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Learning Effectiveness and Student Satisfaction in Mobile Classrooms

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ABSTRACT

As a rapidly growing social-networking generation enters colleges and global workforces, college instructors and IT managers worldwide inevitably face a critical issue of how to better educate this emerging population who could be rarely separated, even in classroom settings, from wireless networks and mobile technology. Drawing from the notion of task-technology fit and various e-learning literatures, we thus develop a research model that seeks to shed light on how mobile technology might shape this social-networking generation's learning experiences. We propose that courses designed with mobile technology embedded contribute to greater learning effectiveness and satisfaction for students compared to course designs where mobile technology is not embedded. We also posit that these positive outcomes may be moderated by the nature of course with higher learning effectiveness and satisfaction in non-technical courses than in technical courses. Proposed research design, measurement issues, and potential contributions are discussed.

Keywords

Learning effectiveness, student satisfaction, mobile technology, Tablet PC

INTRODUCTION

The emergence and rapid development of mobile technologies has captured increasing attention in industry and academia over the years. Wireless networks and relevant mobile devices represent some of fast growing examples. In fact, the discussion of wireless networks and mobile devices has been so overwhelming that a simple search in Google would yield thousands of web pages on these topics. *The Economist*, for instance, reported a series of cover stories in April 2007, all related to wireless and mobile phenomena such as wireless chips and smart services, ubiquitous apartments where everything (i.e. home appliances, consumer electronics, and mobile communications) is controlled and connected online, and a seemingly RFID (Radio Frequency Identification) tag injected into a club patron's arms for entry and purchasing records (Anonymous, 2007). Other issues discussed also included wireless energy and invisible security and privacy issues (Anonymous, 2007).

As the rapid mobile movement continued, the implications of mobile technology was witnessed and embraced by many sectors. For instance, in the health care industry, wireless technology has empowered physicians and enhanced their productivity and patient care (Fiser, 2004); many medical schools have required students to equip with PDA (Personal Digital Assistant) prior to entering the programs (Rege and Kean, 2003). In agriculture, wireless local area networks (WLANs) have been successfully tested to allow rapid data flow among all farming equipments and in turn resolved bottleneck issues for precision farming (McKinion, Turner, Willers, Read, Jenkins and McDade, 2004). In the oil and energy field, recently emerging WiMAX (Worldwide Interoperability for Microwave Access) networks have been launched in Yemen (Hoskins, 2007). In education, mobile technology facilitated learning process by enhancing students' interests in their individual works (Patterson, 2001); some private schools have successfully launched laptop programs to facilitate the notion of anytime, everywhere learning (Rajala, 2003).

All these practice of mobile technology highlighted its potential implications in creating new channels for business competition (Looney, Jessup and Valacich, 2004, Roa and Minakakis, 2003, Urbaczewski, Valacich and Jessup, 2003). More

specifically, at the university settings, an emerging generation of students who “grow up online” (www.pbs.org) with mobile technology are expanding their social networks exponentially across time and space. With 66 millions active users reported and 250,000 new registrations added daily, Facebook, a social networking site founded in 2004 (facebook.com), provided an illustrative example of how technological innovation might shape social movements, particularly among younger generations. Given the enormity of this social movement, it is imperative that university instructors reconsider their traditional instructional method and teaching pedagogy which might no longer satisfy this social-networking generation who could rarely separate their everyday lives from YouTube, MySpace, and/or Facebook even in classroom settings.

Unfortunately, the empirical understanding of how this social-networking generation learns in technologically equipped classrooms is still rather limited in the IS (information systems) research community. The potential problem of such inadequate understanding would be that IS instructors and scholars might no longer connect to, let alone well educate, these future IS professionals that would soon become a major information technology (IT) workforce and significantly shape and reshape our professional community worldwide. Our research purpose, thus, seeks to shorten this knowledge gap and shed light on how IT in general and mobile technology in particular shapes this social-networking generation’s learning process and outcomes.

Central research question proposed for investigation would thus focus on, “what is the impact of mobile technology on college students’ learning?” Situated in a historically underserved university, the investigation will draw further attention to the interaction between mobile technology and a group of minority students who are mostly from disadvantaged social/economic backgrounds and predictably less familiar with mobile technology such as laptop computers that are almost ubiquitous among ordinary college students in other social/economic groups. As we are interested in learning how mobile technology shapes these minority students’ learning outcomes, further research questions would also include “how does mobile technology influence learning effectiveness and student satisfaction” and “how do students’ learning outcomes vary in different course designs.”

LITERATURE REVIEW

The majority of existing literature in the IT education area is devoted to the teaching and learning of information technology in general (Börstler and Sharp, 2003, Lopes and Morais, 2002, Ramesh and Wu, 2004). Little attention is paid to how mobile technology affects the students’ learning experience in the research community. For instance, in a series of papers related to innovation in IS education (Markus, 2005), various teaching and educational issues were examined for IS courses such as outsourcing management (Evaristo, Audy, Prikładnicki, Pilatti and Lopes, 2005), systems analysis and design (Avital, 2005), enterprise IS management (Beachboard and Beard, 2005), and introduction to MIS (Management Information Systems) (Aytes and Byers, 2005). Other empirical studies further suggested specific approaches for teaching information technology (Cope, 2003, George, Craven, Williams-Myers and Bonnick, 2003, Hardaway and Scamell, 2003). For example, Cope (2003) advocated a deep approach of teaching IT courses through which the meaning of content taught was sought beyond immediate task or assignments. In a similar vein, George et al. (2003), based on the ‘reflect-plan-act-observe-reflect’ model, proposed an action research approach through which traditionally teacher-centered courses become more student-centered. Finally, Hardaway and Scamell (2003) presented a constructivist teaching approach in an MBA course where the teacher no longer disseminated the knowledge but simply helped students to direct the subject matter studied and strategies used for knowledge gathering process.

Another area of empirical literature tended to focus on learning issues pertaining to specific technological environments, most notably, web-based (Chiu, Chiu and Chang, 2007, Chou and Liu, 2005, Shee and Wang, 2008) or e-learning context (Sahasrabudhe and Kanungo, 2004, Wu, Chen, Zhang and Amoro, 2005, Zhang, Zhou, Briggs and Nunamaker, 2006). For instance, Zhang et al (2006) examined the impact of instructional videos on learning effectiveness and reported substantial improvement of learning effectiveness for those students who were involved in interactive videos in e-learning environments as opposed to other settings. Similar suggestions were also made concerning the use of interactive computer-aided learning tools (Saadé and Kira, 2004). Online educational mode was also found to be a superior instructional method to traditional ones when the learners’ learning style was more visual and instructor feedbacks were more timely and meaningful (Eom, Wen and Ashill, 2006). Students’ satisfaction in online educational environment might also be significantly enhanced with greater teaching/learning flexibility and students’ online experiences (Arbaugh and Duray, 2002).

Despite knowledge contributions to teaching approaches and educational issues examined, these empirical literatures have not paid sufficient attention to the emerging mobile phenomenon that the current IS education faces, let alone in a unique minority educational context. However, certain common themes could be drawn from these empirical studies. First, student-centered teaching approaches have gained increasing attention as suggested by George et al (2003), Hardaway and Scamell (2003), and Avital (2005). Second, web-based, e-learning, or online environment might be increasingly transforming

instructional mode and enhancing learning outcomes as examined by Zhang et al (2006), Saadé and Kira (2004), and Eom et al (2006). Our research project will thus build upon these existing understandings and examine how the rapidly growing mobile technology reshapes teaching methods and learning outcomes.

MODEL AND PROPOSITIONS

The two outcome constructs of interest in our research model are learning effectiveness and student satisfaction (see Figure 1). We focus on these factors primarily because numerous empirical studies have suggested that learning effectiveness (Chang and Lim, 2004, Cybinski and Selvanathan, 2005, Sahasrabudhe and Kanungo, 2004, Wu, et al., 2005) and student satisfaction (Betoret, 2007, Napier and Johnson, 2007, Shen, Hiltz and Bieber, 2006, Vamosi, Pierce and Slotkin, 2004) often represent major concerns in assessing learning process and outcomes which embody our research purposes .

Specific mobile technology chosen for our research project is Tablet PC, an increasingly popular type of laptop computers with adjustable display. Our rationale for choosing Tablet PC is based on its unique features that might help reshape traditional teaching modes and instructional methods. Those features primarily include wireless accessibility, which enables email, Internet, and instant messaging communications, and on-screen inking capability, which allows handwriting recognition and instant note-taking ability. Drawing from the notion of task-technology fit (Goodhue and Thompson, 1995), we argue that these unique technological features, along with different tasks or courses examined, could allow different teaching and learning dynamic to emerge. More specifically, the interactive dynamic (i.e. the fit) between contrasting tasks/courses and technological uses are projected to lead to different learning outcomes (e.g. learning effectiveness and student satisfaction).

The existing literature, though not necessarily specific to mobile technology or Tablet PCs, has provided some underlying support for our arguments. For example, interactive computer-aided learning tools have been shown to enhance the students' test scores (Saadé and Kira, 2004). Students in an electronic environment also showed significantly higher learning effectiveness than those in traditional classrooms (Hu, Hui, Clark, Milton, Ma and Tam, 2005). Such enhanced learning effectiveness in e-learning environment might further include better learning climate for students (Chou and Liu, 2005). Mobile technology in general and Tablet PCs in particular are typically designed to facilitate electronic learning environment and create a more flexible and engaging learning atmosphere even beyond the possibilities of those aforementioned studies. The students would be able to obtain online information and resources instantly as those did in e-learning environment and at the same time accelerate note-taking process and capability beyond what the students could accomplish in traditional classrooms. It is thus reasonable to predict greater learning effectiveness for students who utilize Tablet PCs in their learning process than those who do not. This leads to our first proposition.

Proposition 1: Students using Tablet PCs are likely to have higher learning effectiveness than students who do not use such tools

Empirical evidence also suggested that students in electronically enabled environments were more satisfied with their learning process (Chou and Liu, 2005) or course contents (Hu, et al., 2005) than those in traditional classrooms. The advantages of e-learning environment might emanate primarily from its flexibility and convenience (Dick, 2003). When the students were less bound by the constraint of time and space and the limitations of technological resources typical of traditional classrooms, they were more likely to be satisfied. Furthermore, the integration of specific instructional technology such as interactive video tools in e-learning environment demonstrated substantial positive effects on student satisfaction (Zhang, et al., 2006). Particularly when the integration of technology fits with the students' learning style, a more flexible learning mode such as online education could be a substantially superior instructional approach to traditional ones (Eom, et al., 2006). However, clear disadvantages in a complete virtual learning environment might lead to students' frustration due to technical problems, substantial amount of reading, and/or lacking face-to-face communications and in turn result in their slower learning progress (Dick, 2003). As such, in electronically enabled and technologically integrated classrooms using Tablet PCs as teaching tools, the students are expected to gain benefits of those in e-learning environment (such as instant online information) but avoid disadvantages such as lacking face-to-face communications. Their learning satisfaction should then be significantly enhanced. This argument leads to our second proposition.

Proposition 2: Students using Tablet PCs are likely to have higher learning satisfaction than students who do not use such tools

While the first two propositions argue that different types of course design (i.e. the use of Tablet PCs vs. no use) would be positively correlated to learning effectiveness and student satisfaction, the next two propositions specify the potential moderating effect of course nature (i.e. technical vs. non-technical courses) on these correlations (see Figure 1). According to the task-technology fit model (Goodhue and Thompson, 1995), technology users' performance would not be simply

enhanced by the use of technology, which was only essential but not sufficient. More importantly, to enhance users' performance the technology adopted must fit with the task requirements (Zhang, et al., 2006).

For the purpose of our research investigation, we intend to compare and contrast technical courses such as Java Programming and non-technical courses such as Strategic IT Management. The former, epitomizing the increasingly important concept of object-oriented technology, is widely considered a technical and difficult subject matter in the IS curriculum (Börstler and Sharp, 2003, Ramesh and Wu, 2004) while the latter by its very nature focuses on managerial concepts and thus constitutes a typical non-technical IS course. One major difference between Java Programming and Strategic IT Management is that the former tends to focus on individual work while the latter highly involves in collaborative case analyses. Research evidence suggested that students involved in collaborative work demonstrate significantly higher sense of learning community and learning experiences (Shen, et al., 2006). Other studies showed that in technical courses such as Statistics, a technology-enabled flexible learning environment might not be appropriate for students who exhibited greater assessment anxiety and lower learning enjoyment and outcomes (Cybinski and Selvanathan, 2005). In other words, non-technical courses such as Strategic IT Management, as opposed to technical courses such as Java Programming, might gain substantially greater effects from flexible and collaborative work environment supported by mobile classrooms using Tablet PCs. This leads to our third proposition below.

Proposition 3: Students using tablet PCs are likely to have higher learning effectiveness in non-technical courses than in technical courses

Similarly, students in high collaborative teams often demonstrated significantly greater learning satisfaction than those in low collaborative teams (Napier and Johnson, 2007). In fact, Napier and Johnson (2007) further pointed out that lack of participation and poor communication with peers were two of major factors that led to low learning satisfaction. In other words, students involved in high collaborative and communication in classes are likely to gain higher learning satisfaction. Moreover, students in technical courses such as Introduction to Financial Accounting reported a lower level of learning satisfaction in the flexible, e-learning environment than in traditional classrooms (Vamosi, et al., 2004). Students who were assigned to managerial, decision-making tasks showed significantly higher satisfaction with better technology provided (Wu, et al., 2005). In other words, in non-technical courses, students would gain greater learning satisfaction in a flexible learning environment while such learning satisfaction would not be apparent (if not diminished) for students in technical courses. This leads to our final proposition.

Proposition 4: Students using Tablet PCs are likely to have higher learning satisfaction in non-technical courses than in technical courses

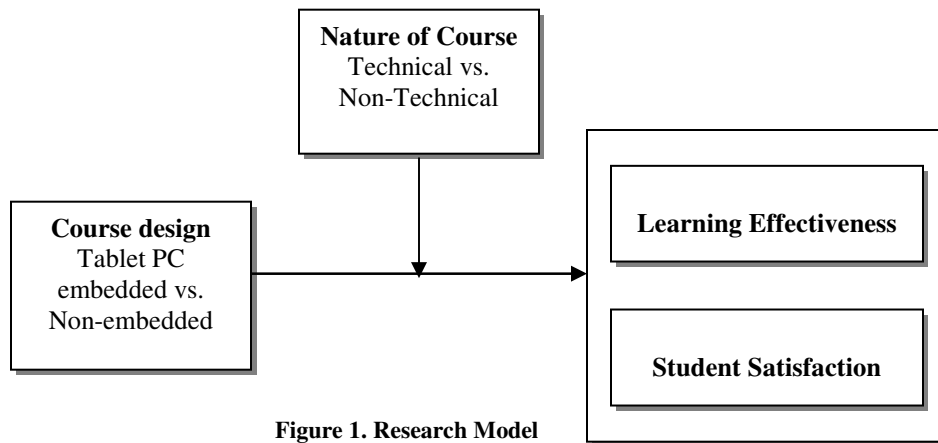


Figure 1. Research Model

As summarized in our research model (Figure 1), we propose that the use of Tablet PCs would enhance learning effectiveness and student satisfaction and at the same time such effects are moderated by the nature of course (i.e. technical vs. non-technical). In other words, based on the notion of task-technology fit (Goodhue and Thompson, 1995), we argue that the use of mobile technology creates necessary situations and when it fits with the task requirements as in a Tablet PC embedded course design, produces necessary and sufficient conditions for positive performance outcomes (i.e. learning effective and student satisfaction). When the features of technology are mobilized to a greater extent and fit with the nature of course (i.e. non-technical course), it facilitates even higher performance outcomes.

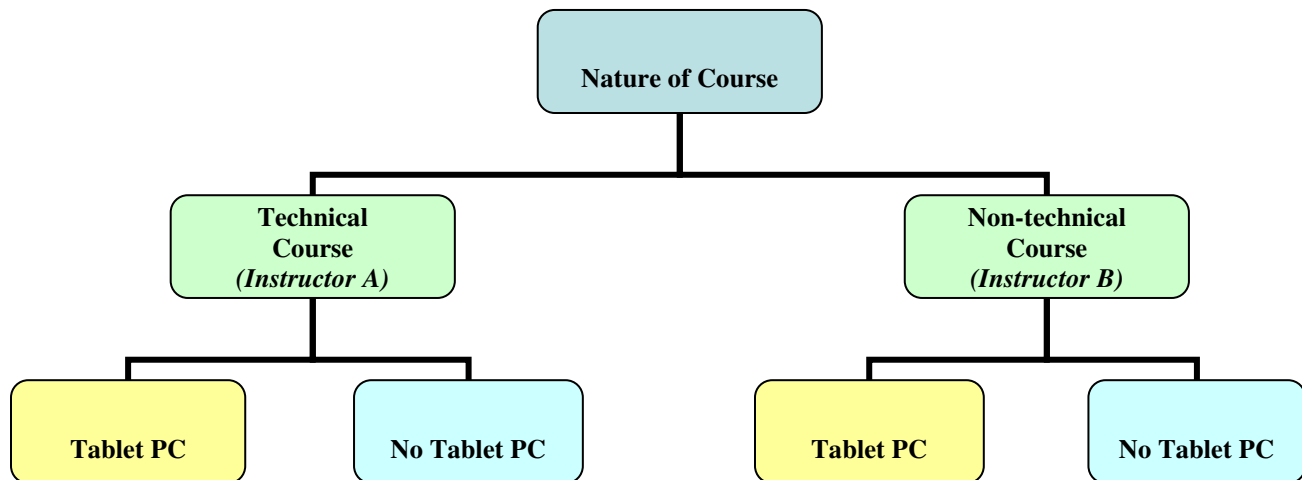


Figure 2. Experimental Design

RESEARCH METHOD

As demonstrated in Figure 2, we plan to use a two-factor nested design with nature of course (technical vs. non-technical) fully crossed against course design (Tablet PCs embedded vs. no Tablet PCs) and instructor nested within the course. In the research context proposed for investigation the same instructor is unlikely to teach both technical and non-technical courses; instructor is thus considered to be nested within the nature of course. As instructors are likely to differ in terms of their course deliverance and teaching effectiveness, we expect to control for this factor by using instructor effectiveness as a covariate. To control for the ability of students across treatments, we would further use the student's GPA (grade point average) at the beginning of the semester as the second covariate.

Measurement

Independent variables examined include course design and nature of course. The former is the experimental manipulation that involves Tablet PCs embedded in course design versus no Tablet PCs embedded. The latter will contrast technical (e.g. Java Programming) and non-technical courses (e.g. Strategic IT Management).

Dependent measures included in our investigation are learning effectiveness and learning satisfaction. The former will be assessed by test scores or final grades, an approach consistent with prior empirical studies (Chou and Liu, 2005, Cybinski and Selvanathan, 2005, Zhang, et al., 2006). The measures for learning satisfaction, in contrast, are quite diverse in the literature (Chien, 2007, Eom, et al., 2006, Vamosi, et al., 2004, Wang, 2003). We will thus develop a survey instrument that is tailored to students' reactions to the use of Tablet PCs and wireless accessibility in classrooms.

Covariates controlled for the study as aforementioned include student ability and instructor's teaching effectiveness. The former could be assessed by the student's GPA prior to taking the course while the latter could be measured by instructor's teaching evaluation for the same course in prior semesters. A 2 x 2 MANCOVA (Multiple Analysis of Covariance) with two dependent measures and two covariates will be conducted for our experimental design.

CONCLUDING REMARKS

Several potential contributions are expected from our research investigation. Overall, the empirical results could help college instructors and educators to better understand how to educate a rapidly expanding social-networking generation of students who does not just 'grow up online' but is also particularly accustomed to wireless networks and mobile technology including in classroom settings. Such understanding could further contribute to the existing knowledge of mobile phenomenon that is swiftly penetrating global society and business world. As this generation of future IT professionals enters the global workforce, our empirical analysis could help IT managers worldwide to better prepare for coordinating and collaborating with this virtual generation that might not like to be managed in traditional approaches.

To researchers, our proposed model integrates the mobile phenomenon that has captured global attention in recent years with the notion of task-technology fit in realizing valued learning outcomes. It should help the research community to better

understand the exponential development of wireless and mobile technology in the private industry, particularly in the higher education context. It is thus expected that the interactive dynamic between tasks (technical vs. non-technical course nature), technology (Tablet PC embedded vs. non-embedded course design), and learning outcomes (effectiveness and satisfaction) would further pave new avenues for future research endeavors.

REFERENCES

1. Arbaugh, J.B. and Duray, R. (2002) Technological and structural characteristics, student learning and satisfaction with web-based courses: An exploratory study of two on-line MBA programs, *Management Learning*, 33, 3, 331.
2. Avital, M. (2005) Innovation in information systems education I: Accelerated systems analysis and design with appreciative inquiry--an action learning approach, *Communications of the Association for Information Systems*, 15, 289-314.
3. Aytes, K. and Byers, S. (2005) Innovation in information systems education IV: Mutual fund management information system: An integrated project for the introduction to MIS course, *Communications of the Association for Information Systems*, 15, 343-356.
4. Beachboard, J.C. and Beard, D.V. (2005) Innovation in information systems education II: Enterprise is management: A capstone course for undergraduate it majors, *Communications of the Association for Information Systems*, 15, 315-330.
5. Betoret, F.D. (2007) The influence of students' and teachers' thinking styles on student course satisfaction and on their learning process, *Educational Psychology*, 27, 2, 219-234.
6. Börstler, J. and Sharp, H. (2003) Learning and teaching object technology, *Computer Science Education*, 13, 4, 243-247.
7. Chang, K.T.-T. and Lim, J. (2004) Learning effectiveness of cross-cultural virtual teams *The Tenth Americas Conference on Information Systems* New York, NY 3016-3024.
8. Chien, T.-K. (2007) Using the learning satisfaction improving model to enhance the teaching quality, *Quality Assurance in Education: An International Perspective*, 15, 2, 192-214.
9. Chiu, C.-M., Chiu, C.-S. and Chang, H.-C. (2007) Examining the integrated influence of fairness and quality on learners' satisfaction and web-based learning continuance intention, *Information Systems Journal*, 17, 3, 271-287.
10. Chou, S.-W. and Liu, C.-H. (2005) Learning effectiveness in a web-based virtual learning environment: A learner control perspective, *Journal of Computer Assisted Learning*, 21, 1, 65-76.
11. Cope, C. (2003) Educationally critical characteristics of deep approaches to learning about the concept of an information system, *Journal of information technology education*, 2, 415-427.
12. Cybinski, P. and Selvanathan, S. (2005) Learning experience and learning effectiveness in undergraduate statistics: Modeling performance in traditional and flexible learning environments, *Decision Sciences Journal of Innovative Education*, 3, 2, 251-271.
13. Dick, G.N. (2003) Teaching online: What price student satisfaction? *The Ninth Americas Conference on Information Systems* Tampa, FL 3054-3060.
14. Eom, S.B., Wen, H.J. and Ashill, N. (2006) The determinants of students' perceived learning outcomes and satisfaction in university online education: An empirical investigation, *Decision Sciences Journal of Innovative Education*, 4, 2, 215-235.
15. Evaristo, R., Audy, J., Prikladnicki, R., Pilatti, L. and Lopes, L.T. (2005) Innovation in information systems education v: The management of outsourcing: Development of a module with implications for the IT curriculum, *Communications of the Association for Information Systems*, 15, 357-368.
16. George, N., Craven, M., Williams-Myers, C. and Bonnick, P. (2003) Using action research to enhance teaching and learning at the university of technology, jamaica, *Assessment & Evaluation in Higher Education*, 28, 3, 239.
17. Goodhue, D.L. and Thompson, R.L. (1995) Task-technology fit and individual performance, *MIS Quarterly*, 213-236.
18. Hardaway, D.E. and Scamell, R.W. (2003) A course design that features a constructivist approach to teaching introduction to information technology, *Decision Sciences Journal of Innovative Education*, 1, 2, 321-327.
19. Hu, P.J., Hui, W., Clark, T.H.K., Milton, J., Ma, W. and Tam, K.Y. (2005) Examining e-learning effectiveness, outcomes and learning style: A longitudinal field experiment *Pacific Asia Conference on Information Systems* Bangkok, Thailand 1023-1036.

20. Looney, C.A., Jessup, L.M. and Valacich, J.S. (2004) Emerging business models for mobile brokerage services, *Communications of the ACM*, 47, 6, 71-77.
21. Lopes, F. and Morais, P. (2002) Lessons learned from the teaching of is development, *Journal of information technology education*, 1, 2, 103-112.
22. Markus, M.L. (2005) Introduction to the 2004 AIS award papers on innovation in information systems education, *Communications of AIS*, 2005, 15, 286-288.
23. McKinion, J.M., Turner, S.B., Willers, J.L., Read, J.J., Jenkins, J.N. and McDade, J. (2004) Wireless technology and satellite internet access for high-speed whole farm connectivity in precision agriculture, *Agricultural Systems*, 81, 3, 201-212.
24. Napier, N.P. and Johnson, R.D. (2007) Technical projects: Understanding teamwork satisfaction in an introductory is course, *Journal of Information Systems Education*, 18, 1, 39-48.
25. Rajala, J.B. (2003) Wireless technology in education, *T.H.E Journal*, 31, 3, 28.
26. Ramesh, V. and Wu, J.-T.B. (2004) An approach to teaching object-oriented programming concepts in business schools, *Decision Sciences Journal of Innovative Education*, 2, 1, 83-87.
27. Roa, B. and Minakakis, L. (2003) Evolution of mobile location-based services, *Communications of the ACM*, 46, 12, 61-65.
28. Saadé, R.G. and Kira, D. (2004) Effectiveness of an interactive application to assist learning: A test case, *Journal of Information Systems Education*, 15, 4, 357-363.
29. Sahasrabudhe, V. and Kanungo, S. (2004) Analysis of the link between e-learning effectiveness and choice of media for contents *Americas Conference on Information Systems* New York, NY 3120-3124.
30. Shee, D.Y. and Wang, Y.-S. (2008) Multi-criteria evaluation of the web-based e-learning system: A methodology based on learner satisfaction and its applications, *Computers & Education*, 50, 3, 894-905.
31. Shen, J., Hiltz, S.R. and Bieber, M. (2006) Collaborative online examinations: Impacts on interaction, learning, and student satisfaction, *IEEE Transactions on Systems, Man & Cybernetics: Part A*, 36, 6, 1045-1053.
32. Urbaczewski, A., Valacich, J.S. and Jessup, L.M. (2003) Mobile commerce opportunities and challenges, *Communications of the ACM*, 46, 12, 31-32.
33. Vamosi, A.R., Pierce, B.G. and Slotkin, M.H. (2004) Distance learning in an accounting principles course--student satisfaction and perceptions of efficacy, *Journal of Education for Business*, 79, 6, 360-366.
34. Wang, Y.-S. (2003) Assessment of learner satisfaction with asynchronous electronic learning systems, *Information & Management*, 41, 1, 75.
35. Wu, J., Chen, C.C., Zhang, Y.J. and Amoro, D.L. (2005) Virtual group learning effectiveness via e-learning mediums *The Eleventh Americas Conference on Information Systems* Omaha, NE 682-690.
36. Zhang, D., Zhou, L., Briggs, R.O. and Nunamaker, J.F. (2006) Instructional video in e-learning: Assessing the impact of interactive video on learning effectiveness, *Information & Management*, 43, 1, 15-27.