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Enhancing the sense of community and learning experience using self-paced instruction and peer tutoring in a computer-laboratory course

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In its second decade of education reform and its third cycle of national ICT master plans, Thailand struggles to transform its aspirations into practice. This paper chronicles three decades of Thailand's ICT national plans and their relation to education reform. It also discusses the effect of global trends, Asian cultures, and Thai cultures on teaching and learning in higher education. After discussion of existing literature on technology integration in Thailand higher education, this study proposes alternative classroom instructional strategies in a large computer laboratory course, using self-paced learning and peer tutoring. The strategies are grounded in constructivist learning theory which can foster a sense of classroom community, and thereby promote learning. The *Classroom Sense of Community Index* was utilised to measure student perceptions of classroom connectedness, learning, and community in traditional and alternative instructional approaches. Results indicated significant differences in two indices: connectedness and community. Although there was no significant difference in the learning index between the two groups, descriptively the scores were higher for the alternative instructional approaches group. The results imply that the proposed instructional choices have the potential to foster a sense of community and support learning.

Introduction

Compared to neighboring countries in Southeast Asia, Thailand is considered to be above average in many aspects of societal and educational advancements. Based on the data of the World Bank (2011), the country in fact has an advantage in terms of its national budget for education, access to technology and the Internet, and literacy of its population. Yet the country struggles to close the gap between its aspirations towards ICT-based national education reform and reality. One of the major hurdles is classroom culture, which fails to create conditions that help achieve the country's ambition to enhance its human, institutional, and technological capacities. These are major sources of new knowledge and innovation, which will impact personal income, economic growth, and social returns (Kozma, 2005).

According to Kozma (2005), there are four types of ICT-based education reform, from low to high levels: (a) improve the delivery of and access to education, (b) learning ICT skills so that learners are better prepared for work, (c) improve student understanding, increase the quality of education, and thereby increase the impact of education on the

economy, and (d) knowledge sharing and creation can sustain economic growth and social development. To reach the highest level, pedagogical, curricular, and assessment reforms must be implemented to support the process of knowledge creation. Such reform helps learners to master multi-dimensional abilities to become lifelong learners and actively participate in the information society.

During the last decade, the pervasive use of ICT in Thailand is astounding. The World Bank (2011) reported that in 2009 Thailand had more cell phone subscriptions per 100 people (120.9) than the European Union (123.4) and North America (94.4). Among Southeast Asian countries, Thailand's subscription record is second only to Singapore (133.4). According to the National Statistical Office (2009), every higher education institution is equipped with Internet access, with 67.9 percent having wireless connectivity. The most recent national survey revealed that children and young adults spent most of their time either studying or working with computers (National Statistical Office, 2008). High school age groups 15 to 19 years old used computers mostly for study (81.6%), while young adults in age group 20 to 24, either in school or their early career, primarily used computers for study (45.4%) and for work (23.7%). For Internet usage in particular, high school age groups reported that their primary activities were to access information and news (69.2%), online games (16.0%), email (8.2%), and e-learning (0.1%). Similarly, the young adults age group reported that their primary activities were to access information and news (63.8%), email (18.3%), online games (11.4%), and e-learning (0.01%). Although these data might be misleading since the proportions of usage time were not reported, statistics on Internet usage based on 'click share' from National Electronics and Computer Technology Center (NECTEC) revealed similar patterns with 40.5% in entertainment, 9.9% in games, 6.3% in social and personal, and only 1.7% for education (Koanantakool, 2007). The NECTEC (Siriruchatanapong & Thuvasethkul, 2010) also reported findings from an Internet user survey in 2009 that the primary activities were to access information (30%), email (22%), news (9.3%), and e-learning (8%). These figures suggest that while Thais have computers and the Internet at their disposal, the level of ICT use for educational purposes is minimal. That is, ICT-based national reform in Thailand as described by Kozma (2005) is at the lowest level.

The low level of ICT adoption could be attributed to pedagogical culture. On a theoretical scale from zero to 100, Thailand scored 75 on traditional practices (Kozma, 2003). A series of nationwide survey studies regarding e-learning readiness in higher education institutes (Laohajaratsang, 2006; 2010a) also reported similar findings of major obstacles to technology adoption. The survey in 2006 indicated that quite a number of instructors and students reported their reluctance to use technology. The subsequent survey in 2008 found that instructors were not interested in content development and did not possess the required ICT skills. Laohajaratsang (2010b) argues that the major reason for slow ICT integration into classrooms is that Thai teachers are very sensitive to changes even after training or professional development programs.

Purposes of the study

Although Thailand clearly links education reform with ICT policy and provides technology and resources to the schools (Kozma, 2003), pedagogical culture seems to hinder the transformation in every level of education in Thailand. This study aimed to shed light on this particular issue in higher education and to provide empirical

evidence about alternative practices at the classroom level. Specifically, it compared the effects of alternative approaches using self-paced instruction and peer tutoring, to teaching with the traditional approach, in terms of perceptions of community and learning.

Research question

This study investigated the following research question:

> Did students' perceptions of community in an alternative approach to teaching and learning using self-paced instruction and peer tutoring, and in a traditional mode of teaching and learning differ?

Specifically, the study compared students' scores from the *Classroom Community Scale* or CCS (Rovai, 2002) for the two groups.

Relevant literature

National policies and education reform

In order to compete on the world stage and to prepare for the ASEAN integration in 2015, which will have impacts on all the member nations in many ways such as mobility of labour, businesses, industry, investment, education, etc., the National Electronics and Computer Technology Center (NECTEC), the National Science and Technology Development Agency (NSTDA), together with the Ministry of Science and Technology (2011) have established a national information and communication technology policy framework, ICT2020, to guide sustainable development in social, economic and environmental aspects.

ICT2020 has its roots in previous attempts to establish a nationwide IT infrastructure before the turn of the century. The first national IT policy known as IT2000 was announced by the National Information Technology Committee (NITC) and endorsed by the Cabinet (Thuvasethkul & Koanantakool, 2002). The policy emphasised the building of an equitable national information infrastructure (NII), developing human resources, and achieving good governance. During this five-year policy, several governmental projects concerning education were initiated including *SchoolNet*, an attempt to empower schools in Thailand to access a large pool of information via the Internet, and the *Golden Jubilee Network*, the project initiated by Her Royal Highness Princess Maha Chakri Sirindhorn as a tribute to His Majesty the King on the 50th anniversary of the accession to the throne. The project aimed to provide large amounts of educational content in the Thai language, with public access (Koanantakool, 1999).

The succeeding policy from IT2000 was the *National IT Policy Framework* for the years 2001-2010, or IT2010, a policy aimed at moving Thailand into a knowledge-based economy and knowledge-based society (Thuvasethkul & Koanantakool, 2002). In this policy, under the supervision of the NITC Secretariat, e-Education was identified as one of the five flagships along with e-Government, e-Commerce, e-Industry, and e-Society. These five flagships are interrelated by overarching themes in education including skills development for all levels from government officers (e-Government), personnel and students in the educational system (e-Education), lifelong learning (e-Society), and skilled and knowledge workers (e-Commerce, e-Industry) (National

Information Technology Committee Secretariat, 2003). The goal of e-Education was "to develop and prepare the country's human resources at all levels in support of the development of a Knowledge-Based Society" (p. 26).

Unfortunately, development under the IT2010 policy did not meet its objectives. The National ICT Policy Framework 2011-2020 published by the Ministry of Information and Communication Technology (MICT) indicated that Thailand's ranking on the *Networked Readiness Index 2002-2009*, rated by the World Economic Forum, has dropped gradually from rank 41 in 2006 to rank 47 in 2009. The policy framework document also reported the failure in promoting the number of knowledge workers, knowledge-based industries, IT literacy, learning materials, contents and media, especially in Thai language (National Electronics and Computer Technology Center et al., 2011). Therefore, MICT has developed the *ICT2020 Policy Framework* (2011-2020) with an effort to ensure continuity at the policy level for the next decade.

The ICT2020 policy framework was established based on five principles: (a) proceeding under the threefold sustainable development concept of social, economic, and environmental dimensions; (b) using ICT to increase equity and opportunity; (c) upholding the philosophy of sufficiency economy; (d) succeeding the former policy framework and strategies to ensure continuity; (e) supporting cooperation between public and private sectors. The vision of ICT2020 or *Smart Thailand 2020* stated that "ICT is a key driving force in leading Thai people towards knowledge and wisdom and leading society towards equality and sustainable economy." Smart Thailand 2020 aims to (a) improve a universal broadband to offer equitable access for the general public, (b) produce 75% high-quality human resources to bolster service and creative economy, (c) raise realisation of the role and significance of IT industries in the Thai economy, (d) reach the top quartile of the *Networked Readiness Index*, (e) increase opportunities in creating revenue and quality of life, and (f) instill awareness of the importance and role of ICT in developing the economy and society in an environmentally-friendly and participatory manner into at least 50% of the population.

It is worth noting that ICT2020 is based on the National Education Act of B.E. 2542 (NEA) in 1999, the first education reform in the recent history of education in Thailand that stresses the shift of the philosophical foundations of the educational system (Fry, 2002). More specifically, teacher should assume the role of a facilitator, and student should assume the role of an active learner (Kozma, 2003). The intentions of NEA aim to improve education on the basis of lifelong learning, social contribution in education, and the development of content and learning processes. According to Fry (2002), the issues of quality standards, learner-centreed approaches, the role of the private sector, and structural reform in decentralisation of education to local organisations are significant in this Act. Four new factors have been added to streamline education reform, including (a) quality of the new generation of Thais, (b) new generation of teachers, (c) new generation of educational facilities and centers, and (d) new educational administration system which aims at decentralisation. That is, "Thais will have quality lifelong learning" (p. 5).

The ultimate goal of the reform is to instill learners with skills that are compatible with the changing economic landscape in the 21st century society (e.g., creativity, higher order thinking, and citizenship). The reform considers that ICT will play an important role at the local to national levels (National Electronics and Computer Technology Center et al., 2011). In response to NEA 1999, ICT2020 refers to "smart learning"

strategy. It states that Thais should have opportunities to participate in on-going skills training in using and applying ICT and developing ICT content. Curricula on ethical use of ICT should be introduced from primary level onwards. Three important skills at the primary and secondary levels are ICT literacy, information literacy, and media literacy.

Although ICT2020 is clearly connected to education reform, creating conditions that support the reform policy is not an easy task. Pedagogy, along with curriculum, assessment, teacher professional development, school organisation, systemic reform and educational transformation are key issues in education reform (Kozma, 2005). The next section explores Thai history and cultural background in order to better understand their roles in the culture of teaching and learning in Thailand.

Asian and Thai cultures in education

Many researchers stress the important role of cultural context in learning. Chinese heritage culture and Confucianism influenced many countries, from East Asian countries such as China, Korea and Japan, to some parts of Southeast Asia such as Vietnam and Singapore (Miller, 2009). Asian students tend to be passive and nonverbal, rarely initiate class discussions unless they are called on, avoid being noticeable in class, prefer to listen to lectures and take notes, and worry about losing face if they make mistake. Pagram and Pagram (2006) provide supportive evidence from Thai researchers' perspective that Thai teachers play a role beyond giving instruction, they carry with them social capacity and expectations. From primary school to higher education, teachers are second parents giving guidance to students.

One of the most important works on cross-cultural studies was that of Hofstede, Hofstede and Minkov (2010) in the 1970s. Data from 76 countries and regions were used to study differences and commonalities using five cultural dimensions including power distance, individualism masculinity, uncertainty avoidance, and long term orientation. According to Hofstede's cultural dimensions, Thai culture was ranked as high power distance, high uncertainty avoidance, low individualism and low masculinity. Of the five dimensions, Thailand's first four dimensions conform with an Asian average (China, Hong Kong, Indonesia, Japan, Malaysia, South Korea, Taiwan), while long term orientation was much lower than the average (Hofstede et al., 2010; Pagram & Pagram, 2006). Almost four decades later, the Hofstede's *Values Survey Module* plus two new dimensions, *Loyalty to the Monarchy* and *Buddhism*, was used by Thai researchers (Wajarasriroj, Kangsanant & Chodchuey, 2007) to study Thai culture and its implications for organisational management. The study revealed significant changes in all five dimensions compared to the original study. That is, power distance (from 64 to 44), masculinity (34 to 19) and long term orientation (56 to 44) indices decreased, while individualism (20 to 55) and uncertainty avoidance (64 to 83) indices increased. The results suggest that Thais have become more individualistic over time, people tend to have more participation and decision in works rather than simply following orders.

Interestingly, the study found that the youngest age group in the study, less than 20 years old, reported markedly high individualism with an average of 78.3 while other age groups average range from 55.5 to 63.1. Moreover, the young Thai generation reported low power distance with an average of 15.7, comparing against other age groups which range from 20 to 48.4. These trends are in fact a global phenomenon of

Generation Y or the *Millennial*. Born between the early 1980s and 2000, the Millennial generation is known for their individualism, yearning for creativity and meaningful work and life (Lancaster & Stillman, 2010). Thai students endure passive approach of teaching and rely on rote learning not because of their preference, but because education is perceived as prestige and honour (Komin, 1991). These conditions are hardly their favourite approach to learning.

In fact, Thai and other Asian students are not inherently resistant to innovative teaching, but are capable of more active forms of learning, and open to engage in their own learning (Kember, 2000). Kember (2000) suggests that designing curricula which foster higher forms of learning, active participation, and are relevant to future careers would greatly benefit Asian students. Although the new generation welcomes innovation, they are not equipped with the required skills for innovative learning, such as ICT literacy and self-directed learning (Pagram & Pagram, 2006; Siritongthaworn, Krairit, Dimmitt & Paul, 2006). In-service teachers also have inadequate computer literacy, largely resulting from a lack of training and experience in innovative teaching (Siritongthaworn et al., 2006). Thus, it is not surprising that they struggle to adopt new pedagogical practices and incorporate ICT into teaching and learning. These situations are observed in survey studies mentioned earlier (Laohajaratsang, 2006, 2009, 2010a), and a large scale literature review of technology integration in Thai education (Achariyakosol, 2006). Details of the literature review are described in the following section.

Technology integration in higher education

Learner-centered instruction is central to the National Education Act of B.E. 2542 (NEA) (Fry, 2002). ICT2020, being founded on this Act, aims to integrate technology into teaching and learning to promote active learning and prepare teachers to assume the role of facilitator. Such aspirations seem to shift instructional methods for learning toward constructivist learning theory, problem-based and inquiry-based learning, and collaborative learning. In other words, learning should be an active, social process.

Despite the fact that constructivism has been around since the 1960s (Jerome, 1966; Piaget, 1967), the theory began to emerge in the body of literature on educational research in Thailand only in 1996 and was the least used theory in Thai research studies (Achariyakosol, 2006). Furthermore, research studies that apply constructivism and other related instructional concepts such as problem-based or inquiry-based learning, problem solving, and collaborative learning, are few and far between. An analysis of theoretical development and utilisation of educational technology in Thailand (Achariyakosol, 2006) with a span of 38 years from 1964 to 2002 found that behaviourism was a predominant theory from 1968 to 1974. A review of recent literature on educational research based on constructivist learning was also conducted, but the authors identified only a few studies that embraced the use of constructivism in teaching and learning with technology. The work of Suanpang and Petocz (2006) is arguably the first research project to investigate the use of e-learning technology in Thailand. The authors investigated two different modes of delivery, online and traditional, in a business statistics course at Suan Dusit Rajabhat University. Resource-based and collaborative learning were used in designing the online learning environment. The results showed the benefits of online learning over the traditional classroom setting in terms of students' learning outcome and satisfaction.

Another recent case study (Satiman, Boonlue & Sittiwong, 2008) applied problem-based learning activities and self-directed learning in the online environment. The research compared pretest and post-test scores for problem-based learning activities undertaken by a self-directed student group with a traditional learning group. They argued that online problem-based learning activities can replace and be used along with traditional problem-based learning activities in the classroom, with a benefit of being more independent and allowing a flexible learning style.

Although results from these early studies are promising, many questions remain unanswered. Compared to the West, countries in Asia have far less resources for teaching and learning at every educational level. The great majority of university lecturers in Thailand, like other countries in the region, teach large, introductory courses without being given teaching assistants. Long hours of teaching coupled with the lack of pedagogical knowledge makes teaching at university level a laborious job. These local aspects are important in developing policies and strategies (Kozma, 2005). This study provides empirical evidence from an alternative approach to developing instruction at the classroom level. The following sections describe alternative instructional strategies, research design, and data analysis.

Alternative instructional strategies

This study proposes alternative teaching and learning techniques using the concepts of self-paced learning and peer tutoring. Grounded in constructivist learning theory, the study hopes to exemplify instructional design which can alleviate the situation that most of the university instructors are facing, foster sense of classroom community, and thus promote learning.

Self-paced learning

The concept of self-paced learning has been around for more than half a century. The concept can be dated back to the time of the renowned behaviourist B. F. Skinner's programmed instruction, where learners are allowed to progress through learning materials at their own pace. Skinner's programmed instruction incorporates behavioural objectives, small frames of instruction, active learning, and immediate feedback (Skinner, 1958). The advent of microcomputers made it possible to design more efficient self-paced instruction, such as computer-assisted instruction (CAI), thus the technique became more mainstream (Belland, Taylor, Canelos, Dwyer & Baker, 1985). The concept finds ways to support cognitivist instruction as in computer-based instruction (CBI) (Ormrod, 2008). Further, the fundamental idea of self-paced learning is compelling when the focus is shifted from instructor to learner in constructivist learning environments, in which individuals have unique backgrounds and knowledge is socially constructed. Other aspects of self-paced learning, such as choosing content, sequence, and learning objectives, also come into play, especially in designing instruction that favours constructivism.

Although self-paced learning contributes soundly to constructivist principles, as students' have different learning abilities, the idea is not always easy to put into practice. Allowing students to choose the speed they want to go through their lessons in a large, introductory course would be chaotic and impractical for instructors to manage and monitor their progresses. Moreover, anticipating customised feedback from subject matter experts is tedious, cost-ineffective and, again, rather impractical.

Nonetheless, self pacing should not be the only concern when designing instruction (Wittrock, 1979). The focus of instructional design should be on elements affecting learning. In particular, two key elements are attention and motivation. The authors concur with other scholars that interaction can promote motivation and enhance learning (Bellon & Oates, 2002; Bernard et al., 2009). Contemporary learning theories, such as social cognitivism and social constructivism, also believe that interaction is important in acquiring and constructing knowledge. Further, the notion of interaction is helpful in designing instruction and classroom management. For instructional design, teacher-student and student-student interactions foster active learning and motivation as opposed to a teacher-directed approach (Menzel & Carrell, 1999; Powers & Rossman, 1985). For classroom management, especially in large classes, allowing students to interact nurtures sense of classroom community, which is a key element in learning (Garrison & Kanuka, 2004; Rovai, 2002). To enhance interaction in a large class, peer tutoring was incorporated into the instructional design.

Peer tutoring

Peer tutoring, an age-old practice since the ancient Greeks, can be defined as students with more knowledge and skills helping other students with less of those capacities to learn in cooperative pairs or small groups (Topping, 1996). Topping argues that peer tutoring is closely linked with social constructivism and possesses many theoretical advantages. First, peer tutoring promotes social and cognitive interaction with an experienced tutor guiding his/her tutee(s) within their zone of proximal development (Vygotsky, 1978). Second, it embraces the concept of "learning by teaching" which was proven to enhance meta-cognitive skills and several higher order thinking skills such as evaluation in declarative, procedural and contextual knowledge. Third, peer tutoring reduces anxiety with greater student ownership of learning process, thus promoting self-esteem and empathy with others. This issue is particularly useful in Thai classroom context where teachers assume the roles of second parents (Pagram & Pagram, 2006). Fourth, peer tutoring allows active, interactive, participative learning, and immediate feedback. Finally, it reduces teacher-student ratio and increases time on task, resulting in more opportunities to make errors and be corrected. In other words, it increases opportunity to respond and promote classroom engagement (Greenwood, Delquadri, & Hall, 1989).

These benefits lead to consideration of peer tutoring to improve learning quality in large classes with limited resources, which are issues of "doing more with less" that higher education is facing (Topping, 1996). In conclusion, peer tutoring fosters interaction among students which in turn generates active learning environments (Menzel & Carrell, 1999; Powers & Rossman, 1985), nurtures sense of classroom community, and thereby promotes learning (Garrison & Kanuka, 2004; Rovai, 2002).

Marrying self-paced learning with peer tutoring may help address many issues in designing instruction and classroom management, especially in large, introductory classes. The combination can serve students with diverse backgrounds, help reduce teacher-student ratio, and allows instructors to devote more time to helping students with less knowledge and skills and needing more guidance. This study is rooted in constructivism and embraces the concepts of self-paced learning and peer tutoring. It proposes that the combination can foster a sense of classroom community and thus promote learning. More details regarding class restructuring is discussed after next section, on the context for this study.

Context of the study

This study focused on freshmen (first year) students enrolled in *Microcomputer Applications*, an undergraduate level, face to face, non-credit computer laboratory course in the second semester of academic year 2010 at an international university in Thailand. The course aims to train students to use three major productivity software packages to develop business presentations, business documents, and calculating documents. Presentation software, word processing, and electronic spreadsheets are introduced. The course covers basic functions of office productivity software, such as creating and navigating software workspace, adding objects and *WordArt*, finding and replacing, and formatting documents. All of these functions are listed in the course syllabus, which is the only official course material given to students. However, instructors may create additional material for students in their sections.

Microcomputer Applications is considered a large class with a total of 1,792 students enrolled in 32 sections (an average of 56 students per section). Students attended a 14-week computer laboratory course for one and a half hours per week. The course was organised into three phases, four weeks for presentation software, four weeks for word processing, and five weeks for electronic spreadsheets. The final week was left open for revision. At the end of each phase, instructors would arrange a quiz to test knowledge and skills on specific productivity software. A quiz for each phase was worth 10 percent with a total of 30 percent for all three phases. Seventy percent was allocated to the final examination.

Ten instructors who were assigned to teach this course shared the same syllabus. Although they were at liberty to alter course structure, all of them followed the order of productivity software as given in the syllabus and gave a quiz at the end of each phase. Teaching typically entailed whole-class demonstrations which relied heavily on lecture-based, step by step instructions, where students followed an instructor who performed certain commands on the projector. The lack of course material and the nature of the instructions, which required full attention from students, generated demands for more rigid controlling solutions such as screen broadcasting or software blacklisting. It should be noted that although some instructors agreed on these controlling strategies, none has been successfully implemented at the present time. Nonetheless, the authors strongly believe that regulating more controlled environments would limit opportunities for students to take control of their learning, and eventually decrease their motivation.

The first author, who was assigned to teach two sections of Microcomputer Application, initiated the course redesign and the research study. A request to conduct the study was made through the office of the vice president for academic affairs and the department chairperson. Although innovative teaching and learning is encouraged among faculty, it is not a requirement. Thus, asking all ten instructors who taught the course to attend a training (e.g., video production, LMS) and change their practice was unlikely and, as a result, the chairperson agreed that the study would serve as a pilot project within the department. However, two other instructors agreed to ask students in their sections to participate in the study as a control group. One of the instructors taught eight sections, while another taught two sections.

On the students' side, typically they sought suggestions from peers and senior students. Depending on students' preferences, some looked for a lenient instructor while others asked which instructor was good at teaching and really knew the course

material. These conversations, albeit unofficial, could be observed in Internet discussion forums set up by alumni. The authors searched through the discussion forums and all three participating instructors were not positively or negatively mentioned. It should be noted that such unwritten rule is evident during the registration period when some sections are filled up faster than the others or some sections are almost empty. The university recognises that if any discrepancy may exist in a pool of faculty assigned to teach a given course, it may opt to hide instructor names during the registration period. However, this was not the case for Microcomputer Applications. Moreover, all three participating instructors had at least five year's experience in teaching this course and thus were considered experts in the field. Importantly, the fact that teaching methods were not identified during the registration ruled out the possibility of choosing a section based on learning style preferences. However, as assignment to a group was not random, this study is considered to be a quasi-experimental design.

Instructional redesign

Microcomputer Application redesign was guided by constructivist principles and had two main aspects: (a) learning materials and (b) teaching and learning strategies. Regarding learning materials, several media such as video clips, web resources, *PowerPoint* presentations, and in-class web exercises were put together into the learning management system (LMS), *Moodle* for students' self-paced learning. These media were meant to replace step by step instructions that instructors typically rely upon. In-class web exercises were utilised to make sure that students attained the learning objectives for each session. In some cases, different sets of web exercises were randomly assigned to students. Further, in order to ease students into these new learning experiences, exercises in the first half of the semester, presentation software and word processing, focused more on individual activities with a low degree of collaboration.

Activities for spreadsheet software during the second half of the semester were more diverse and relied more heavily on collaboration. Given the greater degree of complexity and the wide range of functions in spreadsheet software, many exercises were designed differently while students worked on a similar objective. For example, when students were asked to calculate total, one set of the exercises instructed them to use formulas (e.g., =B1+B2+B3) while the other set instructed them to use the *sum()* function. Similarly, one set of exercises could ask them to use the *countif()* function, while the other set asked students to try *if()* and *sum()* functions to achieve the same outputs. These exercises increasingly required higher degrees of collaboration and those who finished earlier could not simply walk their friends through what they did. Rather, they had to start over and work from the beginning with their peers. The new structure of class activities also affected mark allocation. Instead of giving students 10-percent quizzes at the end of each of the three phases, scores were equally allocated throughout the time of each phase (e.g., three *PowerPoint* web exercises across the first three weeks constituted 10 percent).

Regarding teaching and learning strategies, each session began with an opening discussion, where the instructor gave a quick summary on the class objectives and exercises, and then prompted students to login to *Moodle* and work on their own workstation, at their own pace. After finishing the exercises, students uploaded them back to the *Moodle*. With self-paced learning, instructors could identify quickly

students who possessed greater skills in the subject matter (i.e., those who finished their exercises earlier) and recruited them to guide their less-skilled friends (i.e., peer tutoring). Thus, those who needed help would not have to wait for assistance from the lecturer. It should be noted that once instructors finished with the class introduction, they then acted as coaches by observing how students worked on their own pace and gave suggestions upon request. In other words, the instructor also assumed the role of a tutor.

Lastly, although the exercises were intended to be finished during the class session, because the class was a non-credit, some struggling students were allowed to seek help from instructors after class and submit the exercises within that particular week via *Moodle*.

Research methodology

Research design

The study employed a quasi-experimental design comparing two student groups. Those who participated in the redesigned course were in experimental group; those who did not participate were in control group.

Participants

Of 32 sections with total number of 1,781 students enrolled in *Microcomputer Applications*, 277 participants (15.6%) from 13 sections participated in this study. Fifty seven of the participating students from two sections of the first instructor were in the experimental group, experiencing self-paced learning and peer tutoring techniques, while the other 220 students from 11 sections with the other two instructors were in the control group, experiencing a traditional instructional model with lecture-based, step by step instructions. In terms of course material, students in the experimental group worked with media such as video clips, web resources and *PowerPoint* presentations, while students in control group had the syllabus as their only official course material.

Research instrument

The *Classroom Community Scale* or CCS (Rovai, 2002) was used for data collection. The 20-item CCS consists of three constructs: connectedness, learning, and classroom community. There are 10 items related to feelings of connectedness and 10 items related to feelings regarding interaction among students as they pursue the construction of understanding and the degree to which students share values and beliefs concerning the extent to which their learning goals are being satisfied. With full scale Cronbach's coefficient α of .93, and both the connectedness and learning sub-scales of .92 and .87, CCS is considered a reliable measure of community. Items received a 100-point scale *Flesch Reading Ease* score of 68.4, indicating that they are easy to understand (Rovai, 2002).

CCS was chosen because the goal of the instructional redesign was to shift the role of instructor using self-paced learning and to foster a sense of community using a peer tutoring strategy (i.e., connectedness sub-scale). The eventual outcome of this redesign was to promote learning (i.e., learning sub-scale). The instrument was designed based on the notion of classroom community, which is reasonable for measuring instruction grounded in constructivist learning theory.

Data collection and data analyses

Students from the 13 sections were asked to voluntarily participate in the 20-item CCS online survey via *Google Form*. The data were exported into Microsoft *Excel*, creating a spreadsheet containing a complete set of data. These raw data were converted to CCS scores grouping by gender and corresponding groups (control and experimental), sub-scales, and the total CCS scores. This spreadsheet was imported into *R* software version 2.13.0 (http://www.r-project.org/) and independent-samples t-tests were run on the data set. In addition, a 2 x 2 ANOVA was also carried out to interpret the data based on group (control and experimental) and gender.

Results

Descriptive statistics indicated that the average CCS score in the experimental group (N=57; M=47.33; SD=7.92) was higher than the control group (N=220; M=44.00; SD=7.12). The two sub-scales of the experimental group (connectedness: M=23.84; SD=4.292; perceived learning: 23.49; SD=5.16) were also higher than those of the control group (connectedness: M=21.97; SD=4.53; perceived learning: 22.03; SD=4.63). The results of descriptive statistics are summarised in Table 1.

Table 1: Descriptive statistics

Group	Gender	*N*	Connectedness		Learning		Community	
			M	*SD*	*M*	*SD*	*M*	*SD*
Control	F	148	22.11	4.16	21.91	4.19	44.01	6.35
	M	72	21.68	5.23	22.29	5.45	43.97	8.53
	Total	220	21.97	4.53	22.03	4.63	44.00	7.12
Experimental	F	32	23.91	4.34	24.31	4.58	48.22	7.95
	M	25	23.76	4.31	22.44	5.75	46.20	7.90
	Total	57	23.84	4.29	23.49	5.16	47.33	7.92

Prior to the main data analyses, data were screened for outliers and normality of distribution. Bartlett tests for homogeneity of group variances were non-significant. Independent samples *t*-tests were performed to test whether the average score of students in experimental sections was significantly different from that of the traditional sections. The results indicated significant differences in connectedness sub-scale: $t(275)=2.903$, $p=0.005$, and the total CCS score (sense of classroom community): community $t(275)=2.889$, $p=0.005$. The outcome of the *t*-test comparing two means of learning sub-scale was not significant: $t(275)=1.942$, $p=0.056$.

Based on instructional group (control and experimental) and gender, a 2 x 2 ANOVA was also carried out to interpret the data. The results indicated no main effect for gender and interaction effect in any sub-scale or the CCS score (Table 2). However, the ANOVA applied to the instructional group for the effect of treatment proved to be significant in every measure: connectedness sub-scale, $F(1,273) = 7.858$, $p<.01$; learning sub-scale, $F(1,273) = 4.297$, $p<.05$; and CCS score, $F(1, 273) = 9.432$, $p<.01$.

Students in the alternative instructional approaches group reported significant differences in two indices: connectedness and community. Although there was no significant difference in the learning index between the two groups, descriptively the scores were higher for the alternative instructional approaches group. There was no significant difference between the means from male and female students when they

reported scores of community, connectedness, and learning. That is, there is no main effect of gender and no interaction effect between gender and instructional group. Results indicated that the use of peer tutoring and self-paced instruction can promote a sense of community among students and enhance learning.

Table 2: Group x gender ANOVA

		df	*MS*	*F*	*p*
Connectedness	Group	1	158.972	7.858	0.005 **
	Gender	1	8.293	0.410	0.523
	Interaction	1	0.861	0.043	0.837
	Within groups	273	20.232		
Learning	Group	1	96.421	4.297	0.039 *
	Gender	1	0.918	0.041	0.840
	Interaction	1	55.520	2.474	0.117
	Within groups	273	22.442		
Community	Group	1	503.01	9.432	0.002 **
	Gender	1	14.73	0.276	0.600
	Interaction	1	42.55	0.798	0.373
	Within groups	273	53.33		

Note: The mean difference was significant: * <.05; ** <.01

Discussion

The current study demonstrates how instructional choices and materials can improve the sense of community and perception of learning in undergraduate laboratory settings. As suggested by Kember (2000), students participating in the experimental sections were receptive to the new instructional approach and reported high scores in CCS. It was clear that adding self-paced learning and peer tutoring into the mix enhanced feelings of the community of students. With marginally significant difference in learning sub-scale, the mixture of instructional choices shows potential to foster feelings of students regarding interaction as they support one another to construct knowledge and the degree to which they share values and beliefs about their learning goals and expectations.

The results also suggest that the issue of technology adoption and innovative teaching and learning does not rely largely on students' initial motivation or the lack thereof. Rather, new combinations of instruction could raise senses of community and students' feeling towards learning. In other words, the preconceptions that Thai students are passive and lack motivation are unjust. However, Sareetrakul (2007) cautioned that adoption and sustainability of technology use depends upon perceived ease of use and attitude towards technology, and computer skills. It is incumbent upon instructors and instructional designers to select, design, and integrate appropriate technology into teaching and learning for students to reduce their level of anxiety and continue using technology during school years and beyond. The current study exemplifies an alternative approach to instruction with technology, using peer tutoring and self-paced learning in teaching productivity software in a large class, that allows the instructor to assume the role of a facilitator and, at the same time, foster a sense of community in the classroom.

However, there is no guarantee that this new paradigm of teaching and learning will be welcomed by university lecturers. Innovation in education requires more than redesigning the instruction and integrating technology into classroom. Characteristics

and status of instructors, their knowledge, competencies and experiences are among other interrelated factors that influence acceptance of innovation and educational technology (Krueangniam, 2001). However, it was observed that there have been relatively few research studies dealing with instructors' beliefs in Asia. Awareness in training and re-training university instructors in terms of pedagogical and technological skills was also lacking. In 2008, the *Professional and Organizational Development Network* of Thailand higher education had started to offer a week-long, efficient learning management professional development course targeting new university faculty (http://www.thailandpod.net/). Although the initiative, which is now in its third year, and its seventh training cycle, seem promising, it does not clearly state in the policy how it will expand and sustain the professional community. Without institutional support and long-term policy, training and workshops are nothing more than an event that will not influence changes in practice.

Limitations

Several limitations related to this study are worth noting. First, varying degrees of instructor's teaching approaches were not taken into consideration. Although all participating faculty had served the department for more than five years and relied heavily on teacher-centreed approaches, their choices of instruction (e.g., whether they allowed students to help each other during class time) would shape student perceptions and results. Second, students' prior experiences in the course were not examined. This may be the case because some students were taking the course for the second, third, or even fourth time. Such different levels of experience may shape their expectations of community and learning. Third, this study did not take into account students' proficiency in English. Within the same class, especially in basic courses for first and second year students like *Microcomputer Applications*, students' language skills vary greatly. Some students with limited English language proficiency were taking remedial English while others with moderate English language proficiency were taking intermediate English. The difference in English language proficiency may pose problems in comprehension of instructions and student interactions. Finally, the context of the study hinders the generalisability of the results. The course was redesigned for a large class, basic computer laboratory instruction where students work individually, one computer per student. Instructional strategies employed in this study, the mixture of self-paced learning and peer tutoring, may not be suitable in other circumstances.

Conclusions and future research

One of the serious problems for Thai education is about self-directed learning (Pagram & Pagram, 2006). That is, Thai young or adult students have never been taught to learn by themselves. The present study puts forward practical solutions to break away from conventional teaching and learning approach in computer laboratory course. Using a mixture of instructional strategies leaning toward social constructivism, such as self-paced learning and peer tutoring in this study, allows students to take control of their learning and has potential to qualitatively change students' perception of classroom community and learning. It is also expected that such instructional strategies would better suit this new generation of students.

While some educators resort to more controlling approaches, such as screen broadcasting or software blacklisting, to manage large computer laboratory classes, the

authors believe that such practises suppress the rise of the Millennial generation, increase power distance, and lower individualism dimensions. This study serves as emerging evidence of a more liberal approach in terms of instructional design and teaching practice. Further, the study responds to the National Education Act of B.E. 2542 (NEA 1999) (Fry, 2002), which clearly states its preference for learner-centreed approaches. Digital content developed and utilised in this study also complies with "smart learning," the sixth strategy in ICT2020 which aims to develop and apply ICT in learning (National Electronics and Computer Technology Center et al., 2011). The present study coincides with a growing interest in using constructivist learning theory in teaching and learning in higher education, and adds to the slim body of literature that details changes in educational technology in Thailand. Future research may explore additional factors influencing students' community and learning, such as levels of English proficiency and the number of times students have taken the course. Instructors' instructional choices should also be examined on a larger number of participants.

Finally, the authors wish to use this study to foster open dialogue among university lecturers, educators, and researchers in business, information and communication technology, and related fields. A wider adoption of innovative teaching and learning entails not only research studies, but also changes in practices and professional development, which are still an under-rated issues in higher education in Thailand.

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