2015

Enhancing students’ learning process through interactive digital media: New opportunities for collaborative learning

Kok Siew Benjamin GAN
*Singapore Management University, benjamingan@smu.edu.sg*

Thomas MENKHOFF
*Singapore Management University, thomasm@smu.edu.sg*

Richard Raymond SMITH
*Singapore Management University, rsmith@smu.edu.sg*

Follow this and additional works at: [http://ink.library.smu.edu.sg/sis_research](http://ink.library.smu.edu.sg/sis_research)

Part of the [Computer Sciences Commons](http://ink.library.smu.edu.sg/sis_research)

Citation

Available at: [http://ink.library.smu.edu.sg/sis_research/2533](http://ink.library.smu.edu.sg/sis_research/2533)
Enhancing students’ learning process through interactive digital media: New opportunities for collaborative learning

Benjamin Gan a,1, Thomas Menkhoff b,*, Richard Smith b,2

a School of Information Systems, Singapore Management University, Singapore
b Lee Kong Chian School of Business, Singapore Management University, 50 Stamford Road #05-01, Singapore 178899, Singapore

Article info
Article history:
Available online xxxx

Keywords:
Higher education
Interactive digital media
Singapore

In this paper, we describe and review several examples of web technology-enabled teaching and learning approaches at undergraduate level in an Asian institution of higher learning. We begin by reporting on experiences made in the context of an iPad-enabled mobile learning project conducted during a Knowledge Management course (excursion) in support of the university’s technology-enabled learning vision. This is followed by reflections on the deployment of a collaborative social learning platform website (Edmodo), wiki- and web page-creation tools (Google Site), animated videos, etc. in elective courses on leadership and human capital management. Finally, we describe a proven project-based learning approach adopted annually by numerous undergraduate teams of four to six students as part of their compulsory capstone course in the field of information systems. Besides documenting the multiple opportunities which interactive digital technologies offer for both instructors and students in order to learn collaboratively, we discuss some of the challenges when it comes to implementing and institutionalising technology-enabled teaching and learning in higher education.

1. Introduction

Rapid change in terms of students’ expectations for ‘effective’ learning and teaching as well as the continuous influx of new technologies such as social media (García-Peñalvo et al., 2012; Arnold & Paulus, 2010; Damiani, Lytras, & Cudré-Mauroux, 2010; Ebner, Lienhardt, Rohs, & Meyer, 2010) represent significant drivers for greater innovativeness in higher education. We argue that instructors must push themselves to learn more about technology-enabled learning processes in order to innovate teaching and learning. For us, teaching itself provides a great opportunity for lifelong learning, and we feel fortunate to be part of a community of learners at our university that is open to innovation and peer learning via regular knowledge sharing sessions. With many years of experience in practice, all of us are trying to provide a balance between practice, research, and application in our teaching. Our goals are to provide each individual student with an enjoyable learning experience via useful feedback, engagement, self-discovery through online tools, individual reflection, along with class participation and team dynamics. Our approach involves both collaborative student learning and continuous innovativeness with the help of web technologies in order to enhance the value added of the learning process.

1.1. Research problem

The research problem under investigation is exploratory and fluid in nature and can be formulated as follows: ‘Mastering interactive digital media for effective structured collaboration so that students in groups work together to maximize their own and each other’s learning’. To ensure that students cooperate in the (digital) class context requires special competencies (Johnson & Johnson, 1999; Picciano, 2002; Johnson, 2003). According to educational psychologists, instructors need to create positive interdependence on the basis of challenging group tasks and goals, individual and group accountability with respective controls (e.g. in form of peer assessments) and promotive interaction, both face-to-face and online (Picciano, 2002) so that group members have the opportunity for real knowledge sharing, social support, self-critical reflection, and praise each other’s efforts to learn (http://www.cehd.umn.edu/edpsych/people/Faculty/Johnson.html). In addition, students need to be equipped with the required interpersonal and small group skills to enable them to achieve both project and team tasks such as the ability to understand the communication styles of
foreign' students they are working with. This is even more critical in
digital contexts because communication signals can easily be mis-
interpreted due to the lack of face-to-face contact. Despite the digi-
tal mastery often demonstrated by young learners, the popularity of
digital media such as WhatsApp or Short Message Service (SMS)
has arguably limited their ability to communicate effectively in
diverse face-to-face situations which need to be managed. Another
important enabler of collaborative learning is group processing
which can be considered effective when group members are able
to monitor the attainment of group goals and manage to work
smoothly as a real team. Table 1 below summarizes how the
authors integrated these five components of collaborative learning
into the teaching and learning approaches featured in this article.

In this article, we present several examples of our teaching and
learning approaches. In the first part, we report on experiences
made in the context of an iPad-enabled mobile learning project
conducted during a Knowledge Management course (excursion)
in support of the university's technology-enabled learning vision
(Benson, Morgan, & Tennakoon, 2012; Wallin & Von Krogh,
2010). Apple's second generation iPad 2 is a tablet computer with
various learning enhancing features. Students can download books,
journal articles, music, movies, web content as well as games. It
also features a front-facing and rear-facing camera to capture
audio–visual materials. Learners can access social media sites such
as Facebook, Twitter or Youtube and communicate instantaneously
with the instructor and peers while on a site visit, at home, in the
classroom or on the go. Through applications such as GoodReader,
iPad owners can import, store, read and manage large files such as
images or documents. Qualitative feedback from undergraduate
students who took part in the iPad pilot project aimed at enabling
them to appreciate structure and function of a water-related
knowledge hub in Singapore provides initial evidence that instruc-
tors can effectively engage learners to appreciate pedagogical
objectives and to internalize learning outcomes by leveraging on
the iPad's Gen Y friendly apps (Lytras & Ordóñez de Pablos,
2011). In the second part, we reflect about the novel use of web
technology in two newly developed elective courses on leadership
and human capital management (Thomas, Smith, & Dize, 2013)
with special reference to the use of collaborative social learning
platform websites (Edmodo), wiki- and web page-creation tools
(Google Site), animated videos, mobile apps, etc. to help enhance
the learning process. While not everything was 100% effective,
the overall results were encouraging as evidenced by excellent
course and instructor ratings. The third part presents experiences
made with project-based learning. Every year, around fifty-five
undergraduate teams of four to six students are required to complete
a capstone course for the School of Information Systems. Each
team spends approximately five months working with an industry
sponsor using the latest tools and techniques. Students actively
learn by implementing the system to solve a real world problem.
In addition to delivering value to the local sponsor, our students
learn specialized skills currently needed in the marketplace, which
might not yet be incorporated into electives and core courses. We
discuss the tradeoffs of providing students and project sponsors
flexibility in designing projects while at the same time ensuring
that all students are delivering consistent, assessable milestones.
The approaches described here can also be used for postgraduate
course teaching as personal attention on the basis of individual
learning approaches and technology-enhanced learning are even
more critical.

1.2. Method and research questions

Research methods deployed in this explorative–interpretative
case study (Eisenhardt, 1989; Stebbins, 2001) include reflections
about our own class experiences based on memos and sporadic
observations of learners, the analysis of secondary literature as
well as discussions with students, instructors and learning experts
in the university’s Centre for Teaching Excellence (CTE). The largely
descriptive–reflective accounts of our experiences of embedding
web technologies in collaborative (blended) learning contexts do
require a more systematic analysis vis-à-vis similar studies in
order to develop testable hypotheses about effective collaborative
teaching and learning for a future quantitative research study
(Cook, Bradley, Holley, Smith, & Haynes, 2006; Lundin, Lymer,
Holmquist, Brown, & Rost, 2010). The main research questions
we intend to address in this paper are as follows:

- How can new educational technologies and approaches such as
  the iPad, social learning platforms such as Edmodo, team-ori-
tented sites (e.g. Google Sites, a wiki- and web page-creation tool
  provided by Google's Apps Productivity suite) or ‘appification’
  (collaborative apps development and application projects led
  by students on behalf of external clients) enrich the collaborative
  learning experience of students in institutions of higher
  learning?
- How can such interactive web technologies and approaches be
effectively integrated into course designs and delivery modes?
- Besides the opportunities which these technologies offer for
  both instructors and students, what are some of the challenges
  when it comes to implementing and institutionalising respec-
tive initiatives?

2. Encouraging university students to learn with iPads: New
opportunities for mobile learning

One of the latest technologies which can support (mobile)
learning in the context of blended learning is the iPad. In 2011,
the authors began experimenting with iPads in an undergraduate
course on Knowledge Management after the university had
approved funding and sourced a couple of iPads. Apple's second
generation iPad 2 is a tablet computer with various learning
enhancing features. Students can download books, journal articles,
music, movies, web content as well as games. It also features a
front-facing and rear-facing camera to capture audio–visual mate-
rials. Learners can access social media sites such as Facebook, Twitter
or YouTube and communicate instantaneously with the instructor and peers
while on a site visit, at home, in the classroom or on the go. Through
applications such as GoodReader, iPad owners can import, store, read and
manage large files such as images or documents. In the context of higher
education, the iPad arguably represents an effective tool for instructors to engage
students and to encourage them to expand their knowledge and skills aimed
at making learning more meaningful, fun and effective (Wankel,
2009).

It is challenging for educators to effectively engage students and
to ensure meaningful participation in the classroom. More and
more universities proactively support teaching innovations and
encourage instructors to deploy educational technologies in class
in order to motivate learners and to enhance learning impact
(Saeed, Yun, & Sinnappan, 2009). While laptops are a common
sight in the classrooms of the Singapore Management University
(SMU) which serves as the backdrop for this paper, the use of the
iPad among students is still rare. In the following we report expe-
riences made during the introduction of iPads in a Knowledge
Management class in an undergraduate course with 45 students
aimed at enabling them to appreciate both the economic impor-
tance and management challenges of Singapore’s new economic
cluster “WaterHub”. Knowledge Management, the core topic of
the course, is a key enabler of building sustainable knowledge
clusters such as Singapore's WaterHub due to the importance
of knowledge for innovation and value creation.

Please cite this article in press as: Gan, B., et al. Enhancing students’ learning process through interactive digital media: New opportunities for collaborative
Groups of 6–8 students were given one iPad and tasked to execute various learning assignments such as activating the iPad’s map application to get a spatial understanding of Singapore’s water catchment areas or the business locations of key corporate and institutional players such as Hyflux or the Public Utilities Board (PUB). They were also invited to experiment with the iPad’s multiple platforms such as internet search function, communication and social media applications such as email, YouTube or image capturing to gain a deeper understanding of Singapore’s WaterHub with its over 70 local and international organisations ranging from R&D, engineering and manufacturing to headquarter activities. Fig. 1 below shows the cluster map which the students created as part of the assignment. The establishment of a diversified water supply (coined the Four National Taps), implementation of holistic water management practices, and the promotion of a water conservation culture are significant achievements that Singapore has made in recent years as it progresses towards self-sufficiency in terms of water supply by 2061.

Singapore’s water research and activity hubs are primarily located in the southern shore regions. While some test beds, research centres and collaborating educational institutions are geographically close to each other, the entire cluster is still evolving due to its relatively young age and the recency of water-related policy issues and forceful interventions which were instrumental for its rapid evolution. Since 2006, this new cluster has created over 2300 new professional and skilled jobs, and Singapore-based firms have secured related overseas contracts worth $5.4bn. In terms of the cluster life cycle, the WaterHub is located in-between the ‘emerging stage’ where actors start to cooperate qua agglomeration effect around a core activity and the ‘collaborative’ or ‘established’ stages where the cluster has gained a distinct identity and where it has attracted new entrants due to real collaboration advantages.

The student groups were tasked to provide answers to various questions with the help of the iPads in the context of a site visit of the NEWater Visitor Centre in Bedok such as: (i) names and business models of well-known companies that have chosen WaterHub as their launch pad to expand and set up their R&D centres in Asia; (ii) role and mission of PUB’s Institute for Advanced Learning for Water Professionals; (iii) purpose and market prospects of polymeric hollow fibre ultra filtration membranes; (iv) key processes involved in the production of NEWater or (v) why proximity and technological closeness do matter in successful knowledge hubs. Students were encouraged to take pictures of relevant images during the site visit such as membranes. All assignments had to be tackled both on the way (in the bus) to the NEWater Visitors Centre, and at the centre itself in order to test the mobile learning enhancing power of iPads.

Towards the end of the term, the class was invited to reflect about the usefulness of iPads by answering three evaluative questions such as: What did you like or dislike about using the iPads in OBHK211? In what ways can the iPad facilitate and enhance learning? Where do you see potential problems? Overall, students found the iPad useful, learning-enhancing and enriching. Main apps used included Safari, Notes, Camera, Quickvoice/Voice memo and Maps. As one learner stressed, “It is the first time iPads were introduced in a class at SMU. We felt that many students were very engaged and interested. We worked in groups for a web quest activity to answer quiz questions. It is incredible that the Internet is ‘in your hands’, as Steve Jobs puts it, and better still, it requires no boot time. The iPad was useful as it allowed us to browse the Internet for instantaneous information in relation to the quiz, search for images and download them to get an idea of what the new water plant looks like prior to the visit”. Besides taking group photographs, participants also utilized the Voice recording feature to record the presentation by a PUB (Public Utility Board) representative during the centre visit. This was regarded as “excellent” as it allowed them to capture learning contents and discussion details for later reuse.

In order to effectively integrate modern communication tools such as the iPad into course designs, it is essential that the chosen technology is pedagogical meaningful. In our case, questions posed by the instructor via an old-fashioned quiz to be tackled ‘on the go’ and ‘on site’ were challenging, closely related to the learning objectives of the respective session topic and required access to various apps, including 3G (the third generation of wireless technologies). In comparison to previous generations of wireless technologies, iPad2 3G enhancements such as high-speed transmission,

### Table 1

<table>
<thead>
<tr>
<th>Core collaborative learning elements</th>
<th>Learning with iPads</th>
<th>Leveraging web technology for various connection points</th>
<th>Tackling real business problems with capstone courses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Positive interdependence</strong></td>
<td>Challenging group tasks and stretch goals included the mapping of Singapore’s water cluster</td>
<td>Mobile application connection with push notifications created multiple connections. At the same time the web-based lessons provided content on demand to create multiple learning opportunities</td>
<td>The capstone projects are client-centric and therefore very demanding. Teams can see the progress of other teams and the technologies they use on a project wiki which encourages cooperative learning</td>
</tr>
<tr>
<td><strong>Individual and group accountability</strong></td>
<td>Group was intrinsically motivated, perhaps as a result of the innovative learning mode: on the ‘go’ in a bus/mobile site visit</td>
<td>The technology allows transparency with regard to the frequency of individual and team contributions which creates a bit of competition</td>
<td>Understanding projects of other teams creates a sort of ‘healthy competition’ which motivates each team to strive to achieve more</td>
</tr>
<tr>
<td><strong>Promotive interaction</strong></td>
<td>Cluster and quiz assignments required good collaboration both on the go during/after the site visit</td>
<td>On line brainstorming along with team shared documents facilitated new ways of collaboration</td>
<td>Knowing which technology is used in other projects stimulates the willingness to help each other when facing difficulties, e.g., with the tools. Incentives are provided for students to help each other</td>
</tr>
<tr>
<td><strong>Appropriate use of required interpersonal and small group skills</strong></td>
<td>No special skills training was provided except for a short briefing before the site visit</td>
<td>Students were already well prepared for working in teams through prior courses. The web technology enhanced and challenged them with the on-line posting of ideas</td>
<td>There are several milestones and gradable moments in the capstone project journey during which reviewers assess the team with a team grade. This motivates them to work together and helps to avoid social loafing</td>
</tr>
<tr>
<td><strong>Group processing</strong></td>
<td>The nature of the ‘graded’ group activity (cluster map) enabled smooth work processes and goal attainment</td>
<td>Weekly instructor feedback to each team on the team web site creates a feedback and coaching loop that forces more group assessment and self evaluation</td>
<td></td>
</tr>
</tbody>
</table>

advanced multimedia access, high speed web browsing or the faster downloading of data were functional and value added as the learning goal achievement required such ‘connectivity’.

But there were also a few unforeseen teething problems like unanticipated requests to provide worksheets and quizzes online on the iPad itself to make it easier to work (rather than as a hard-copy distributed on the bus as done by the instructor) or to allocate more time for problem-based group work so that every student can utilise the iPad. Some students felt that an iPhone has the same portable search tool capability and that “an iPad is just a blown up version of it”. Others claimed that the quality of the iPad camera is not as good as that of an iPhone 4.

Despite some critical feedback, our pilot project suggests that the iPad is particularly useful for mobile learning in the context of field trips and site visits as confirmed by students who found the iPad’s connectivity “convenient” as they do not have Internet access on their laptop. As one student stressed, “Overall, it was a good experience as I could get access to all the information even when I was walking around. And the fact that there is 3G everywhere I go makes learning even more convenient.” While typing on a laptop keyboard was perceived as “much faster” than typing on a touch screen, the iPad comes in handy when learners are “out there on the go” because it provides them with a “lighter option”.

3. Leveraging web technology via several connection points

One limitation in teaching during term time refers to the connection points with students if we are confined to primarily classroom time. Yet, we know as educators that the learning process is arguably taking place at other times (and perhaps mostly outside the classroom). At the same time, we see our students all over campus continually connected to their mobile devices, laptops, and tablets. Our goal in using technology is to supplement the contact time and make our experience together in the term something that is more enriching and thought provoking – which is especially important in leadership and human capital-related courses. As such, we were looking for tools that would help with on-line discussion, easy access to supplemental and entertaining materials, and engaging sites that would draw them into the learning process. The following innovative teaching approaches turned out to be suitable for that purpose:

3.1. Edmodo site

Like Twitter, YouTube, Facebook or Moodle, Edmodo is a collaborative social learning platform website teachers and students can use to manage events, course assignments or study groups. With a Facebook-like interface, it allows students to feel comfortable posting in a secure site to share ideas about learning contents as illustrated in Fig. 2 which shows group posts by students enrolled in the course ‘Leadership in a Global Context’. As the posts indicate, replies to posts by other students help learners to gain new insights before and after the lessons. This helps enrich the topics and allows time for reflection, which is quite important in topics such as leadership. Supplemental course content such as videos and articles are linked to enhance the learning and allow for personal exploration. In order to get access to Edmodo sites, the instructor needs to create a link such as https://www.edmodo.com as in the case of our course ‘The Mosaic of Leadership’ and ‘Leadership in a Global Context’. Each user must set up an Edmodo account. Instructors can then lock the account at the start of the term to ensure security and trust in the sharing for the site. Students who would like to access the site will have to log in and request to join or to contact the university’s Centre for Teaching Excellence if they need help. The instructor can unlock the sites for review, but they will automatically lock after a few days. Figs. 2 and 3 below show how students made use of this site.

The Edmodo Mobile App (https://www.edmodo.com/mobile) allows students to see posts, add comments, and explore content on the go. Nothing is arguably more rewarding than seeing one’s own students outside the classroom watching one of the class videos instead of doing Facebook! The Edmodo Mobile App enabled students to stay connected on the go. While it did not have full functionality, it allowed for simple collaboration and comments to posts. Students were able to respond to discussion threads on hot topics such as generational differences, diversity in leadership,
and cultural considerations when they were away from the classroom. The mobile app was optional and used by students with a keen interest in the use of mobile devices.

The collaboration for the first course started a bit slowly as the students took a while to warm up to this new idea. In the course ‘Leadership in a Global Environment’, the site became quite active. It is great to see the on-line collaboration and sharing of ideas outside the classroom. Many students have commented on the fact that it adds a bit of richness to the topic and allows them to contribute to the learning process in a different way. Several commented that learning about leadership also includes how to lead with on-line tools and social media. This tool allows students to not only share ideas and views, but also to see the dynamics of leadership in the social media setting.

3.2. Google Site for human capital strategy course

Google Sites is a structured wiki- and web page-creation tool which Google provides as part of its Google Apps Productivity suite. In the course on ‘Human Capital Strategy’, this tool enabled easy access to course content, discussion fora, and class sharing. This site serves as a means of organizing and sharing supplemental information that accompanies the course and the textbook. While the Edmodo site provided a means for collaboration, it helped with organisation, sharing of external materials and a fun way of keeping the class on track with the topics. The site is only accessible to enrolled students with an SMU ID. Fig. 4 below shows a view of the site.

As a part of this site, a number of videos were incorporated, including an animated video series. Using animation software, the instructor used a video animation software called “GoAnimate” to create a series of short videos where the characters explore the topic of the week in a fun and light way to help convey the key points. While it contains a bit of dry humor and light-hearted fun, each video carries the key messages about the topic for each lesson. These videos are housed in a secure YouTube account embedded into the Google Site that is only accessible with a university ID and password (single sign-on). Fig. 5 below shows how this sub-site looks like with reference to the topic ‘Organisation Culture’ covered in week 2 of the course.
3.3. Strategyzer team web site

Strategyzer is a tool to develop ‘better’ business models (https://strategyzer.com). We introduced this team-based tool in a new ‘Business Capstone Course’ to help students to manage their team processes both inside and outside the classroom experience more effectively. As this is a secure external site for SMU, the instructor cannot open the access to everyone. The screenshot below (see Fig. 6) indicates how students can use Strategyzer to interactively brainstorm and capture team ideas for a business concept (it literally adds virtual post-it notes to the business model canvas). The site has a back end that allows groups of students to build a business case and to prototype their ideas.

3.4. Instructor web site and repository

For the new ‘Business Capstone’ course (which was created together with another colleague), a special site for instructors was created to share materials, ideas, activities, and experiences as a first attempt at team teaching for this core course (see Fig. 7). Since we intend to use this site as an ongoing collaboration mechanism, we posted all our course materials, lesson outlines, potential activities, and supplemental information. In addition, videos of each lecture have been embedded for easy reference by new instructors (see Fig. 8). While we are still learning how to optimize this tool, initial feedback by students is promising. Access is restricted only to capstone instructors within the university.

3.4.1. Business capstone student site

This capstone student site is a Google Web Site to help students stay organized and on track in this resource-rich project-based course (see Fig. 9). The site allows us to keep students on track and offers instructors a consistent experience across the various capstone sections. This site is secured and limited to the students in each class section. To help us organize the Business Capstone course across sections, we created a special site that can be

![Fig. 3. Students’ posts in course ‘The Mosaic of Leadership’.](image-url)
Fig. 4. Google Site of Human Capital Strategy Course.

Fig. 5. Embedded videos in Instructor's Google Site.
Fig. 6. Strategyzer team web site.

Fig. 7. Secure site for ‘Business Capstone’ Course Instructors.
replicated and used by each instructor. This allows us to embed a number of video supplements, course materials, and plans for the students in a way that makes it easy for students to follow and track.

3.4.2. Individual feedback

Students receive a personal connection from the instructor about their assignment and their progress in class. Attempts are underway to provide this through the technology as an additional personal connection. We have found that this level of personal attention is highly valued by students. One of them put it this way: "The prof really helps us to learn more about ourselves. For example, during our individual assignment, he gave each and everyone of us an envelope (containing a letter) to tell us about our strengths and weaknesses. Honestly, the weaknesses he identified were a little blunt and it affected me for a few days. However, I am really glad that he did it because it got me to reflect on myself and encouraged me to see how I can improve myself."

4. Aligning an information systems capstone course with real-world business problems

Capstone courses are common in engineering, computer science, information systems and business schools. At SMU, about 250 Information System students have to complete a core capstone course before they graduate. In this capstone course (Boesch & Gan, 2014), students get an opportunity for active learning (Bonwell & Eison, 1991; Lowman, 1989). They apply what they learn in the classroom to solve a real-world business problem. The out-of-class environment provides a challenging experience where students encounter unexpected obstacles, which usually leads to learning new tools or techniques. Students are matched with local companies to solve industry problems that might be addressed by the creation of a new information system. Over the years, our students have created web portals, mobile applications, content management systems and a variety of other systems for clients, including a scheduling system used to schedule our capstone presentations. As the capabilities of the student teams and the capstone course in general have improved, more companies have begun to partner with the university to make additional projects available to the students. We use a wiki to manage the many projects and communicate across the different stake holders.

4.1. Development methodology using wiki

Students are encouraged to use an agile methodology with the focus on iterative development (Ochs & Getzler-Linn, 2012). Many
teams elect to follow a modified version of SCRUM (Sutherland & Schwaber, 2013). There are three milestones: acceptance, midterm and final presentations; and three deliverables: a poster, a video pitch, and a public wiki page. To aid in setting expectations, all students are required to maintain a public wiki page outlining all aspects of their projects. This wiki along with their presentations serves as the documentation for their project. Since most wiki pages are public, teams currently enrolled in the course can see the other teams’ projects. The midterm and final presentations assessments comprise the majority of the students’ final grades. Before the final presentations, teams are required to create a poster, a video pitch and attend a poster fair. The poster and videos are available on the wiki as well. The poster fair is a public event on campus attended by project sponsors, students, faculty, and the general university community. Various prizes are awarded to the top teams. Teams create new applications to solve real-world problems each year. The opportunities to make an impact are significant. At the same time, if students are given opportunities to work on problems at the forefront of technology to solve real problems, they will be actively learning and will be better prepared to make a positive impact when they graduate and enter the workforce. By raising awareness and improving the overall project quality, we hope that the capstone course will produce better-trained students for the Singapore IT industry; one of the primary goals of the SMU Information Systems undergraduate program (see Fig. 10).

4.2. Active learning

The main idea behind active learning is to involve students in doing things and thinking about the things they are doing. This does not have to be in the classroom (McKenzie, Trevisan, Davis, Beyerlein, 2004). Our capstone course involves only one hour of classroom time where all students are gathered to hear a briefing on the assessment structure and methodology. Students are expected to meet regularly as a team with their sponsors and with faculty supervisors. Meetings with sponsors involve gathering requirements, validating prototypes, and testing the quality of the system. The regular interactions with the faculty supervisors involve the team reporting their weekly progress and sometimes reflecting on what they learnt. These meetings allow the faculty to provide feedback and formatively assess the students’ progress. In most cases, students are actively learning during teamwork, interacting with real clients and reporting progress to faculty supervisors.

In 2004, a study on capstone design courses and assessment (McKenzie et al., 2004) found that assessment is not done well with uncertain assessment practices. More recent research by Ochs and Getzler-Linn (2012) suggests that industry sponsors have direct impact on how students are assessed. They suggested a formative assessment during “gradable moments”, similar to our regular supervisor meetings. That research uses sponsor feedback to help improve the assessment, such as the requirement for suitable written communication. In the following, we discuss the assessment of the student experience, which is largely determined by the types of industry projects and tools they use. As a relatively young school of just over 10 years, we are able to improve the quality of industry sponsors and project deliverables as the Singapore IT market place changes. This is done by raising the quality of the deliverables by supporting some tools and techniques involved.

4.3. Tools and techniques

As an Information Systems school, we teach many software development tools. Students pick up technologies that are most appealing to them, such as mobile technology (Lytras, 2010). As
they extend their skills, multiple teams start to deploy Apple’s iOS App Store and Google’s Play Store. Another technology is the use of cloud computing. Teams are using virtual machines that are hosted by the university. This has progressed towards utilising web hosted platforms and eventually platforms-as-a-service such as Amazon Web Services, Google App Engine and Microsoft Azure.

By using third party platforms, students build on existing rich frameworks and tap on their development methodology. On the mobile, this allows them to develop “apps” that are tested, and deployed to an application platform or service prior to the end of the capstone term. This methodology provides a clear milestone. Apps can be downloaded quickly and used in the real world. Similarly, by pushing web applications on the cloud, they can be continually tweaked and modified easily. The methodology teaches students to develop smaller chunks of applications that can be tested by many users. It also helps that companies such as Apple conduct some quality checks on application that are submitted to their iOS App Store. Students learn the concept of minimum viable product (Ries, 2011), where they can acquire a maximum amount of validated learning about customers with the least effort. These deployed applications on mobile or the cloud can be tested quickly to understand how customers use their functionality. Students learn by doing a real world project for real customers in a direct, user centred and test based environment.

While mobile applications and minimum viable product works well in a start-up environment, multinational enterprises require more scalable, secure and reliable solutions. In order to provide for a diverse group of graduates, our capstone project sponsors include enterprise solution providers that use tools such as Oracle, PeopleSoft, Sales force and SAP. These projects require a different approach with sponsors that support training of these tools. Working with large financial and healthcare companies, solution providers, and consulting firms encourages students to take on these projects despite the higher learning curve. However, due to the schedule of our capstone course, teams are mostly able to develop proof of concept demonstrations of the enterprise solutions designed for larger enterprises.

5. Conclusion

Web-based teaching and learning approaches have been recognized as important tools to enhance the educational experience of students and their collaborative learning curve. While representative studies about the effectiveness of iPads in higher education are still rare, we argue based on prior pedagogical research (Menkhoff & Bengtsson, 2012; Menkhoff, Thang, Chay, & Wong, 2011) and our experiences in various classes that such tools are useful in the context of collaborative learning for the following reasons: (i) as part of students’ blended learning experiences, they support groups of learners in mastering collaborative project tasks and achieving course objectives; (ii) they help students to leverage the power of collaborative learning scenarios and to further develop key competencies with the help of their peers; and (iii) they engage students to search for (and gain) more knowledge, e.g., by tackling truly challenging project assignments with relevant issues. As one course participant suggested, it would make sense to supplement iPad-enabled learning exercises with (even) more social media applications. It was stressed that the class could have been given more time as a group to tweet about their learning experiences and to evaluate the iPad use during the bus ride back from the NEWater Visitors Centre to the university. This would have greatly enhanced knowledge flows amongst them via responses to twitter messages and retweeting.

As the comment about Twitter suggests, instructors have a tremendous opportunity to embrace technology as an integral part of the learning process. Going forward, we are pushing towards a more blended, collaborative learning experience for our students while also introducing new ways for them to prepare for their future careers (McCarty, 2010). As our pilots with Google Site or mobile apps have shown, technology can enhance our impact on
students and provide opportunities for more personalization amidst greater collaboration, eventually helping instructors to not only be more effective teachers but also create students able to embrace new challenges in their future careers. In addition to our individual efforts as instructors eager to make collaborative learning more effective as illustrated in Table 1, we believe that more cooperation amongst instructors is necessary. Too often we focus only on our own courses and do not consider the overall curriculum requirements vis-à-vis the dynamic and volatile environment in which we find ourselves. Leveraging technology, project-based learning and real team teaching will arguably help to better prepare our students for future challenges in business and society.

As the process of creating and deploying IT solutions has become easier, our focus in the area of information systems management teaching and learning has started to shift more towards ensuring that the right solutions are being built and to destil some of the lessons learnt by students while creating these solutions. It is no longer a question of what can be built in five months but rather what should be built and how students and their clients will know if a good solution was built given the time and resources provided. As the questions about projects have shifted from the technical to the experiential, new tools, processes, and resources have been added. Many students now follow the Lean Startup Methodology (Ries, 2011), and all teams are required to do multiple rounds of user testing during the course. The Lean Startup Methodology allows minimum viable products to be developed and tested quickly with actual users thereby improving the quality and focus of user testing during the course. The Lean Startup Methodology will arguably increase the chances that educational disruptors such as business and societal environment changes.

University leaders interested in leveraging interactive digital media and a strong brand will have to ensure that there are sufficient resources to purchase an adequate number of gadgets in an era of rapidly changing technologies and to enable both students and instructors to make full use of them. Educators will have to be properly trained (and retrained) so that they can effectively deploy these technologies and fairly monitor/assess students’ collaborative learning outcomes. Both technophobic and technophile instructors (as well as students) expect instant technical support to create radically successful businesses.


