International Journal of Engineering Education Vol. 31, No. 2, pp. 567–573, 2015
Printed in Great Britain

0949-149X/91 $3.00+0.00

Comparison of Varied Social Media in Assisting Student Learning

WEN-HSIUNG WU [1, 2], WEN-CHENG YAN [2], WEI-YANG WANG [2], SUNG-LIN LI [2] and HAO-YUN KAO[1]**

[1] Department of Healthcare Administration and Medical Informatics, Kaohsiung Medical University, Kaohsiung 807, Taiwan, ROC. E-mail: whwu@kmu.edu.tw

[2] Institute of Information Management, National Kaohsiung University of Applied Sciences, Kaohsiung 807, Taiwan, ROC. E-mail: 1098405113@cc.kuas.edu.tw; wyang@kuas.edu.tw; 1097345106@cc.kuas.edu.tw; haoyun@kmu.edu.tw

In recent years, a trend has emerged of integrating aspects of social media to promote learning outcomes in the field of engineering education. However, most previous studies of this phenomenon only investigated the application of a single type of social media and few studies conducted a comparison analysis of the impact of different social media on student learning. Hence this study investigates the impact of two different social media, Facebook and wikis, on the learning process through questionnaires and follow-up interviews. Significant findings included indications that the different social media showed distinct and specific pedagogical features, and that effective use of social media in learning contexts requires the involvement of a teaching assistant (TA) as facilitator.

Keywords: social media; Facebook; wiki; learning process

1. Introduction

Maximizing the effectiveness of instruction and learning is a critical aspect of engineering education but, within engineering departments, pedagogical modules often deliver generic content (i.e., mathematics) to a wide range of specific engineering disciplines (i.e., electrical engineering, mechanical engineering) and it is logistically difficult to provide discipline-specific examples and case studies within the traditional lecture setup. This makes it difficult for lecturers addressing large groups of students to engage learners in the learning process or for learners to provide meaningful feedback [1]. Rovai and Jordan [2] indicated a significant move toward student-centered and community-based modes of learning in higher education and a recent trend is to integrate social media functions in engineering education to help address the shortcomings of the lecture format [1, 3–4].

Social media, such as Facebook, wikis, MySpace, Twitter, YouTube and Google+, can be used to extending the learning experience beyond lecture slots and office hours, reduce the need for redundant emails, facilitate collaborative learning and knowledge transfer, and improve engagement in the learning process [1, 3, 5–7]. This study examines the use of two of these tools, specifically Facebook and wikis. Facebook presents opportunities for users to organize themselves into groups based on personal or professional affiliations, including school, workplace, interests, hobbies, and political and religious beliefs [8–10]. Wikis enable communities of users to collaborate on projects, with all members able to add and edit content [11–13].

Many studies have examined the use of social media in facilitating learning from a range of different perspectives. For example, studies of Facebook have examined key issues including pedagogical affordances, preferences, positive or negative engagement and academic performance. Manca and Ranieri [14] showed that pedagogical affordances (e.g., expanding the context of learning, mixing information and learning resources, and hybridization of expertise) of Facebook have only been partially implemented and that there are still many obstacles that may prevent a full adoption of Facebook as a learning environment. Schroeder and Greenbowe [15] reported that undergraduate students had a strong preference for Facebook over WebCT for online discussions to supplement face to face instruction. Positive engagement with Facebook has been shown to be closely related to an increase in college students' social capital, especially for those low in self-esteem and life satisfaction, and helped strengthen social relationships among students, heighten their self-esteem and boost their learning performance [16–17]. On the other hand, the use of Facebook may produce negative or neutral results in terms of academic performance because students used Facebook primarily for social purposes and it potentially distracted students [18–20].

In terms of wikis, studies have focused on the

** Corresponding author.

* Accepted 1 September 2014.

main issues, such as collaborative learning, positive or negative engagement, barriers to successful implementation, and resources and knowledge sharing. For example, Tsai et al. [6] and Adcock [21] applied a wiki-based collaborative network for computer science undergraduate education and a graduate course in teacher education. This wiki is used for sharing research and resources, and for submitting assignments during the course. Hughes and Narayan [13] found that wikis can support student collaboration and learning, and Hemmi et al. [22] found, compared with online bulletin boards, the collaborative editing and collective meaning-making of the wiki environment results in increased formality and discipline. Hughes and Narayan [13] also found that students perceived the wiki as positively supporting collaboration efforts, learning and engagement. However, Cole [23] indicated integrating poorly designed or supported wikis into an existing teaching format had little impact on student engagement. In terms of barriers to use, Karasavvidis [11] found seven major types of problems for student use of wikis—time and effort investment, task requirements, plagiarism, lack of communication, lack of collaboration, validity of interpretations, and reluctance to edit texts. Finally, from a knowledge management perspective, Biasutti and EL-Deghaidy [12] suggested that wikis can develop teachers' knowledge management processes and Kump et al. [24] found that externalization co-occurred with internalization (student learning) in wiki use based on knowledge co-evolution under conditions of accommodation and assimilation.

Most previous studies of the impact of social media on learning outcomes only examined the application of a single type of social media to assist students' learning. Few studies have attempted to provide a comparative analysis of the impact of different social media on student learning outcomes. Deng and Tavares [9] investigated the motivating and inhibiting factors that influenced English students' engagement in online discussions via two social media: Facebook and Moodle. They found that online engagement was influenced by a set of factors including technical tools, subjective perceptions, goals of online discussion, social presence within a community, rules for participation, and participant roles. Alloway et al. [25] found young people who had used Facebook for more than a year had higher scores in tests of verbal ability, working memory, and spelling, but no such effect was found for the use of YouTube or Twitter. Moreover, longer Facebook use was linked to higher reported levels of social connectedness, while use of YouTube showed no impact.

Despite these valuable results, previous studies have largely ignored the fact that different types of social media have widely different features [26]. Also, we found that few studies provide before–after quantitative and qualitative comparison analysis of different social media. More importantly, the comparison between different social media can provide more insight for the use of social media as a means of facilitating learning. Hence this study compares the use of Facebook and wikis during the students' learning process in the context of a semester-long university level course on information systems development in Taiwan.

2. Method

2.1 Participants

A total of 81 3rd-year students (68% male) were recruited from a university in Taiwan. They were aged between 20 and 22 years, were enrolled in a semester-long course on information systems development, and had never used social media such as wikis or Facebook as a learning tool.

2.2 Materials and procedure

The major contents of this course include requirements engineering, analysis and design engineering, software testing and risk and quality management. The major procedures were divided into four phases. The first phase focuses on course preparation and installation of learning-assistance tools. The former consisted of a course syllabus and instructional modes such as lectures, discussions with students and social media use. The latter involved having students install and/or register for MediaWiki [27] and Facebook before the beginning of the course. We also assigned a graduate student to serve as a teaching assistant (TA) to interact with students and answer their questions via these tools.

The 2nd phase is from week 1 to 8. A pre-test questionnaire (described in the following subsection) was conducted before this phase. The major tasks of this stage include the instructor providing key elements of each chapter and discussing them with students. Students also begin using the learning-assistance tools at this time. In the wiki context, students selected keywords (e.g., 'requirements engineering') to find content related to the current chapter. They then collaborated to edit the content according to tasks assigned by the instructor. The basic requirements for editing include: (1) explaining keywords and providing different keyword descriptions for reference for other students, (2) establishing various schemas (i.e. basic introduction, categories or applications) based on keyword data attributions, (3) listing references and external links used as sources for the edited content, and (4)

integrate information presentation techniques other than text (e.g., images, graphs, etc.). In the Facebook environment, students first create an account and then joined the teacher's group. The TA uses the group to conduct online discussions with students. If they have any questions about wiki or Facbook use, they can ask the TA who can reply immediately or later, depending on his/her availability. The TA can also post messages from the instructor and upload supplemental course material. The TA serves a facilitating role and is not expected to provide instruction.

Week 9 is taken up by mid-term exams, and the 3rd phase lasts from week 10 to week 17. The major tasks are similar to those in stage 2, with the instructor providing key elements for each chapter and discussing case studies with students in class. For the students, they still did their keyword setting and editing their content on wiki context and discussing their problems with other peers and the TA.

The final phase takes place in week 18. In this phase the instructor evaluates the edited content from the wiki platform and Facebook discussions. A post-test questionnaire was also administered to assess changes in student perceptions of the use of social media for learning support.

2.3 Instrument and data analysis

The pre-test and post-test questionnaires each consisted of two parts. Section A solicited demographic information, including gender, age, and familiarity with social media-assisted learning. Section B consisted of five constructs: Wiki (or Facebook) interaction, usefulness, ease of use, self-efficacy, and contextual awareness for wiki and Facebook-assisted learning. Contextual awareness includes three sub-constructs: Time, Focus, and Happiness.

The wiki (or Facebook) interaction section includes five items, with the sample 'I feel comfortable using the wiki (or Facebook).' Usefulness also has five items such as 'Using wiki (or Facebook) tools can promote my learning performance.' Ease of use consists of four items, with the sample 'I find the wiki (or Facebook) easy to use.' Self-efficacy has six items including 'I can use the wiki (or Facebook) tools to assist my learning if I had never used them before.' Finally, Context Awareness includes fourteen items with five, five and four items, respectively, for Time, Focus and Happiness, with the sample item for Focus being 'I feel engaged in learning when I use the wiki (or Facebook) tools.' These constructs, using a 7-point Likert scale from 'Strongly disagree' to 'Strongly agree', had a very high Cronbach alpha score (0.83 for wiki interaction and 0.90 for Facebook interaction), and they were adapted by the authors from previous studies [28–29] that examined the use of information systems and social media tools for teaching and learning.

Finally, student comments about their experience using wikis and Facebook-assisted learning were used to support and supplement the quantitative data analysis to allow for a comparison analysis. Student comments were coded to correspond to a student identifier (e.g., S1, S2, S3, . . . S81). The comments from the participants were cited as they were expressed or stated by the students and identified by their respective codes.

3. Results and discussion

3.1 Descriptive statistics

Of the 81 3rd year undergraduate participants, 68% were male, and the mean age was 20 years 4 months.

3.2 Wiki as a learning-assistance tool

Table 1 shows the mean and standard deviation of five constructs based on the pre- and post-test for wikis. For example, the pre-test mean (M_{pre}) is 4.33 and that of the post-test (M_{post}) is 4.61 for the construct of wiki-based interaction, with respective standard deviations, SD_{pre} and $SD_{\text{pre,}}$ of 0.79 and 0.59. The highest scoring construct was Usefulness ($M_{\text{pre}} = 4.81$) while the lowest scoring construct was Contextual Awareness—Happiness ($M_{\text{pre}} = 3.98$). We also found the highest and lowest scores of mean in the post-test were for the constructs of Usefulness ($M_{\text{pos t}} = 5.07$) and Contextual Awareness—Happiness ($M_{\text{post}} = 3.91$).

Table 1. Mean and standard deviation of constructs based on pre- and post-test for a wiki

	Wiki			
Construct	M_{pre}	M_{post}	SD_{pre}	SD_{post}
Wiki interaction	4.33	4.61	0.79	0.59
Usefulness	4.81	5.07	0.82	0.53
Ease of use	4.28	4.45	0.94	1.03
Self-efficacy	4.69	4.68	0.55	0.55
Context Awareness—Time	4.06	4.63	0.86	1.05
Context Awareness—Focus	4.07	4.22	0.54	0.50
Context Awareness—Happiness	3.98	3.91	0.35	0.35

Table 2. Mean and standard deviation of constructs based on pre- and post-test for Facebook

	Facebook			
Construct	M_{pre}	M_{post}	SD_{pre}	SD_{post}
Facebook interaction	5.22	5.25	0.68	0.75
Usefulness	4.01	4.42	1.33	1.14
Ease of use	5.28	5.45	0.87	0.89
Self-efficacy	5.00	5.07	0.65	0.80
Context Awareness—Time	4.98	4.99	1.50	1.79
Context Awareness—Focus	4.24	4.24	0.46	0.66
Context Awareness—Happiness	4.67	4.59	0.30	0.34

3.3 Facebook as a learning-assistance tool

Table 2 shows the means and standard deviations of the five constructs based on pre- and post-tests for Facebook. For example, the mean pre-test (M_{pre}) and post-test (M_{post}) for Self-efficacy are 5.00 and 5.07, respectively, with respective standard deviations of 0.65 and 0.80. In the pre-test, Ease of use scored highest with 5.28, while Usefulness scored lowest with 4.01. In the post-test, Ease of use also had the highest score (5.45), while the lowest score (4.24) was for the construct of Context Awareness—Focus.

3.4 Comparisons between wiki and Facebook use for assisting student learning

Table 3 shows that the three constructs of Wiki interaction, Usefulness, and Context Awareness-Time differ significantly from the pre-test to the post-test, while other constructs, such as Self-efficacy, are non-significant. For example, wiki use can increase professional knowledge ($t = -3.77$, $p < 0.001$) based on the construct of Usefulness. Also, wiki use is seen as being highly time-consuming ($t = -3.63$, $p < 0.01$) under the construct of Context Awareness-Time.

For Facebook, only the construct of Usefulness is showed significance, indicating that the use of Facebook can promote learning motivation ($t = -2.90$, $p < 0.01$) and is useful for learning ($t = -2.89$, $p < 0.01$).

Table 3. Comparisons of pre-/post-test for wiki and Facebook use

Assisting learning tool	Construct	*t*-value	
Wiki	Wiki interaction	−2.44	*
	Usefulness	−2.49	*
	Ease of use	−1.15	
	Self-efficacy	0.17	
	Context Awareness—Time	−4.75	***
	Context Awareness—Focus	−1.53	
	Context Awareness—Happiness	1.06	
Facebook	Facebook interaction	−0.30	
	Usefulness	−3.05	**
	Ease of use	−1.52	
	Self-efficacy	−0.57	
	Context Awareness—Time	−0.08	
	Context Awareness—Focus	−0.03	
	Context Awareness—Happiness	1.34	

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

3.5 Discussion

Based on the quantitative results above and the summarized qualitative data in this subsection, we present the following findings.

Finding 1

Different social media (i.e. wiki or Facebook) had specific and distinct pedagogical features to assist student learning.

For wiki use, the highest scoring construct on both the pre-test and post-test was Usefulness while the lowest scoring construct was Context Awareness—Happiness (see Table 1). However, for Facebook, the highest scoring construct for both the pre-test and post-test was Ease of use, but the lowest scoring construct changed from Usefulness on the pre-test to Context Awareness—Focus on the post-test (see Table 2).

Our findings were consistent with those of previous studies. For example, Smith and Caruso [26] summarized the pedagogical features of wikis such as communicating with peers and teachers about course-related issues and establishing social presence with a community. This study also stressed the utilization of such features to improve students' learning outcomes. Alloway et al. [25] and Junco [18] suggested Facebook features such as creating a personal profile, making friends and sharing information or resources to provide users with a sense of enjoyment. From the standpoint of tool usage for assisting learning, this study provided Ease of use as a critical supplemental feature. For example, S28 stated 'I think Facebook facilitates interaction with other students because its user interface is easy to use.'

Finding 2

Wiki use can help improve students' professional knowledge via peer collaboration, but learning to use the wiki functions is time and labor-intensive.

Table 3 shows that the three constructs of Wiki interaction, Usefulness, and Context Awareness –

Time differ significantly between the pre-test and the post-test. In the pre-test, S07 stated 'I feel a certain amount of pressure because I have never used wiki features before. However, I think I can use the wiki to edit and arrange the course content through peer collaboration.' Also, in the post-test this subject said 'I have a positive attitude toward wiki usage. For example, the wiki can help me review the course content and do my final report.' In the pre-test, S69 said 'When I used the wiki for the first time, I found the functions to be complicated and had to spend considerable time to learn to use it.' In the post-test, she said 'After I became familiar with the wiki functions, I found it useful for editing my work. It also allows me to search content quickly and understand it easily.'

Comparison with the results of previous studies, including those in the engineering education field [6, 13, 21–22], confirmed that collaborative learning and the transfer and sharing of knowledge are critical aspects of wiki interaction and Usefulness. Respondents in the present study found the wiki functions to be difficult and time-consuming to use, supporting findings by Karasavvidis [3]. More importantly, qualitative results reflected the process by which students came to adopt the wiki-based tools, a finding which supplements past studies using cross-sectional surveys.

Finding 3

Instant interaction via Facebook can help increase learner focus on course content and thus improve learning outcomes.

Table 3 shows that only the Usefulness construct changes significantly between the pre-test and post-test. More importantly, from the qualitative data, in the pre-test S44 stated, 'I do not know how to use Facebook for learning.' In the post-test, he said 'The interactivity and instant feedback of Facebook helped me in the course through engaging in problem solving discussions with peers and in collaborating on homework assignments.' In the pre-test S50 stated 'I think Facebook is more useful for social activity than learning. Moreover, I am afraid I will be easily distracted by chatting with Facebook friends.' In the post-test, she said 'I still have some concerns about using Facebook for learning. For example, you can be distracted by adding new friends or by online games.'

Our findings were consistent with those of previous studies [10, 15]. For example, from the standpoint of positive engagement, we found that Facebook's synchronous communication and interactive functions can help improve student learning outcomes. More importantly, if students use Facebook properly, the Usefulness construct (encompassing improved learning performance) is significant for both the pre-test and the post-test. From the negative engagement standpoint, some previous studies [18–19] had indicated that the use of social media resulted in reduced engagement and low academic performance. The present study found that such results can be explained by the easy availability of games and social activities with friends not engaged in the common coursework.

Finding 4

The teaching assistant (TA) plays a critical facilitating role in helping students to use social media in the learning process.

In the qualitative results, many students mentioned receiving online assistance from the TA. S61: 'The TA helped me to better understand the course concepts by answering my questions online.' S71: 'The TA provided supplemental content on Facebook and also answered my questions online. I found this very helpful.' S79: 'The TA posted important information about the course, with alerts to let me know where to find it. The TA also encouraged us to present our opinions about the course content.'

From the technological assistance perspective, most previous studies [13, 18] suggested wiki or Facebook use could produce useful outcomes. The present study stresses the importance of assigning a TA to provide online assistance to students.

4. Conclusion

Social media tools are increasingly being applied to instructional contexts to improve learning outcomes, particularly in the engineering education field. However, most previous studies on the use of social media in learning only studied a single type of social media rather than compare outcomes from the use of multiple social media platforms. This study assesses the use of two social media platforms—Facebook and wikis—on learning outcomes in a one-semester undergraduate level course on information systems development in Taiwan.

Based on the findings of this study, we propose several recommendations for educators, researchers and policy makers. First, different social media platforms have different pedagogical features with various impacts on learning outcomes: beneficial features should be integrated into engineering courses. Second, educators and researchers should better understand students' needs in the learning process and take steps to ensure that they are able to use the social media features effectively. Third, social media platforms frequently include features that distract students from learning, and measures should be implemented to minimize this effect.

Finally, educators and researchers can assign a TA to provide students with online assistance.

Future work can consider adding other social media platforms (e.g., YouTube or Twitter) with different pedagogical features to provide a more advanced comparison analysis or conducting a systematic review based on related articles from social media issues for understanding the research trend in the engineering education field.

References

1. B. Evans, Enhancing undergraduate teaching and feedback using social media—an engineering case study, *Engineering Education,* **8**(2), 2013, pp. 44–53.
2. A. P. Rovai and H. M. Jordan, Blended learning and sense of community: a comparative analysis with traditional and fully online graduate courses, *International Review of Research in Open and Distance Learning,* **5**(2), 2004, retrieved from http://www.irrodl.org/index.php/irrodl/article/viewArticle/192/274.
3. G. Murphya and S. Salomoneb, Using social media to facilitate knowledge transfer in complex engineering environments: a primer for educators, *European Journal of Engineering Education,* **38**(1), 2013, pp. 70–84.
4. K. Silius, T. Miilunaki, J. Huhtamaki, T. Tebest, J. Merilainen and S. Pohjolainen, Social media enhanced studying and learning in higher education, *IEEE EDUCON Education Engineering 2010—The Future of Global Learning Engineering Education,* 2010, Madrid, Spain.
5. E. Tambouris, E. Panopoulou, K. Tarabanis, T. Ryberg, L. Buus and V. Peristeras, Collaborative learning through advanced Web2.0 practices, *IEEE Learning Technology Newsletter,* **12**(3), 2010, pp. 13–16.
6. W. T. Tsai, L. Wu, J. Elston and Y. Chen, Collaborative learning using Wiki web sites for computer science undergraduate education: a case study, *IEEE Transactions on Education,* **54**(1), 2011, pp. 114–124.
7. Z. Wang, J. M. Tchernev and T. Solloway, A dynamic longitudinal examination of social media use, needs, and gratifications among college students, *Computers in Human Behavior,* 28, 2012, pp. 1829–1839.
8. S. Aydin, A review of research on Facebook as an educational environment, *Educational Technology Research* and *Development,* 60, 2012, pp. 1093–1106.
9. L. Deng and N. J. Tavares, From Moodle to Facebook: exploring students' motivation and experiences in online communities, *Computers & Education*, 68, 2013, pp. 167–176.
10. M. D. Roblyer, M. McDaniel, M. Webb, J. Herman and J. V. Witty, Findings on Facebook in higher education: a comparison of college faculty and student uses and perceptions of social networking sites, *Internet and Higher Education,* 13, 2010, pp. 134–140.
11. I. Karasavvidis, Wiki uses in higher education: exploring barriers to successful implementation, *Interactive Learning Environments,* **18**(3), 2010, pp. 219–231.
12. M. Biasutti and H. EL-Deghaidy, Using Wiki in teacher education: impact on knowledge management processes and student satisfaction, *Computers & Education,* **59**, 2012, pp. 861–872.
13. E. Hughes and R. Narayan, Collaboration and learning with Wikis in post-secondary classrooms, *Journal of Interactive Online Learning,* **8**(1), 2009, pp. 63–82.
14. S. Manca and M. Ranieri, Is it a tool suitable for learning? A critical review of the literature on Facebook as a technology-enhanced learning environment, *Journal of Computer Assisted Learning,* **29**(6), 2013, pp. 487–504.
15. J. Schroeder, and T. Greenbowe, The chemistry of Facebook: using social networking to create an online community for the organic chemistry laboratory, *Innovate: Journal of Online Education,* **5**(4), 2009.
16. N. B. Ellison, C. Steinfield and C. Lampe, The benefits of Facebook 'friends:' social capital and college students' use of online social network sites, *Journal of Computer Mediated Communication,* **12**(4), 2007, pp. 1143–1168.
17. A. Y. Yu, S. W. Tian, D.Vogel and R. C. W. Kwok, Can learning be virtually boosted? An investigation of online social networking impacts, *Computers & Education,* **55**(4), 2010, pp. 1494–1503.
18. R. Junco, The relationship between frequency of Facebook use, participation in Facebook activities, and student engagement, *Computers & Education,* **58**, 2012, pp. 162–171.
19. P. A. Kirschner and A. C. Karpinski, Facebook and academic performance, *Computers in Human Behavior,* **26**(6), 2010, pp. 1237–1245.
20. C. Madge, J. Meek, J. Wellens and T. Hooley, Facebook, social integration and informal learning at university: 'it is more for socialising and talking to friends about work than for actually doing work', *Learning, Media and Technology,* **34**(2), 2009, pp. 141–155.
21. P. Adcock, Building collaborative networks using Wikis in education courses, *Society for Information Technology & Teacher Education International Conference (SITE),* New Orleans, Louisiana, United States, 2013.
22. A. Hemmi, S. Bayne and R. Land, The appropriation and repurposing of social technologies in higher education, *Journal of Computer Assisted Learning,* **25**, 2009, pp. 19–30.
23. M. Cole, Using Wiki technology to support student engagement: Lessons from the trenches, *Computers & Education,* **52**, 2009, pp. 141–46.
24. B. Kump, J. Moskaliuk, S. Dennerlein and T. Ley, Tracing knowledge co-evolution in a realistic course setting: a wiki-based field experiment, *Computers & Education,* **69**, 2013, pp. 60–70.
25. T. P. Alloway, J. Horton, R. G. Alloway and C. Dawson, Social networking sites and cognitive abilities: do they make you smarter? *Computers & Education*, **63**, 2013, pp. 10–16.
26. S. D. Smith and J. B. Caruso, The ECAR study of undergraduate students and information technology, *EDUCAUSE,* 2010.
27. M. Verhaart, Case study examples of MediaWiki in teaching and learning, *IEEE Learning Technology Newsletter,* **12**(3), 2010, pp. 24–27.
28. X. Liu, Empirical testing of a theoretical extension of the technology acceptance model: an exploratory study of educational Wikis, *Communication Education,* 2010, **59**(1), pp. 52–69.
29. J. B. Thatcher and P. L. Perrewé, An empirical examination of individual traits as antecedents to computer anxiety and computer self-efficacy, *MIS Quarterly,* **26**(4), 2002, pp. 381–396.

Wen-Hsiung Wu is a Professor of the Department of Healthcare Administration and Medical Informatics at Kaohsiung Medical University, Taiwan. He holds a B.S. in Electronic Engineering from National Taiwan University of Science and Technology, an M.S. in Computer Engineering from the University of Massachusetts-Lowell, and a Ph.D. in Information Management from National Sun Yat-Sen University in Taiwan. His primary research interests focus on instructional learning system development and assessment, behavior of information system learning, medical informatics and knowledge management.

Wen-Cheng Yan is a doctoral student of the Department of Information Management at the National Kaohsiung University of Applied Sciences, Taiwan.

Wei-Yang Wang is an Associate Professor of the Department of Information Management at the National Kaohsiung University of Applied Sciences, Taiwan. He holds a B.S., M.S. and Ph.D. in Information Management from the National Sun Yat-Sen University in Taiwan. His primary research interests focus on information management and system dynamics.

Sung-Lin Li is a master's student of the Department of Information Management at the National Kaohsiung University of Applied Sciences, Taiwan.

Hao-Yun Kao is an Assistant Professor of the Department of Healthcare Administration and Medical Informatics at Kaohsiung Medical University, Taiwan. He holds a B.S. in Public Health, an M.S. in Healthcare Administration from Kaohsiung Medical University, and a Ph.D. in Information Management from the National Sun Yat-Sen University in Taiwan. His primary research interests focus on healthcare learning system development and assessment, design of information systems, medical informatics and Healthcare Administration.