powerful and is better remembered and applied in new contexts (Greeno, Collins, & Resnick, 1995). Knowledge must be applied in context in order to be used and made explicit (Brown, Collins, & Duguid, 1989). Furthermore, learning is a function of the social and cultural activity and the social context in which it occurs (Lave & Wenger, 1991). Related to IM, the technology breaks down superficial barriers by building bonds and communications among all participants. In essence, technologies potentially cultivate social networks that are essential in the social construction of knowledge.

Collectively, these finding are important as recent cognitive research has identified the need for students' active engagement, participation in groups, frequent interaction and feedback and their connections to real-world contexts as essential learning principles (Roschelle, Pea, Hoadley, Gordin, & Means, 2001). Both of the aforementioned forums provide the "opportunity to successfully carry out more complex skills than they could execute alone. Performing a task with others not only provides an opportunity to imitate what others are doing, but also to discuss the task and make thinking visible" (Roschelle et al., 2001, p. 8).

These studies were not designed explicitly to examine the merger of Net-Generation technology practices and effective learning principles. However, they begin to reveal the possibilities of and reasons for paying attention to such a combination. This raises two questions. First, what can we learn from youth technology practices to further inform learning designs? Second, how do communities of practice emerge as knowledge is socially constructed? Since youth are often early adopters of technology and utilize technology in contextualized real world experiences, examining their practices is uniquely important for testing new learning opportunities. While forms of technology-mediated social interactions exhibited by technology users of this generation is not an end-all, tapping technology participation will be one means of creating and facilitating effective and emerging learning designs.

THE STUDY

This study explores the potentiality of tapping youth technology practices for learning. In the presented case, I investigate a student-initiated use of one technology, Instant Messenger (IM), which is not only popular among these teens but also with many technology users. Students chose to use IM for student-teacher communications in their after-school lab management club. This scenario is pertinent because out of school activities have recently received acute attention. Given that out of school time is the largest block of youth time (Council on Adolescent Development, 1992), these times have become particularly interesting to researchers who examine emergent and new ways of understanding learning designs. Researchers view after school engagements as deepening youth participation and allowing youth to take on meaningful and increasingly complex tasks, responsibilities and roles (e.g., McLaughlin &

Heath, 1994; Cole, 1996). This after school management club was designed for students to begin to take on more independent and adult-like roles within authentic activity. As a part of their independence, the students initiated the use of IM with their teacher to support the completion of their responsibilities.

To analyze the activities of the teacher-student IM interactions, I use a *socio-technical system* framework. This framework is selected because of its attention to the simultaneity of social and technical aspects of these interactions. This framework affords the opportunity to consider socially constructed learning and the emergent communities of practice as a unified system. Briefly, sociotechnical systems (STS) provide a conceptualization of social activity and technology systems as inseparable (Trist & Bamforth, 1951). In such systems purposes, tools and participation coexist. While studies of sociotechnical participation in popular teenage tools have been on the rise, few studies focus on emergent adult-youth participation for learning. The question becomes, *what participation structures support learning when adult and youth participate in a popular teenage technology tool?* The intention of this question is to understand how teacher-student interactions in predominant youth-driven innovations potentially bring to light the role of these technologies for socially constructed and situated learning. If we want to recognize how technology becomes a central component of such learning activities, we must continue to investigate the use of technology in spontaneously generated and student-initiated learning engagements such as in this example.

In short, analysis from this study illuminates the emergent participation structures within the sociotechnical system. These participation structures refer to roles of the participants and the goals in these exchanges. While this is a situated case study, the results are valuable to those interested in attempting to embark on using popular Net-Generation innovations and/or allowing students to initiate possible modes of engagement. In what follows, I provide a theoretical and methodological conversation of this study. Following this, I present a description and associated examples of the emergent themes. I conclude with a discussion of the overarching implications for learning environments.

THEORETICAL FOUNDATION

According to sociotechnical systems theory the social and technical are interlocked. Specifically, when people use technologies, the social and technical aspects of persons and technology dialectically create activity. Sociotechnical systems cannot be thought of as only technological factors, but rather as a "complex interplay among different factors with no mere linear causality involving one factor alone" (Lenk, 1997, p. 104). In this theory, s*ocial* refers to the people. In particular, social is the knowledge, skills, attitudes, values, and needs people bring to the environment. The *technical* is comprised of tools, devices, and techniques needed to support the transformation of inputs to outputs (Coakes, 2002). The social and the technical systems act together as one system. The value of this theory is often espoused as illuminating how the interactions among these systems can either hinder or enhance the performance of the organization. Organization in most sociotechnical studies often refers to the efficiency and success of work practices (Coakes, 2002; Mitchell & Nault, 2003; Rognin, Salembier, & Zouinar, 2000). For example, one might consider how the integration of socio and technical systems merge to allow pilots to effectively maneuver a plane (Hutchins & Klausen, 1996) or miners to more efficiently do their jobs (Trist & Bamforth, 1951). Explicitly, the significance of using this theory is to begin identifying guidelines for patterns of interaction expected to improve the outcomes of the system.

Although this theory places weight on social interaction and technology factors for work functions, knowledge distribution and knowledge construction are other key factors that add to the emerging practices and shape of the system. In sociotechnical studies, it is shown that the system provides for the propagation, visibility, and transformation of thought representation across a number of media as well as the ability to represent information in the technology (Hutchins & Klausen, 1996). Furthermore, the use of material across media supports the sharing and building of ideas (Bell & Linn, 2000; Hermann, Loser, & Jahnke, 2007) and helps to shape the larger cognitive system (Hutchins & Klausen, 1996).

In this case study, sociotechnical analysis is used to consider what participation structures emerge through the social and technical convergence of teacher and student. Sociotechnical analysis also assists in shedding light on how these structures provide insight into the design elements that support situated youth learning with their adult counterparts through IM. The IM interactions in this after school activity reflect work situations in the sense that the boys from the lab manager's club are performing work related activities. What is revealed is that the emergent learning structures readily support what we currently know about how people learn (Bransford, Brown, & Cocking, 2000; Sawyer, 2006). What is more, the students drew upon the aforementioned youth learning characteristics to participate in their IM communications.

METHODOLOGY

Participants

This study took place over a six month period beginning in the spring of 2003. The participants included four students, all of whom were upper-middle class white boys from a suburban private all-boys school outside of Philadelphia, Pennsylvania, and their teacher, Ms. Geight (all names used in this study are pseudonyms). Ms. Geight was also the director of technology who organized an after school Lab Manager's Club to which these boys belonged. The mission of the club was to involve students in assisting with technical support and ongoing technology-related decision making in the high school. Some of the duties included troubleshooting, hardware maintenance, Web development, and hardware purchases. Four of the seniors in this group (the boys in this study) had gained more responsibility than the others over the years. These students worked not only after school during the allotted hours of time, but also took work home with them. Completing their assignments with their home technologies, the boys found themselves wanting to access their teacher. They asked their teacher, (Ms. Geight), "Do you IM?" She answered, "Yes." The result was a series of interactions and communications between the teacher and four of the boys from this club.

My role was purely one of researcher. This research opportunity came to my attention through Ms. Geight. Ms. Geight and I know each other through a mutual colleague. Following our introduction, I became a math teacher at the school for one semester. She and I had developed a strong relationship during this time. Our conversations had revealed her interest in research related to technology and learning. This interest led to her requesting that I follow the interactions and communications on IM associated with this club. As the researcher, my role was to observe and analyze, as well as share data findings with the participants. I was a lurker in the system and had no participatory interactions during any of the IM sessions. With the students' consent, Ms. Geight collected the transcripts of the Instant Messaging sessions between her and her students.

Rationale

My rationale for accepting the invitation to conduct this research was related to my interest in how the adoption of emergent technologies supports learning. In addition to considering how IM would support learning in this situation, I was also inspired by the fact that the students initiated the use of the technology. In my experience, student-initiated technology use with teachers was highly unusual. This event was an opportunity to examine the implementation of a student-generated use of IM in a situational case study. The students in effect were adapting a familiar use of IM into one that was innovative. *Innovative* refers to using an invention (IM in this case) for something other than its originally intended purpose and/or its current use. According to Rogers (2003), one of the major components of the adoption of innovations is that the innovation be flexible enough to be adapted in new situations. Moreover, "an innovation diffuses more rapidly when it can be re-invented and its adoption is more likely to be sustained" (Rogers, 2003, p. 17). Innovation flexibility is often spontaneous. Furthermore, innovations are frequently tested locally before attempts to diffuse them to multiple contexts. What is learned through local implementation can be readily tried in a new situation, once value is realized.

In relation to sociotechnical activity, the adoption of tools for innovative uses is a continuous evolution of the activity both social and technical. In terms of learning designs, paying attention to the initial implementation of this technology for the purposes of situated activity reveals the unfolding learning structure—both technical and social—shaped by those involved. Thus my aim was to study how IM was supporting learning in this local innovative use in order to consider its potential use in broader contexts. From this study, we can begin to propose foundational principles of engagement for learning when adopting new technologies. This holds true for the beginning stages of development as well as the potential diffusion of what is learned about the emergent practices in IM.

Data Sources

Upon meeting with the students and teacher at the onset of this study, each agreed to various forms of data collection. These data included the IM transcripts, semi-structured interviews with students and the teacher (once a month during the study and once at the conclusion of the study), journals where the participants recorded their thoughts about the IM interactions, and a time stamp of the technologies used to communicate with the teacher.

The principal data source was the IM transcripts. These transcripts were collected daily and were generally 4 to 10 pages in length. The journals depicted the participants' thoughts and experiences of each IM conversation. The communication logs included the number of hours per week that they spent on IM and on the projects as well as the number of e-mails that they sent to their teacher per week. This data assisted in supporting that IM was the student-preferred mode of continuing to work on their projects with their teacher. The interviews allowed me to share my interpretations with the students so that they could confirm, disconfirm, and add their interpretations of the social and technical aspects of the data. Each form of data helped to uncover how the social (teacher and student attitudes, beliefs, knowledge, skills, values and needs) and technical (use of tools to do work and to communicate) converged to identify the emergent participation structures.

Analysis

The analysis employed consisted of interpretive research (Erickson, 1986) from a constructivist perspective (Guba & Lincoln, 1989). The goals of interpretive research are to make sense of the contextual experience and build patterns of meaning and relationships connected to the particular situation. From this, the researcher can communicate what has been learned from the situation. Constructivist perspectives are an important support to this research method in that its underlying assumption is that truth is a matter of consensus. The consensus comes through involving participants in the process of determining findings. Thus the analysis is hermeneutic and dialectical in that the research is moving back and forth between personal data interpretation and participant views.

The process of analysis for this study began with interpretative research. In order to make sense of the data and begin to identify patters of practice, I reviewed and read each of the individual IM student-teacher transcripts and recorded social and technical aspects. In particular, I was reading the text for both participants' attitudes, values, and needs related to the activity as well as participants' use of IM to communicate and work with each other. Keeping in mind that social and technical are intertwined, I returned to the transcripts and reread for linkages between these two characteristics. After categorizing initial patterns of sociotechnical connections, I revisited the data again asking *"What are the different patterns of interaction that are going on in these transcripts?"* The next pass, I asked *"What are the differences between the interactions?"* After several passes of going back and forth I created larger themes that associated with how these linkages between social and technical were supporting particular kinds of participation structures. Taking the currently emerging themes then back to the data again, I tested these on more transcripts.

In between each pass of the data, I had a meeting with the teacher and a meeting with the students. I shared my codes of the social identifiers and technical uses that I saw, asking for their interpretation and/or validation. When unclear of each other's perspectives, we often negotiated until we agreed on our explanations. With the assistance of the participants and in continually crossing data sources, I was adequately able to substantiate how the intertwining *social* and *technical* qualities of the interactions elucidated different forms of participation for learning. Moreover, I was able to maximize, corroborate and authenticate the emergent themes that I was seeing by cross checking what they saw; thus, I was increasing the likelihood that my developing assertions regarding the themes were not solely influenced by my experiences and interpretations. In essence, I was constructing the data and analysis together.

After multiple iterations of coding and recoding and working with participants, my analysis suggested three distinct participation structures that support learning. I identified these structures by examining how the knowledge, skills, attitudes, values and needs people of participation dialectically interlaced with the technical uses to do work and communicate as described above. Furthermore, I arrived at these categories by continually asking the questions of how the social and technical merge to create activity specifically for learning. I named these themes, which directly related to learning activity: *Negotiated Goals*, *Co-Constructed Problem Solving* and *Collaborative Argumentation.* The following section defines and illustrates how each of these emergent themes was informed by the sociotechnical frame. It should be noted that all IM transcripts are in their original form, spelling errors and short hand "IM speak" included.

EMERGENT PATTERNS OF TEACHER-STUDENT IM PARTICIPATION

Negotiated Goals

In interactions falling within this theme, the initial teacher-dominated goal was reshaped throughout the conversation. The sequence was as follows. A student would log in and ask to discuss the assignment with the teacher. The teacher would refer to her notes and ask for results of the given task. In the initial stages of these conversations, it was obvious that the teacher aimed to acquire particular information from the student. This was not surprising since students were often assigned a task. Nevertheless as the conversations continued, the students would begin to nudge and position their goal for the assignment.

An example of this is evident in a vignette where the teacher began by asking if the Web site had been updated. The teacher assigned one student the task of redesigning a particular aspect of the school webpage. The teacher's goal was to have the site completed within the Web editor owned by the school. The student had another goal. He wanted to tinker with and utilize the newer version of flash. The following conversation is an excerpt from this account.

Teacher: So you will use our editor?
S2: hmmm I just found out about flashmx
Teacher: What is it?
S2: it's the next generation flash creator
S2: after flash 5

Teacher: now flash MX
Teacher: flash 6?
S2: (he provides the link)
S2: See
Teacher: I've got it
S2: id like to uset hat to complete it
Teacher: Sure sa long as we keep the same due date

While it appears that the original goal was still intact, the sub-goals for the teacher and the student were different. Both the teacher and student had a shared goal of completing the assignment. However, the goal of the teacher shifted from the student using the school-owned Web editor to giving the student some ownership of the project. The student's secondary goal was to have the opportunity to *play* with a new application to *work out* the webpage design. The student and teacher negotiate the process of completing the task while keeping the overarching original expectation.

A second vignette illustrates a similar pattern to the previous example. In this situation, the student came to the table with the goal of convincing the teacher to buy a particular Web server. The teacher's goal was to be sure that the student was considering the population of the community and their continued access to the technology. The following is a conversation extending from one that began during the after-school times.

S2: I found the perfect web server
Teacher: really, what is it
S2: (he provides the link)
S2: starta at only 1 million
Teacher: hahahahahaha
S2: im jk
S2: ¼ million I think I was looking around though
Teacher: looks nice, worried about the cost
S2: yeah, but we consolidate
S2: moving files will take tiem
Teacher: we'll need to think about that for access
S2: yeah, but we can take it down at night
Teacher: good idea
S2: S3 will help
S2: take a few hours
Teacher: as long as we are back up for teachers and admin
S2: can do
Teacher: ok, maybe we should get it and get rid of all the others
S2: sounds like a plan
Teacher: how much is it really
S2: starts at 250,000
S2: but I have a feeling that's only the case or seomthing because on the same webpage another server started at $600
S2: look at the [provides links] to see the difference

Both the teacher and student had technical-related concerns. While financial costs of the server were an underlying issue for the teacher, her primary responsibility related to ensuring continued technology access for the teachers and administration. The student's technical interest was linked to finding the most sophisticated and up to date server that streamlines the functions that currently reside across several servers. In the end, the student used the technology to support his interests and negotiate a decision for the betterment of the school's technical foundation.

Often teachers and students come to the table with disparate goals. From a sociotechnical system perspective, the goals show themselves as emergent. The social aspect of the system is not only the teacher and the student goals, but their skills as well. The student asserted his skills of learning new technologies as well as used them to substantiate the goals. The technical aspect was the tool (IM), the technique (Flash vs. school Web editor) and the research of different technologies. IM afforded the opportunity for students as a relative equal in the distributed space. The teacher shared that in normal situations these students would not have approached her with alternative ideas. In class, they rarely spoke. Bringing together the social motivations of the students and articulating them through their medium, the students found voice. They affirmed their strengths, ideas, and own goals through the technology, showed the ability to do the work, and adapted activity slightly toward their own motivation.

Co-Constructed Problem Solving

The next participation structure is co-constructed problem solving. In various interactions the teacher and her students would often use IM to aid in troubleshooting. In these cases, the teacher and student were working with the same devices from different locations. The common goal was to figure out a strategy to render a technology functional. The following examples are representative of type of interaction.

In this scenario, the teacher and student were attempting to resolve an issue with the newly constructed library webpage for the school's site.

S2: did you get my email about the library webpage
Teacher: what does it need?
S2: its not ready to o yet
Teacher: what does it need?
S2: work, attention
Teacher: now let's take this opportunity to get *Student X* to do it, he has suggestions.
S2: The links don't work
Teacher: plus I feel like I am giving you too much to do
Teacher: What did you try to get the links to work?
S2: reconnecting the page
Teacher: how?
S2: coding
Teacher: did you try looking at the path name?
S2: let me check

S2: path name is correct
Teacher: let me take a look
Teacher: what else is missing?
S2: oh wiat...
S2: there is no index page
Teacher: You know what to do?
S2: Ya, just forgot about the index page til now
Teacher: What about S4?
S2: i didn't talk to him about it yet
Teacher: ok think we should fill him in?
S2: when he comes on

The student came to the teacher with a technical issue related to a webpage he was working on. The teacher asked the student for his interpretation of the problem. She continued to ask him more questions to draw out his perspective. When the student referred the teacher to the issue, she immediately recognized the problem. Instead of offering the answer to him, she directed him to the problem by asking another question. The collective problem solving became one of guided conversation.

Another example reinforces the pattern of co-constructed problem solving. In this excerpt, the teacher and student discussed the potential cloning capacity of the hand-held product. Cloning is a common computer imaging practice used to ensure that all computers have the same configurations. The excerpt below was taken from a conversation where the student helped the teacher clone a hand-held device.

S3: oh, i know the problem
S3: go to active sync
Teacher: yes
S3: file>connection settings
S3: allow serial connection on COM1
Teacher: yes
Teacher: ok
S3: now try it
Teacher: ok hold on
S3: k
S3: you might have to change it to COM2
S3: well which ever one is your serial port
S3: usually its COM1

Despite the fact that the teacher and student were in different locations, both were able to conceptualize the problem (trying it on each end) and to communicate a solution. This shared understanding was because each knew what the other was doing and trying. An extended transcript of this vignette illustrates that the teacher tried to talk through a solution. When this did not work, the student then offered an alternative suggestion. While the teacher attempted the strategy the student provided, he continued to suggest other possible solutions in the event that the first one does not offer the desired result. The teacher's troubleshooting did fail. The teacher and student chatted about additional possibilities; each offered a suggestion that built on the last. Finally, they were able to trouble shoot the outcome.

In this interactional theme, teacher and students have a similar goal. That is, they were focused making the technology work. In these sociotechnical examples, both teacher and student utilized skills to achieve a solution. IM served as a mutually-shared space where student and teacher articulated, distributed, and built on strategies that they attempted. In these cases, students drew not only on experience with these devices because of the leadership role given to them, but also on the characteristic of *figuring things out* without a manual and *working across people* and *media* to do so. Yet the figuring out was in tandem with the teacher through the technology. The activity and action of achieving the end goal became one. Here, IM afforded a shared collaboration space so that each can participate in co-constructing the problem solving strategies.

Supportive Argumentation

The relations that fall within this type of interaction are labeled as argumentation. Both student and teacher reengage in dialogue illustrative of disagreement on a potential technology-related decision. In this context, student and teacher were arguing. Arguing to learn is "not oppositional and aggressive" rather it facilitates coming to resolution and agreement (Andriessen, 2006, p. 443). This process consists of the ability for each party to elaborate, reason, reflect and work together to formulate decisions. The passage below was a window into this type of argumentation.

In this scenario, the teacher and student decided together on the operating system for the handhelds. The teacher suggested the purchase of Windows CE operating systems for the handhelds. The student was charged with researching a handheld system and argued against this purchase.

S4: here are the tablet PCs
S4: (he provides the link)
S4: tablet PC home…
S4: (he provides the link)
Teacher: ok
S4: and why aren't we getting these instead of the CE based computers?
S4: gives link
Teacher: did you notice prices anywhere?
S4: not just yet
S4: they seem more pricey than the [*hand-held product*]
Teacher: the windows one was #3000 the last time iread about it but that was a month or so ago.
S4: I'm most likely going ot give you a lot of links, I doing research on these things now
S4: I'm just too afraid that this school commits to CE… it's too dangerous despite what S3 says

S4: what if MS drops CE and there are IE security bugs?
S4: Big trouble
Teacher: Good, I agree I would prefer a real operating system but the price is one big issue.
S4: I think it is in the interest of [this school] to make sure money is spent well, not recklessly
Teacher: Also part of the CE platform was the idea that students the could not really get on the network, but I don't see that as a bad thing
S4: plus the [*hand-held product*] has more hardware defects than [*brand*] computers… at least the [*brand*] work for 3 years
S4: [h*and-held product*] seem to be DOA about ever 10 days or so that we get
Teacher: after lookin gat them and seeing what we've gotten so far i am not concerned about the [*hand-held product*] performance we got 25 and 2 are already on their way back to Germany.
S4: And then they have massive hardware failure after a month of use
S4: another is blown?
S4: what happened to it

In this excerpt, the teacher and student used IM as a mode of positioning, supporting and providing evidence to talk around a decision. The teacher argued for the CE product for reasons that are important to what she represents. That is, she represented the political and financial realities of the school. The student was arguing with support around the stability and longevity of the product. In particular the student was drawing on skills of multitasking. This was displayed as he searched for files and links within his computer and on the Internet respectively. These items helped him to support his argument.

The sociotechnical participation of supportive arguing for learning mirrors a fundamental component to the authenticity of learning effectively together. Performing the action of arguing within IM, affords student and teacher to share perspectives as well as bring about researched information related to the task at hand. Through this practice the student and teacher were developing a collegial relationship. IM, in this case, offered the opportunity for each to constructively engage in authentic argumentation. When bringing together these different positions, the collective argumentation can result in decisions that reflect both agendas.

DISCUSSION AND IMPLICATIONS

Together the aspects of this sociotechnical system suggest several implications for creating learning designs that tap the net generation's technology practices and for considering constraints as well as equity issues. Sociotechnical systems are emergent and adaptive because the social and technology intermingle. On the one hand, the personal interactions of the system bring together different perspectives of those involved, allow for the co-construction of problem solving, and require that individuals explicate their thought processes with supportive information. The technology, on the other hand, becomes a mediating tool that makes visible the social aspects of the system as well as the mode of constructing knowledge. Therefore both the social and technical combine to influence the larger system itself.

Creating Learning Designs

This learning activity, as all learning, is situated (Greeno et al., 1995). Specifically, whether we intentionally think about learning designs or not, they are situated in the context and culture in which the learning occurs. Situated learning is inherently emergent and adaptive by its very nature because it is in many ways unintentional (Lave & Wenger, 1991). In this situation, the newcomers (the students) are socially interacting with the expert (the teacher) and over time are increasingly becoming legitimate participants. The intention is to engage students in a particular set of concepts and understandings in practice; yet the path to getting there was not always intentional. Rather, the path emerges from the simultaneity of the social and technical system interlocking to create activity. That is activity materializes from a set of social interactions across teacher, learners, and tool. The students in this IM case study become more legitimate and the result was the participation structures of negotiating goals, co-constructing problems and providing supportive evidence. These indicators reflect the aforementioned research regarding how sociotechnical systems shape knowledge sharing and construction (e.g., Bell & Linn, 2000; Hermann, Loser, & Jahnke, 2007; Hutchins & Klausen, 1996). Though this situated activity did not intentionally result in these effective learning frames, a design implication is that we need to consider the ways in which we can more intentionally organize learning activities that further influence desired outcomes. The following four suggested design principles to intentionally shape sociotechnical activity stem from what was emulated across the three aforementioned emergent patterns of teacher-student IM participation.

Ground Learning Activities in Real World Experience. As the students were placed in real-world experiences, with real purposes and real people, and with the ability to use their tools, the social and technical become intertwined systems which emerged due to multiple influences. As a result of this, student knowledge and culture of participation is celebrated, communities of learners are built, and fact, skill, and knowledge are applied in meaningful ways. Furter, ongoing insight into the nature and construction of knowledge generate new directions of participation. Through the technology their thinking is made visible and the activity is continually authentic. This authentic activity relates to activity for student's own purpose rather than for an externally enforced one (Barab, Squire, & Dueber, 2000).

Allow Technology to Foster Adaptive Activity. Learning environments that include technology as an authentically integral part of learning activities foster emergent and adaptive practices. Although this type of learning design can happen without technology, the technology, together with the social, facilitates the emergence of participation and ultimately the social construction of knowledge (Papert, 1980). IM in this case is a cognitive tool that affords learning where students have an active part in developing arguments (Engle & Conant, 2002) and in constructing the concepts and decisions around those concepts (Scardemelia & Bereiter, 2006). In such activity students can generate constructive questions related to the goal at hand and can provide support for interpretation as they use multiple tools (IM, internet searchers, print resources) at their disposal (Engle & Conant, 2002; Linn, et al., 2004). From these characteristics of learning, knowledge and activity are continuously adapting (Walker, 2005).

Invite Learners to Innovate. Our tech savvy students are empowered when we use the tools that are an extension of who they are. In this case, the students initiated an innovative use of IM with their teacher. The students suggested the idea because IM is a tool that they regularly use and found effective for facilitating conversations amongst themselves. When we embrace learner's ideas for using technologies, we implicitly send a message that we value learners' social and cultural ways of engaging with each other. Furthermore, we allow these learners to draw upon the characteristics that define the Net-Generation. As a reminder, these characteristics include multitasking, figuring things out for themselves, tinkering with technology, and working across multiple media were pervasive in the different themes. In particular, our Net-Generation learners will legitimately add to the culture of participation. Allowing the students to lead us in some of the ideas about how to engage them—as this teacher did—will support motivation and sustained interest. Asking students to participate in their learning has proven to enhance their motivation and interest in what they do (Taylor, Fraser, & Fisher, 1997). Allowing youth to take ownership and to have a voice in what and how learning happens is essential to the success of their learning activities (DeGennaro, 2008; Heath & McLaughlin, 1994).

Celebrate Unique Forms of Participation. Using the technology supports the authenticity of activity for both student and for teacher. In this case study, IM facilitated student initiative, student voice and authentic participation. Another implication for IM use is that it afforded work across home and school spaces. Each of these implies a non-hierarchical structure where power relations are diffused and expert/novice expectations fluctuate as seen in CSILE (Scardamalia & Bereiter, 2006). As a result, both teacher and student felt the potential for shared participation, voice, and possibility. This principles supports other research that suggest technology-mediated communications changes in social standings (Lewis & Fabos, 2000). In addition, these communications afford opportunities for students to employ social strategies for learning and provide more occasions to be part of a conversation (Beach & Lundell, 1998).

Constraints and Equity Issues

Although sociotechnical systems illuminate unique possibilities for learning designs, they do not come without constraints. For one, the teacher will need to make particular considerations such as how much time she was willing to commit to online communications and how communications would be initiated. When the student requested using IM with their teacher, Ms. Geight set boundaries. First, she insisted on bounded times of communications. This was set at a few hours in the evening. She also insisted that the students initiate contact with her and not the other way around. She never initiated any of the conversations. The above transcripts are not time stamped and do not reflect the lulls in communication. However during these lulls, this teacher took opportunities to briefly walk away, complete other academic tasks such as grading or planning and return periodically to answer and ask questions appropriately. Not surprisingly, students enjoyed this flexibility of completing other tasks in the midst of the conversation as well. This example points to a unique affordance of IM. Despite its constraints, IM does allow both teacher and student to work across different physical spaces that are situated within different patterns of practice. It allows each user to more seamlessly engage across the online and in-context practice.

In addition to the above constraints, teachers will also need to consider the limitations of the technology. Technology drawbacks are always a factor when choosing to use technology as a truly integral part of learning. Some of the restrictions of IM to consider include potential technology failure and exclusive text-based communications. Technology failure—power, software crashes, and internet connectivity—will inevitably occur from time to time. Teachers must consider back up plans when these issues arise. The constraints of the technology used are also something to keep in mind. At the time IM had only a text-based option. Communicating with only written cues can be difficult. For example, expressing oneself is one dimension that requires that the participants be more explicit than if student and teacher were face to face. The latest version of IM has a voice feature and a video feature. These new technical elements can help to increase possibilities that were once limiting the communications between users.

Still other considerations remain. One relates to the potential of implementing an IM situation such as this, in a classroom where the learning environment consists of 25—30 learners. This is a very difficult question to answer. Coordinating conversations on IM takes a significant amount of attention and conversation can become complex and multiple conversations can often occur simultaneously. As a result, facilitating and following conversations is difficult. A possible solution is to use IM with small groups. Teachers can begin by modeling the process of communications with students. She can then move students to facilitating each other's conversations. Alternatively, the teacher could set up teams and identify a "team leader" for each group. This team leader could have direct contact with the teacher during designated IM times. To ensure equity, team leaders could rotate on a regular basis.

Aside from considering ways of instituting IM in a large classroom, teachers need to consider issues related to technology access. This is always a challenge in schools; access to resources can vary. A limitation of employing the activities suggested here is that this study involves a very small proportion of students in a privileged upper-middle class. At the time of this study, all students had high speed Internet access both at school and at home. Furthermore, this is a privileged community where technology has been an integral part of student lives and money to ensure continued access is never a problem. We know, however, that this is not the case everywhere. A potential solution is to arrange IM communications in school. Most schools in the United States now have Internet communications. However, restrictions on the use of IM in school are often very fierce. School officials who make decisions regarding technology will have to reconsider the possibilities that technology affords for learning.

While it is difficult to assert definitive generalizations from a small situational case study, successful aspects of this local implementation highlight considerations for the diffusion of and attempts to embrace youth uses of technical tools. Situating learning, connecting with youth technology practices, and designing learning environments that are flexible and potentially adaptable worked well for supporting authentic activity in this case. Based on the co-existence of the socio (personal beliefs, skills, values, and needs) technical (IM and other technical devices of the individuals) participation, each resulting structure was shaped by context, by social interactions, by activity which is coexistent with the technology. Learning designs that give attention to the situated nature of activity and that utilize technology as a completely integral part of emergent activity can foster the same success as was realized in this after school learning opportunity.

Contributor

Donna DeGennaro's research interests center on youth technology practices and interactions to inform innovative and emergent designs of learning environments. She is also interested in how cognitive, social, and cultural dimensions of learning illuminate the relationship between aspects of educational organizations (leadership, teaching, learning, professional development) and the adoption of technology-based innovations and learning designs. (Address: Donna DeGennaro, PhD, Assistant Professor of Instructional Technology in Curriculum & Instruction, Graduate College of Education, University of Massachusetts-Boston, 100 Morrissey Boulevard, W2-93, Boston, MA 02125-3393)

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