Blended e-Learning Model for Geomatics Curriculum: Design, Implementation and Evaluation

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Key words: blended e-learning, geomatics, curriculum, self-directed learning, knowledge transformation.

SUMMARY

Blended e-learning is the integration of different learning theories with e-learning, e-collaboration and e-communication in views of appropriateness and cost-effectiveness. The Internet and the World Wide Web have changed how we obtain and share information in blended e-learning and knowledge management. Under the rapid advancement of the information communications technologies (ICT), e-Schools without physical boundaries are emerging in which students, teachers, parents, professionals, web-citizens and communities are linked together by the e-communicating environment in the e-collaborative learning environment towards learning success. This paper explains the goals, benefits and instructional strategies of blended e-learning; the promotion of self-directed learning skills and knowledge creation by its e-collaborative learning environment; and the design, implementation and evaluation of geomatics curriculum under the blended e-learning model.

1. INTRODUCTION

According to the different views on learning and learning theories (Table 1), all learning are blended or combinations of e-learning, classroom learning, workplace learning and social learning in the form of formal, non-formal or informal learning and education. Blended e-learning (electronic learning) is the use of information and computer technologies to facilitate and enhance learning experiences in the form of standalone course with or without interaction with instructor or classmates, Web-based virtual classroom, computer games and simulations, mobile learning using PDAs and smart phones, or by a combination (blended) of some of the aforementioned computer technologies and educational settings (Bielawski and Metcalf, 2003; Horton, 2001a, 2006). It is the integration of multiple learning theories with e-learning, e-communication and e-collaboration among all stakeholders as shown in Figures 1 and 2.

The primary *goal* of applying blended e-learning instructional strategies and technologies is to help students develop lifelong learning skills including self-directed learning skills (e.g., taking the responsibility for learning), reflective learning skills (e.g., knowing technical rationality, reflection-in-action, reflection-on-action, reflection-for-action and action research), problem-solving and other high-level metacognitive skills, and techniques of using of Internet and other information and communications technologies (ICT) in building their knowledge. It should be noted that self-directed learning is our natural process of psychological development (Knowles, 1975, p. 14) driven by the globalization of production, social justice and cohesion, and modern educational settings and policy (Jarvis, 2004); and

that upskilling and reskilling in the form of self-directed lifelong learning enables nations, business and individuals to meet diverse global economic needs, to decrease unemployment and underemployment, and to enhance social cohesion. Gibbons (2002) emphasizes that self-directed learning must be congruent with the natural life of experiential learning asserted by (Knolb, 1984) and that all-round development is needed under proper educational settings and beyond personal, social and technical domains. So that, learners become self-motivated and reflective learners who are competent in managing learning, self-assessment, and applying what they have learnt in solving problems.

Therefore, as shown in Figure 1, *instructional strategies* for the educational settings of blended e-learning should include: (a) interactive virtual classes; (b) enquiry-based discovery learning (e.g., problem-based learning); (c) experiential learning (e.g., real-world experience for learners under partnership with professionals, e-mentors, e-moderators and community); (d) collaborative learning by team work and projects; (e) authentic and challenging assessment (i.e., assessment for learning); (d) integration of ICT in teaching and learning. As a result, learners of the *knowledge-creating* organization (e-school) experience knowledge conversion spiral through the following four stages (Figure 2):

1. Socialization – the transformation from operational tacit knowledge to sympathized tacit knowledge by, for example, team building.
2. Externalization – the transformation from sympathized tacit knowledge to conceptual explicit knowledge by, for example, meaningful dialogues between learners.
3. Combination - the transformation from conceptual explicit knowledge to systematic explicit knowledge by, for example, information processing.
4. Internationalization – the transformation from systematic explicit knowledge to operational tacit knowledge by, for example, organizational learning.

During the above stages of the knowledge management process, new knowledge or new understanding can be created. Thus blended e-learning is an educational strategy rather than an object of study by itself; and basic understanding of personal computers and the Internet are required of learners who join the e-learning.

Economic, social and academic *benefits* of adopting the blended e-learning systems are shown in Table 2. Studies on higher education reported that students learned more from the blended e-learning system because of: (1) pedagogical richness, (2) increased access to knowledge, (3) improved student interaction, (4) self-directed and managed, (5) increased cost-effectiveness, and (6) ease of revision (Graham, 2006, p. 8). The blended environment has also changed the traditional publishing/broadcast environment, in which a small percentage of population was educated, to the catalyst/interactive environment in which learners share or exchange knowledge with experts, teachers, peers, parents and web-citizens for continual improvement of their e-learning systems and knowledge creation/management process (Horton, 2006). Thus students can be teachers when they publish their projects in e-bulletins and teachers can be students when they learn from others in the learning networks (Horton, 2006, p. 579); and the e-learning will be continual throughout life with trainings accessible universally. The following sections illustrate the design, implementation and

evaluation of a blended e-learning model which is commonly applied in developing curriculums of higher education.

2. DESIGN OF THE BLENDED MODEL

In the design, questions to be answered are: (1) what should learners learn; (2) how should learners learn, that is, what are their learning characteristics; (3) how to teach and assess. Under the above blended model and according to (Dick and Reiser, 1989; Dick and Carey, 1996), components of the curriculum design include: (a) setting goals and objectives by analyzing the characteristics and needs of students; (b) critical review and selection of curriculum contents; (c) establishing criteria-referenced assessments to evaluate learners' knowledge levels, intellectual skills, motor skills and attitudes; (d) selection or production of textbooks, Web pages, videos and other multimedia presentations; (e) design of teaching schedule; (f) design of organizational structures, administrative mechanisms, implementation schedule, settings of classroom and e-learning system, and overall evaluation model.

A sustainable curriculum for geomatics higher education is given by (Lam and Chan, 2007), the design, implementation and evaluation of one of them is shown in (Lam, 2006a, 2006b). There are four main approaches of planning and developing a curriculum, namely the target-oriented approach (e.g., Tyler, 1949), the situational approach (e.g., Skilbeck, 1984; Oliva, 2004), the research-informed approach (e.g., Griffiths, 2004; Healey, 2005) and the academic consensus approach (Lam, 2006a) which is a combination of the aforementioned ones to develop a sustainable curriculum. The academic consensus approach is recommended by (Lam, 2006a) for the design of geomatics curriculum, by which knowledge and practice are agreed by all stake holders who are involved in the curriculum development process. As previously mentioned, the goals are to meet global economic needs, to increase employment opportunities and to enhance social cohesion.

At this stage, delivering strategies, teaching and learning units (activities), facilities and resource allocation are designed to support the learning. In Hong Kong, reports show that PBL is very suited to Chinese learners (Stokes, 2003), and that intrinsic motivation, collaborative learning and respect for teachers are found in PBL (Ho, 1986; cited by Stokes, 2003). Also, from previous teaching experience, the majority of university learners are 'silent observers' unless the lecturer motivates them. Therefore, reference readings, group discussions, projects and problem-based learning are chosen or designed for achieving the cognitive and intellectual objectives of the subject. Real-life or simulated experiences from the projects are designed for achieving the motor skills and provision of reinforcements to performance. Self-directed learning is promoted in information searching by individuals. Teamwork skills and proper attitudes are promoted through collaborative-learning experiences in group projects.

The design blends e-learning with conventional classroom training by providing classroom materials electronically in e-books, CD-ROMs, videos or Adobe Acrobat's Portable Document Format (PDF) in e-learning systems (e.g., Internet, Intranet, WebCT, SMILE) so

that learners can read them directly anytime and anywhere via the Wi-Fi network of the campus (i.e., mobile learning).

3. IMPLEMNTATION AND EVALUATION

After obtaining the approval of the program document, personnel, time frame, funding, facilities and other supports for the curriculum, program coordinators and lecturers implement the program. Before the commencement of the subject, teaching schedule and Student Handbooks containing the updated curriculum are distributed to the learners through the e-learning system (Figure 3). Core topics are discussed face-to-face lecture or practiced in the field/lab followed by additional or more advanced Web-based materials be issued for individuals' interest. On-line tutor, virtual classroom and ICT are provided to support the e-collaborative learning environment and to enhance learners' problem-solving skills. Students' performance is assessed by formative and summative assessments according to the University's Assessment Regulations and Briggs and Collis (1982)'s the criterion-referenced levels of the Structure of the Observed Learning Outcome (SOLO) Taxonomy. Teacher performance is assessed by the overall student performance, Student Feedback Questionnaire (SFQ), teaching portfolio, In-class Peer Evaluation (IPE) by colleagues or academic advisor, student-staff consultative meeting and program committee meeting. According to (Kirkpatrick, 1996; cited by Horton, 2001b), holistic evaluation should base on proven performance and should include the following levels:

1. Response: Did learners like the training? What were the attendance rate and assessment score?
2. Learning: What skills and knowledge did the learners acquire?
3. Performance: How much is learner's performance improved? What can learners apply to their jobs upon graduation?
4. Results: How well did the organization meet its business goals? Was the result profitable?

(Horton, 2001b) gives some of the tools and examples for the e-learning evaluation..

4. CONCLUSIONS

This paper asserts that self-directed skills, reflective skills, e-learning environment (Figure 1), e-communicating environment, e-collaborative environment, and knowledge creation (Figure 2) are key elements of e-learning success. The economic, social and academic benefits of e-learning are given in views of cost-effectiveness, building learning networks and social cohesion, and knowledge creation respectively (Table 2). A blended e-learning environment for geomatics curriculum is presented to illustrate the design, implementation and evaluation of such a combination of e-learning and classroom training. It has been found that the blended e-learning is a individualized process in which learners build and create 'technological knowledge, educational knowledge, social knowledge, cultural knowledge, economic knowledge, political knowledge, virtual knowledge and environmental knowledge

in the knowledge-creating e-school (Yip et al., 2004, p. 265)'; and that the learning model will become mainstream strategy in the design, implementation and evaluation of geomatics programs.

Table 1: Models of learning

Views of learning	*Learning theories and models*
Physiological	Neurological; genetic; multiple intelligences (Gardner, 2005).
Sociological	Radical; transformative; liberal; human/social capital (Hiller, 2005).
Psychological	Behaviorism; cognitive-constructed; social constructed (Shuell, 1996); integrated multi-theoretical (Davidson-Shivers and Rasmussen, 2006).
Multi-disciplinary	Knowledge base/levels; experiential (Kolb, 1984); social and situated (Lave and Wenger, 1991); blended (Bersin, 2004).

Table 2: Economic, social and academic benefits of blended e-learning (Driscoll, 2000; Rosenberg, 2001; Horton, 2001a; Yip et al., 2004).

Economic	Social	Academic
1. e-Learning lowers the costs of education including the costs of classroom and instructors, tuition fee and travel expenses of learners. 2. e-Schools are more financially viable as learners from all over the world can enroll in e-programs of study. 3. e-Learning enhances business responsiveness by communicating with large amount of customers or learners virtually and simultaneously. 4. e-Learning provides an increasingly valuable customer/learner service. 5. e-Learning solutions are highly scalable for example, from 10 participants to millions. 6. e-Learning leverages corporate investment of Web-based knowledge management.	1. The Web enables people build learning communities, motivates social and organizational learning, and enhances social cohesion. 2. The easy-to-access knowledge by learners expedites upskilling, reskilling and career prospects. 3. Learners can access e-learning anywhere and any time in school, in workplace or at home. 4. Universality because e-learning is Web-enabled using Internet worldwide facilities.	1. e-Learning develops self-directed learning and interactive skills of learners. 2. Curriculum contents are standardized or customized, depending on learning needs. 3. Curriculum contents are more timely and reliable because information can be updated instantaneously. 4. e-Assessment system facilitates self-improved learning, online grading, auto-scoring, immediate feedback, public review, data analyses, question bank. 5. e-Portfolio system facilitates quick retrieval of students' academic performance (e.g., test results) as well as non-academic performance (moral, intellectual, physical, social, aesthetic, religious). 6. e-Learning promotes knowledge management in increasing the knowledge of individuals, capturing knowledge in a reusable form, refining knowledge, sharing knowledge and applying knowledge to solve problems.

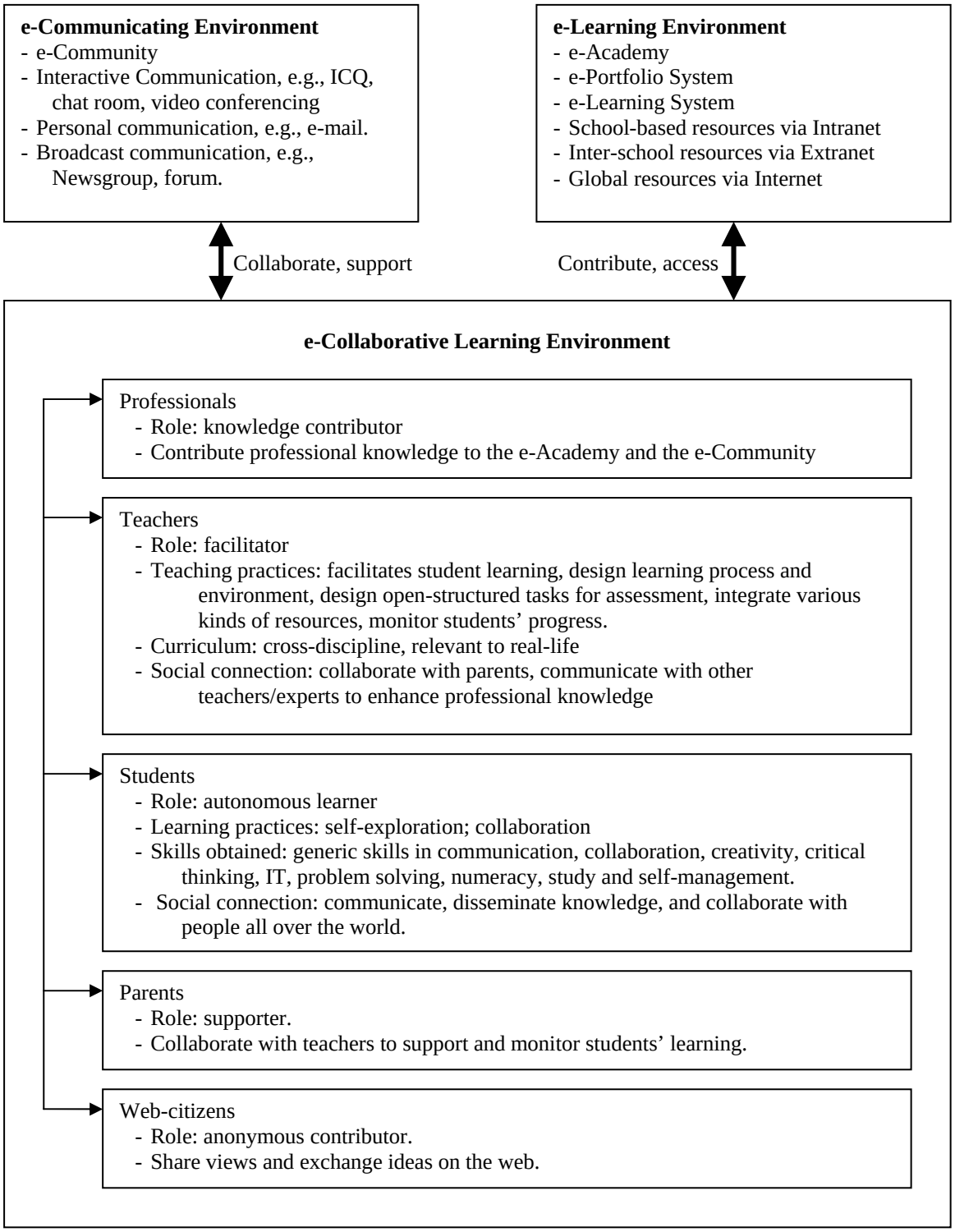

Figure 1: Learner-centered blended e-learning model (Yip et al., 2004, Diagram 1.1, modified)

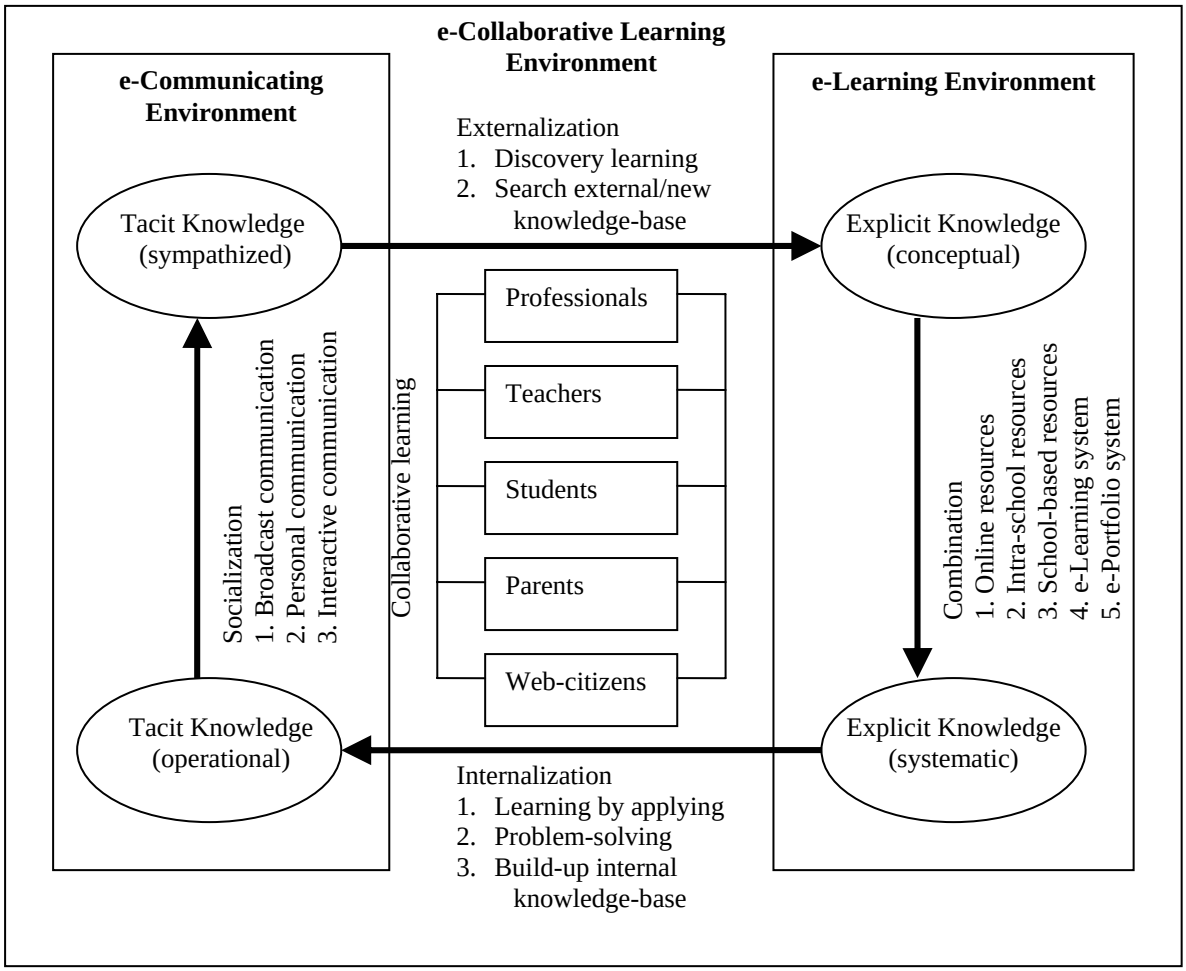

Figure 2: Knowledge conversion and creation under blended e-learning environment (Nonaka, 1994; Kidd, 2002; Yip et al., 2004, Diagram 20.3)

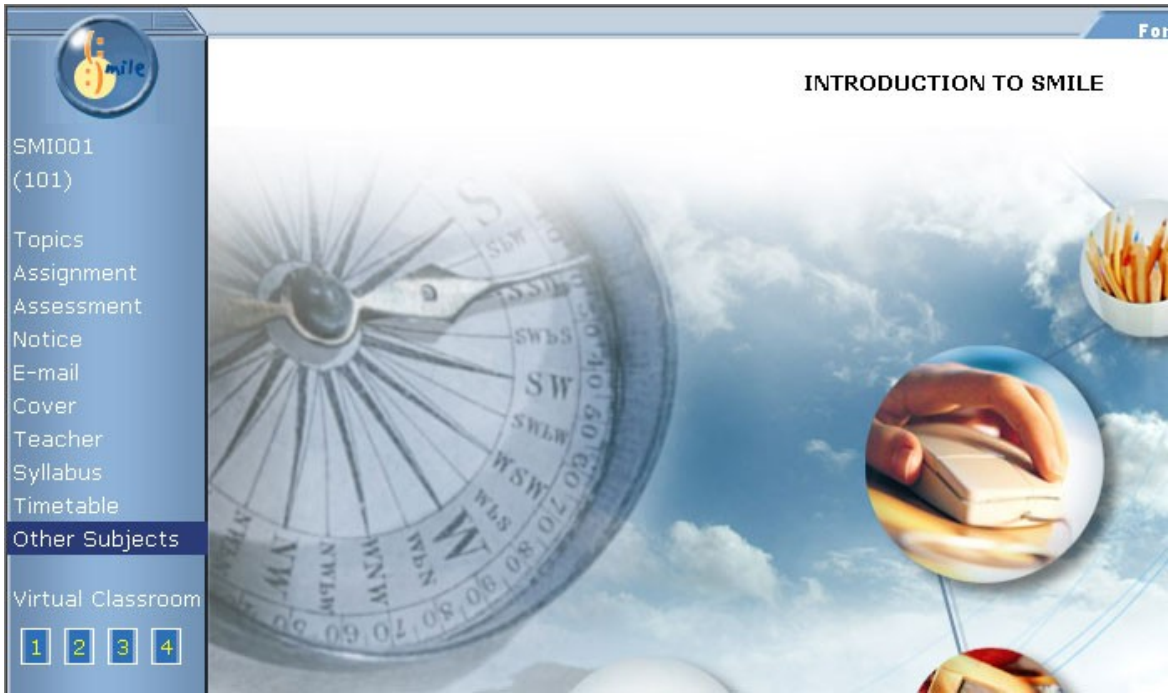

Figure 3: e-Learning platform for a subject (Courtesy: PolyU and SMILE Technologies Ltd.)

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