Computer-Supported Collaborative Learning (CSCL) in an Omani undergraduate course: a design-based study.

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Researchers have suggested collaborative problem-solving as an important method for linking students' classroom learning with needed workforce skills. However, research has done little to help us understand the reaction of students from traditionally instructivist cultures—where lecture, memorization and high-stakes assessment are the norm—to such innovative curriculum. I will report on current efforts at introducing two innovative methods into an undergraduate education course at Sultan Qaboos University in Muscat, Oman: a blog-based Computer-Supported Collaborative Learning tool called Future Learning Environments 4 (FLE4), and teaching methodology based on Brown and Campione's Fostering Communities of Learners (FCL). The research utilizes an education design research methodology, applying mixed research methods over multiple iterations to design a locally-sustainable learning environment. Implications for integrating these two innovative methods in Middle East classrooms will be explored.

Keywords: CSCL, Fostering Communities of Learners, Knowledge Building, Oman, Education Design Research

Connecting education with work

A major goal in educational research and practice is to bridge the gap between classroom instruction and real-world capabilities in order to develop the global workforce and aid in social and economic development. To meet this goal, international agencies (UNESCO, 2005; World Bank, 2008) as well as educational researchers (e.g., Bereiter, 2002) have called for constructivist-based teaching methods as a way of developing globally-connected knowledge societies. They argue that educators worldwide can no longer stress passive reception of sanctioned information through memorization and recall, but need rather to foster skills in information gathering, evaluating source quality, collaborating, problem-solving, and ultimately knowledge creation. Many educators have turned to Computer-Supported Collaborative Learning (CSCL) as a way to bridge the distances amongst learners (physically, temporally and interpersonally) as well as between learners and relevant performance (Collis, 2008) with the goal of fostering collaborative knowledge creation (Scardamalia & Bereiter, 1993).

However, many of the nations that could benefit most as knowledge societies continue to promote education practices that are largely instructivist in nature; that is, they rely on verbal transmission of information through lectures and textbook readings and a heavy emphasis on memorization of discrete facts that can be assessed through high stakes exams. Thus they limit dialogue by transforming learning into a banking model, with teachers making information deposits that can be withdrawn from students during exams (Freire, 2000). This is especially true in the Middle East/ North Africa region, where traditional instructivist methods contribute to the gulf between education and the labor force, creating challenges as graduates are unable to find work due to lack of relevant and practical skills (World Bank, 2008).

While many policy makers advocate a shift to constructivist-based social learning methods to aid in educational development (see, for instance UNESCO, 2005), the actual process of change from instructivist to constructivist methods has been poorly investigated (Catterick, 2007). Specifically, in a
traditionally instructivist learning culture such as Oman there is little research into how personal and institutional factors affect the adoption of CSCL. Lin and Hatano (2002), for example, note the lack in cross-cultural studies of CSCL that address questions such as “How do students who are used to quietly receiving information respond to the discussion and argumentation that are central to CSCL?” Furthermore, in the development of knowledge societies (plural), the question of what locally-relevant values constitute a sustainable CSCL program is central, but too often ignored in education research.

For this reason I am exploring how students in an undergraduate educational technology course at Sultan Qaboos University (SQU) in Muscat, Oman respond to the introduction of collaborative problem-solving through CSCL. The course is being designed by means of an educational design research methodology (van den Akker, Gravemeijer, McKenney, & Nieveen, 2006). In this way, I hope to find a sustainable solution for the improvement of Omani education that could provide a model for educational practice in an Omani knowledge society while also contributing to understanding of learning and educational change.

This paper will focus on the design of the course, and the implementation of two innovations to the current curriculum: a blog-based CSCL tool called Future Learning Environments 4 (FLE4) and a teaching methodology based on Fostering Communities of Learners (FCL; Brown & Campione, 1996). First I will examine how CSCL fits into the background of Omani education and then explore some of its theoretical roots and current practices. I will then describe the course and theoretical reasons for course decisions. I will look at how educational design research has informed the instructional design, and implications for educators in the Middle East.

Omani Education

Oman’s government has been highly committed to developing education, and has made many resources available for use at SQU and in public schools. The government provides significant financial resources toward education, spending an estimated 31.1% of government spending on education (UNESCO Institute for Statistics, 2006). The national government also provides much of the curricular resources for primary and secondary schools, including a standardized curriculum and textbooks. However, recent reforms (from 1998) have emphasized the teacher’s role in providing additional resources for the classroom, including online resources (MOE, 2008).

In terms of technology, Oman has traditionally had limited access to resources. In the 1990s the Omani government began investing heavily in educational technology for schools and universities (Al-Musawi, 2002). SQU, for instance, has increased access to technology labs, made internet access available in every classroom, and created a center for educational technology (Abdelraheem & Al-Musawi, 2003). Despite these advances, studies of technology usage in Oman have demonstrated poor network performance and a limited number of computers on campus (Osman, 2005), limited number of “fixed/portable equipment” and a reliance by instructors on “obsolete equipment” (such as conventional film cameras, VCRs and slide projectors; Al-Musawi, 2007), as well as limited internet access (among the poorest in the Gulf Region; see Elnaggar, 2007). Al-Musawi (2007) suggested that “Oman needs a vision by which its higher education can adapt ET [educational technology]” (p. 396). The technological situation will hopefully improve with the recent establishment of the national-level Information Technology Authority
and advances in the technological infrastructure since the abovementioned articles were written. Additionally, the Omani educational system has undergone massive reform over the past four decades. For instance, in 1998, Oman restructured the public primary and secondary system, introducing what they term the “Basic Education” system. These reforms affect not only SQU graduates who work in these schools, but also future SQU students who will be graduates of the basic education system, so it is worth noting how the goals, structure and assessment requirements of these reforms affect the adoption of CSCL in Omani classrooms.

Omani leaders, especially Sultan Qaboos have realized the importance of developing human resources in order to make the country globally competitive, and have done more than leaders of many other developing countries in improving education and aligning education with workforce needs (Rassekh, 2004). In order to obtain these goals, the Ministry of Education collaborated with international experts to create a system that would “foster critical thinking skills and problem solving capacity among students and provide opportunities for practical experience and application to real life situations” (p. 15). Students are expected to construct meaning for themselves through involvement in authentic tasks (Alsarimi, 2001) and contribute to knowledge generation rather than consumption (MOE, 2001). This involves a commitment to student-centered and experiential learning (Rassekh, 2004).

Furthermore, the Basic Education system seeks to improve assessment, aligning it better with the goals of education (Rassekh, 2004). Traditionally, assessment has been summative, occurring at the end of the educational cycle, as is common in the Arab Middle East, and designed to measure lower-order cognitive skills, such as fact recall. The Basic Education system proposes more authentic assessment that is formative and made up of many and frequent forms of assessment—including performance assessment, portfolios of assignments, and self-assessment by students (Alsarimi, 2001). Murphy, Ambusaidi, and Beggs (2006) suggest that this shift from a single high-stakes assessment may be a leading factor in Omani students’ comparatively positive attitudes toward science, since students spent more time in classes experiencing science rather than preparing for tests.

Despite these advances, many classes remain instructivist in nature, and little collaboration or technology use is actually seen in the classroom. It is for this reason that I have turned to CSCL as a tool for enhancing deeper cognitive processing in students, enhance their social learning skills, and prepare them for their future work.

Using CSCL to Build Knowledge

As a theoretical foundation for CSCL research and practice, many researchers turn to Vygotsky (1978) to understand the socially-situated nature of collaborative learning. Learning, according to Vygotsky, includes a goal-directed learning environment, the use of mediational tools, and opportunities to interact with more knowledgeable persons in a “Zone of Proximal Development” (ZPD). According to Stahl et al. (2006), Vygotsky’s ZPD is, simply stated, the measurement of the differences between individual ability and collaborative outcomes.

This focus on the socially-constructed and situated nature of learning has fostered many closely-related social practice theories of learning, all of which are foundational to CSCL. Among these are reciprocal teaching (A. L. Brown &
Palincsar, 1986), situated learning (Lave & Wenger, 1991), situated cognition (J. S. Brown, Collins, & Duguid, 1989), cognitive apprenticeships (Collins, J. S. Brown, & S. E. Newman, 1987), distributed cognition (Salomon, 1997), and knowledge-building (Scardamalia & Bereiter, 1993). While each of these differ in their emphases (see Suthers, 2006, for a distinction of epistemologies underlying these differences), they all point to a collaborative learning that is separate from individual learning—one that is contextually, socio-culturally, and dialogically bound. Each of these provides an approach for reaching some sort of intersubjective learning, where learners create meaning together (in what Roschelle & Teasley, 1995, call a “joint problem space”) and then interpret or appropriate (Rogoff, 1995) that learning. This is what Vygotsky (1978) calls the “general genetic law of cultural development” wherein inter-personal meanings become intra-personal.

It is in this process of intersubjectivity and interpretation that CSCL finds its raison d’etre and its strength (Stahl, 2003). More than simply learning alongside others (as happens in cooperative learning), collaborative learning is a process of constructing meaning together (D. Newman, Griffin, & Cole, 1989). The collaborators create artifacts, such as meaning, theory, or knowledge, which have ontologically-independent existence in what Bereiter (2002; based on Popper, 1972) calls “world 3”, an ontology that transcends objectivity or subjectivity (or worlds 1 and 2, respectively). For Stahl (2006), the individual/group learning tension is the heart of CSCL. As he stated, “while some established disciplines privilege the individual and others the social, theories of collaborative learning must center on the dialectical relationship between them” (Stahl, 2008).

Upon these foundations of social and individual learning a theory of CSCL is being built. As Dillenbourg (1999) has proposed, this theory includes the situations, interactions, process of cognition, and effects of CSCL, suggesting that proper situations would lead to collaborative interactions that would then impact cognitive processes and result in various learning effects, though not necessarily in that order.

According to this model, a situation conducive to collaboration is central to effective collaborative learning. Simply placing students next to each other is not enough for collaborative learning (D. Newman et al., 1989), and CSCL studies have suffered from shallow learning, ineffective collaboration, and lack of dialogue and intersubjective knowledge building (Arnseth & Ludvigsen, 2006; Crook, 1998), often due to potential CSCL problems that Roberts and McInnerney (2007) recognized, including student antipathy toward group work, problems in group selection, a lack of essential group-work skills, free-riders, possible inequalities of student abilities, withdrawal of group members, and improper assessment of individuals within the groups.

The success of any CSCL project, then, is dependent on creating situations that will foster collaborative interactions (Martens, Bastiaens, & Kirschner, 2007). Crook (1994) has suggested that effective settings require an awareness of communal purpose among participants, a rich supply of external resources, and pre-existing interpersonal relations. Central to the creation of this environment is the teacher, both as an integral part of the collaboration and a party to the group meaning-making, from whence he or she can interpret intersubjective meaning into his or her own practice (Stahl, 2003). Whether the teacher remains distant (such as Roschelle & Teasley, 1995) or as the source of
meaningful anchors for discussion through direct student involvement (Dennen & Wieland, 2007), the role of the teacher is an important one in creating stimulating collaborative situations (Ku, Lohr, & Cheng, 2004).

Furthermore, as both a learning resource and an artifact of mediation (van Drie, van Boxtel, Erkens, & Kanselaar, 2005), computers play a central role in enabling collaborative situations. Regardless of the designer’s underlying paradigm, Kolodner and Guzdial (1996) suggested that computers can assist collaboration by promoting conversation, facilitating knowledge building, providing record-keeping, enabling communication at a distance, promoting reflection, and supporting teacher planning and implementation of collaborative activities.

Central to computers’ use in CSCL is the design and study of what Stahl et al. (2006) call, “fundamentally social technologies.” As they further explain, “to be fundamentally social means that the technology is designed specifically to mediate and encourage social acts that constitute group learning and lead to individual learning” (p. 419). This means focusing on the affordances of technology (Kirschner & Kreijns, 2005) and understanding how to build scripts within that technology that will lead the students to collaborative learning (Dillenbourg, 2002). These scripts can guide learning as well as social negotiation and can focus, among other things, on the nature of the problem (Kapur & Kinzer, 2007) or the task-orientation for the students (Schellens & Valcke, 2006). An example of “fundamentally social technology” is Future Learning Environments (FLE; see more below), which is an open-source web-based collaborative knowledge-building tool developed by a group of Finnish researchers that enables students to create knowledge representations (Muukkonen, Hakkarainen, & Lakkala, 1999) and is based on the ideas of CSILE or Knowledge Forum (Scardamalia & Bereiter, 1993, 1996).

CSCL in Practice
CSCL has been used in many international settings, but most especially in North America, the UK, Finland, the Netherlands, and Germany (Kienle & Wessner, 2006). It has been used cross-nationally (Ligorio & van Veen, 2006) as well as with foreign students (Lea, Rogers, & Postmes, 2002) and among Diaspora communities (Bekerman & Horenczyk, 2002). Among developing countries, documented cases are much rarer, though it has been used in Singapore (Hung, Lim, Chen, & Koh, 2008; Tan, Yeo, & Lim, 2005) China (van Aalst & Chan, 2007), India (Kapur & Kinzer, 2007), and Turkey (Dooly, 2007).

Within the Arab Middle East, the documented use of CSCL is extremely limited. In fact, of the few studies found, none specifically claimed to be CSCL, relying instead on the foundations of cooperative work. For instance Hertz-Lazarowitz and Bar-Natan (2002) used computer-mediated communication (CMC) and collaborative learning (though not specifically CSCL) to teach writing skills to Israeli and Arab children in Israel. Interestingly, they found no significant difference between Arab and Israeli populations (n=599) when using collaborative CMC for writing, though there had historically been a large difference between populations in documented writing skills assessments. In Egypt, El-Deghaidy and Nouby (2008) conducted a pretest/posttest quasi-experimental study of pre-service science teachers (n=14 and n=12 control) using a “Blended e-learning collaborative approach (BeLCA).” Despite the low sample size, it is interesting to note that they found no difference in attitudes of students toward cooperation versus
traditional methods, though there is no evidence in the study of actual collaborative learning.

In Oman, Khan (2006) surveyed 36 women in post-graduate teaching-certificate programs to gauge their perceptions of CMC use in collaborative education. While the term “collaborative” was used in the study, most of the examples demonstrated cooperative learning events. Despite the small sample (n=36), the study showed that many women preferred CMC because of the social freedom they had as compared to face-to-face interaction (evidenced from the large number of respondents who claimed to take neutral or male pseudonyms during conversations). Additionally, several studies have been undertaken to understand the use and perceptions of students and teachers of e-learning tools in Oman (Al-Musawi, 2007; Cobb, 1999; Naqvi, 2006; and Osman, 2005). While these studies present tools that could potentially be termed CSCL, such as WebCT, none of the studies evidence collaborative learning, or intersubjective meaning-making. In many ways, CSCL represents an entirely new paradigm (Koschmann, 1996) for learning in Oman, as will be described in more detail below.

Building a CSCL Environment

My goal through this study is to create a knowledge-building CSCL environment for use by undergraduate students in the Instructional and Learning Technologies program at Sultan Qaboos University. I am teaching the course for the first two semesters, and will transfer the course to an Omani teacher for the last semester. In this course I introduce exercises based on Brown and Campione’s (1996) Fostering a Community of Learners (FCL). The structure of the course allows for one session a week devoted to traditional lectures, and another session within a more interactive “lab” setting. For the first half of the semester students work in groups or individually during the lab section to produce simple educational media products. This allows the students to build interpersonal relations, an important prerequisite to collaborative knowledge building noted above (Crook, 1994). Furthermore, many of the students are in a cohort together and know each other from other courses, thus strengthening their interpersonal relations.

Throughout the semester students are encouraged to become familiar with the CSCL tools of the course. They are asked to contribute regularly to the course wiki, which helps to provide many of the rich external resources noted as necessary by Crook (1994) above. They are also asked to participate in ongoing discussions about course topics on the course blog, which is scripted using FLE4, an open-source plug-in for WordPress blogs. FLE4 guides students’ comments on the blog according to “knowledge types” which are categories of scripts. For instance, during the initial week, students respond to a question about the role of the university in the Arab world by posting comments that are scripted by “six hat thinking” in an attempt guide the online discussions (de Bono, 1999). Using a familiar and widely used tool such as WordPress blogs allows the students to focus their time to learning how to use something useful outside of the structure of the course, which is not possible with earlier versions of FLE, or other similar tools, such as Knowledge Forum.

During the second half of the term students divide into groups to build a multimedia kit around a unit of instruction. They use the CSCL tools during this project to facilitate group decision making, recording group decisions, and share information and resources. Each group is given a group wiki page for collaborative designing and an FLE4 discussion thread utilizing the “progressive inquiry” knowledge type (Muukkonen et al., 1999).
In addition to the CSCL tools, the course is structured to fulfill Crook’s third requirement, “an awareness of communal purpose among participants” (1994) through employing the Fostering Communities of Learners (FCL) methodology (Brown & Campione, 1996). While many variations of FCL exist (Schoenfeld, 2004), Brown and Campione noted that the important thing was fundamental principles, not surface procedures. As Sherin, Mendez, and Louis (2004) note, these fundamental principles are activity, reflection, collaboration and community. To encourage these principles I created a scenario for the students to share information and created for them a consequential task, in which the students answer the question “How does an Omani teacher integrate technology into his or her lessons?” To answer this question, they work in self-selected groups of 4-5 individuals, and create their own learning scenario (age of students, how it fits in the curriculum, what technology is available, what the unit is about, etc.). This grounds their work in authentic data and tasks (Herrington & Oliver, 2000) and helps them to learn the skills of the educational technology community of practice (Lave & Wenger, 1991), while immersing them in a form of cognitive apprenticeship (Collins, Brown, & Newman, 1987).

Within these groups they chose specializations or “jigsaw” groups, namely project manager/resource manager, instructional designer/learning theorist, visual designer, audio/video specialist, and web specialist. These divisions are meant to replicate authentic educational media production teams while ensuring that each member is essential to the collaborative process. After the groups are formed and the students decide on their task, the students are given time to research more about their role, finding ways to contribute to their consequential task. The students are asked to share their questions and findings with others in the class who share their role through FLE4 threads on the course blog. Then, after 3 weeks, the students return to their groups, sharing what they have researched. These groups meet with other groups to discuss plans, concerns, etc. in a face-to-face “cross talk.” Then the groups spend the remainder of the semester working as a group, with occasional “jigsaw” sessions to discuss questions that arise during group production.

**Preliminary Findings**

This course is designed following an educational design research methodology (van den Akker et al., 2006). This methodology utilizes mixed data collection methods (including interviews, questionnaires, observations and course artifacts) with the dual purpose of addressing a local educational design need and informing learning theory (Reeves, Herrington, & Oliver, 2005). Over the course of three separate iterations, I will work with local educators to refine the design of the course. As such, the data collected to data is very preliminary and represents only the initial stages of formative evaluation.

That being said, the most striking design consideration so far has been building a collaborative classroom in a culture where men and women are segregated. In order to address this need, I asked students to form their own groups, which allowed them to create single-sex groups. In order to allow for jigsaw discussion, however, I rely heavily on the CSCL tools—one of the strengths of using such a tool in this setting. Students discuss with each other asynchronously online, in an environment that most are comfortable with. One student even remarked that she felt collaboration between men and women would allow more creative ideas to emerge. What remains to be seen is how effective this discussion is in generating deep-level discussion when the students
Students need to possess a high level of language skills and a maturity to remain motivated and take responsibility for their own learning. Students in this course are senior students, many currently undertaking their teaching practice, or having just completed it. This strengthens their motivation as they are able to see the relevance and direct application of course assignments. Because their language skills are excellent, online and face-to-face discussions in English (the language of instruction) are not limited by language difficulties, which would probably not be the case if the students were in their first or second year at the university.

A further design consideration has been managing the varied and large number of resources. Initially course resources were managed through a Wiki. However, future iterations will investigate managing most of the course through the open-source Moodle Course Management System, with links to FLE4 on a WordPress blog. Moodle will thus allow students to turn to one site, which they are already familiar with, and which will provide them with many CSCL tools for greater collaboration, such as wikis, synchronous chat and web conferencing.

Internet speeds as well as student access to computers have also been a problem for the course. Online collaboration is frustrating when uploads and downloads take several minutes. While all students can access the internet at the university, several do not have reliable internet at their homes, and are unable to engage in asynchronous discussions very often throughout the week. Furthermore, limited numbers of computers in classrooms mean that students often share computers during class. Future research may examine whether that limits or enables deeper collaboration.

Probably the greatest challenge presented from the preliminary research is sustainability of the program. The amount of time taken to set up the tools, and prepare course resources is greater than most instructors would normally allot for their courses. Future research will examine ways to make the course scalable, examining the design of a template that interested teachers could easily copy in their own classroom.

Implications

For many in the Middle East, the issues discussed in this paper are relevant to their country as well. Collaboration between men and women is difficult and often culturally inappropriate. However, CSCL tools allow students to share ideas while maintaining cultural expectations. Students around the Middle East possess varying levels of language proficiency. Therefore successful implementation may depend on students’ ability to fluently converse in the language of instruction. Furthermore, students’ motivation and self-regulation vary considerably, and teachers may need to examine ways to ensure students see the relevancy of assignments so they can take responsibility for their own learning, rather than simply follow a set of scheduled tasks.

The CSCL tools described in this paper are open-source and freely available to teachers of any budget. They are not difficult to learn, and students have adopted them quickly. However, internet speeds and access in most of the Middle East do limit the amount of online collaboration possible for the students. Teachers can be creative in adapting assignments to technical limitations.

While CSCL tools like FLE4 and FCL methods are new to many Middle Eastern classrooms, preliminary results show there is little cultural, institutional or personal barriers to their adoption. The biggest difficulty in implementing a similar
course structure in Middle Eastern classrooms is the adjustment to expectations necessary from students, faculty and administrators. The amount of work to make a course like this successful is significant on both the part of the teacher and the students. However, the successes in the classroom may be worth the effort, as classrooms begin to develop skills valued in the workforce. Working collaboratively, teachers can adopt FCL and FLE4 tools into their classroom as they work to increase student collaboration and knowledge-building.

As Stahl (2009) outlined in his introduction to a recent issue of the *International Journal of Computer-supported Collaborative Learning*,

Although most CSCL systems are still experimental prototypes, once fully developed with all the supports needed for deployment, they could provide effective learning environments to broad audiences of students. In doing so, they would even make it possible for students to collaborate across national borders, preparing them for an ever more global world.... The catch is that students, teachers, parents, schools, and politicians all have to transform how they think about education so that they can appreciate and support the profound kinds of learning that can take place in CSCL experiences. Some countries have begun to commit to constructivist and collaborative learning as appropriate to our global knowledge-building economy. It is up to CSCL researchers to continue to provide persuasive evidence for transforming our educational institutions in this direction (p. 2).

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