

Whose technology enables learning through discussions? The 'shoutboard': A new design for asynchronous discussions

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The literature confirms that learning occurs through discussions. However, the question of 'how' discussions are conducted in an online environment continues to challenge educators. Technology has recapitulated a discussion approach to aid learning by building tools to enable discussions between multiple users. There appears to be a short supply of research which considers whether these current technologies used in the common Learning Management Systems (LMS) and computer conferencing (CC) enhance or limit learning. The cognitive processing required of learners when they engage in the common threaded messages on many of the LMS platforms, is laboured and cognitively demanding. The structure and content appears to be driven by the need for e-management and e-administration, relegating learning to a secondary position. This paper discusses the psychological reading process and how, if used to drive the technology, the reading and processing of content within discussions may be accessed more easily and expanded to include debate and compare and contrast focussed discussions, thus minimizing the cognitive work required for reading posted discussions. The level of interactivity and sociability is also examined. The rationale, development, trial and evaluation of the 'shoutboard' are reported.

Keywords: online learning, discussions, cognitive processing

Background

Never has the need to find efficient ways to enable learners to interact with information systems and each other been so important than at the present time— the Information Age. Learning through and with interactions is not new as it was fundamental to Socrates and in later centuries to the theories of Vygotsky and Piaget. However, the application to sources such as technologies is relatively new. Their theories have been applied to teaching and learning in classrooms over the decades and have influenced indirectly, designs for online learning. Cooperative and collaborative learning strategies emanating from these theories have been applied to enhance conversing and interacting and ultimately learning.

There has been a strong movement to imitate or replicate classroom interactions in which learning occurred to the online environment. Chat rooms, discussion forums, threaded and unthreaded discussions have been included in the now decade old LMS of WebCT and Blackboard to promote 'talk' and preferably critical thinking as a means to learning (Coffin, Painter & Hewings, 2005; Hara, Bonk & Angeli, 1998). Such discussion forums require the mechanisms to initiate, facilitate, conclude and provide feedback. Hara et al. found that "there was never a sense of real heated or seminal online discussions with students negotiating meaning, taking sides on issues, or coming to compromise" p.26. They argue for improved pedagogy to motivate students' participation at this level. Dennen (2005) analysed nine different online classes in the search for the effect different discussion activities impacted on quantity, quality, timing and the nature of messages. Harasim (1989) (cited in Marra) describes interactivity as the most striking characteristic of Computer Mediated Conferencing and the factor with the greatest potential to impact on learning. Further, the research on instant messaging (Lewis & Fabos, 2005) and how the insight it provides into how messaging is negotiated and understood, may contribute to the motivational aspect of online discussions.

The LMS platforms have included features which enable teachers to: track student's contributions – frequency and length over a period of time; ascertain the date messages are posted; identify read and unread messages; and to moderate discussion messages by deleting inappropriate messages. It is clear that the familiar structuring of threaded and unthreaded, read and unread messages and the way these discussions visually appear and are used reflect the need of e-management of students and assessment. Academics want to know who makes a contribution and whether the contribution was worthwhile, so marks can be allocated. It appears the LMS discussion tools component is being used complete with limitations possibly in the belief it will, simply by employing it, enhance learning: a critique of the system is absent in the literature. The use of the systems as shells waiting to be filled (Winn, 1992) emphasises content at the expense of activity and message design, a point reflected in the research of Holmes (2004). The authors of this paper support the idea of deliberate asynchronous message design with the development and trialing of their approach reported in this paper. There is extant literature reporting on the various analyses to identify the educational or learning effectiveness of online discussions, particularly asynchronous (Holmes, 2004) but there appears to be no research on the comprehension afforded by these same messages, or by varying message approaches, to the readers.

We have challenged the current message functionality and the power of these to a) promote higher level thinking through engagement and interactivity and b) to enhance the learning outcomes for students. It appears academics are devising multiple ways to engage learners in these linear and asynchronous discussions, and to engage them at deeper and higher cognitive levels (Thomas, 2006; Coates, James & Baldwin, 2005; Dennen, 2005; Hara, Bonk, Angeli, 1998) without critiquing the functionality of the discussion forums to achieve interactivity, learning, understanding and knowledge. Based on theories of comprehension and reading we took up this critique and asked if there were alternative structures to improve the cognitively demanding task of comprehending across many messages to arrive at higher thinking, synthesis and challenge. Readers have to manage their limited working memory capacity to process the many messages, to filter the unimportant and distracting detail often in the headers of messages, scan and obtain coherence. Reading online in this way may require different cognitive processes, or maybe the structuring of messages can better represent the already learned linear processes for obtaining meaning from text. Is the process of linearity in traditional text a constraint in adapting to the need to interact with information in a nonlinear way? Is one approach more suitable for particular learning approaches than others, or more suitable to young versus mature students?

Literature review

The need for a system development of messages in discussion forums is essential. Ways to promote interaction between readers and text should prevail in any online facilitation of learning. The quality of display, number, shape, location of windows, window width, navigation tools, colour, length etc., can vary and ultimately affect flow and coherence of reading and comprehension. Effectiveness and quality must be of educational relevance: Usability and learnability are two sides of the same coin. Studies in hypertext structures (Britt, Rouet & Perfetti, cited in Rouet, Levonen, Dillon & Spiro, 1996) identified a reader's need for coherence and top-level representations. As messages and discussion postings presented in LMS have similarities in their hierarchical presentation and user controllability to hypertext, it is believed readers of messages also desire features which promote coherence. Exactly what processing skills are needed, and if they can be taught, have not been determined through research.

The increasing emphasis and importance placed on information and communication in the future, extrapolates into a need for a similar emphasis of the same in Higher education degrees and programs. Based on the assumption that the cognitive approaches to reading hard copy text also apply when reading online, the 'shoutboard' was developed to address the limitations of linear approaches online and utilise the best of nonlinear approaches. Reference to the reading process it (Tzeng, van den Broek, Kendeou & Lee, 2005) indicates we may not be enhancing learning, but limiting it. When reading is done in the hard copy world, people have the freedom to read how they want to and not be controlled by an external system. For instance, the reader can go anywhere to anywhere; from the first to the last page, and back and forth among paragraphs while all the while building a coherent representation of the information. Effective and efficient readers exploit this freedom. In comparison, readers of messages and discussions in online environments have to open/close each topic thread and have no visual representation of where the information contained in various messages is taking them. There appears a loss of freedom, something which will be examined in the method within the 'shoutboard'. What may appear as contradictory to the

above is that in the latter, readers have to make decisions about what it is they want to read. Do they want to follow the points made by one particular person/s and reject those made by others? Do they want to open every message or only a sample? As individuals they choose how to build meaning but this may not necessarily equate with establishing coherence, which in itself is a cognitive load. To obtain meaning the reader needs to have a mental representation or structure of how the discussions may unfold – to know the structure seems more efficient than opening messages unaware of the content. This is in difference to passively following through a text and awaiting the ‘important’ part to emerge, and indeed in contrast to the purpose of the approach developed in this paper in which careful critical reading is required prior to making an informed and worthwhile response to the discussion.

Research into how hypertext influences learning and understanding has been conducted (Rouet, Levonen, Dillon & Spiro, 1996; Wenger & Payne, 1996). A study by Rouet et al. (1996) found readers benefit from moderate degrees of nonlinearity. For example, the need for such features as accessing definitions while reading. In contrast Dee-Lucas (1996) affirmed comprehension is a continuous process and warned interruptions could be harmful. In addition, hypertext readers experience disorientation and navigation problems. Foltz (1989) found users employed looping and flipping strategies to demonstrate this orientation. But even then, little reading was accomplished.

The conceptualization of the ‘shoutboard’ was informed by the research on hypertext and the reading process, which suggests that the provision of structural cues to the reader and the improvement of coherence of information help to reduce the heavy cognitive load (Wenger & Payne, 1996). Headings, connectives and other text organizers which facilitate comprehension (Rouet et al., 1996) were designed into the ‘shoutboard’ together with other flexible features as discussed later. The type of task and the motivation by students to engage in the discussion was noted in addition to cues. Attaining meaning is a difficult task in itself (Rouet et al., 1996) but readers are motivated to seek coherence when the text is complex. When many diverse learners contribute to a discussion board online such as in LMS, the level of coherence is likely to be low. Individuals need to read all postings to obtain knowledge of the discussion, to learn from it, and in turn contribute to further discussion. Readers have to know where they are in the discussion, where to go next, which message to review before moving on and to overall build a cognitive representation of the discussion. This is not to say all readers in discussions consciously develop a procedure such as this. Many do not. Strategic exploration of messages is one aspect of online discussions and learning by processing and finding meaning across all discussion postings is another. Learning cannot be assumed or taken for granted when a linear threaded design is used.

In addition to the features of cues and coherence, is the actual act of reading online. Reading from a screen has been found to be slower (Gould as cited in Rouet et al., 1996), less accurate (Wilkinson & Robinshaw, 1987 cited in Rouet et al., 1996) and more fatiguing (Cushman, 1986 cited in Rouet et al., 1996). Whereby these findings are somewhat outdated given the developments in software and hypertext they contain a message relevant to reading postings in discussion forums today. We believe it is better to err on the side that postings may impair processing of information than to ignore them and therefore address shortcomings in any new design. As noted by Dillon, “such issues are important because our theories of information use and human cognition are themselves shapers of future technologies” (Rouet, Levonen, Dillon & Spiro, 1996, p.27). Technological capabilities must be married with human abilities if we are to enhance learning.

When reading a linear text, processing occurs at many levels from low level of word recognition to high level of obtaining meaning. And, although a representation of the meaning can be attained differently by readers, it is the relatedness in which the information is presented that assists meaning making. A reader seeks a macrostructure, also provided by the task and headings. Readers have to make many inferences when reading text and may need to make many more when reading from different authors. When information is fragmented the reader is forced to make more inferences and hold information in memory, creating a heavy cognitive load and possible misinterpretation or reduced comprehension of the text. These issues have been considered in the ‘shoutboard’. The sociability of messaging was considered in the design of ‘shoutboard’ from the position of motivation. The age of the students indicated friendships would be important as late adolescence is a time to be ‘intimate’ with friends. In contrast to this position, anonymity may be considered as a positive feature to enable honest contributions to be made without fear of being recognised.

The trialing of the ‘shoutboard’ was about testing the assumptions derived from theory in order to improve the outcomes from discussion online. The discussions above concluded that the available systems of discussion are not ‘real’ enough or matched closely enough to human cognitive processing and the e-learning must take priority over e-management of students. Dillon states ‘...learning as a goal...needs to be addressed at a task level where, indeed, aspects of information location, summarization of ideas, memory, and so forth, may be identified. Such tasks can be analyzed and subsequently supported technologically’ (p.33). It is from this position that education can proceed to truly enhance learning.

The ‘shoutboard’

It was affectionately called the ‘shoutboard’ to encapsulate the importance and value of each person’s message – one was encouraged to shout for all to ‘hear’, but the name was never replaced. It valued contributions of thought and de-emphasised personality and bias. Figure 1 provides a screen capture of the ‘shoutboard’.

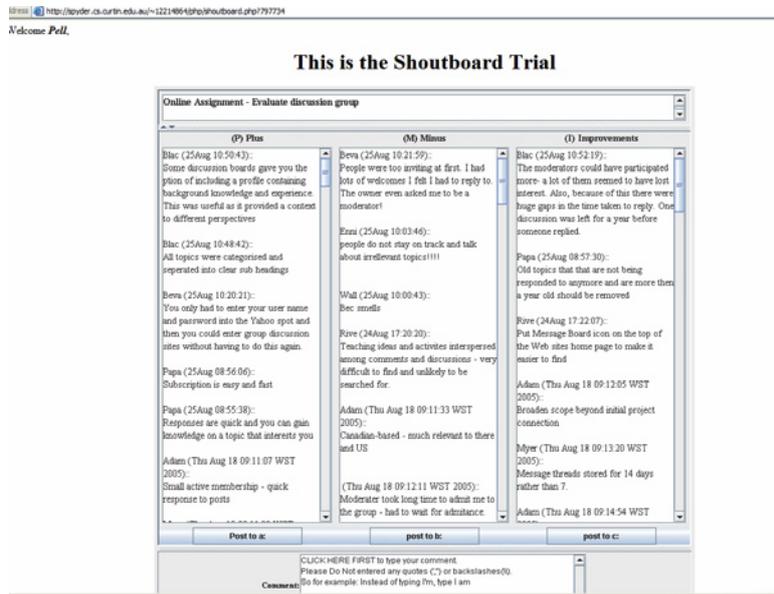


Figure 1: Screen capture ‘shoutboard’

The ‘shoutboard’ is conceptualised as a multiple column with independent scrolling space into which to post discussions. Each column is cued with a heading, minimising cognitive load, and readers can scan vertically and horizontally in accordance with their own approach to processing information. Coherence is obtained when readers post their message into any or several columns and readily access other discussion points at a glance or scroll movement. A reader can selectively browse sections/columns to build up a representation of the meaning and then jump to the next column. Column headings assist in developing coherence and the building of a representation of the discussion or debate. In addition, the function of scanning backwards and forwards or from column to column assists in reducing cognitive load.

One could surmise this simple navigational feature minimises cognitive load. As a learner’s point of view or knowledge (recorded in a response of the author’s choice) is challenged or supported by examples from the responses by others, the learner can use the views in each column to consolidate and learn. A reader chooses the path through the text postings and the time spent on each posting to establish user controllability.

The use of scrolling columns means that tasks can now be set that require higher cognitive processing, critical thought and deep learning. Tasks that ask for similarities, differences, advantages, and disadvantages can be given to students, thus advancing higher synthesis of information while at the same time maintaining coherence. Higher levels of thinking are possible if the cognitive load is decreased.

Despite its theoretical conceptualization it is the user which determines its functionality and assistance to enhance learning. The following section presents the initial findings of the 'shoutboard' trial.

Methodology: 'shoutboard' trial

The development of the 'shoutboard' software was the result of a special project that aimed to develop a tool to enhance debate, authentic, critical and reflective tasks within WebCT which better utilize cognitive learning and comprehension theory, in the reading and processing of written material using an open, but asynchronous collaborative structure. The project involved a number of personnel from the following sections of the University: WebCT team; Computer Science and IT project students and Department of Education staff. The project was broken into three phases: Development; Pilot implementation; and Implementation and evaluation. This paper reports on the final phase, the implementation and evaluation of the 'shoutboard' tool.

The 'shoutboard' was trialed in semester 2, 2005 with Education students (N=30) at Curtin University of Technology. Ultimately, this research project adopted a case study approach where the case was a cohort of students enrolled in an Educational Technology unit that meet once a week for a 2 hour workshop in a computer laboratory. The students were introduced to the 'shoutboard' tool at the beginning of the unit where they were informed of the trial and instructed in its use.

These students were in their second year of the course and were already very familiar with WebCT, so it seemed appropriate to provide a function housed within WebCT to enable debates and other structured tasks, which require reflective and considered asynchronous contributions to occur. The idea was based on class discussion/debates where a whiteboard is used by students to record their points of view, but facilitated by the lecturer. The role of the lecturer was to structure the task, set the format and mediate the contributions.

The role of the student was to enter a piece of information into a space at the time they decide to open and access WebCT. Further, the element of scanning all entries above or beside their own, to enable a synthesis of views was essential. This newly arrived synthesis may trigger other views. The reader used their prior knowledge and understanding to move between the information presented by the messages. In much the same way face-to-face discussions function, students examine the list, reflect, and offer their contribution. The major intention of the 'shoutboard' is critical appraisal. Instead of several students thinking the same thing and posting these, unaware that each has the same idea, as may happen in linear messaging, each student has to critically review those posted and come up with something new, or something not yet addressed. It was hoped that critical thought and problem solving skills would be further developed through such an online collaborative process and directed through the following three assessment tasks.

1. Online discussion groups

Find and subscribe to one useful educational online discussion group. You are required to provide evidence of participation in the discussion group and a written evaluation. As part of your report you need to provide clear details about: The name of the group

- A written evaluation – you are required to evaluate the discussion group. Complete a PMI – Positive, Minus and offer comments about how you could improve the quality of the discussion. To do this go to the 'shoutboard' icon on WebCT, and add your comments to the respective labeled columns. You will notice these will grow in size. Post early to be assured of original comments. Be aware that if you post last other members will have come up with most of the ideas. Read through all of the comments and from these develop your written evaluations of discussion groups in general or your own discussion group.

2. Technology investigation

For this assignment you must investigate a school's technology situation using the Framework for Learning Technologies given in class. Your task will be to document your specific school's current status and progress according to this document. Once you have visited your school, use the 'shoutboard' (three columns) to include comments regarding: Planning; Integration & Use; and Staff Capabilities. You will have only a one week timeframe to add your comments. In light of the comments made in the 'shoutboard' conclude your report with a summary of your findings and recommendations for your particular school. Use the 'shoutboard' to help you make final

conclusions. In essence, the 'shoutboard' comments should help you to compare schools. Remember, the 'shoutboard' is used as a databank – a resource. Your comments need to be brief and informative of your specific school.

3. WebQuest

Your task is to design an integrated program of work which is solely introduced to the students through the structure of a WebQuest (inquiry based instructional tool). It is vital that you use the following structure for your WebQuest: Introduction (The Question*, Background Information, Resources); Task/Individual Roles; Process (Group Process); Resources; and Conclusion.

*The design of your Question for your WebQuest is one of the most crucial elements of your WebQuest. Once your group has devised your question use the 'shoutboard' to obtain feedback from your colleagues. Your group must:

- Post your question in one column
- In the second column, identify how this is a suitable question for a WebQuest.
- Each group must respond to two questions by adding their comments in the third column. The aim is to provide valuable feedback on the potential of the actual question for a WebQuest. A question is deemed to be completed when two responses have been made to that question. The 'shoutboard' will be closed by a given date.

All Education students in the unit were required to participate in each of the tasks. A separate 'shoutboard' was specifically created for each task. At the end of the semester the students were asked to complete a 'shoutboard' Evaluation. The findings were analysed using a coded content analysis and frequency counts which provided valuable information regarding the future use of the 'shoutboard'. The following section presents the results of this survey.

Results and discussion

The survey attempted to focus on three key areas of the 'shoutboard' tool: cognitive processing; sociability; and functionality. The data for the questions pertaining to cognitive processing from the survey are presented in Table 1 as a percentage (N=30). Interestingly, the majority of the students (50%) identified that they 'sometimes' could easily scan for information to assist in their understanding, while 36.6% were able to 'frequently/always'. Question 4 also attempted to identify whether students were able to cognitively process information without distractions or interference but according to these results 26.6% (never/rarely) of the students indicated that this was not the case. A further 53.3% noted that 'sometimes' searching for understanding seemed to flow without distractions or interference, while 20% noted this occurred 'frequently'. Perhaps this also raises the extent of student's awareness of the reading process and what they understood as interference.

Table 1: 'shoutboard' evaluation survey: cognitive processing (N=30)

Cognitive processing		Never	Rarely	Sometimes	Frequently	Always
1	I was able to easily scan up and down and across and back searching for information to assist in my understanding.	0	13.3	50	23.3	13.3
2	I did not feel as though I was forced to follow a predetermined sequence of messages.	13.3	13.3	40	20	13.3
3	I controlled what information I would cognitively engage with.	0	3.3	33.3	53.3	10
4	Searching for understanding seemed to flow and be without distractions or interference.	3.3	23.3	53.3	20	0
5	I was able to read comments in one column and at any time move to another column.	0	0	20	46.7	33.3

As identified earlier, the issue of reader control or freedom can be restricted by management systems when reading online, thus affecting cognitive load. Questions 2, 3 and 5 attempted to determine whether the reader still maintained ultimate control while reading messages in the 'shoutboard' environment. The majority of students (40%) identified that they did not feel as though they were forced to follow a predetermined sequence of messages, while 33.3% felt that they could do so 'frequently/always'. The data for question 3 clearly identifies that the majority (63.3%) of the students controlled the information they would cognitively engage with 'frequently/always'. The issue of reader control was further

supported when 80% of the students indicated that they ‘frequently/always’ read comments from one column and at any time moved to another column possibly indicating the search and need for coherence.

The students were also given the opportunity to provide additional comments where they were asked to identify a particular feature/characteristic of messages and the power of this feature/characteristic on learning specifically in relation to the WebCT and the ‘shoutboard’ environment. The following comments identified in Table 2 were categorized in relation to cognitive processing.

Table 2: ‘shoutboard’ evaluation open-ended responses: cognitive processing

Feature	WebCT threaded/linear message	‘shoutboard’ and multi processing messages
Ability to locate information	Easier to follow someone’s argument	Can see a range of positive and negative and interesting arguments at once
	Messages follow from previous message	Hard to follow
	Clearly threaded	Cannot see which messages reply to another message
	Linking to other ideas is easy	No linking
	Related messages, opinions etc are easily identified	The nature of the ‘shoutboard’ means that if someone goes in another direction, the topic can still remain on the original focus
Layout	You have to scan through messages to find a topic	It is right in front of you, it is all a matter of scrolling
	Categorised according to student	Categorised in subject headings – clearer, quicker to sort
	Harder to follow messages	Easy to focus on a subject
	Hard to find a topic	Easy to find a topic
	Easier	Cognitively overwhelming at first
	Separate topics	Altogether, messy
	Good for keeping up to date	Not so good – sometimes confusing

Overall 12 students made comments regarding the cognitive processing of messages presented within WebCT and the ‘shoutboard’. There appeared to be mixed views regarding the ease of following and comprehending messages in the ‘shoutboard’ environment. Some students appreciated the specific topic/subject/concept focus of the ‘shoutboard’ while others found it difficult to link ideas when there was no visual representation of which message replied to a particular message. However it was not apparent whether students were comparing the ability of both systems to track an individual’s responses throughout the discussion or follow the main tenet of thought or argument. This same issue also impacted on the functionality of the ‘shoutboard’, addressed later in this paper.

As the ‘shoutboard’ was designed to replicate the essential features of face-to-face discussion or debate it was seen as important to track the sociability and interactivity of the ‘shoutboard’. Table 3 presents the data from the ‘shoutboard’ Evaluation Survey with relation to the items that gauge sociability in the ‘shoutboard’. Once again, 30 students were surveyed and the results are presented as a percentage.

Table 3: ‘shoutboard’ evaluation survey: sociability in the ‘shoutboard’

Sociability in the ‘shoutboard’		Never	Rarely	Sometimes	Frequently	Always
6	The ‘shoutboard’ enabled me to interact well with others.	6.7	36.7	40	13.3	3.3
7	I learn from reading the comments and opinions of others.	0	10	23.3	43.3	23.3
8	Reading the comments by others made me review my own opinions and understandings.	3.3	3.3	30	46.7	16.7
9	The ‘shoutboard’ enabled me to better accept critical responses which I learned were not about me personally.	6.7	16.7	36.7	30	10
10	The interaction was enjoyable.	3.3	33.3	36.7	20	6.7
11	When others challenge my ideas I believe I learn more.	3.3	0	20	60	16.7
12	Writing messages in ‘shoutboard’ was an easily learned approach to focus my thoughts.	6.7	13.3	26.7	36.7	16.7
13	I valued the support of peers even when they disagreed with my idea, understanding or opinion.	3.3	0	26.7	63.3	6.7

The data for questions 7, 8, 11, and 13 clearly indicate that students value and learn from the type of interaction afforded to online forums. For instance (question 7), 66.6% identified that they ‘frequently/always’ learn from reading comments and opinions of others, and (question 11) 66.7% noted that they

‘frequently/always’ learn more when others challenge their ideas. More importantly, question 8 reveals that 73.4% ‘frequently/always’ believe that reading the comments by others made them review their own opinions and understandings. This was one of the key aims of promoting the use of the ‘shoutboard’ with higher education students.

One would almost assume that interacting with a new environment without any technical glitches would be enjoyable. Question 10 revealed that 26.7% of the students ‘frequently/always’ enjoyed the interaction, while 36.7% enjoyed the interaction ‘sometimes’. Interestingly, 36.6% of the students ‘never/rarely’ enjoyed the interaction. Several reasons are postulated for this result. It was not determined how many do not enjoy learning at university irrespective of the form or mode of learning; how many do not enjoy using computers, or how many were late adolescents and mature students. It is possible late adolescence may desire discussions with their friends. We believe that the lack of enjoyment could also have been influenced by the nature of the tasks. The students were asked to interact with particular ideas/concepts not specifically to and with individuals. In previous units these students have been exposed to the WebCT environment where their experience with discussion boards would mainly have seen them reply to their friends’ messages – the interaction was much more social and usually always involved someone they actually knew. Perhaps this group of students could not personally engage with this process because they could not identify the individuals who actually posted the comments. The sequencing of and timing of postings may also have contributed. Unlike WebCT, if you posted an idea/concept in one of the columns of the ‘shoutboard’ the message would be seen at the end of all of the previous messages in that column and each message was identifiable by a brief codename that was only obvious to the lecturer. In addition students never knew if any new messages had been added since their last reading of the discussions.

Similarly, question 6 revealed that 43.4% of the students identified that ‘never/rarely’ did the ‘shoutboard’ enable them to interact well with others. Forty percent of the students noted that ‘sometimes’ the ‘shoutboard’ enabled them to interact well with others, while 16.6% rated ‘frequently/always’. Perhaps this is the expected trend as the idea was not to have a social chat but to think and process ideas at a critical level.

Table 4 presents the open-ended data identified in the survey relating specifically to the sociability element of the ‘shoutboard’. Students identified a feature and then addressed how each feature within the WebCT and the ‘shoutboard’ environment affected their learning. The number denotes the amount of times this comment was made.

Table 4: ‘shoutboard’ evaluation open-ended responses: sociability

Feature	WebCT threaded/linear message	‘shoutboard’ and multi processing messages
Interaction with others	Easy to interact with others (3)	Cannot interact directly with others i.e. Reply to a message (3)
Identification of a person	Very good and clear	Hard to find all posts by a particular person
Participation	People contribute to certain sections only	People contributed to each section. This gave me great feedback on my own perspectives.

Once again, many of the comments made by these five students support earlier data from Table 3, that students interact more with the content if and when they can actually directly respond to a particular message and when they know the identity of the person who made the comment. However they clearly identify the different purposes for each system: WebCT is more socially oriented and ‘shoutboard’ requires more processing if they wish to track personalities.

It was interesting to note the final comment made by one of the students in Table 4 – the student identifies that WebCT users contribute only to certain sections of the discussion/bulletin board, while in the ‘shoutboard’ students contributed to each section which provided this student with great feedback on their own perspective. Surely, this is what we are trying to achieve! One of the key questions for further investigation is which elements of the ‘shoutboard’ encouraged this, or was it directly related to the specific tasks set for the students? Student attitude and learning preference may also be reflected in the learning challenges presented by ‘shoutboard’. The final element examined in the ‘shoutboard’ Evaluation Survey was the functionality of the ‘shoutboard’. There has been a great deal of research (Bates, 2000; Deden, 1998) on the importance of technology usability and functionality and how this

affects the uptake of the technology. Table 5 presents the data relating to the functionality of the 'shoutboard' obtained from the 'shoutboard' evaluation survey.

Table 5: 'shoutboard' evaluation survey: functionality

	Functionality	Never	Rarely	Sometimes	Frequently	Always
14	The multiple processing and non-linear approach was easy to use.	10	20	33.3	30	6.7
15	The freedom and flexibility of the 'shoutboard' made it easy to use.	6.7	20	36.7	26.7	10
16	Reading in the 'shoutboard' was more akin to reading information in a book than reading lists of messages.	16.7	30	20	26.7	6.7

The majority of the students (36.7%) identified that 'frequently/always' the multiprocessing and nonlinear approach was easy to use, while 33.3% found this to be 'sometimes'. A total of 30% of the students clearly had difficulty with the multiple processing and non linear approach. A similar pattern of response from the students was also obtained for question 15, where 36.7% identified that the freedom and flexibility of the 'shoutboard' made it 'frequently/always' easy to use. The final question of the survey asked the students to identify whether reading in the 'shoutboard' was similar to reading in a book rather than reading a list of messages – 36.7% identified that this was 'never/rarely' the case, while 33.4% found this to be 'frequently/ always'. The results support the purposes behind the development of the 'shoutboard'. However the responses for question 16 may be more to do with ambiguity and lack of clarity in the question than the outcome. Of course reading and manipulating multiple scrolling columns was not how one reads a book. The flexibility and reader controllability may be akin to reading a book, but the question did not seek this explicit understanding.

Table 6: 'shoutboard' evaluation open-ended responses: functionality

Feature	WebCT threaded/linear message	'shoutboard' and multi processing
Character Limit	Able to express ideas fully and to your best ability	Character limit constraints
Readability	Was easy to read and didn't get confused (5)	Was tricky to read eg. Font and italics (5)
Usability	Looks more professional and is slightly more intuitive in nature(2)	Format is not at all intuitive (2)
	Takes more time to post messages	Easier to post messages
Visual display	WebCT is more engaging (2)	Looks boring (2)
Inclusion of Time/date and student name	Breaks up each member entry and identifies entries	This feature was distracting
	Clearly see how many people have responded and clear separation of messages from different people – also includes dates/times	All text quickly follow on from one another, can't really see separation, who wrote it. Not much clear space
Access	Very easy to access from home, can see new messages posted (3)	Only able to access at Curtin, many screens to pass through (3)
Response time	A bit cumbersome but its not a problem	Good for immediate responses in discussions
Function	serves its purpose – keeps communication open	not the most functional
Flexibility	Operates well – maybe organised into class times	Could only use for a limited time

The open ended responses for functionality identified some valuable comments with which to improve the 'shoutboard': Fonts, access, identification of new postings, and being informed of new postings.

Conclusion

The most outstanding finding from this trial of the 'shoutboard' was that students were challenged in their critical and deeper thinking and they believed they were learning as a result. The students also thought that the 'shoutboard' tool was relatively easy to use but their main concern was that it performs the same functions as the WebCT discussion/bulletin board environment. It appeared they did not discriminate in the purpose of each system in the contribution to learning outcomes. The results challenge the idea of mental sets and their use in new and novel settings. Students tried to use the new technology 'the 'shoutboard' ' in the same manner as the technology they were already familiar with (WebCT). Thus, it is important for Academics and those involved in designing or using new technologies that require students

to participate in online forums, to appreciate that students expect the same functionality as other Learning Management Systems and to moderate students through the procedures and outcomes of any new system. The students appear to want only one 'size fits all'. This in itself tells us a great deal about our students in today's climate. The new 'shoutboard' would have to encompass all of these functions, which is not entirely impossible as the improvements they noted can be added to 'shoutboard'. We are now questioning the sequence. Would students have felt differently if they had been exposed to the 'shoutboard' prior to WebCT? This was clearly articulated by one of the education students in her survey: "I prefer to use WebCT because you can easily link comments and it is much easier to read. It was something we are more used to and easier to access".

The survey data revealed that students value interacting with their peers in online forums and were able to identify how these interactions in the 'shoutboard' aided their own learning. As identified earlier, interactivity is the most striking characteristics in computer mediated communication and the one that has the greatest potential to impact learning according to Harasim (1989) (cited in Mara). If this is the case, then one could understand why the Education students found it quite frustrating not being able to directly reply to a particular argument/opinion/discussion. However there may be differences between engagement and interactivity which need further investigation when students participate in an online discussion tool.

The results identify some ambiguity as to whether coherence is achieved and whether it contributes to deeper learning. The cognitive load may be less, that is the process of building information mentally has decreased, but has this increased the planning and strategies the reader has to do before reaching understanding and arriving at this deeper level. Further research involving other disciplines and assessments may identify what factors promote effectiveness of the 'shoutboard' and for what kind of student and cognitive styles (adolescents, mature age, independent, dependent, creative, impulsive). The degree of moderate nonlinearity also needs further investigation. Is there a middle line between nonlinearity and linearity which is more effective?

The data revealed that the Education students engaged with the content within the 'shoutboard' environment at various levels. The 'shoutboard' attempted to present an alternative structure to improve the cognitively demanding task of comprehending across many messages, and the data revealed that most students found this structure valuable as it helped them to focus on specific concepts. Perhaps the limited number of columns (two or three) helped the students' focus on specific concepts in comparison to a typical discussion board that could cover many concepts at one time. On the other hand, some students could not cope with so many messages at once and were overwhelmed by the sheer volume.

The data from the survey was unable to clearly identify whether the actual design of the 'shoutboard' helped to reduce the cognitive load often associated with reading online and especially given multiple sources. However, one thing is clear: we need to expose our students to a variety of online linear and non-linear texts in many different forms and provide them with strategies to work effectively in these environments such as promoting the use of some form of visual representation – mind/concept maps, matrix, grids etc. Whatever the process, technology capabilities must be married with human abilities. Further research questions have emerged: Is there a basic set of strategies / processes for reading online discussions and messages? Can a schema of macro-organisation of traditionally presented hard text be applied to obtain maximum efficiency in online-text? Can systems and learner focused approaches be better unified?

In summary, the 'shoutboard' was seen to be a valuable resource bank that enabled the students to add and store ideas, opinions and knowledge, which in turn because of the nature of the tasks given to the students forced them to synthesis these ideas to consolidate and formulate their own learning.

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