Frontiers for Learner-Centered IS Education

Wai K. Law
SBPA, University of Guam
UOG Station
Mangilao, Guam 96923, USA
ici.wlaw@gmail.com

ABSTRACT

The heterogeneous backgrounds and interests of prospective students has been an emerging challenge in Information Systems (IS) education. Pounding waves of technology carried students away from the shores of traditional IS training. Pragmatists avoided the traditional IS programs, many of which struggled among budget reduction, competing training options, and shrinking enrollment. Learner-centered instruction has shown promise in recapturing the interest for IS training, and it could be a powerful instructional tool for the Net Generation, and the technically literate generations following..

Keywords: Motivate, Meaning, Interest, Problem Solving, Creative, Demonstrate, IS Education

1. INTRODUCTION

The widespread availability and affordability of computing technology have created tremendous challenges as well as opportunities for the Information Systems (IS) educational community. The once highly popular IS programs experienced enrollment declines, drowning in the pounding waves of new technology, losing financial supports and talents to the rapid growing Information Technology (IT) industries, and torn between the general education mission and pressure to deliver practical skills (Denning, 2002, Schlenker, 2002).

On university campuses, an emerging perception of technology as a foundation skill distorted the roles of IS programs, which were increasingly expected to fill the gaps of technological skills (Ehrmann, 2004). The added service roles of IS programs flooded IS courses with students with broad backgrounds, abilities and learning motivation (Chen, 2003). At the same time, multiple disciplines were eager to offer their versions of IT training, leading to the dilution of resources as well as student pool. Indeed, students unprepared for vigorous IS training would flee to other programs. IS programs were under pressure to spread their limited resources to satisfy broadening student interests.

The educational attention was shifting from the vigorousness of IS education to the popularity of IT training. Debates began to arise surrounding standards for technology, rather than the effectiveness of IS education. In many cases, group and department secured exclusive rights to selected IT trainings, feuding and fighting over shrinking student interests. Changing funding and reward practices drove innovation out from university campus to high technology industries, widening the technology gap. New requirements on program assessment prompted curriculum changes to align instructional activities with measurable student competency.

The diversification of technology deployment in organizations also made it more difficult to train students to meet the immediate needs of recruiters. IS programs were slow to retool to meet demands for user-oriented applications. Increasingly, firms turned to internal training programs to inject the needed skills to the new recruits. Corporate training programs and private trainers filled the void of training needs. IS programs struggled to increase program flexibility.

A new generation of technologically literate students carried with them a distorted view of IS issues and applications (Law, 2007). Many of these students were accustomed to multi-tasking, hypermedia, and high-speed, high bandwidth computing activities. The widespread availability of application software based on 4GLs drew great interests in end-user IT training. The short-term interest in learning IT application tools erased the desires to understand holistic systems thinking and IS managerial considerations. These students were inclined to be independent learners. They preferred interactive learning compared to the textbook style sequential knowledge dispensation (Hay, 2000). They resisted constraints on the time and place where learning could occur. The vigorous disciplining of IS training lost ground to selective sampling of knowledge through ubiquitous multimedia e-learning.

As e-learning technology opened up the training opportunity for non-IS professionals, the responsibility of technology decision was divided among IS professionals and end-users (Barker, 2002). For the pragmatic majority of users, application software and consumer computing equipment would be a sufficient substitute for the sophisticate, custom designed information systems. Features,

usability and costs surfaced as important criteria for information systems decisions, pushing aside systems design considerations such as integrity, reliability and compatibility.

IS programs faced the challenge to build on top of the existing skills and knowledge of students; linking end-user computing interest to organizational informational needs; preparing students to meet the unknown challenges beyond campus environment. Learner-centered education, with problem-based learning has been found to offer solutions to the numerous needs for flexible IS education..

2. FLEXIBILTY THROUGH LEARNER-CENTERED EDUCATION (LCE)

The traditional channels of dispensing knowledge has been challenged by widespread availability of information. Students became dissatisfied with learning through passively receiving limited bundles of knowledge from traditional IS courses. Increasingly, students demanded practical skills that they could relate to and apply in work environments. Difficulties in serving students include the heterogeneity of computing platforms, large selection of competing software packages, variations in learning habits and changing skills expectation for rapidly expanding career paths.

LCE has been proposed for IS training for more than a decade (Adler et. al., 1998; Norman et. al., 1996; Soloway et. al., 1996). The learner-centered model expected high interaction of students with the instructor and one another. The instructor served as information resource and students were given choices of learning targets ("Teacher", n.d.; "What is learning", n.d.). The instructors assumed new roles as mentors and advisors, monitoring the learning experience of students (Karagiozov, 2003). The interactive role of teachers, group influences, and a nurturing classroom environment could significantly impact learning. Students learned through discovery, inquiry, and problem solving ("Student-Centered", n.d.). The goal was to teach students how to learn, acquiring the ability to use information to assimilate knowledge (Barton, n.d.). The teacher played a key role in creating the learner-centered environment to facilitate a meaningful learning experience for the student (Bransford, et. al., 1999). Collaboration between students was encouraged, but all students would be expected to demonstrate the results of their learning through a task performance ('Learner-Centered Class", n.d.). According to the American Psychological Association ("Learn-Centered Psy", n.d.), successful learners would be active, goal-directed, self-regulating toward creating meaning consistent with personal interests. These are the same learning traits promoted through LCE. LCE has gained significance endorsement recently, including endorsement from the Board of Regents for a state university system in the United States (Woelfel, Kay D. (2003); "Learner Centered Education", n.d.).

LCE shifted the learning focus toward explorative learning. Students acquired the appropriate tools while engaging in problem solving, diversifying their perspectives, and addressing individual needs for growth (Weimer, 2002; Gunderman, R. B, et al., 2003). LCE emphasized the commencement of learning from the current experience of students; facilitate the construction of meaning while doing tasks (Soloway, et. al. 1996). Well-planned tasks, activities, and tools would support the learning process. Thus the lesser-prepared students could learn without fear of failure, while the advanced students could learn through exploring the more challenging portion of problem-based tasks. Recognized advantage of LCE included providing individual attention, flexibility, competency-based, adopting a variety of methodology and removing constraints of time and place..

3. LCE IN PRACTICE

Key practices of learner-centered education included (1) engaging and motivating students to seek out new knowledge and skills according to their needs; (2) structuring learning to continue from the level of understanding of the learners; (3) empowering students to self-direct their learning processes; and (4) assisting students to apply the correct tools for problem solving (Adler et. al., 1998; Norman et. al., 1996; Soloway et. al., 1996)

3.1 Engaging students

Modern day students actively mixed training programs and learning channels. An immediate impact was the uneven preparation of enrolling students. Students also shifted their attention away from learning towards the speedy completion of required activities. Some students simply "switched off" in class with required attendance, and eroded class morale (Yeo, 2005). LCE placed emphasis on linking the prior experience of the learner to the targeted learning process. Survey on student backgrounds and abilities provided valuable information for instructional designs. Realistic tasks were assigned whenever possible. Students became more motivated to seek and discover knowledge as an extension of their experience and understanding, instead of merely satisfying the instructors.

3.2 Continuous Learning

As students acquired technical skills outside of formal academic environments, neglecting these abilities caused misjudgments on real student interests, thus learning motivation of students. Some students suffered from inferior technical preparation, while others became bored with repeated materials. Students losing interest in curriculum contents performed poorly and eventually drop out of learning programs. The LCE approach included curriculum designs that accommodated individual differences in prior experience and learning ability, ensuring higher retention and success of students with diverse backgrounds.

3.3 Empower students

The LCE approach focused on evidence of individual learning. The students were expected to demonstrate learning outcomes, allowing room for creativity. On the other hand, the need to demonstrate learning outcomes reduced the incidences of plagiarized works. Similarly, students were empowered to choose alternative tools to complete tasks. The individual choice of accessible technology improved motivation for learning. Students freed to learn by exploration often took time to interact with other students and compared learning experience. One LCE practice was to allow student to select from a menu of tasks and allowed

flexibility for students to choose the time and location to complete the tasks. Lastly, flexible course time frames allowed students to complete course requirements at different rate.

3.4 Problem-solving

LCE emphasized teaching students the skill of learning. Selective guidelines were designed to allow students to complete tasks through critical analysis. Students were encouraged to seek out improved tools and methodologies for effective problem solving; to learn by exploration; to ask questions and seek answers by observing successful models, and sometimes through failures. The instructor provided guidance to students through strategic usage of demonstrations, repeated experience, and peer motivation.

4. IS INSTRUCTION AND PROBLEM-BASED LEARNING (PBL)

The traditional IS educational approach frequently utilized project-based instruction. Students were expected to follow elaborate procedures in the reconstruction of tasks with predefined features and outcomes. Students were evaluated on their ability to complete the projects with the correct solution in a give time frame. Instructors may found themselves competing with the students through difficult problems that only a few students could completely resolve. However, students could be frustrated by the learning experience.

PBL involved using a realistic problem-solving challenge to be handled by either an individual student, or a team. Students were charged to determine and locate problem-solving resources, which were provided on-demand. Student teams could follow different paths of problem-solving, and ending in a variety of solutions. Students learned through the solution process, and through comparing their solution methods with other teams, and through feedbacks from the instructor. As a result, students learned both feasible solution methods, as well as the relative effectiveness of different solution methods. The creative students were also able to invent solution methods to solve the problem.

The rich learning context of PBL supported a broad variety of individual learning goals. While the average students learned the core skills, the better-prepared students could fast forward to advanced computing skills. Peers learning was a significant factor in PBL, and allowed the instructor to focus on motivating and teaching the few highly motivated students, who in turn set the standards for other students to achieve. Peer competitions promoted the pace of learning, and many students took pride in tutoring their peers while reaffirming their newly acquired skills.

In a tradition instruction-by-subject approach, students would spend enormous amount of time learning a large array of concepts and practicing skills. However, these students ending up forgetting a substantial portion of the knowledge, and ill-prepared to solve problems. PBL intended for students to learn on demand, taking the time to thoroughly examine alternative tools and solution methods. As a result, students retained the tools and methods deemed useful and meaningful to each of them. The repeated application of the selected tools and methods reinforced learning. A precious "teachable moment" appeared when a student who exhausted solution methods for a problem requested assistance. At that moment, the student would be eager to acquire additional tools and knowledge to continue solving the problem. The recognition of achievable targets motivated students to complete problem solving on their own, refusing the intervention of the instructor. This was a favorable factor since IS students would be expected to independently solve a large variety of problems at work.

5. INSTRUCTIONAL CONCERNS FOR PBL

Some critics of PBL were concerned that students may not achieve learning objectives when allowed to self-direct their learning. The concern was valid because PBL assumed the existence of sufficient learning motivation on the part of the students, and the PBL problem was merely a catalyst to stimulate learning and knowledge exploration. Some students lack motivation to learn. However, a LCE environment could provide motivational designs enhancing stimulating experience, deep learning and realization of meaning.

PBL required substantial works in designing realistic problems with the richness to motivate explorative learning. At the same time, the problems must be simple enough to support easy comprehension by the students. Problems that students could easily engage in through extension of personal experience became significant motivation factors that contributed to the success of the PBL approach. Thus careful design and choice of PBL problem would ensure the success of the PBL method of instruction (Hansen, 2006). Cultural difference, prior experience, accessibility to technology, career goals, peer expectations, time availability, work experience and individual maturity would be examples of factors affecting the design of PBL problems. Each PBL problem must support open-ended questions and ideally allowed multiple solution approaches. This created the environment necessitate for students to acquire additional skills and knowledge in order to solve the problem. The existence of multiple solution approaches demanded students to critically examine and defend their solution approach, thus creating opportunities for deep learning.

An instructor for PBL approach must learn role adjustment to become a facilitator. The instructor must resist the temptation to guide students toward a "correct" answer, and in the process, must develop tools to evaluate student learning, rather than merely solving a problem (Mykytyn, 2007). The instructor must also become open-minded toward alternative solutions that could require similar learning experience to achieve. More importantly, the instructor must be prepared to detour from intended learning objectives during those rare teachable moments.

There were also concerns about additional instructor workload, and the lack of high caliber instructors. There were expected workloads increases during the initial conversion to PBL approach, mainly for the development of instructional materials. Incremental improvement was the best approach to develop problems suitable for the targeted audience, matching with personal growth for the instructor. Since PBL problems tend to have a long usable life, the

workloads decreased over time with familiarity of solution outcomes. The continuous assessment of students eliminated waste time and emotional energy in corrective actions, especially when students gained a realistic picture of their learning achievements.

6. LESSON FROM A SUCCESSFUL LCE IMPLEMENTATION

The IS curriculum at the School of Business of a 4 years regional university was initially designed for business administration students. The "Introduction to Computing" course became so popular over the years that non-major students accounted for up to seventy percent of enrollment (Table 1). Beside the diverse career interests, students came from over 12 ethnical backgrounds, with broad age range and work experience. The broad spectrum of students had created tremendous instructional challenges in assuring student success in the course without compromising the learning standards. For example, the learning pace of younger learners intimidated adult students, who exhibited a high failure rate. The advanced students were affected by boredom and developed negative learning attitude. Students from some cultures were either reluctant to think critically, or too polite to ask question even when they could not understand the assignments.

	Enrolled Semester					
Career Interests	S05	F05	S06	F06	S07	Su07
Business Administration	22%	23%	28%	24%	27%	33%
Non-business	53%	47%	47%	37%	33%	41%
Undeclared	25%	30%	25%	39%	40%	26%
	100%	100%	100%	100%	100%	100%

Table 1. Distribution of Students by Career Interests

Under traditional instructional approach, students consumed valuable time on duplicating mundane details such as following detailed instructions of exercises and in data entry. However, they could not solve application problems on their own. Many students were only interested in obtaining the "correct" solutions, and became totally dependent on the instructor.

A PBL approach has been developed to enhance the speed of student learning and to improve problem solving skills. During the initial years since 2000, students were required to work at the same pace, and penalty would apply for late works and incomplete works. Although PBL increased coverage of skills and contents, many students "recycled" solutions from other students to avoid grade penalty. Other students argued over the slightest mistake. Learning was not stimulating. There was an atmosphere of distress, frustration and fear. Students avoided learning new materials and complained about excessive works and materials. A LCE environment was introduced in spring semester 2005. Under LCE, the students were allowed to work on their own pace, with multiple opportunities to repeat tasks, to experiment, and to interact with other students (Uden, et. al., 2006). Instead of assigning grade based on the percentage correctness of tasks, students earned points on their works presented face to face to the satisfaction of the instructor. Several strategically scheduled due dates were used to ensure continuous learning progress. Full credits were granted only for completed tasks complying with all skill standards associated with the tasks, and presented successfully by published deadlines. At the end of a semester, a student had to pass a comprehensive, task oriented hands-on computer skill test to receive a passing grade in the class (Lynam, 2002).

The LCE course design lessened the time pressure on students. Peer pressure among friends and acquaintances was a positive motivation. The advanced students stimulated other students working at a slower pace. Students enjoyed the learning experience with spontaneous interaction, and freely tutored each other under the supportive supervision of the instructor. They effectively shifted their attention towards learning rather than seeking the approval of the instructor. The face-to-face interactive grading of the completed assignments motivated students to produced quality work and many students were proud to exhibit their creativity. The high instructor-student interaction actually saved instructor time in the long run since the students were conditioned to present only completed works! Students completed more tasks at increasing difficulties during the same time frame (Table 2). Many students completed extra tasks as personal challenges. There were fewer students withdrawing from the course (Table 3), and the skill levels were raised over a two-year period with tougher standards for the competency skill test. The higher standards were introduced in Fall 2006 and Spring 2007 semesters, respectively. The summer 2007 (Su07) was an intensive 4 weeks course. Students began to report how they applied their newly acquired skills, instead of forgetting their learning experience. Instructor learning curve accounted for the lag in effectiveness of the LCE implementation.

	Semester						
Tasks completed	F04	S05	F05	S06	F06	S07	Su07
Average	16	18	18	18	22	21	22
Max	22	22	22	22	28	28	28
Median	17	19	20	19	22	22	23
Mode	17	20	20	19	22	22	22

Table 2. Number of Tasks with Increasing Difficulties Completed

	Semester						
	F04	S05	F05	S06	F06	S07	Su07
PASS WITH HONOR	38.1%	29.1%	24.7%	33.3%	6.3%	50.9%	8.3%
PASS	20.6%	21.8%	46.8%	36.7%	71.9%	22.8%	70.8%
MARGINAL PASS	6.3%	5.5%	0.0%	0.0%	3.1%	0.0%	0.0%
FAIL	3.2%	9.1%	3.9%	10.0%	12.5%	17.5%	12.5%
WITHDRAWAL	31.7%	34.5%	24.7%	20.0%	6.3%	8.8%	8.3%

Table 3. Competency Skill Test Performance Distribution

Students enjoyed controlled creativity and many included their personal touch to the tasks, knowing that they were expected to demonstrate the mastery of skills rather than creating a replicate of the standard solution. The interactive feedback from the instructor contributed to student learning, and many students were eager to reconstruct the exercises after reviews by the instructor. Some observable benefits of the LCE approach included (1) learning motivation; (2) goal-directed learning; (3) self-regulated learning; (4) creation of meaning; and (5) extension of personal interests.

6. 1 Motivate student learning

A majority of the students enrolled in the course as an elective and were not motivated to invest time in the course. Many perceived that they already knew the computer skills. In reality, more than 95% of these students had a very superficial understanding of computer applications. Many could not use computer without step-by-step detailed instructions.

A key ingredient of the LCE implementation was a special learning package, which concisely presented key concepts, with annotated sample exercises, technical notes and tips for the students, who must creatively use the recommended tools to complete tasks that reflected common experience in daily life. The package freed class time from the presentation of basic information, shifting attention towards interactive activities.

The flexible LCE schedule encouraged students to experiment with tools, taking time out to interact and collaborate with other students. The opportunity to individually defend their solutions stimulated creativity, and lessened the concern to seek the "correct" solutions. As a matter of fact, many students were eager to learn beyond the required skill sets. The face-to-face evaluations of student assignments providing instance feedback were highly effective in the identification of individual learning obstacles, and motivated students into deep learning.

Students involving in active learning tended to spend more time in learning, paying attention to details, and exhibited less behavior problems such as absenteeism, excuses, plagiarism, and indifference. More importantly, students were relaxed while learning, with occasion bursts of excitement for tasks accomplished. There were evidence of motivated learning when some student insisted on solving problems on their own, refusing the offers of the instructor to provide tips and assistance. Other student would voluntarily repeat working on tasks that were completed with the assistance of the instructor. Students even voluntarily tutoring each other, comparing noting, and challenging each other to perfect task completion.

6.2 Goal-directed learning

The LCE course included a set of achievable goals with incremental difficulties. Simple goals were set at the beginning of the course to provide ample time for adjustment, bringing all students to a minimum technical competency level. The observed technical ability of the students was an important factor for determining the actual pace of the course, and the final mix of course activities. Formal instruction was reduced to a minimal. For example, when students exhibited familiarity with electronic presentation, then the instruction for PowerPoint would be shortened to a 10 minutes lecture on advanced features. Otherwise, a full lecture on the topic would be delivered according to student needs. However, when students experienced difficulties on a concept, instruction on the problematic topic would be repeated. When the students became familiar with the primary skills, additional goals would be added at more frequent intervals. A final set of challenging tasks was included with no formal instruction. At that stage, students would have to apply their problem interpretation and analytical capabilities, and complete the assignment through self-learning. The set of goals supported an elaborate statement of skill expectations that would be measured by a skill test at the end of the course.

Goal-directed learning allowed students to focus on the outcomes, and not the process, and time spent in the process. The ability to achieve multiple goals in a short period of time rewarded and motivated students to attempt greater challenges. Some student preferred to start multiple tasks simultaneously. On the other hand, there was nothing shameful about not achieving a goal, thus students were encouraged to keep trying until they mastered the learning materials. In the process, many students would have invested considerable among of time to ensure their successful achievement of the goals. This approach was effective in handling students with diverse learning motivation and interests.

Another important strategy involved setting goals related to the common knowledge and prior understanding of the students. This encouraged students to explore solutions to problems they can relate to in their personal experience. This strategy also helped to channel the attention of students towards problem solving, and not wasting energy in resolving communication problems between the students and the instructor.

6.3 Self-regulating learning

A LCE design allowed the active learning students to set goals, prioritize the goals, and determine the pace of learning, and method of learning. Thus the students were the driving forces for learning, while the instructor assumed a supportive role.

The first issue was the location of learning. Computer laboratory was available for the convenience of students, but students were allowed to utilize any compatible resources to complete the required tasks. Resourceful students would be able to utilize computing resources at home, at work, or at other available locations to complete their assignments. For the same reason, there was no assumption on the specific technology requirement for task completion, recognizing that alternative software could be used to complete the tasks. A challenge for the LCE instructor was the need to be acquainted with multiple software packages and software versions to support instruction.

Students were given the freedom to determine when to attend class, but they were required to report to the instructor on regular intervals to assure successful progress in the course, for addressing learning difficulties, and to keep students in line with the learning goals. Class attendance was an incentive, not a requirement. For this purpose, occasional attendance taking, and restrictive assignment deadlines were the tools used for monitoring student learning. This also helped to spread out the workload of the instructor to assure that the instructor could always attend to individual student needs.

A flexible set of learning outcomes applied to students for fulfilling course requirements. Thus the advanced students were allowed to skip minute details, while the beginning learners were required to repeat details to enhance their learning. This adjustment to the grading system recognized difference in learning styles and interests; prior

learning experience; and learning achievements over a broad range of time and space.

6.4 Creating meaning through learning

The course started by challenging students to complete simple tasks with more efficiency and effectiveness. For example, the instructor would demonstrate the completion of an assigned task in under 3 minutes, knowing that the it would easily required an average student between 30 minutes to 5 hours to learn and complete the same task! The drive to imitate the efficiency in problem solving was a strong learning motivation for the students. Each student would end up completing tasks through the methodology that captured their individual attention, but eventually recognized the advantage of the best problem solving approach through other students or the instructor. Learning became an experience of discovery, and not a compulsory repetition of pre-designed works! Students often proudly presented their successful learning outcomes to the instructor, even after repeated failure.

Brief demonstrations were effective in creating mental images that could be easily assimilated into the experience of the students. The selection and timing of the presentations were coordinated with the anticipate learning obstacles, through careful observation of student behaviors. The goal was to present new information when students were most likely looking for the new information, ensuring that learning became an extension of the current experience of students. Through the LCE approach, failure and inefficiency were utilized as learning opportunities, enriching the learning experience for the students. The LCE approach bridged new learning experience with past experience, promoting the linking of knowledge and allowed students to drive the learning process. Students generally found learning to be mentally challenging, and enjoyable.

6.5 Relate to personal interests through learning

A major challenge in technical training was to ensure that students retain their newly learned skills. Although the driving demands of the instructor could temporarily shape the behavior of students, deep learning was much harder to achieve. The LCE approach allowed students to mix learning with their personal interests. For example, students were allowed to choose any topic to create an electronic presentation. Many students came back with highly creative projects. More importantly, students committed extensive amount of time to complete tasks, and even voluntarily teaching other students to learn the tasks. The later behavior required internalization of concept and deep learning to acquire the ability to past on the knowledge to others. It also enriched their learning experience. With tasks that were related to personal interest, students had a vested interest in ensuring the successful completion of the tasks.

To encourage the development of personal interest and deep learning, the instructor resisted the temptation to restrict learning outcomes to a limited scope. Students were given the option to replace some tasks with other assignments. The instructor ensured that students could visualize the expected outcomes, and allowed them to find rules and procedures that facilitate their task completion. Students were challenged to complete tasks with speed and professional quality. The tasks assigned were challenging enough to require careful analysis and extensive exploration. Some students preferred to learn from each other, and some student learned through helping others. Some students demanded constant attention from the instructor, when others insisted on solving problems on their own

7. FRONTIERS FOR LEARNER-CENTERED EDUCATION

This section provides rationales for LCE as a pedagogical solution to emerging IS educational challenges –student interests, curriculum coverage, learning outcomes, technology sourcing, team collaboration, rapid application development, creativity and agility.

Many traditional IS programs are input-based, meaning that students are channeled through a collection of activities considered important to meet learning objectives. Some of these activities include exposure to a body of knowledge, practicing a set of skills, and familiarize with practices of design. However, existing IS instructional approaches could be neglecting some of the coveted characteristics of top students such as abilities for critical thinking, creativity and self-directed learning. LCE with the application of PBL enhances motivated and lasting learning, nurturing a habit of continuous learning in students. The necessity of evaluating alternative solution methods toward problem solving prepares students to handle technology sourcing; the close collaborative relationship between students under PBL promotes team approach to problem solving; the developing habit of learning on demand translated to skills for rapid application development, creativity and agility.

The implementation of LCE for IS education presents both opportunities and challenges to assumptions in IS education:

1. Should IS education prepare a student for the most recent technology and information systems design methodology? The existence of knowledge gaps between industrial practices, instructor understanding and student interests will continue to post recruitment challenges for IS students. LCE and PBL provide an opportunity to link student experience and learning to practical issues in working environments.
2. Should IS education be reserved only for IS professional, or IS training are relevant for everyone in the Information Era? LCE supports the simultaneous education of students with different backgrounds, interests and abilities. This could create tremendous opportunities to reposition IS education in the Information Era.
3. Should IS education be limited to a selected body of knowledge, or preparing students to function in the dynamically changing technical fields? LCE develops the learning capacity of the learner, rather than ensuring that the learner completes a selection of training activities. LCE encourages collaboration and fast learning cycles.
4. Should IS education be primarily theoretical based, while leaving the training of practical skills to other entities? LCE provides valuable experience for the learner to utilize the latest available tools for students to source, select, and assimilate knowledge on demand towards task

completion. At the same time, LCE can push the limits on academic vigor without alienating potential learners.

5. Should IS education be mass producing students with similar skills and ability, even when businesses are tackling global and agility issues? LCE creates a learning environment to stimulate individual growth, producing a broad range of skills and ability among the students? Potentially IS students could become business leaders, government leaders, medical professionals, educators, artists and entrepreneur; without following the traditional IS career path.

The LCE approach requires special preparation from the instructor, who must be thoroughly proficient with the materials being taught; with in depth understanding of the tasks students were required to perform. Learning no longer occurred in controlled environment. The instructor must be capable of diagnosing and resolving various unexpected obstacles students encountered since there were no prescribed procedures for completing the tasks. The LCE approach creates learning opportunities for IS educators, and could help to redefine the roles and importance of IS education. Consistent with Dale's Cone of Learning on the benefit of experiential learning, some exciting LCE developments include:

1. Instruction through gaming: students learn computing practical skills in a network environment, or through computer simulation.
2. Learn through web-based research: students learn IS management issues through critical review of Internet research on a topic of their choosing.
3. Applied creative projects: students utilize a software tool of their choices to complete multimedia projects.
4. E-portfolio: students utilize IS tools to demonstrate personal accomplishments..

8. CONCLUSION

In the pursuit of instructional flexibility, instead of generating an endless combination of coursework, testing alternative channels for delivery of educational services (such as e-learning), perhaps it is also worthwhile to consider instructional approach with intrinsic flexibility for accommodating individual student needs. Learner-centered education, especially through problem-based learning, has great potential for handling complex training such as in the IS field. A key advantage was its effectiveness in handling a broad spectrum of student needs, without resorting to an endless array of specialized instructional delivery. Through the application of technology in instruction and innovative practices, LCE could be manageable and cost effective even for handling large groups of students, while simultaneously attend to the individual development needs of the students

9. REFERENCES

Adler, R. and Milne, M. (1998). "The challenges of learner-centred education", Chartered Accountants Journal of New Zealand, Vol.77, No.1, p. 12

Barker, S. K. (2002). "Training Business Students to be End-User Developers: Are Case Studies the Best Option?" In Khosrow-Pour, M. ed. Issues & Trend of Information Technology Management in Contemporary Organizations, Hershey: Idea Group Publishing. pp. 62-65.

Barton, H. (n.d.) "Information Literacy: Learning How to Learn." Retrieved September 25, 2004, from http://www.ri.net/RITTI_Fellows/Barton/infolit.html

Bransford, J.D., Brown, A. L. & Cocking, R. R. (eds.) (1999) "How People Learn: Brain, Mind, Experience, and School", The National Academy of Sciences.

Chen, K. (2003) "Evolving Learning Environments in Information Technology Education" In Khosrow-Pour, M. (ed.) Information Technology and Organizations: Trends, Issues, Challenges and Solutions. Hershey, PA: Idea Group Publishing, pp. 1032-1033

Denning, P. J. (ed.) (2002). "The Invisible Future: the seamless integration of technology into everyday life", New York: McGraw Hill. pp. 295-339

Ehrmann, S. C. (2004). "Beyond Computer Literacy: Implications of Technology for the Content of a College Education", AAC&U. Retrieved September 18, 206, from http://findarticles.com/p/articles/mi_m0NKR/is_4_90/ai_n1380100

Gunderman, R. B, et al. (2003) 'Learner-centered Education', Radiology, Vol. 227, No.1, pp. 15-17

Hansen, J. D. (2006) 'Using Problem-Based Learning in Accounting', Journal of Education for Business, Vol. 81, No. 4, pp. 221-224

Hay, L.E. (2000) 'Educating the Net Generation – educational planning for technology-knowledgeable students", American Association of School Administrators. Retrieved September 18, 206, from http://findarticles.com/p/articles/mi_m0JSD/is_4_57/ai_77204709

Karagiozov, V. (2003) "Using Innovative Teaching Techniques in Transition from Teacher-Centered to Learner-Centered Education" In Khosrow-Pour, M. (ed.) Information Technology and Organizations: Trends, Issues, Challenges and Solutions, Hershey, PA: Idea Group Publishing, pp. 836-837

Law, W. K. (2007) "IT Educational Challenges for the Internet Generation" In Khosrow-Pour, M. (ed), Managing Worldwide Operations and Communications with Information Technology, Hershey: Idea Group Publishing. Hershey: IRM Press, pp. 354-357

"Learner-Centered Classrooms, Problem-Based Learning, and the Construction of Understanding and Meaning by Students' (n.d.) Retrieved September 25, 2004, from http://www.ncrel.org/sdrs/areas/issues/content/cntareas/science/sc3learn.htm/

"Learner Centered Education General Information" (n.d.) Retrieved August 30, 2007, from http://www.abor.asu.edu/special_programs/lce/general_lce.html

"Learn-Centered Psychological Principles" (n.d.) Retrieved September 25, 2004, from http://www.apa.org/ed/lcp2/lcp14/html/

Lynam, L. (2002) "Software Proficiency Testing in a General Education Computer Course at a Moderately-Selective Midwestern State University". In Khosrow-Pour, M. (ed.) Issues & Trends of Information Technology Management in Contemporary Organizations, Hershey, PA: Idea Group Publishing, pp. 1041-1042

Mykytyn, P. P. (2007) "Educating Our Students in Computer Application Concepts: A Case for Problem-Based Learning", Journal of Organizational and End User Computing, Vol.19, No.1, pp. 51-61

Norman, D. A, and Spohrer, J. C. (1996) 'Learner-centered education", Communications of the ACM, New York: Association for Computing Machinery, Vol. 39, No.4, pp. 24-26

Schlenker, L. H. (2002) "The Challenges Facing Higher Education in Training the European Workforce for the Information Society", In Khosrow-Pour, M. ed. Issues & Trend of Information Technology Management in Contemporary Organizations, Hershey: Idea Group Publishing, pp. 1095-1097

Soloway, E and Pryer, A. (1996) "The next generation in human-computer interaction", Communications of the ACM, New York: Association for Computing Machinery, Vol. 39, No.4, pp.16-18

"Student-Centered Learning" (n.d.) Retrieved September 25, 2004, from http://www.gsu..edu/~mstswh/courses/it7000/papers/students-2.htm

"Teacher vs. Learner-Centered Instruction" (n.d.) Retrieved September 25, 2004, from http://www.nclrc.org/essentials/goalsmethods/learncentpop.html/

"Uden, L. and Beaumont", C. (2006) Technology and Problem-Based Learning, Hershey, PA: Idea Group Publishing.

Weimer, Maryellen (2002) "Learner-Centered Teaching: Five Key Changes to Practice". San Francisco, CA: Wiley, John & Sons.

"What is 'Learner Centered'" (2004) Retrieved September 25, 2004, from http://tlt.suny.edu/Learner-Centered.htm

Woelfel, Kay D. (2003) "Learner-Centered Education: Implementing the Conceptual Framework - Moving From Theory to Action", Education, Vol. 124, No.1

Yeo, R. (2005) "Problem-based learning: lessons for administrators, educators and learners", The International Journal of Educational Management, Vol.19, No.6/7, pp. 541-552

AUTHOR BIOGRAPHY

Wai K. Law is professor of Strategy and Information Systems at the University of Guam. He has taught more than 25 years at major and regional universities. His special research interests include simulation, information resources management and cultural dynamics in information management and education. He is the coordinator of a popular IS curriculum with learner-centered educational approaches.

Information Systems & Computing
Academic Professionals

STATEMENT OF PEER REVIEW INTEGRITY

All papers published in the Journal of Information Systems Education have undergone rigorous peer review. This includes an initial editor screening and double-blind refereeing by three or more expert referees.

ISSN 1055-3096