A case study in enhancing analytical preparedness through education technology

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Abstract: This paper critically analyses an actual case involving the design of an online discussion board intended to foster analytical learning preparedness. The goal of the study was to consider how instructional design theory could be applied to foster a more effective design. The conclusion highlights how user training, enhanced instructor engagement, strategic design of discussion questions, devolving responsibility to learners and adopting clear evaluation strategies can significantly improve the efficacy of the technology.

Keywords: discussion boards; educational technology; instructional design.

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1   Enhancing student preparedness

Enhancing student preparedness prior to in-class facilitated sessions is a common challenge in most institutions of higher learning. In theory, student preparedness can be incentivised to a certain extent through selection of appealing readings; ensuring that the material is clearly connected to the ensuing in-class session; by peer pressure; pressure from course facilitators and by the structure of the assessment system.

Effective implementation of such strategies can lay a foundation that allows class facilitators to help students extend their learning. However, there are circumstances where institutional barriers undermine the effectiveness of these strategies and therefore alternative approaches must be adopted to attenuate any institutional hurdles that confound attempts to enhance student preparedness. This article presents a case study of just such a challenge and critically examines the implementation of an alternative strategy to enhance preparedness which employs education technology.

2   Student preparedness at Big City University

At Big City University (BCU)[1], the manner in which teaching performance is evaluated has undermined the ability of faculty to enforce standards of student preparedness. The university has adopted a 'teaching and learning questionnaire' (TLQ) as the sole method for evaluating teaching performance. The results from this evaluation are used both for determining annual faculty performance pay and as a key input to the tenure evaluation process. Consequently, there is pressure on teaching faculty to ensure that the interests of the students are served.

According to a student evaluation exercise that is conducted at the intake stage, BCU students possess alarmingly low levels of self-motivation and willingness to learn. This stems partly from the secondary school education system in Big City, which tends to stress learning by rote over learning through discovery. In combination, the teaching evaluation system and the low levels of student motivation to learn result in a situation where students do not prepare for their classes and faculty is incentivised to turn a blind eye to this development.

This case study that is elaborated on in this article is based on an actual strategy employed by one of the authors. In an attempt to develop a strategy for enhancing student preparedness under the conditions described, this faculty member of BCU decided to turn to educational technology in search of a tool to encourage better preparedness.

As a first effort, the instructor developed an online assessment that was designed to meet an initial objective of encouraging students to "at least scan through the assigned readings". Each week, students were asked to log-on to the course's Blackboard Learning System (BLS) site and complete a reading comprehension assessment that was comprised of ten multiple-choice questions. The test was open book and could be completed at home, but once students began the test, they had to finish it in 20 minutes. After 20 minutes, the test was automatically terminated, the answers were tabulated by the system and the results were forwarded to the course facilitator. In total, there are 11 weekly reading comprehension tests given to the students, with the test with the lowest mark being excluded from the overall assessment in order to provide a buffer in the event that there was a connectivity failure while a student was taking a comprehension test. Each comprehension test was weighted at 3% of the overall course

grade – so the total weighting for the series of reading comprehension tests amounted to 30%.

Results from the assessments (class average of 80% per exam) and complaints by the students in regard to being forced to read indicate this first goal – getting students to scan the material before class – was by and large, met. However, in-class interactions with students revealed that the level of theoretical knowledge that was inculcated by these students as a result of these reading comprehension exercises was negligible. Students were clearly scanning the material before class in order to derive the answers to the test; but, in general, they were not retaining the knowledge in a way that would allow them to apply it in class discussions.

This came as somewhat of a surprise because, in the same course, in order to encourage greater analytical preparedness, the course facilitator introduced a group discussion board exercise that was administered five times throughout the duration of the course. Each of the five postings presented were designed to encourage students to evaluate the readings in an analytical manner. An example of a discussion board question and the rubric is in Figure 1.

Figure 1 Sample discussion board topic and rubric (see online version for colours)

In practice, this educational strategy did not yield the desired outcomes. The objective of this strategy was to ensure that students extracted knowledge from the readings and tried to apply the knowledge to real-world environmental policy analysis, which is the theme of the course. Unfortunately, the exercise yielded student posts that were by and large unstructured thoughts. Many of the posts did not demonstrate attempts to apply knowledge to theory. Moreover, there was no student-to-student interaction on the discussion boards. Each student simply logged onto the discussion board, posted his or her thoughts and logged off.

The assessment process underpinning this discussion board activity was also problematic. The instructors were aware that the rubric was not as clear as it should be. Time was also a barrier. Given the time constraints of the course facilitator, it was not possible to provide students with customised feedback on 50 posts, five times during the term. Moreover, since there were only five discussion board assignments, students were still coming to the classes that were not preceded by these assignments without any critical insight into the readings.

The aim of this article is to critically evaluate the student preparedness enhancement strategy that has been described above and then put forth recommendations for improving the instructional design. Section 3 will present a critique of the instructional design choices that have been adopted and implemented. Section 4 will draw from educational technology design theory to recommend improvements to the instructional design. Section 5 will consider alternative strategies that the course designer could have adopted.

Section 6 will put forth strategies for verifying the efficacy of the recommended improvements. Finally, Section 7 will present a summary of the key redesign elements.

It is hoped that this analysis will not only provide educators with greater insights into the pitfalls of educational technology design but also provide guidance into how educational technology design flaws can be pre-empted through better planning.

3   Critique of current instructional design

It is understood that there are two learning objectives underpinning the educational design challenge presented in this case:

1   to ensure learners achieve a basic level of comprehension of the readings before class

2   to develop the learners' abilities to evaluate the readings critically and apply the content to inform a real-world application.

Due to the word limitations of this paper, and because the first objective is adequately being met by the assessment tool, this discussion will focus on strategies that address the second learning objective – encouraging critical evaluation – in regard to effectively employing the discussion board tool.

The introduction of the student discussion board reflects a step toward best practice in enhanced student interactivity. The act of interaction has a transformative impact upon the learner, helping him/her to internalise and take ownership over what was previously inert information (Anderson, 2008). In this way, learner interactions help to advance learning further up the ranks of Bloom's taxonomy from a position of simply having knowledge to a point of being able to make critical evaluations (Bloom et al., 1971). Garrison et al. (1999) would agree that employing interactive learning tools of this type enhances the teaching presence while developing the cognitive presence of learners, in other words nurturing critical thinking skills. Indeed, these are two important elements of their 'community of learning' conceptual model (Garrison et al., 1999). It could also be argued that utilising a discussion board helps to provide learners with scaffolding to build their knowledge upon (Anderson, 2008).

However, both the comprehension tests and the discussion board exercises lack a sufficient level of formative feedback to enhance student development and student extrinsic motivation, as advocated by Perkins (2008). In this way, the instructional design can be overly didactic (Adler, 1983) – the student is instructed to do something, they do it and the instructor duly assesses the performance. Only the reading comprehension text results are discussed in class; therefore, the discussion board activities, in particular, lack the feedback that Jenkins (2004) proposes is needed to motivate and educate learners.

Like so many higher education course elements, this instructional design lacks important characteristics of effective constructivist instructional design theory, an approach to teaching and learning that places the learner at the centre of the activity (Jonassen, 1999). In the constructivist approach, learners and instructors are considered to be part of a 'knowledge-building community' which is analogous in many ways to a research community (Lax et al., 2004). Ideally, there should be no curriculum (Papert, 1980), or if there is, it should be iterative (Lax et al., 2004) – progressively responding to student needs. Rather than scripting outcomes, learning should be a by-product of solving real problems. Moreover, learners should identify the problems that they want to solve

and what they need to learn to achieve their objectives. Learners create their own learning objectives – to some degree guided by their instructors – but also in dialogue with other learners outside of their group (Scardamalia and Bereiter, 1993).

By embracing these elements of constructivist design, the learner becomes a part of a learning community of practice (Barab and Duffy, 2000). In such a community, the emphasis is not on individual learning but on group learning (Scardamalia and Bereiter, 1993). Within an online environment, learning community members are typically characterised as being multi-literate – able to interpret and communicate using a diversity of media in a variety of cultural contexts (Cazden et al., 1996). Optimal group learning occurs within the learning community as the group benefits from individual strengths of members without forcing assimilation of perspectives. Within such an environment, individual learners can focus on achieving their personal learning objectives, not on getting good grades as one would in a bricks and mortar higher education course (Scardamalia and Bereiter, 1993). It stands to reason that all these elements that should be integrated into any revisions to the discussion board activity.

Before giving further consideration to specific revisions, the profile of the learners should also be evaluated (Reigeluth, 1999). Papert (1980) argues that we construct knowledge by drawing on what we already know – employing cultural models or symbols we acquire through our own cultural experience – to make sense of the new knowledge. In the BCU case, the learners come from a secondary education system where learning by rote is favoured over learning by discovery. This suggests that students likely lack the analytical skills and learning inspired motivation that can inspire students to attempt to apply knowledge to theory. This partially explains the sub-optimal performance of the learners in the discussion groups. Considering these cognitive limitations, asking learners to 'critique' a reading does not provide sufficient direction to achieve the desired goals. A more measured, 'learning-centred' approach to scaffolding student knowledge-building should be considered with a view to encouraging learners to take ownership of their learning (Anderson, 2008).

One way to address this is through liberalising the learning experience. Currently, the strategy for selecting topics for the discussion board follows the Socratic model where the teacher initiates, the student responds and the teacher evaluates (Adler, 1983). The same activity could arguably have been achieved using email or even paper-based assignments. Using the discussion board in this way is an example of what Halavais (2006) would describe as a 'horseless carriage' – employing new technology to achieve a task in a similar way to how it had been done before the new technology was available.

In summary then, any recommendations for improvement should promote enhanced interactivity, incorporate learner-centric constructivist design principles and nurture knowledge building communities. All of this must be done while recognising the unique needs of the learners and designing appropriate educational strategies to meet learner needs.

4   Strategies for improvement

The 'community of inquiry' model, advanced by Garrison et al. (1999), suggests that deep, meaningful learning in an online environment occurs when there is a conflation of three core elements – cognitive presence, social presence and teaching presence. As the BCU discussion board, along with the supporting rubric, are not producing the desired

outcome of enhanced critical analysis, we will examine how the 'community of inquiry' model can be drawn on to better inform revisions to enhance student preparedness, deepen understanding, and entrench applied learning.

4.1   Cognitive presence

Cognitive presence, as suggested by Anderson, is the essential learning element of the 'community of inquiry' model. This element must be managed by the instructor to facilitate "an environment that supports the development and growth of critical thinking skills" (Anderson, 2008). Cultivating critical thinking skills entails a four stage design process. The first stage is the *triggering event*, where the student is first introduced to a concept or issue. The learner is then guided into an *exploration* stage where they engage with an idea or question. The third stage of cognitive presence is *integration*. During this stage, learners are encouraged to reflect on how theory applies to a concept. Finally, the critical thinking learner moves into the *resolution* phase where the learner is prompted to apply newly acquired knowledge or create new concepts (Kanuka and Garrison, 2004). Applying the 'community of inquiry' model to guide the discussion board redesign process would permit the instructor to create opportunities for the BCU students to move from the initial introductory stage through to the application phase.

A number of viable strategies support operationalisation of the community of inquiry model at BCU. For starters, learners could be provided with an exemplar of an exceptional discussion board post. Rovai (2007) suggests, that when instructors clearly communicate learner expectations, "students will be able to better judge their own behavior and engage in self-reflection and self-regulation". It is in this phase of reflection (self or content-based) that the learner begins to internalise concepts which is a precursor to evolutionary learning. In brief, clear learner expectations must be set in order to promote a cognitive transition.

Another strategy to enhance *exploration* and *integration* is to create small discussion groups. Smaller group brainstorming sessions produce an increased number of usable ideas, in comparison to the quality of ideas emerging from larger groups. As Gallupe et al. (1992) explain, in larger groups, one person tends to take a dominant role which suppresses discussion and some individuals tend to withhold thoughts due to the fear of rejection of those ideas. Therefore, constructing questions for smaller groups consisting of 5 to 6 students should minimise individual dominance and the fear of publically sharing ideas. Smaller groups working on different but connected themes would likely increase participation and enhance understanding of concepts. It would also allow the instructor to follow up on the discussion board contributions in class by designing follow-up activities to encourage students to try and integrate their perspectives into a systematic whole.

A final strategy to encourage students to migrate toward *resolution* is to increase student-student interactions. Research suggests that increased interactions enhance collaborative learning, resulting in "higher levels of cognitive (presence)" (Anderson, 2008). One strategy for increasing student-student interactions would to incorporate student facilitation of the discussion board, with the instructor providing the starting point of the discussion. Each student or group could be obligated to guide the discussion, provide additional insights, critique discussions, and ensure collaborative and reflective participation.

4.2   Social presence

Kehrwald (2008) suggests that even though "technology gets much of the attention in online learning, it is people who make online learning environments productive. Social presence is the quality of people in online environments, conveyed through their use of language, media, and communications tools". Social presence goes beyond a friendly face and enhancement of student satisfaction, it has the capacity to support "cognitive objectives through the ability to instigate, sustain, and support" learners (Lee, 2014). This is an important factor in the online learning process because students who participate in online educational learning environments are at a higher risk to "experience isolation and alienation from the institution because of their physical separation from the school and from other students" (Rovai, 2007). This can also be relevant in a blended environment, as in our example from BCU.

To foster a greater social presence, the instructor for the BCU discussion board should consider participating in and guiding student discussion to a greater extent. Increasing social presence, as suggested by Anderson (2008), allows students to experience a safe environment to express thoughts, explore differences and accept support from peers. It is through positive feedback from instructors and collaboration with fellow students that students can begin to move from comprehension to synthesis of material. Research supports this claim-instructor and student interaction "contributes directly to the success of the learning experience" (Rovai, 2007).

As previously mentioned, time constraints curtail the ability of the instructor to respond to every student contribution. However, by developing discussion activities around small groups focusing on one theme, instructor participation can be enabled. In small groups (5 or 6 learners), instructors can address the collective contributions in a single posting, thereby altering requisite instructor from a ratio of 1:1 to a more manageable ratio of 1:5 or 1:6. Research suggests that posting at least one instructor message aimed at encouraging students with positive comments, ensuring the discussion board is on topic, and guiding the discussion with open-ended questions can increase social presence and result in higher student satisfaction (Rovai, 2007).

4.3   Teaching presence

Teaching presence can be defined as the structure and process of the learning experience that takes place for each student. In a face-to-face environment, teaching presence is readily apparent. Online, this can be increasingly difficult to ascertain. According to Kanuka and Garrison (2004), an instructor's perceived presence, whether observed or not, affects student learning. Therefore, it is inferred that if student preparedness and deep, meaningful learning is to occur, the students must perceive instructor presence. Creation of an effective online teacher presence should be incorporated into the design and organisation of facilitated discussions (Bangert, 2008).

Facilitation of online instruction should adhere to a set of well-established principles. Best practice indicates that to enhance teaching presence, discussion board instructors should utilise video tools, create written responses to student discussion boards, and model discussions as subject-matter experts (Bangert, 2008). One concrete approach is to design and organise an online discussion area through an asynchronous, online instructor video post, which guides students through topics such as how to post, proper online etiquette, and how to respond to create dialogue (Jones, 2011). Perhaps the Echo 360

personal capture system can be used to deliver tutorials on-demand to help students think through topics or acquire a foundation in how to undertake critical analysis. Additionally, Anderson advocates Dabbagh's practice of providing students with the discussion board marking rubric to help motivate students to critically engage with the readings and we feel that this practice also merits adoption (Anderson, 2008).

Instructor-student interactions, as Anderson (2008) suggests, are "supported in online learning in a large number of varieties and formats". In the BCU discussion board, one strategy that could be adopted to support learning is through incorporating formative assessment methods which can be as simple as providing threaded guidance and feedback to each theme-based group.

Keeping in mind the objective behind the adoption of the discussion board (to encourage higher levels of cognitive understanding), another strategy would be to utilise the DEAL model to guide designs which will encourage critical reflection through guided teacher-learner interaction. Ash et al. (2007) argue that critical reflection can be increased by structuring activities to encourage the learner to *D*escribe what they are learning, *E*xamine learning concepts or application of student learning and then *A*rticulate their *L*earning. By applying this approach through structured activities, course facilitators would be able to affirm that learners comprehend specific content, thereby ensuring reflective learning.

Another strategy to improve the effectiveness of the BCU course discussion board would be to restructure the types of questions to induce higher-level thinking, such as, evaluation rather than simple application. As the BCU course discussion board is currently designed, students are required to apply what they read in a very basic manner. Conversely, the instructor could design a case study which would allow students to apply course content to a more elaborate, real-world issue. Another option is to present controversial or opposing perspectives related to the assigned readings and encourage debates. Analysing competing perspectives allows the students to explore solutions to 'cognitive conflicts' and it is the "resolution of these conflicts that results in higher forms of reasoning" (Anderson, 2008). This is particularly salient for social science subjects such as the environmental policy course that constitutes the subject of the BCU case study.

5   Alternative technologies

A new learning technology should not be adopted purely for its novelty (Bates and Poole, 2003). Among a number of considerations, the technology should ultimately be assessed in terms of how it meets the needs of the intended learning objectives (Dick et al., 1990). In this case, viable instructional design alternatives should be partly informed by instructor access, student access and how well a competing technology facilitates the challenge at hand (Bates and Poole, 2003). As the instructor in the BCU case is limited to using the technologies selected by BCU, and the discussion board activity does hold promise if properly planned and implemented, we have chosen to confine our analysis to how to improve the existing discussion board activity. However, there are some supporting alternative technologies that are available within the BCU learning management system (LMS) that can be considered to supplement the instructional design and entrench learning.

As the learners become more confident at critiquing the readings, introducing them to a wiki and/or a blog tool would be a viable option in developing their autonomy as critical thinkers. Halavais (2006) argues that in his experience, because learners are potentially addressing an audience than extends beyond the instructor and fellow students, the quality of work improves when employing these tools. Moreover, connecting with a global community empowers learners to view themselves as contributors to a "continuous collaborative large scale conversation"; thereby, incentivising student performance.

While tools like Echo360 and Videoscribe (part of the Blackboard LMS used at BCU) can be considered as broadcast tools that provide a visual platform for instructors to develop education materials, these tools can also be flipped and made available to learners to design and utilise. In this way, students can foster improved literacy in multimodal texts supplementing wiki, blog or discussion board posts with video posts (Gee, 2007). In true constructivist spirit, expanding the array of educational technologies can potentially improve connectedness with a broader spectrum of students. Web conferencing tools like collaborate (part of the Blackboard LMS used at BCU) can be similarly flipped and used by learners in a student-lead synchronous webinar or, asynchronously, by making use of recording features. Web conferencing can be similarly employed to create multimedia posts for a wiki blog or discussion boards.

6   Verifying efficacy of strategic enhancements

In Section 4, a number of strategies were put forth as ways to improve the effectiveness of the BCU course online discussion board in terms of equipping students with the skills and motivation to apply critical analysis to course content. However, the value of these strategies cannot be ascertained unless a system is developed for evaluating efficacy (Howlett and Ramish, 2003). In this section, we outline a program for doing so.

In developing an evaluation system for vetting the effectiveness of the strategies put forth in Section 4, one should first develop a comparative benchmark to establish a foundation from which to measure whether or not the strategies are actually more effective than the original design. Therefore, the following evaluative strategies could be applied to the online discussion board structure and to a structural redesign incorporating the strategies outlined in the previous section.

As Bardach (2011) emphasises, although "the most important evaluative criterion is whether or not the projected outcome will solve" the problem, other issues dealing with efficiency and effectiveness must also be considered. Therefore, rather than having just one criterion to assess the added-value of these recommendations, it is recommended that a number of criteria be established for verification (Hill, 2005). These can be broadly classified as input, process and output criteria.

Output criteria are easily the most important because they address the attainment of learning objectives. In the case, there are three ways that efficacy of the recommendations can be evaluated – by student, by instructor or by peer. In terms of student-led output evaluation, students could simply be surveyed and asked to agree or disagree with the following: "the discussion board activities have been useful in helping me to hone my critical analysis abilities". This could be done on a five-point Likert scale with one extreme represented by 'completely disagree' and the other extreme represented by 'completely agree'. Output can also be measured by the instructor. The students are

already receiving a grade for their posts. If the rubric and exercises are aligned to meet learning objectives, this can be a measure for evaluating whether output objectives have been met. Alternatively, the activity could be evaluated by a peer faculty member who reviews the student responses and compares these to the learning objectives for the course. We recommend that in regard to output evaluation, both the student and instructor-led evaluation techniques described in this paragraph should be implemented. Implementing peer evaluation can be costly and time-consuming and might not be justified for one activity of this type.

Input criteria are also important because this speaks to the efficiency of an instructional design. There are two important criteria that need to be included in the input evaluation process. The first is time-effectiveness, which is a form of effort evaluation (Howlett and Ramish, 2003). The time spent on implementing enhancement strategies need to be measured and compared to improvements in student performance. The relevant ratio should be student improvement (measured by the output criteria discussed above) divided by time spent. The second important criterion is cost-effectiveness. This is related to time effectiveness in that time is money. More specifically, an hour of a faculty member's time comes at a cost that should be measured. This will tell the program administrators whether or not the enhancements are actually cost justified. Like any enterprise, education comes at a price that must be managed. Both input criteria are recommended for verification purposes. The time effectiveness criterion can be measured by the instructor (or teaching assistant) logging time spent on the discussion board activities (even for just one semester) and measuring this against any improvement in student grades on the assigned posts. The cost-effectiveness criterion can be easily measured by attaching a dollar figure to the time spent.

Process evaluation is also a useful way to measure the effectiveness of implementing the strategies outlined in Section 4. Process evaluation can serve as a triangulation tool in order to ensure that output evaluation is not confounded by evaluator bias or other external changes that might affect student performance and which cannot be attributed to the new discussion board facilitation strategies (i.e., maybe the professor does a better job in a subsequent year in encouraging enhanced critical analysis in a class setting prior to the discussion board posting). One way that the process can be evaluated is by measuring the number of posts and dividing that by the total number of students to derive a posting per student benchmark. As outlined earlier, encouraging frequency of interaction is a useful way to enhance collaborative learning. Accordingly, by aiming to increase the number of posts per student, the revised approach to the discussion board activity will have achieved a learning outcome that might not be picked up when attempting to measure results strictly against learning objectives. An alternative approach would be to use total words of each posting as the process benchmark. The shared weakness with these two approaches is that total postings or word counts do not reflect the quality of the posting; however, the evaluation of quality would be picked up by the output criteria.

It should be noted that there other ways to evaluate the efficacy and efficiency of these suggested revisions – student satisfaction feedback, focus groups with students, formal assessments designed to better evaluate student performance on the discussion boards etc. – however, time constraints necessitate a degree of parsimony in selecting evaluation criteria.

In summary, by establishing the input, process and output criteria outlined in this section, and comparing the results from the revised discussion board activity to results

from the existing discussion board activity, we can obtain a sufficiently clear picture of how much more effective the revised strategy is compared to the original discussion board design.

7   Conclusions

In conclusion, although the BCU discussion board activity represented a commendable attempt to enhance student learning by improving student preparedness, it suffered from a failure to exploit the full potential of this technology by adapting the instructional design to better appeal to the needs of the learner. As it stands, the existing BCU course discussion board activity did not differ much from simply assigning analytical questions to students for homework, which was a prevalent strategy for enhancing critical analysis abilities prior to the advent of the computer. This paper has employed a review of instructional design theory to put forth recommendations on how to improve the BCU discussion board activity to move beyond a substitute for paper assignments and realise more of its technological potential (Halavais, 2006).

First and foremost, students must be trained to make use of this technology (Bruns and Humphreys, 2005). They must be given examples of the type of output that is expected, they need to receive training in basic critical analysis techniques and they have to receive formative feedback on their initial posts in order to ensure that they are on the right track.

Second, the instructor should be more engaged in the discussion board. It is recognised that time constraints might prohibit independent responses to all student posts; therefore, we recommend that the instructor considers a redesign of the discussion board activities to enable students to address customised themes in smaller groups. In this way, the instructor can provide feedback on the work that is produced by the group members in aggregate.

Third, the instructor should put more attention into strategies for motivating students to participate in a more robust fashion. Although instructor engagement will have some effect, engagement alone is not sufficient. It is with this in mind that we recommend that students be conscripted to act as discussion board facilitators on a rotating basis. This not only allows students to learn by facilitating, it also enhances the prospects of others engaging in a conversation led by a class friend or a peer. If a student's post is directly addressed by another student, prospects for continued collaborative discussion will be elevated.

We acknowledge that the efficacy of these recommendations must be evaluated and that implementation comes at a cost in terms of design time and increased facilitation time. Therefore, we have put forth comprehensive (input, process and output criteria) but manageable measures for evaluating the effectiveness of the recommended redesign of the discussion board activities. Overall, we contend that implementation of these recommendations will not pose an onerous burden on the course designer or the course facilitator and, in the end, will produce far more effective results in terms of enhancing student preparedness.

Acknowledgements

References

Adler, M.J. (1983) *Paideia Problems and Possibilities*, Macmillan, New York.

Anderson, T. (2008) 'Towards a theory of online learning', in Anderson, T. (Ed.): *Theory and Practice of Online Learning*, pp.45–74, Athabasca University Press, Canada.

Ash, S., Clayton, P. and Moses, M. (2007) *Teaching and Learning through Critical Reflection: An Instructors Guide*, Stylus Publishing, Sterling VA.

Bangert, A. (2008) 'The influence of social presence and teaching presence on the quality of online critical inquiry', *Journal of Computing in Higher Education*, Vol. 20, No. 1, pp.34–61.

Barab, S. and Duffy, T. (2000) 'From practice fields to communities of practice', in Land, D.J.A.S. (Ed.): *Theoretical Foundations of Learning Environments*, Lawrence Erlbaum, Mahweh, NJ.

Bardach, E. (2011) *Practical Guide for Policy Analysis: The Eightfold Path to More Effective Problem Solving*, CQ Press, Thousand Oaks, CA.

Bates, A. and Poole, G. (2003) *Effective Teaching with Technology in Higher Education*, pp.75–105, Jossey-Bass, Indianapolis, IN.

Bloom, B.S., Hastings, J.T. and Madaus, G.F. (1971) *Handbook of Summative and Formative Evaluation of Student Learning*, McGraw-Hill, New York.

Bruns, A. and Humphreys, S. (2005) 'Wikis in teaching and assessment: the M/Cyclopedia project', *Proceedings of the 2005 International Symposium on Wikis*, pp.25–32, ACM.

Cazden, C., Cope, B., Fairclough, N., Gee, J., Kalantzis, M., Kress, G., Luke, A., Luke, C., Michaels, S. and Nakata, M. (1996) 'A pedagogy of multiliteracies: designing social futures', *Harvard Educational Review*, Vol. 66, No. 1, pp.60–92.

Dick, W., Carey, L. and Carey, J.O. (1990) *Introduction to Instructional Design: The Systematic Design of Instruction*, Harper Collins, New York.

Gallupe, R.B., Dennis, A.R., Cooper, W.H., Valacich, J.S., Bastianutti, L.M. and Nunamaker, J.F. (1992) 'Electronic brainstorming and group size', *Academy of Management Journal*, Vol. 35, No. 2, pp.350–369.

Garrison, D.R., Anderson, T. and Archer, W. (1999) 'Critical inquiry in a text-based environment: computer conferencing in higher education', *The Internet and Higher Education*, Vol. 2, No. 2, pp.87–105.

Gee, J.P. (2007) *What Video Games Have to Teach Us About Learning and Literacy*, Revised and Updated ed., Macmillan.

Halavais, A. (2006) 'Weblogs and collaborative web publishing as learning spaces', in Weiss, J., Nolan, J., Hunsinger, J. and Trifonas, P. (Eds.): *The International Handbook of Virtual Learning Environments*, Springer, Netherlands.

Hill, M.J. (2005) *The Public Policy Process*, Pearson Education, Essex, UK.

Howlett, M. and Ramish, M. (2003) *Studying Public Policy: Policy Cycles and Policy Subsystems*, Oxford University Press, Oxford, UK.

Jenkins, M. (2004) 'Unfulfilled Promise: formative assessment using computer-aided assessment', *Learning and Teaching in Higher Education*, Vol. 1, No. 1, pp.67–80.

Jonassen, D. (1999) 'Designing constructivist learning environments', in Reigeluth, C.M. (Ed.): *Instructional Design Theories and Models*, Lawrence Erlbaum, Mahwah, NJ.

Jones, I.M. (2011) 'Can you see me now? Defining teaching presence in the online classroom through building a learning community', *Journal of Legal Studies Education*, Vol. 28, No. 1, pp.67–116.

Kanuka, H. and Garrison, D.R. (2004) 'Cognitive presence in online learning', *Journal of Computing in Higher Education*, Vol. 15, No. 2, pp.21–39.

Kehrwald, B. (2008) 'Understanding social presence in text-based online learning environments', *Distance Education*, Vol. 29, No. 1, pp.89–106.

Lax, L., Taylor, I., Wilson-Pauwels, L. and Scardamalia, M. (2004) 'Dynamic curriculum design in biomedical communications: Integrating a knowledge building approach and a Knowledge Forum® learning environment in a medical legal visualization course', *Journal of Biomedical Communications*, Vol. 30, No. 1, p.30.

Lee, S-M. (2014) 'The relationships between higher order thinking skills, cognitive density, and social presence in online learning', *The Internet and Higher Education*, Vol. 21, No. 1, pp.41–52.

Papert, S. (1980) *Mindstorms: Children, Computers, and Powerful Ideas*, Basic Books, New York.

Perkins, D. (2008) *Smart Schools: From Training Memories to Educating Minds*, Simon and Schuster, New York.

Reigeluth, C.M. (1999) 'What is instructional-design theory and how is it changing?', in Reigeluth, C.M. (Ed.): *Instructional-Design Theories and Models: A New Paradigm of Instructional Theory*, Lawrence Erlbaum Associates, Mahwah, NJ.

Rovai, A.P. (2007) 'Facilitating online discussions effectively', *The Internet and Higher Education*, Vol. 10, No. 1, pp.77–88.

Scardamalia, M. and Bereiter, C. (1993) 'Computer support for knowledge-building communities', *The Journal of the Learning Sciences*, Vol. 3, No. 3, pp.265–283.

Notes

1   This case study is based on an actual case but the name of the school has been changed to preserve anonymity.