Educational Media International

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/remi20

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Published online: 27 Jun 2014.

To cite this article: Verily Tan & Xiaojing Kou (2014) Case-based reasoning to help educators design with Web 2.0, Educational Media International, 51:2, 91-108, DOI: 10.1080/09523987.2014.924662

To link to this article: http://dx.doi.org/10.1080/09523987.2014.924662

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Case-based reasoning to help educators design with Web 2.0
Verily Tan* and Xiaojing Kou

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(Received 23 October 2013; accepted 14 March 2014)

This study proposes the use of case-based reasoning to help educators design with Web 2.0. Principles for designing a web-enhanced case-based activity (CBA) were used to design an online professional development course for a group of 16 in-service educators. The Learning in Context model was used as a scaffold to help participants in their design of activities. Formative evaluation points toward the utility of this approach, and rich description is provided to help readers assess the findings. Findings related to the use of CBA design principles include: the possibility of using open resources to build case libraries; the importance of using expert cases analogous to the needs of participants; the importance of direct and soft scaffolding; the need for feedback, reflection and design iteration; and the perceived usefulness of the Learning in Context model as a scaffold. An unexpected finding was how hands-on familiarity with the tools appeared to be a prerequisite for participants to engage in the expert case exploration, and to design with Web 2.0.

Keywords: case-based reasoning; instructional design; Web 2.0

Web 2.0 is a platform where innovative technologies allow for the co-construction of knowledge, embodying “collective knowledge” (Dede, 2008). This is made possible by mechanisms such as the sharing of multimedia content, creation of user-defined links, prominent personal profiling, and intertechnology applications (Cormode & Krishnamurthy, 2008). The barriers of entry for these activities have been lowered in the last decade, making it possible to not just “read” the web, but also to “write”. According to Bower, Hedberg, and Kuswara (2010), the key categories of Web 2.0 tools include: social bookmarking, wikis, shared document creation, blogs, microblogs, online presentation, image creation and editing, podcasting, video editing and sharing, screen recording, mindmapping, and digital storytelling.

In their critical analysis of research on web-based teaching and learning, Hannafin and Kim (2003) commented on how research efforts in web technologies had been diffuse and contradictory. They pointed out that information about new pedagogies relating to web-based teaching and learning had not matched the increased interest in the use of these technologies. In Hew and Cheung’s (2013) review of literature on the use of Web 2.0 technologies across the Academic Search Premier and ERIC databases, articles from higher education settings were seen to be

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predominantly anecdotal. An important question to consider is: with this knowledge base, can educators design learning activities with Web 2.0 tools? The answer to this question is complicated by the fact that educators have to keep up with the rapid advances in technology and the availability of new tools.

Hence, designing with Web 2.0 tools can be an ill-structured, complex task for educators, especially novices with little or no knowledge about the technologies. This study proposes the use of case-based reasoning (CBR) to help novices transition toward becoming experts in designing with Web 2.0 tools. In CBR theory, individuals think, reason, and act based on experiences in the form of cases (Kolodner, 1993; Kolodner, Owensby, & Guzdial, 2004; Schank, 1999; Schank, Berman, & Macpherson, 1999). When faced with a problem, the individual would retrieve previous experiences stored in the form of cases, and apply it to the new problem situation. According to the theory, these previous cases have been indexed in the individual’s case library, and form the knowledge base for the individual to draw upon. CBR has been put forward as a theory for designing learning environments for ill-structured, complex problems and tasks, and has been applied specifically to instructional design (Jonassen & Hernandez-Serrano, 2002; Kim & Hannafin, 2007).

Kim and Hannafin (2008) further elaborate on applying the principles of CBR theory to web-enhanced learning environments, through what they call “case-based activities” or CBA. They highlight the following as important for novices to develop the reasoning and application of experts:

1. Design and indexing of experts’ case libraries. This should include the stories of experts and their experiences, complete with artifacts. The schema of the case indexes is also determined at this stage and can be based upon the knowledge structure of experts in that domain.
2. Analyzing and using experts’ case libraries. Here, learners engage in case discussions to bridge the knowledge gap between novice and expert. Case analysis can be designed for learners to use the knowledge in the expert cases, helping them to personalize the knowledge. Optimally, the expert cases should be analogous to the learners’ situation.
3. Designing the structure of CBA activities. This involves first identifying the characteristics of the authentic tasks for learners. Tasks should be structured from simple to complex. Learner activities can be further supported with explanations, demonstrations, coaching, feedback, and resources.
4. Participating in social activities. Learners need to be motivated to participate in social activities. These activities are designed for learning and include peer feedback, group discussions, and instructor feedback or instructor-led discussion.
5. Developing learners’ case libraries. Here, learners’ reflection stories can be made into cases as solutions for the future. This would include contextual information, specific details on the process of accomplishing their tasks, and determining keywords for indexes.

In CBR environments, novices can improve their expertise by scaffolded interactions with expert case knowledge. The expert cases are provided to enhance cognitive flexibility – to empower the learner to “construct a knowledge ensemble tailored to the needs of the understanding or problem-solving situation at hand”
CBR environments also emphasize learning-by-doing as a way to both experience and learn.

Scaffolds are tools, strategies, and guides that support learners in attaining a higher level of understanding. Scaffolds can be classified as hard or soft (Brush & Saye, 2002). Soft scaffolds are dynamic and situation-specific help, provided by an instructor or peer in the learning process. They require close monitoring of learners in order to provide timely feedback. Hard scaffolds, on the other hand, are static supports that are anticipated and planned in advance, based on perceived difficulties learners may have with a task.

Kim and Hannafin’s (2007) work with pre-service teachers is an example of a web-enhanced case-based activity. This involved a web-based tool and guiding templates. The tool or activity had four parts: case analysis; scenario and planning; doing; and reflection and transfer. The “doing” phase involved teachers creating lesson plans and teaching materials using unit-specific software. Reflection was encouraged through journaling and peer feedback.

**Activity or learning design**

Oliver, Harper, Wills, Agostinho, and Hedberg (2007) offer a definition of learning design for online learning: “A learning design typically involves descriptions of the learners and a space where they act with tools and devices to collect and interpret information through a process of interaction with others” (p. 65). This description of learning design highlights a form of learning well described by Jonassen, Hernandez-Serrano, and Choi’s (2002) Learning in Context model. In the model, learning is a process of meaning making, not mere knowledge transmission, with the learner taking an active role in meaning making. This takes place in a social context or community, where the meaning making is a process of social negotiation among participants in an activity. Knowledge is constructed, with peers or others, creating socially situated learning (Savery & Duffy, 1996) and distributed cognitions (Lave & Wenger, 1991). Web technologies can enable a learner to represent (reflect and construct) and amplify their understanding. Within the Learning in Context model, the production of artifacts during learning can serve as a way for learners to externalize their knowledge. Tools are used, and these are not just the web technologies, but also learning theories, methods, and sign systems.

Jonassen et al. (2002) also discuss the importance of examining the affordances of web technologies: the fundamental properties that determine how the technology can be used. One can utilize these web technologies and their affordances in different ways, engaging different types of learning, e.g. learning by working, performing, experimenting, exploring, visualizing, constructing, conversing, reflecting, or all of the above.

In this study, the course was designed making use of the principles of the web-enhanced case-based activity (Kim & Hannafin, 2008). The Learning in Context model (Jonassen et al., 2002) was used as a scaffold to guide participants to design with Web 2.0.

**Course design**

This study involved a group of in-service educators participating in a 10-h online professional development course, which was conducted over two weeks. The key
objective of the course was for the participants to design an activity that could be carried out with their class during the semester, or during the institution’s e-learning week. Participants were encouraged to design an authentic task, which, depending on their technical expertise and experience with Web 2.0 tools, could be a complex and ill-structured task.

The learning environment was the learning management system of the educational institution. The course was co-designed by the author of the paper, and the instructional designers (collaborators) from the Learning Academy (professional development department) of the institute. The first author was the instructor for the course.

Within the learning management system, the participants went through:

1. Course preamble: This included a synchronous session where participants discussed the context and reasons for the use of Web 2.0 tools.
2. Expert case exploration activity: This activity was followed by a synchronous debrief session with the instructor.
3. Activity design: Before this activity, the Learning in Context model (Jonassen et al., 2002) was introduced to participants through a screencast, followed by a sample activity design.
4. Poster session: This was a final synchronous session where participants were invited to share their designs.

The online course design followed the framework provided by Kim and Hannafin (2008) in the following ways:

**Design of the CBA activity**

The key objective of the course was for the participants to design an activity that could be carried out with their class during the semester, or during the institution’s e-learning week. The artifact or deliverable for the course was the activity design. For this, a template was provided as a scaffold. This template contained prompting titles from Jonassen et al.’s (2002) Learning in Context model (see Appendix 1).

**Design of the experts’ case library**

There were constraints in the course design due to two factors. First, the professional development course for in-service educators had a standard duration of 10 h. Hence, the course focused on six selected Web 2.0 tools – blogs, microblogs, wikis, social bookmarking, online shared documents, and online presentations. Additionally, the institution did not have resources to put together an extensive expert case library. Here, open resources from the web were used to build the case library. For each tool, two to four expert cases were chosen – these were real-world cases in the form of Youtube videos of educators or educational institutions that document the use of these Web 2.0 tools. These cases were selected and curated by the first author and collaborators at the research site (see Appendix 2). The number of cases was deliberately kept small so that they would be manageable for course participants.
Analysis and use of experts’ case library

The expert cases were put into a course wiki. As participants explored the cases, they co-constructed knowledge on the wiki. This was designed as a way for the participants to be engaged actively in the discussion of the cases, and for them to document the learning from the expert cases. To help participants engage with the cases, guiding questions were provided. These were questions on how learning takes place in Web 2.0 spaces. For example, how did the learners make sense of the information; organize their ideas; learn through collaboration; establish and maintain relations; and benefit by being part of the community or network? (Efimova, 2004).

Participation in social activities

The synchronous sessions were designed to build a sense of community among the participants. The instructor also used the synchronous sessions as a place to summarize key learning points – for the expert case exploration activity and the activity design. Another key social practice was the peer review of activity designs. After participants completed their activity designs on the template provided, they uploaded their documents as Google documents. The peer review process then took place between assigned partners.

In the course design, learning-by-doing was emphasized in the co-construction of knowledge on the wiki based on the expert cases, and the design of an activity based on the participants’ teaching and learning context. Hard scaffolds were provided in the form of templates, using guiding questions or prompting titles.

Purpose of study

The study is framed as a case study with the following research questions:

- What happens when in-service educators go through a course designed using Kim and Hannafin’s (2008) principles for web-enhanced case-based activity?
- How can this inform the application of these principles in designing a learning environment to help educators design with Web 2.0?

Setting

The participants were in-service lecturers in an educational institution or polytechnic in Asia. The in-service educators teach students from 17 years and above, helping students achieve diploma certification. The lecturers are encouraged to have 100 h of professional development per year. The Learning Academy, the professional development department of the institute, provides workshops on the use of the learning management system and the integration of technology in teaching. Three

<table>
<thead>
<tr>
<th>Technical expertise (self-reported)</th>
<th>Beginner</th>
<th>Between beginner and intermediate</th>
<th>Intermediate</th>
<th>Between intermediate and expert</th>
<th>Expert</th>
<th>Unknown</th>
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instructional designers (collaborators) co-designed the course with the first author. This country has high internet connectivity, and use of web technology in education is highly encouraged by the Education Ministry and the institution. Participants signed up for this course through their online system in response to an email advertisement.

**Participants**

The course took place in Fall 2012. There were a total of 16 participants (11 females and 5 males). The participants varied in age and teaching experience. In terms of self-reported technical expertise, the participants were well distributed (see Table 1).

**Data collection procedures and analysis**

The following data were collected and analyzed:

**Profile information of participants**

A questionnaire was administered at the beginning of the course asking for participants’ age, years of teaching, and prior experience with Web 2.0 tools. Participants also rated their level of technical expertise, on a 5-point scale based on descriptors.

**Course wiki**

This contained the knowledge co-constructed by the participants based on their exploration of the expert cases. Each tool was placed in a different sub-page within the course wiki. Analysis of the course wiki gave an understanding of participants’ understanding of the use of Web 2.0 tools in educational contexts. The “page edit” history provided information on the level of participation from individuals.

**Activity designs of participants**

Participants worked on their activity designs using the given template. This included a 150-word reflection. The activity designs were interpreted as an externalization of the participants’ understanding. The two authors did a close reading of the activity designs, and noted interesting cases and specific trends. In order to evaluate whether the activity designs met the objectives of the course, the author and co-author rated

<table>
<thead>
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<th>Table 2. Key questions in the end-of-course questionnaire.</th>
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<tr>
<td><strong>Likert scale</strong></td>
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<td>Free response</td>
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<td>Free response</td>
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the designs based on a set of criteria: (1) learning objectives and use of web 2.0; (2) match between tool and activity; (3) match between learning outcomes and sequence of activities; (4) support of social learning and knowledge construction; and (5) reflection (see rubric in Appendix 3). The first author originally crafted the evaluation rubric. After an initial evaluation of eight activity designs, it was revised and finalized. On using this rubric to evaluate the 16 activity designs, the inter-rater consensus was 70%. An additional two meetings between the two authors were used to achieve 100% consensus.

End-of-course questionnaire
Participants took part in this questionnaire as part of their end-of-course feedback, a standard procedure in the professional development courses in the institute. The questionnaire was customized for this research, and contained 11 questions on a 5-point Likert scale, as well as two open-ended questions (see Table 2). Responses were identifiable by participant. Fourteen out of 16 participants completed the questionnaire. The questionnaire measured the reactions of participants to different aspects of the course, and the qualitative responses served as a form of data triangulation for the findings.

Semi-structured interviews with collaborators from the Learning Academy of the institute
The three instructional designers involved in the development of the course were interviewed. The interview questions were determined after preliminary analysis of data, and included discussions on the level of participation in the case exploration activity, and analysis of selected activity designs. Much of the analysis discussed in the findings was informed by these interviews with collaborators.

Methodological issues
The author of the study is both the researcher and facilitator of the course. This arrangement was ideal to ensure fidelity of the implementation according to the proposed framework. The exempt review from the Internal Review Board (IRB) removed the possible problems associated with the Hawthorne effect (Baumann, 1996; Zeni, 2006).

For the study, there was no access to interview the educators during or after the course. These interviews would have provided insights into various aspects of the course from their perspective. Hence effort was made to triangulate the findings through multiple data sources: participant reflection of the activity design was included in the activity design template; open-ended questions were included in the end-of-course questionnaire; and interviews were conducted with the collaborators after preliminary analysis of data.

The involvement of a co-researcher/author who was not involved in the development and implementation of the course was deemed necessary. This was especially important to provide an independent evaluation of the course and the educators’ activity designs.
Findings
The findings are reported according to the two key activities in the course – the exploration of expert cases, and the activity design with participants’ choice of Web 2.0 tool(s).

Exploration of cases
The responses to questions on the case exploration were positive (The Wiki activity was useful in helping me understand the affordances of the different web technologies. M = 4.28, SD = .469; The Wiki activity gave me ideas of how I can use web technologies in my teaching-learning. M = 4.21, SD = .426). However, the history of the page edits for each wiki page corresponding to each tool showed varying levels of participation. The bulk of participation occurred on the blog page, followed by the wiki page. This page edit behavior corresponded to the number of participants choosing blogs and wikis for their activity designs.

On analyzing the number of edits according to the self-reported technical expertise, it was noted that the key contributors to the wiki were participants with intermediate level of self-reported expertise, followed by those who were between beginner and intermediate (see Table 3). Participants at the beginner level made few page edits.

On discussing this finding with the collaborators, confidence of participants was perceived as a possible explanation. Collaborators felt that participants who were beginners might have felt uncomfortable editing the pages, especially in a group of participants with varying levels of technical expertise. Additionally, two out of three collaborators and the co-author felt that the cases might not be adequate in explaining the affordances and uses of the Web 2.0 tools for participants encountering these tools for the first time. The collaborators also pointed out that the participants’ editing of the blog and wiki pages, and the corresponding choices for design could be explained by the institution’s push to use the blog and wiki tools available in their learning management system.

In general, participants’ activity in co-constructing of knowledge on the wiki was lower than anticipated. It is important to note, however, that not editing the pages did not imply that the participants did not access these pages for understanding.
Activity design

The ratings were favorable for the question related to the activity design (The Activity Design activity was useful in helping me plan an activity for my students in my course. $M = 4.29$, $SD = .914$). In reviewing some of the activity designs with collaborators during the interview, all three of them highlighted the value of the template in scaffolding the activity design. This is echoed by one of the participants in response to the open-ended question about aspects of the course that they enjoyed: “I particularly enjoyed the activity design activity. The template was very useful in structuring my thoughts on how to conduct such an activity.”

The following highlights the activity designs deemed interesting by the authors:

Cognitive flexibility

Two participants exhibited cognitive flexibility (Spiro et al., 1992), making use of ideas in the case examples, and adapting them creatively for their teaching contexts. For example, one of the expert cases provided discussed the use of *microblogs* (Twitter) to facilitate class discussions. One participant took on the idea and sequenced his activity, complete with his subject-specific hash tags. He was detailed in planning the student interaction. Additionally, he decided to extend the discussion online by requiring his students to make blog posts after the discussion (see Appendix 3).

Another expert case provided showed how *social bookmarking* (Diigo) could be used to facilitate group work and collaboration online. One participant was personally excited about this tool, and started using it himself (as evidenced in his conversation with his peer in the activity design document). In order to encourage his students to pool web resources and read each other’s research findings, he created social Diigo groups for the students. He designed his activity to engage his students in a collaborative research and report, writing on a *wiki*. As one of his learning outcomes was to have students conduct research collaboratively, he directed students to summarize each other’s findings as part of the wiki activity.

Use of three to four tools in one activity design

Two participants designed activities that made use of multiple Web 2.0 tools. For example, one design on the topic of conflict management involved the use of *social bookmarking* (Diigo) to document the students’ group research. This was followed by the group co-authoring content on a *wiki*, which included the creation of a video (Youtube) that showcased how they would solve a given conflict. Finally, students were to make individual *blog* reflections on their group collaboration, as well as comment on each other’s postings.

Another participant designed a jigsaw activity for the class to learn about the different types of web graphics. Each group would document their findings on a group *wiki*. A *social bookmarking* (Diigo) group would be set up for the sharing and contribution of web resources. Each group would then present their findings in class using their *wiki*. Finally, they would make individual *blog* postings of what they learned, and comment on each other’s postings.

These activity designs validated the two participants’ understanding of the use of the tools. However, use of three to four tools in each activity design appeared
excessive. In discussing these designs with the collaborators, one of them highlighted the importance of focusing on achieving the learning outcomes, not the use of technology. The collaborator talked about how the same learning outcomes could be achieved in simpler ways without the use of all the Web 2.0 tools listed. The collaborator also voiced the concern of overwhelming students with the use of numerous tools at one time.

**Blogs vs. discussion forums**

In at least three of the activity designs, participants proposed the use of blogs for a one-time reflection by students, followed by students commenting on each other’s postings. During the case exploration, many participants highlighted the affordance of blogs as supporting reflection and exchange of ideas. However, they seemed to have missed another affordance: the chronology of postings in blogs, and the ability to capture the thoughts/reflections on ideas over a period of time – these were illustrated through the expert cases provided. For the three participants, the learning outcome they described could possibly be achieved using a discussion forum, saving the hassle of setting up a blog. In trying to understand their design, there could be two explanations: first, the institution appeared to use blogs as discussion forums frequently; second, the activities the participants designed appear to be over a short duration. Although not explicitly stated in the activity designs, at least one of the three designs appeared to be designed for the “e-learning week” of the institution, which is typically a one-week event.

**Conversations between participants**

Participants were assigned partners, and they had about one and a half days to review each other’s designs. Although most conversations were cordial in nature, two conversations were constructive in nature. Specifically, one of the participants teaching pharmacotherapeutics planned a wiki activity where there would be a “patient-pharmacist” role-play. The activity appeared well planned with the roles of students and instructor clearly defined. The reviewer noted that one of the learning objectives was to “demonstrate verbal cues to ensure effective communication”, and pointed out that this was not likely to be accomplished through the wiki activity. He suggested an alternative tool, which could be more suitable – a shared online presentation that allowed video input (VoiceThread).

An interesting trend was observed upon rating the activity designs according to self-reported technical expertise (Figure 1). In general, the median scores for each criterion: (1) Learning objectives and use of web 2.0; (2) Match between tool and activity; (3) Match between learning outcomes and sequence of activities; (4) Support of social learning and knowledge construction; and (5) Reflection – increased as the level of self-reported expertise increased. This seemed to indicate the importance of technical expertise in designing. During the discussion about the participants in relation to their activity designs, the collaborators shared their opinion about how the educators’ hands-on familiarity with the tools could enable them to make better use of the affordance of the tools in their activity design. They suggested a hands-on workshop before the online course to familiarize participants with the various Web 2.0 tools.
Discussion

Pragmatic constraints of resources and duration of the course resulted in a relatively limited case library. However, evidence of cognitive flexibility could be found in the activity design of two participants. These participants were able to modify the expert cases provided to fit their specific teaching and learning context. This points to the possibility of using open resources to build case libraries. The limitation is that these expert cases did not contain information about the related artifacts. With the completion of this course, the activity designs of the participants could be turned into stories, or cases for the institution’s case library. This could include contextual information, specific details on the implementation, reflection, and keywords for indexing (Kim & Hannafin, 2008). A case library constructed this way would be highly specific to the institution, and the cases analogous to the educators’ needs.

The co-construction of knowledge based on the exploration of expert cases was relatively weak in the course – with some pages in the wiki edited by only three to four people. Most participants edited the blog and wiki pages. One of the collaborators suggested the inclusion of more cases on blogs and wikis, because these were tools available in the institution’s learning management system. This points toward the importance of providing expert cases analogous to the needs of learners.

The social practice of peer review of activity designs did not contribute significantly to the learning of the participants. Close reading of the activity designs show design issues that could be attributed to conceptual misunderstandings, or a lack of consideration of the pragmatics of implementation. This weakness of the course
could have been addressed with direct scaffolding (Kolodner et al., 2004), in which participants are prompted to consider goals, issues, criteria and constraints. The following questions could have been asked as part of the direct scaffolding: Did the activity warrant the use of Web 2.0 tools? Should a different activity have been chosen? Was there a match between the activity and the tool’s affordances? Did the activity take full advantage of the tool’s affordances? Was the key consideration the achievement of learning outcomes? Was there a need to use all the tool(s) suggested?

The co-author of the study also highlighted the need for more soft scaffolding, based on a close monitoring of the participants’ activity designs, which could be carried out by the instructor and the collaborators. This would mean more time for feedback, reflection and iteration of design. The iteration of design is seen to be crucial in strengthening the conceptual understanding of participants.

The scaffold or template for the case-based activity was seen to be of good utility. This was an observation made by all three collaborators, and a number of participants. The Learning in Context model (Jonassen et al., 2002), on which the template was based, is interpreted as useful in helping participants conceptualize their designs.

An unanticipated finding is the importance of technical expertise in the co-construction of knowledge based on the exploration of expert cases, and in the design of the activities. Hands-on familiarity with the tools is seen as a prerequisite for participants to engage in the expert case exploration, and for designing with Web 2.0.

Conclusion

This is a single case study with 16 participants, and findings cannot be generalized across all settings. However, the study provides insight into how a case-based, web-enhanced activity would work within an in-service setting. In contrast to pre-service settings, professional development courses are much shorter in duration. The constraints of this in-service setting (time and resources) resulted in some adaptation of the principles of a web-enhanced case-based activity (Kim & Hannafin, 2008). The findings in the study are formative evaluations pointing toward the utility of using CBR as a way to help educators design with Web 2.0. Rich description has been provided for readers to assess the findings of this study.

Acknowledgments

This study would not be possible without the collaboration of Temasek Polytechnic, Singapore. The authors would like to thank Dr Moira Lee, Soo Teong Beng, Woo Boon Seong, Charles Choong, and Pratima Majal from the institution. Special appreciation goes to Professor Elizabeth Boling and Dr Curtis Bonk from Indiana University Bloomington, for their guidance and input.

References


Appendix 1. Sample activity design
(This template was provided. Italicized text are by the participant)

<table>
<thead>
<tr>
<th>Course</th>
<th>Data structures and algorithms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topic</td>
<td>Queue data structure</td>
</tr>
<tr>
<td>Target implementation</td>
<td>Week 3 of course</td>
</tr>
</tbody>
</table>

1. **Activity**
(Aim to design something that can be of use in one or more of your courses)

**Title: Queues as a Data Structure**

(A) Learning Objectives
At the end of the activity, participants will be able to:
1. Understand what is a queue
2. Know how a queue data structure works
3. Apply a queue to simple scenarios in an IT-related sense.

(B) Learning by
Conversing/Reflecting/Producing

(C) Tool (web technology)
Blogs, Microblogs (Twitter)

(D) Software
Twitter, Blogs in learning management system (LMS)

(E) Details of Activity
(In your description, include details on how your students will (where applicable)
- make sense of the information
- organize their ideas
- learn through collaboration
- establish and maintain relations
- benefit by being part of the community or network

Include information like prior knowledge, or required resources etc.)

1. Students will view a video clip (5-7 min) on the concept of queues in the LMS.
2. Students will respond to a series of questions posted by the lecturer in Twitter. They will use hash tags created by the lecturer.
3. Students will be asked to post at least one new question with an appropriate hash tag, for other students to respond to.
4. Students will be given time to comment on each other’s postings.
5. As the final deliverable, students will write a blog post that identifies a real-world application of queues, and to suggest how it can be implemented using a programming language (based on their prior knowledge of computer programming).

(Continued)
2. **Artifact and Deadlines**
   Are students required to produce an artifact? What is the expected evidence of learning?
   1. Comments on twitter (by Wed of the week)
   2. Blog posting by each student in LMS (by Friday of the week).

3. **Community**

   **Roles**

   List the specific tasks for:
   (A) Members of the group
   N/A

   (B) Other students in the class
   All participants have access to Twitter to post and comment using hashtags.
   1. Reader of comments on Twitter
   2. Post comments on Twitter.
   3. Produce final blog post.

   (C) Lecturer
   1. To initiate a set of questions through Twitter.
   2. To encourage discussion on twitter.
   3. To provide support.

   **Rules**

   A) Important instructions to students
   1. Students should have created a Twitter account. They are allowed to use their existing accounts.
   2. Students should follow the "DSAG" Twitter account created by the lecturer.
   3. When responding to a question, each student must include the hashtag.
   4. When creating the final blog post, students may include screenshots of the discussion on Twitter as references for their main points.
   5. Timelines for the activity.

   B) Assessment criteria (where applicable)
   Completion of activity is required for successful completion of e-learning week.
Appendix 2. Expert Cases (Number of cases kept small for the 10-h online professional development course)

<table>
<thead>
<tr>
<th>Web 2.0 Tool</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blogs</td>
<td>(1) Penn State U: Blogs in a Philosophy Course</td>
</tr>
<tr>
<td></td>
<td>(2) U of New South Wales: Using blogs for peer feedback and discussion – First Year Architecture Class</td>
</tr>
<tr>
<td>Microblogging</td>
<td>(1) Following Interests using Twitter</td>
</tr>
<tr>
<td></td>
<td>(2) UT Dallas – The Twitter Experiment – Twitter in the Classroom</td>
</tr>
<tr>
<td>Shared online docs</td>
<td>(1) Growth of Google Doc (Edmonton Public Schools, Canada).</td>
</tr>
<tr>
<td></td>
<td>(2) Collaborative Economics Lesson using Google Spreadsheet and Motion Chart (secondary school, Mumbai, India)</td>
</tr>
<tr>
<td></td>
<td>(3) *New Zealand High Schools – Use of Googledocs</td>
</tr>
<tr>
<td></td>
<td>(4) *How to integrate Google Docs in Science and Math like a Pro</td>
</tr>
<tr>
<td>Shared online presentation</td>
<td>(1) Example Use of VoiceThread.com in the Classroom</td>
</tr>
<tr>
<td></td>
<td>(2) St. John’s University: Learning Visual Arts with VoiceThread</td>
</tr>
<tr>
<td>Social bookmarking</td>
<td>(1) Diigo groups made easy</td>
</tr>
<tr>
<td></td>
<td>(2) *Teaching a Lesson using Diigo</td>
</tr>
<tr>
<td>Wiki</td>
<td>(1) The Wiki Classroom – Different ways of using wikis</td>
</tr>
<tr>
<td></td>
<td>(2) Swinburne University – Use of Wikis in Online programs</td>
</tr>
</tbody>
</table>

*These are not Youtube videos, but webpages or blog postings that document the use of these tools.
Appendix 3. Rubric used to evaluate the activity designs

<table>
<thead>
<tr>
<th>Criteria</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Learning objectives and use of web 2.0</td>
<td>Learning objectives do not warrant the use of Web 2.0 tools.</td>
<td>Learning objectives warrant limited use of Web 2.0 tools; or less than half of the activity makes use of the Web 2.0 tool(s).</td>
<td>Learning objectives warrant the use of Web 2.0 tools. Between half and three quarters of the activity makes use of the Web 2.0 tool(s) in an effective and efficient way or three quarters or more of the activity make use of the Web 2.0 tool(s) but not in a sufficiently effective and efficient way.</td>
<td>Learning objectives warrant the use of Web 2.0 tools. Three quarters or more of the activity makes use of the Web 2.0 tool(s) in an effective and efficient way.</td>
</tr>
<tr>
<td>2. Match between tool and activity</td>
<td>Match between the tool’s affordance and the activity is unclear.</td>
<td>Match between the tool’s affordance and the activity. However, an alternative tool would be a better match; or some selected tools are a match, while some are not.</td>
<td>Clear match between the tool’s affordance and the activity. This is implied from the activity description.</td>
<td>Clear match between the tool’s affordance and the activity. This is clearly articulated in the Reflection section of the template.</td>
</tr>
<tr>
<td>3. Match between learning outcomes and sequence of activities</td>
<td>The design of the activity: the whole sequence of activities do not appear to achieve the learning outcomes. There is a lack of detail in the plan for understanding.</td>
<td>The design of the activity: the whole sequence of activities appears to achieve the learning outcomes. Some inference or guesswork is required; or learning outcomes are not clearly described.</td>
<td>The design of the activity: the whole sequence of activities is well suited to achieve the learning outcomes.</td>
<td>The design of the activity: the whole sequence of activities is well suited to achieve the learning outcome. The activities integrate the Web 2.0 tool(s) to form a coherent sequence.</td>
</tr>
<tr>
<td>4. Support of social learning and knowledge construction</td>
<td>It is unclear how the activity supports social learning and knowledge construction.</td>
<td>The activity clearly supports social learning and knowledge construction to some extent.</td>
<td>The activity clearly supports social learning and knowledge, but it is implied from the activity.</td>
<td>The activity clearly supports social learning and knowledge construction, and this is clearly articulated in the description.</td>
</tr>
</tbody>
</table>

(Continued)
<table>
<thead>
<tr>
<th>Criteria</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Reflection</td>
<td>Reflection does not specifically provide an explanation for the design.</td>
<td>Reflection provides some explanation for the design.</td>
<td>Reflection is detailed, comprehensive and coherent.</td>
<td>Reflection is detailed, comprehensive and coherent, providing an argument for their design.</td>
</tr>
</tbody>
</table>