

Digital Devices in Classroom – Hesitations of Teachers-to-be

Paul Lam and Aiden Tong

Centre for Learning Enhancement and Research, The Chinese University of Hong Kong, Hong Kong, China

paul.lam@cuhk.edu.hk

aiden.tong@cuhk.edu.hk

Abstract: More and more teachers are facing the decision whether they should allow or promote students the use of technology in the classroom. The decision is difficult as there are apparently both advantages and disadvantages in doing either way. In terms of positive impacts, research revealed that the use of digital devices in the classroom setting was capable of facilitating faculty-student interactions and in-class participation, which in turn enhanced engagement and active learning (Fitch, 2004; Partee, 1996; Stephens, 2005). On the contrary, evidence was also identified to show a relationship between notebook use and distraction in class. The pilot study investigated the desirability of allowing digital devices in class in our local context, and to explore the factors that influence the success of the practice. Two studies were conducted with students in teacher-training programmes at The Chinese University of Hong Kong. In the first study, students were allowed to use computers in the lessons (free use) in the whole semester and then they were asked to reflect upon the learning benefits, if any. In the second study, the future teachers were asked to comment openly on the use of digital devices for more guided purposes such as student response system and e-textbook. Results in general revealed that it is indeed a very controversial and complicated issue. On the one hand, many positive learning benefits relating to using digital devices in class are acknowledged. On the other hand, distraction is a major concern as students may use the technology for irrelevant purposes in class. Participants thus were also very conservative about channeling the use of computers in classroom to other academic contexts. The answer to the question whether computers be allowed in class thus is not a simple yes or no but is a series of suggestions concerning when and how to do it more appropriate.

Keywords: computers in classroom, distraction

1. Digital devices in classroom

Portable digital devices such as notebook/ tablet computers and handheld mobile devices such as smartphones have become almost standard equipment in tertiary education (Weaver and Nilson, 2005). These devices are also readily connected to the internet. In Hong Kong, for example, there were 14.58 million subscriptions of mobile cellular services in 2011. Taking into account that Hong Kong population was only around 7 million, the ratio was roughly one to two. Among the 14.68 million subscriptions, 5.1 of them were subscribed to broadband services (Lam & Duan, 2012).

We roughly categorized the use of digital devices in classroom into the following two main scenarios. On the one hand, there is a relatively **guided use** of these devices in classrooms – i.e. teachers have controlled and well-defined tasks for students to work on their computers in the classroom. For example, there is a recent interest in using e-textbook to replace paper-based textbook (Yuen, Cheung & Tsang, 2012). Wang, Shen, Novak and Pan (2009) also suggested that mobile devices can be used for instantaneous communications among teachers and students. Cobb, Heaney, Corcoran and Henderson-Begg (2010) also looked at a system that allowed students to comment on teaching through texting on mobile devices.

On the other hand, there is a comparatively **free use** of mobile devices in classrooms – students use the devices in the classroom for their own purposes. Salter, 2010 reported in many universities it has become a common scene that students take out and use their own digital devices for various purposes in the classroom.

The use of digital devices in classroom has attracted considerable controversy concerning its advantages and disadvantages. On the positive side, a number of studies unveiled evidence to show positive impacts of permitting digital devices in classroom. For instance, research revealed that the use of digital devices in a ubiquitous computing environment was capable of facilitating faculty-student interactions and in-class participation, which in turn enhanced engagement and active learning (Fitch, 2004; Partee, 1996; Stephens, 2005). Moreover, web-based activities increased

overall class satisfaction and that in group projects (Driver, 2002). On top of an increase in engagement and satisfaction, Demb et al (2004), also found that students perceived that digital devices had positive impacts on their study habits and their academic success.

It was also evident that the use of digital devices in classroom was effective in enhancing motivation, the ability to apply course based knowledge, and overall academic achievement among students (Mackinnon and Vibert, 2002; Siegle and Foster, 2001). Moreover, the use of computers, coupled with wi-fi connectivity, had increased active exploratory learning and was effective in promoting interactions between students and the instructor in large classes (Barak et al, 2006). Some of these claimed were empirically supported. In a comparative study between classrooms with and without the use of computers, students from classrooms with computers reported to have participated more, to be more interested in learning, and to be more motivated to perform well (Trimmel and Backmann, 2004).

On the negative side, however, there have been worries that use of digital devices in class distracted students from learning in class. The problem seems to be more apparent in the free use scenario.

Tesch, Coelho and Drozdenko (2011) conducted a study to investigate the opinions of students about whether computer use not under the guidance of teachers would result in substantial distraction. A total of 57 general potential distracting factors were identified by students such as discussion among neighbors and people coming in late for lectures. Students rated use of digital devices to be a moderately distracting factor. Hembrooke and Gay (2003) designed an experiment to explore how the use of digital devices impacted on learning performance among students. The experiment involved two groups of students who listened to exactly the same lecture in which one of them was allowed to use computers whereas the use of digital devices was forbidden in the other group. Results indicated that students who were allowed to use computers experienced decrements in the same memory test that the other group took. Similarly, Fried (2008) reported a survey study that students who spent considerable time multitasking with their notebooks were prone to decrease in self-reported understanding of course material and overall course performance. Such results were consistent with that of Grace-Martin and Gay (2001) where use of digital devices in class encouraged the conduct of non-learning usages and therefore limited or even reserved benefits in relation to academic performance. Also, the problem of maintaining attention among students in class was also reported in a number of other studies (Biggs and Tang 2007; Bligh, 2000; Chickering and Gamon, 1987; Geske, 1992; Hartley and Davies, 1978; McKeachy, 1999; Bonwell and Eison, 1991).

In fact, misuse of technology in class affected not only individuals who engaged in a particular activity but people around that individual (Mueller, 2009). Also, few teachers integrate notebooks fully into classrooms (Olson, 2002). There were extreme cases in which some of the professors were frustrated enough to unplug the wireless transmitter manually because their students engaged in non-academic activities via the internet without paying attention (Schwarz, 2003). A number of other studies also reported the presence of some kinds of frustration experienced by teachers (Kladko, 2005; McWilliams, 2005; Szaniszlo, 2006; Young, 2006).

Despite a large amount of research in the effectiveness of notebook use in overseas institutions, the study in the use of notebook in local classroom has not been extensively explored in tertiary institutions of Hong Kong. A recent study that was relevant to our local context was interesting. It compared the use of notebook in classroom among students from 36 award winning teachers in Hong Kong, Canada, and Australia. Results of the study revealed that 78 % of the students from Hong Kong reported to have used personal notebooks almost always or often in class. In comparison, only 67% of students from Canada and 60% of those from Australia reported so in the study (Salter, 2010). The results thus suggested to us that this issue of whether or how students should be allowed to use computers in class is of particular importance in our local context.

2. The study

We had the following research questions in mind: whether students engage in distracting activities as they use their digital devices in local classroom, and whether they agreed with the advantages of such practice.

Due to practical limitations, the evaluation method focused on the collection of perception data. In other words, the present study looked at people's perceptions of computer use in classroom and its

distraction rather than they were actually doing with the computers. We were aware of the limitations of the subjective nature of the study but hoped the findings could nevertheless lead to preliminary understanding of the issue.

Two sets of data were solicited. The first study was conducted in one of the postgraduate courses in an English programme at The Chinese University of Hong Kong in 2011. It began by giving permission to the 15 postgraduate students in the course to bring in their own notebooks to one of their courses. Computers were used as both a teaching tool and self-studying tool in the course. Since the course was on computer applications in second language teaching, the teacher at times would show-how software and platforms and students could have hands-on using their own computers in the classroom. In this way, computers were actively used as teaching tools in this course (guided use). On the other hand, students were allowed to use their digital devices continually so that they could conduct information search, note-taking or any other related tasks initiated by the students themselves (free use). In order to study their views about notebook use in class, a survey was administered to all students at the end of course. The investigation consisted of a survey with a response rate of 100%. The focus of this study was more on the desirability of free use of digital devices in class.

Subjects of the second study were also future teachers. They were students studying a post-graduate certificate programme in the Chinese language teaching stream at The Chinese University of Hong Kong in 2012. Students attended a workshop on teaching and learning technologies. In the workshop, students experienced using their own mobile devices to interact with teachers on a web-based student response system called uReply. The use of eBooks was demonstrated and the possibility of using e-textbook to replace paper-based books was discussed. 19 of the students the 26 students returned the survey distributed at the end of the workshop (response rate being 73%). The focus of this study was more on the desirability of guided use of digital devices in class.

3. Findings

3.1 Study one

In the first section of the survey, participants were asked to self-report the types of tasks they used the digital devices for in the class. They were asked to remark on a pre-defined list of tasks using a 3-point scale (Frequently [3]; Occasionally [2]; Never [1]). Table 1 summarizes the engagement in activities related to course. Among the four activities that students were asked to report on, students spent most of their time with their notebooks on reading class materials (average score being 2.47). The other activities in the order of their relative frequency were taking class notes (2.29), reading web materials that were related to course content (2.27), and communicating with others (1.93).

Table 1: Mean frequency of engagement in activities related to course

Activities that are related to course	Frequency
1. Read class materials	2.47
2. Take class notes	2.29
3. Read web materials that are related to course content	2.27
4. Communicate with others using computers for issues related to subject content	1.93
Average for item 1 - 4	2.24

Table 2 summarizes students' engagement in activities that were not related to course. It seemed that students were not actively engaged in most of these activities as most of the ratings were around 1 to 1.8. An obvious exception was using the notebook computers to read emails (2.13).

Participants were asked to write down the approximate percentage of time that they spent on notebook working on tasks related and not related to course respectively. On the whole, students reported to have spent the majority of their time (69.96%) in class on activities that were related to course whereas the rest of time (30.36%) on activities not related to course.

In the next part of the survey, participants remarked on a 5-point scale (Strongly agree [5]; Agree [4]; Neutral [3]; Disagree [2]; Strongly disagree [1]) how much they agreed upon a list of statements

concerning advantages and disadvantages of letting students use their own computers in classroom (Table 5).

Table 2: Mean frequency of engagement in activities non-related to course

Activities that are not related to course	Frequency
1. Read email	2.13
2. Send email	1.67
3. Read/send instant messages	1.73
4. Read news	1.47
5. Visit e-commerce sites such as Amazon and eBay	1.00
6. Play games	1.07
7. Work on assignments from other classes	1.47
8. Work on other things that are not related to this class	1.87
Average for item 1 - 8	1.55

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Table 5: Mean perceived advantages and disadvantages caused by activities non-related to course

Advantages/disadvantages	Strongly disagree [1]- Strongly agree [5]
Improved my motivation to learn	4.07
Enhanced meaningful course-related interactions in class through online communications	4.27
Enabled me to actively explore information for learning as I look for online resources	4.13
Distracted my attention from teacher’s teaching	3.80
Enabled me to become more attentive in class	2.93
Made me appreciate that the teacher was considerate to students’ needs	3.73
Made me more willing to attend class	4.13

On the one hand, students were very positive about the benefits of having their computers handy in the classroom. They agreed with advantages such as 1) Improving their motivation to learn (4.07); 2) Enhancing meaningful course-related interactions in class through online communications (4.27); 3) Enabling them to actively explore information for learning as they looked for online resources (4.13); 4) Making them appreciate the teacher was considerate to students’ needs (3.73), and 5) Making them more willing to attend class (4.13).

On the other hand, however, students also recognized the potential danger that computers can be a source of distraction. They agreed such practice would distract their attention and stopped them from listening to their teachers (3.80). Also, they did not tend to agree that notebooks “Enabled me to become more attentive in class” (2.93). Thus on the whole the findings clearly showed a very mixed sentiment held by students concerning the use of personal computers in the classroom.

In the last part of the survey, participants were asked to comment on whether computer use in class could be integrated into other academic contexts, ranging from other courses at the university to classrooms in secondary schools. Table 6 summarizes their responses.

Table 6: Mean perceived possibility of transfer of notebook use in classroom

Possibility of transfer	Strongly disagree [1]- Strongly agree [5]
I would like to be allowed to use personal computers in my other courses,	3.73
I will learn better if I can use personal computers in my other courses.	3.40
I think secondary school students can benefit if they are permitted to use computers in classroom.	2.33
When I am teaching, my students should be allowed to use personal computers in the classroom for better learning outcomes.	2.20
Under the present situation, I think it is practical to promote computer-in-classroom in schools.	2.73
Average	2.88

In the university context, some of the students remarked that such practice could be made available to other courses (3.73) and they believed they would learn better if they adopt such practice (3.40). In the open-ended remarks, these students explained that being able to use computers in class provided them greater degree of autonomy. They were able to access to a wide range of online resources and references instantly, including powerpoint slides for their lectures and readings that were reading to their course. Moreover, by allowing access to the internet, they were able to share files with each other via the course platform. The combined effect enhanced the learning experience among students.

Some of the students, however, regarded technology a likely distraction in other university courses. In particular, many courses do not seem to relate to online resources or they are not benefited by additional online interactions in class (perhaps because there are already discussion opportunities).

As for the transferability of the practice to classes in secondary schools, students' comments were very conservative. They disagreed with the idea that secondary school students would benefit if they are allowed to use notebooks in classroom (2.33). They disagreed that students should be allowed to use notebook in class even at the expense of achieving better learning outcomes (2.20). Moreover, they doubted it was practical to promote notebook use in classroom to schools in Hong Kong (2.73). According to them, secondary students were not mature enough to exercise discipline. Rather than taking notes with their notebooks, they were more likely to engage in non-academic activities, which undoubtedly would distract their attention from teachers' teaching.

Allowing computers in class can be distracting from the teacher's point of view too. The teacher found that students did not look at him during class as they were all reading materials on their own notebook screen. Students smiled at times during a demonstration when it was supposed to be a serious one - he suspected his students were engaged in non-academic activities. Also, some of the students typed actively and nosily throughout the whole lecture, and this was annoying to the teacher as well as the other students.

The teacher, however, also recalled times when notebooks in class led to apparent teaching and learning benefits especially in the guided usage. For example, he observed that students engaged in class activities more actively when these activities involved the use of web materials. Besides, by allowing notebooks in class, he was able to explain content more clearly particularly when the class was about software, platforms and web pages students can get access to exactly at the time the teacher was talking about them. It was especially useful when he had to demonstrate operation of software in class. Some of these demonstrations normally took some time to set up and students often had to wait for long. Rather than waiting, the teacher was able to instruct his students to follow the steps required to set up these demonstrations.

Concerning free use, teachers also felt more comfortable suggesting additional reading materials and learning resources to students. He also found that some students asked more in-depth questions in class perhaps because they had been doing additional reading in class.

3.2 Study two

Participants in the second study were asked three open-ended questions concerning whether they would support the use of digital devices by students in the local secondary schools in three different scenarios. Two of the scenarios were the comparatively guided use of the devices for teaching and learning: for classroom interaction (e.g. uReply), and for replacing paper-books with e-textbooks. The third scenario was free use and teachers just give free hand to students to do what they like with their own devices while they are teaching.

The participants were less comfortable with the free use scenario. Only three out of the 14 remarks collected in this question indicated a clear 'yes' and claimed they would let students use their digital devices on their own free will when they teach in the future. As expected, distraction was the main problem related to free use. Below are some remarks related to this concern. The "+" symbol indicates that the statement was a translation from Chinese; the "*" mark indicates that the statement has been subjected to considerable editing for language reasons.

- "No, classroom management will be a huge problem. Teachers cannot monitor each students all the time. Students are easily distracted by mobile devices.
- "I don't agree because e-devices may distract students' attention in class."
- "+No, because they will not concentrate on their study."

Comparatively, the participants were more positive if the digital devices would be used for more specific learning purposes. 14 out of the 16 remarks collected, for example, were supportive of the use of student response systems such as uReply in classrooms. They acknowledged advantages such as increased interactions as well as learning motivation.

- "+It gives more chances to students to voice out and to participate in extended discussions"
- "Yes, because it can improve students' motivation."

However, the participants were much more conservative with the use of e-textbooks. Only five out of the 16 comments received were clear-cut "yes" to the question. Another two were lukewarm or they remarked that e-textbooks are good in only some specific teaching and learning contexts.

The participants were able to identify many more potential challenges if the guided use of digital devices in the classroom is long-term rather than occasional. For example, equity will be an issue.

- * "I just worry about the expenses, especially for some poor students."

Usability becomes much more important if it is a long-term strategy.

- "+Long term use is strainful to the eyes."
- "Students can drop notes more easily on paper."

There are also administrative and practical problems.

- "I am afraid that the secondary schools may not allow students to bring their phones into the classroom."
- * "Using e-textbooks needs school to have supporting infrastructure which cost problems and difficulties to many schools."

Lastly and interestingly, the same distraction problem surfaces. Apparently, teachers are not confident that they can really control and monitor each and every student's activities on their digital devices.

- "So the classroom management is also important."
- * "It is because they can write on paper-books and they pay more attention to the teaching."

The line between guided and free use thus cannot be clear-cut when the digital devices become standard equipment in a classroom. The results showed once again the complexity of the issue at hand.

4. Discussion

The results in general confirmed that the use of digital devices in classroom is a controversial and complicated issue. On the one hand, it impacts positively on learning. Participants in current study believed that computer uses related to course were beneficial to their learning. Participants in current study remarked that they spent the majority of their time (70%) on course-related tasks on the

computers. They reported activities that were course-related to be beneficial to their learning substantially. Out of the 70% of participation in academic-related activities, participants read class materials most frequently and perceived academic-related activities to be beneficial to their learning experience.

On the positive side, our findings affirmed some of the optimistic views in the literature. For example, Mackinnon and Vibert (2002) regarded notebook use in classroom to be effective in enhancing motivation, the ability to apply course based knowledge, and overall academic achievement among students. The adoption of notebook in local classroom in the present study also produced a prominent effect in motivation. Participants in our study agreed that by allowing the use of digital devices in classroom, they were more motivated to learn in class. Thus, unlike Tesch, Coelho and Drozdenko (2011) and Hembrooke and Gay (2003) who tended to have a more pessimistic view towards the issue and regard notebook activities in the classroom distracting, results of this study suggested that the practice becomes a problem only when users engaged in non-related activities whereas such practice served as a facilitator to learning if activities engaged were course-related.

We found to a certain extent an enhanced motivation to learn as well. The findings corresponded with past results uncovered by Fitch (2004) and Stephens (2005) where notebook use in their research revealed enhancement in in-class participation and engagement. Our finding was consistent with Barak et al (2006) too, as notebooks installed with wi-fi seemed to increase active exploratory learning. Also, notebook use in class seemed to have encouraged students to attend class. Increase in participation rates was also found in past research by Trimmel and Backmann (2004). They found that students who were in computer-possible classrooms, in comparison with those who weren't, had higher participation rates, enhancement in interests and motivation to perform well during the course.

On the other hand, the disadvantage is also real that there is the temptation to use the computers for irrelevant purposes in class. Our studies thus showed people were conservative about channeling the use of computers in classroom to other academic contexts, especially in secondary school setting with the less mature students.

The problem of potential distraction is obviously more serious in the free use scenario. However, we found distraction can also be a problem in the guided use situation too when the digital device becomes a long-term standard equipment in the classroom. Teachers just cannot monitor every minute of the class. It seems that the most comfortable scenario now for most teachers now is an occasional use of digital devices for guided activities in the classroom.

5. Conclusion

The present study revealed that use of digital devices was effective in enhancing motivation, the conduct of meaningful course-related interactions, active exploration of online information, and participation rates. Nevertheless, even for those who acknowledged the benefits of use of digital devices in class, some of them reported to have been distracted at times during the lecture. In fact, the teacher who was responsible for the course in the first study had also experienced occasional distress in maintaining attention among a number of students.

Apparently, the answer to the question whether computers be allowed in class should not be a simple yes or no but is a series of suggestions concerning when and how. Therefore, in order to address these negative impacts, it is necessary to provide guidance and instruction for students to refer to if notebooks are to be used for achievement of better learning outcomes.

As an implication, therefore, the real challenge is on promoting good practices. In this regard, we identified a few factors relating to these good practices. First of all, students' characteristics seem to be an important factor as most of the time we rely on students' ability to control themselves to do things appropriately. Maturity of the students is also the main reason why many of our students did not regard the practice a good idea in secondary school classrooms.

Second, meaningful activities are important. For example, in the course of the first study, the computers assisted students' understanding of course-related software and the procedural knowledge needed in using software. The additional materials on the web were also important suggested readings of the course. Also, teachers had a package of teaching materials in digital format and students could easily retrieve them, view them and work on them on their computers during the class.

In the second study, the students appreciated that the use of digital devices actually led to richer interaction in class and thus enhanced learning outcomes.

Third, new teaching skills may be important too. Teachers need to design class learning activities that incorporate the use of technology. Teachers should also be more attentive to what students are doing on their computers. Interfere at times when s/he thinks computers are turning into distractions.

We would like to emphasize again the pilot-study nature of the present study. The study is seriously limited as we studied a very small cohort of students in one course over one semester. The preliminary findings and implications are interesting but they are yet to be subject to further investigation in future studies.

References

- Barak, M., Lipson, A. and Lerman, S. (2006) "Wireless Notebooks as Means for Promoting Active Learning in Large Lecture Halls", *Journal of Research on Technology in Education*, Vol 38, pp 245–263.
- Biggs, J. and Tang, C. (2007) *Teaching for Quality Learning at University*, Open University Press, Maidenhead.
- Bligh, D. (2000) *What's the Use of Lecture?* Jossey-Bass, San Francisco.
- Bonwell, C.C. and Eison, J.A. (1991) *Active Learning: Creating Excitement in the Classroom*, ASHE-ERIC, Washington, DC.
- Chickering, A.W. and Gamson, Z. (1987) "Seven Principles for Good Practice in Undergraduate Education", *AAHE Bulletin*, Vol 39, pp 3–7.
- Cobb, S., Heaney, R., Corcoran, O. and Henderson-begg, S. (2010). "Using mobile phones to increase classroom interaction", *Journal of Educational Multimedia and Hypermedia*, Vol 19, No. 2, pp 147–157.
- Demb, A., Erickson, D. and Hawkins-Wilding, S. (2004) "The Notebook Alternative: Student's Reactions and Strategic Implications", *Computers and Education*, Vol 43, pp 383–401.
- Driver, M. (2002) "Exploring Student Perceptions of Group Interactions and Class Satisfaction in the Web-Enhanced Classroom", *The Internet and Higher Education*, Vol 5, No. 1, pp 35–45.
- Fitch, J.L. (2004) "Student Feedback in the College Classroom: A Technology Solution", *Educational Technology Research and Development*, Vol 52, pp 171–181.
- Fried, C.B. (2008) "In-class Notebook Use and Its Effects on Student Learning", *Computers and Education*, 50, pp 909–914.
- Geske, J. (1992) "Overcoming the Drawbacks of the Large Lecture Class", *College Teaching*, Vol 40, No. 4, pp 151–154.
- Grace-Martin, M. and Gay, G. (2001) "Web Browsing, Mobile Computing and Academic Performance", *Educational Technology & Society*, Vol 4, No. 3, pp 95–107.
- Hartley, J. and Davies, I. (1978) "Note Taking: A Critical Review", *Programmed Learning and Educational Technology*, Vol 15, pp 207–224.
- Hembrooke, H. and Gay, G. (2003) "The Notebook and the Lecture: The Effects of Multitasking in Learning Environments", *Journal of Computing in Higher Education*, Vol 15, No. 1, pp 46–64.
- Kladko, B. (2005) 'Wireless classrooms: Tool or distraction?', *The Record*, 16 April, A1.
- Lam, J. and Duan, C.G. (2012). 'A review of mobile learning environment in higher education sector of Hong Kong: Technological and social perspectives'. In: S. K. S. Cheung et al., (eds). *Lecture Notes in Computer Science 7411* (pp 165–173). Springer-Verlag Berlin Heidelberg.
- Li, K.C., Yuen, K.S., Cheung, S.K.S. and Tsang, E.Y.M. (2012). 'eVolution from conventional textbooks to open textbooks: A way out for Hong Kong'. In: K. C. Li et al., (eds). *Communications in Computer and Information Science 302* (pp 211–225). Springer-Verlag Berlin Heidelberg.
- Mackinnon, G.R. and Vibert, C. (2002) "Judging the Constructive Impacts of Communication Technologies: A Business Education Study", *Education and Information Technology*, Vol 7, pp 127–135.
- McKeachy, W.J. (1999) *Teaching Tips*, 10th edition, Houghton-Mifflin, Boston.
- McWilliams, G. (2005) 'The dark side of the notebook university', *The Wallstreet Journal*, 14 October, B1.
- Mueller, D. (2009) "Digital Underlife in the Networked Writing Classroom", *Computers and Composition*, Vol 24, No. 1, pp 240–250.
- Olson, F. (2002) 'Duke U decides against requiring freshmen to own notebooks', *Chronicle of Higher Education*, 11 Jan, A44.
- Partee, M.H. (1996) "Using e-mail, web sites, and newsgroups to enhance traditional instruction", *T.H.E. Journal*, Vol 23, No. 11, pp 79–82.
- Salter, D. and Lam, L.K.J. (2010) 'Approaches to teaching and technology use among international award winning university teachers', in *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2010* (pp 2565–2574), AACE, Chesapeake, VA.
- Siegle, D., and Foster, T. (2001) "Notebook Computers and Multimedia and Presentation Software: Their Effects on Student Achievement in Anatomy and Physiology", *Journal of Research on Technology in Education*, Vol 34, pp 29–37.
- Stephens, B.R. (2005) "Notebooks in Psychology: Conducting Flexible In-class Research and Writing Laboratories", *New Directions for Teaching and Learning*, Vol 101, pp 15–26.
- Szaniszlo, M. (2006) 'Harvard profs lay down law: no notebooks in class', *The Boston Herald*, 4 June, A6.

- Tesch, F., Coelho, D. and Drozdenko, R. (2011) 'The relative potency of classroom distracters on student concentration: We have met the enemy and he is us', in *Proceedings of American Society of Business and Behavioral Sciences 2011* (pp 886–894), ASBBS, Las Vegas, VA.
- Trimmel, M. and Bachmann, J. (2004) "Cognitive, Social, Motivational and Health Aspects of Students in Notebook Classrooms", *Journal of Computer Assisted Learning*, Vol 20, pp 151–158.
- Wang, M., Shen, R., Novak, D. and Pan, X. (2009) "The impact of mobile learning on students' learning behaviours and performance: Report from a large blended classroom", *British Journal of Educational Technology*, Vol 40, No. 4, pp 673–695.
- Weaver, B.E. and Nilson, L.B. (2005) "Notebooks in Class: What are They Good for? What Can You Do with Them?", *New Directions in Teaching and Learning*, Vol 101, pp 3–13.
- Young, J.R. (2006) 'The fight for classroom attention: Professor vs notebook', *Chronicle of Higher Education*, 2 June, A27–A29.