

Students' critical thinking level: examining Wimba Voice Board and text online discussions

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Abstract In this study, we examined the use of Wimba Voice Board and a text-based online discussion in supporting students' critical thinking. Specifically, we addressed the following question, "Is there any significant difference in the level of students' critical thinking in asynchronous audio compared to text discussions?" Two undergraduate classes participated in the study. Class A ($n = 23$) was randomly assigned to use the Wimba Voice available at Blackboard, while Class B ($n = 18$) used a text discussion forum, also at Blackboard. Both classes were asked to discuss on a similar open-ended topic with the same duration of time. We investigated if there was any significant difference in the levels of critical thinking between these two classes using Greenlaw and Deloach's (2003) taxonomy of critical thinking. Results of a Pearson χ^2 test statistics suggested a significant relationship between the levels of critical thinking and the type of asynchronous online discussion. Students produced more than expected higher critical thinking levels during asynchronous audio discussion. On the other hand, students exhibited more than expected lower critical thinking in asynchronous text discussion.

Keywords Critical thinking · Asynchronous online discussion · Audio discussion · Text discussion

Introduction

In recent years, the use of online learning is increasingly being utilized by many educators around the world. Allen and Seaman (2013), for example, reported that

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there were over 6.1 million students who took at least one online course during the fall 2011 term; this was an increase of 560,000 students over the previous year. In addition, as many as 65 % of higher education institutes now say that online learning is a critical part of their long-term strategy (Allen and Seaman 2013).

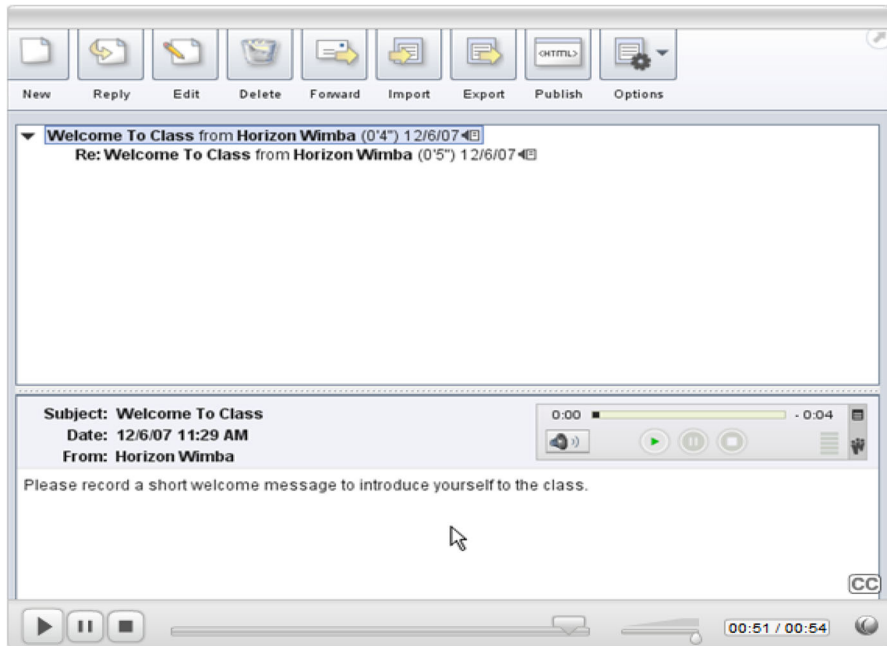
Although the trend toward online learning is expected to increase, it is important to note that successful online learning does not occur automatically just because an online component is added to it (Cheung and Hew 2011). Opportunities for students to interact with one another, and with the instructor have been identified as one of the important factors that could maximize success in an online learning environment (Dziuban et al. 2004). Indeed several scholars have identified online discussion as being one of the activities that students found most beneficial to their learning because it enables students to ask questions, exchange opinions, share multiple perspectives, and clarify doubts (Dunlap 2005; Ertmer et al. 2007; Richardson and Swan 2003).

One of the most common means for students to discuss with one another online is through text-input asynchronous discussion forums which allow students to communicate at their own pace (Kalelioglu and Gulbahar 2014; Lee 2013; Loncar et al. 2014; Thomas 2013). This, however, may not work well for some participants. For example, participants may find it difficult to explain complex concepts in words, while others complain of being misunderstood due to the absence of verbal cues (Hew and Hara 2007). Still others find it very burdensome to read and respond because they have weak reading or writing abilities (Bowe 2002). The recent emergence of technological tools (e.g., Wimba Voice Board, Voice Thread) that support voice input has provided a possible alternative for students to participate in a discussion. So far there has been little research into the use of asynchronous audio discussion in learning and teaching.

While the use of audio in online learning is not new, many of the audio technologies used such as radio, audiocassettes, compact disks, and more recently podcasts suffer from a lack of interactivity among students or between students and the instructor (Junor 1992), because these technologies are commonly used to transmit information one-way to students. The use of asynchronous audio discussion, on the other hand, provides a means for multiple-way interactions such as students communicating with other students, or with the instructor.

In this study, we examined the use of a Wimba Voice Board to support asynchronous online audio discussion as it was available in Blackboard, a course management system that our university adopted. The Wimba Voice Board (Fig. 1) allows participants to speak into a microphone and record it as an audio clip on a computer.

The audio clips (i.e., online messages) are then archived and the message structure is easily visible with threaded message trees. Participants also have the option of typing a short description to be appended to the audio clip. Participants can easily click on any audio clips, hear the online message, and orally reply to the message. Discussion posts can also be exported and downloaded in various audio formats such as MP3, and WAV should the participants desire to keep a permanent record of the asynchronous audio discussions.



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Fig. 1 Screen shot of a Wimba Voice Board (<http://www.wimba.com/assets/videos/VoiceBoard/VoiceBoard.html>)

The rest of the article is organized as follows. First, in the literature review section, we briefly describe and summarize some of the past available research on asynchronous audio discussion. We then describe the methodology of the study, followed by the findings, discussion, and conclusion of the study.

Literature review

Asynchronous online discussion has become a common means of facilitating interactions among students beyond their physical classrooms. However, most previous studies have largely examined asynchronous text discussions. Research on asynchronous audio discussions is relatively scarce.

Scholars such as Akasha (2011), Brunvand and Byrd (2011), and Mandernach and Taylor (2011), among others have suggested that using asynchronous audio discussion can increase student engagement and motivation during the learning process. Such claims and suggestions, however, have often been made not based on empirical findings. The actual number of empirical studies on asynchronous audio discussion is still relatively small, compared to studies on asynchronous text

Table 1 Summary of previous empirical studies on asynchronous audio discussion

Author	Purpose	Design	Context	Data sources
Chang (2010)	Determine students' acceptability of asynchronous online discussions on mobile devices	Case study	32 information management students	Questionnaire, interview
Cho and Carey (2001)	Explore the use of Wimba Voice Board on Korean oral fluency	Case study	7 students in a Korean language beginner's course	Not mentioned
Gleason and Suvorov (2011)	Examine students' perception of using asynchronous voice discussion for developing their second language oral proficiency	Case study	10 non-native English students	Questionnaire, interview
Hew and Cheung (2013)	Examine students' perception of using asynchronous voice versus text	2 case studies	Study I—41 graduate students majoring in instructional technology, Study II—42 undergraduates majoring in education	Student reflection
Marriott and Hiscock (2002)	Determine the viability of using asynchronous voice discussion to stimulate discussion and student understanding of weekly readings	Case study	154 in year 2001, 124 in year 2002 communication course students	Server log, questionnaire
McCormack (2010)	Explore students' use of Voice Thread for reviewing and reflection on shared learning experiences	Case study	25 student teachers	Interview
McIntosh et al. (2003)	Explore students' experience of using Wimba Voice Board	Case study	41 international students learning English	Questionnaire, observation, server log
Nowakowski and Frazier (2009)	Explore the use of Wimba for teaching basic Spanish vocabulary	Case study	41 students enrolled in Spanish for eye care course	Questionnaire, server log
Poza (2011)	Investigate the influence of asynchronous voice discussion on second language learners' speaking anxiety	Case study	35 students majoring in Spanish	Questionnaire, interview
Yaneske and Oates (2010)	Evaluate the use of a Wimba Voice Board to support asynchronous audio discussion	Case study	11 graduate students in a MA course entitled "Language Learning and Teaching with ICT"	Questionnaire, interview

discussion. Table 1 summarizes some of the available empirical-based papers that used asynchronous audio online discussions. The dearth of data on asynchronous audio discussion speaks to the need for research in the area.

Overall, a review of the literature suggested that asynchronous audio discussion has the following advantages: (a) it provides a more natural and hence easier way to present ideas and respond to others (Marriott and Hiscock 2002), (b) it provides participants with a richer means of communication (e.g., verbal cues and emotional context) which helps enhance the meaning of a message posted (Marriott and Hiscock 2002; Yaneske and Oates 2010), (c) it helps participants (especially language learners) to practise speaking, listening, and do self-diagnosis of pronunciation errors (Gleason and Suvorov 2011; McIntosh et al. 2003; Yaneske and Oates 2010), (d) it can help increase social presence because the ability to hear other people's voices helped foster a more personal connection to them (Yaneske and Oates 2010), and (e) it is relatively easy and user-friendly to use without the need for additional software or complex installation (Gleason and Suvorov 2011; McCormack 2010; McIntosh et al. 2003).

Some of the challenges of using asynchronous audio discussion, on the other hand, include the following: (a) it is difficult to correct errors because participants were unable to edit the recordings once they were posted (Gleason and Suvorov 2011; Marriott and Hiscock 2002), (b) some participants were embarrassed to record their voices and let others hear how they sounded (Marriott and Hiscock 2002; McIntosh et al. 2003; Yaneske and Oates 2010), and (c) an inability to skim audio quickly forces participants to replay the message repeatedly should they want to hear something again or could not hear it properly (Yaneske and Oates 2010).

There are two major limitations concerning the existing research on asynchronous audio discussion. First, all the studies were primarily limited to an examination of students' affective outcome such as their feelings or attitudes toward using asynchronous audio discussion. There is a need to investigate whether the use of asynchronous audio discussion could affect other students' outcome such as their level of critical thinking. Second, a majority of previous studies focused on disciplines such as language learning (e.g., learning Spanish or English), or communications studies (e.g., Cho and Carey 2001; Gleason and Suvorov 2011; Marriott and Hiscock 2002; McIntosh et al. 2003; Poza 2011; Yaneske and Oates 2010). The examination of asynchronous audio discussion in these studies was mainly limited to how it could improve students' oral and listening skills, and whether it was easy and user-friendly to use (e.g., Cho and Carey 2001; Gleason and Suvorov 2011; McIntosh et al. 2003).

Research questions

The current study attempts to overcome the aforementioned limitations. This study is situated in a teacher education context and attempts to measure students' critical thinking level in relation to asynchronous audio discussion usage. More specifically, the following research question was explored in this study:

Is there any significant difference in the level of students' critical thinking in asynchronous audio compared to text discussions? More detail explanations of critical thinking levels are provided in the "Method" Section.

Method

Participants

Forty-one students participated in this study. These 41 students came from two classes, class A and class B, henceforth referred to as Group A and Group B, respectively. Group A consisted of 23 students, 8 male and 15 female. Group B consisted of 18 students, 5 male and 13 female. These students were pursuing an undergraduate degree in education. Both groups were taught by the same instructor for semester. In both groups, students used the same course materials, and did the same asynchronous discussion activities.

Procedure and data analysis

One of the groups (Group A) was randomly assigned to use the Wimba Voice Board while Group B used a text discussion forum. Both the Voice Board and the text discussion forum were available in BlackBoard. Specifically, students from both groups were asked to discuss on the topic, “Organ Trading,” i.e., “Recently, there was a spate of discussion about organ trading in Singapore. Do you think it’s okay for people to buy or sell organs? Justify your viewpoints.” No teacher’s intervention or facilitation was present. The students were given the liberty to create their own threads or to respond to other students’ threads.

“Organ Trading” topic was selected due to its nature as a controversy topic which enables different individuals to hold different views. In other words, this topic was an open-ended topic with more than one possible perspective, and no obvious right or wrong answers. Using open-ended topics or questions has been found to encourage student contribution and stimulate students’ interactions (Dythe 2002; Hew and Cheung 2012, 2013; Poscente and Fahy 2003). This topic was much debated upon after a Singapore Tycoon Tang Wee Sung was reported paying a broker \$220,000 to secure a healthy kidney from an Indonesian man. Various views emerged to support or against the act. For example, several people suggested legalizing the payment of kidney donors in the local newspaper. On the other hand, several prominent doctors were against this idea of legalizing payment and the Singapore Medical Association has also come out against such payment. There is hence, a good ground for active discussion for the students on this topic.

To answer the research question, “Is there any significant difference in the level of students’ critical thinking in asynchronous voice versus text discussions?”, we first coded all the students online posts using Greenlaw and Deloach’s (2003) taxonomy of critical thinking. We used Greenlaw and Deloach (2003) Taxonomy of Critical Thinking (Table 1) to evaluate the level of critical thinking of the participants in both the Wimba Voice Board and text discussion forum. This taxonomy provides a greater analysis of the different levels of critical thinking, unlike that of other scholars such as Cheung and Hew (2006), or Henri (1992) that merely describes a dichotomy of surface or shallow versus in-depth level of critical thinking. The unit of analysis was the thematic unit. This selection was consistent

with Merriam's (2001) recommendation that communication of meaning be the main focus.

Greenlaw and Deloach's particular framework (Table 2) assesses the quality of student critical thinking in terms of seven different levels of information processing: (a) level 0—off-topic, (b) level 1—unilateral descriptions, (c) level 2—simplistic argument, (d) level 3—basic analysis, (e) level 4—theoretical inference, (f) level 5—empirical inference, and (g) level 6—merging values with analysis.

In order to estimate the consistency of the analysis, an independent observer coded all the messages posted by both groups. The percentage of agreement of the coding was 84.48 % for group A (asynchronous text discussion), and 89.13 % for group B (asynchronous audio discussion). Since there is more than 80 % accuracy in both groups' analyses, it can be assumed that the coding was fairly accurate. After the coding had been completed, a Pearson χ^2 test of relationship was computed to examine if there was any significant relationship between the levels of critical thinking and the type of asynchronous online discussions.

Results

The results of the critical thinking analyses of both groups are summarized in Table 3.

As seen from Table 3, both group A and group B have the same number of critical thinking points of 106. However, group A had a total of 58 posts while group B had 46 posts. Since the total number of posts was different for each group, it was not a fair comparison for the total number of critical thinking points. As such, the average was taken, which was the total number of critical thinking points divided by the total number of posts of the particular group to achieve the average critical thinking points per post. Group B's average critical thinking point per post was computed to be 2.30, whereas group A's average critical thinking points was 1.83. We can therefore say that on average, the critical thinking level as exhibited by group B (asynchronous audio discussion) was higher than that of group A. Table 4 shows the different levels of critical thinking and the frequency of its occurrences for both groups. The results of a Pearson χ^2 test of statistics confirmed a significant relationship between the levels of critical thinking and the type of asynchronous online discussions: $\chi^2(2, N = 104) = 14.578, p = 0.001, \text{Cramer's } V = 0.374$. The data in Table 5 suggested that students produced more than expected higher critical thinking level during asynchronous audio discussion. On the other hand, students exhibited more than expected lower critical thinking in asynchronous text discussion.

Conclusion

In this study, we investigated the use of asynchronous audio discussion. We found no discussion posts coded as off-task or off-topic, which implies that the students in both asynchronous audio and text discussion groups focused very much on content,

Table 2 Critical thinking framework (adapted from Greenlaw and Deloach 2003)

Level (points)	Description
Level 0 (0)	Off-the subject or otherwise unscorable
Level 1: unilateral descriptions (1)	Students paraphrase information, they repeat and restate the question Define terms Simply repeat information Simple “good” or “bad” statements Add little or nothing new to the issue or question Present a source
Level 2: simplistic alternatives/argument (2)	They take a side, they do not explore other alternatives, they make unsupported assertions, they make simplistic arguments An assertion, without evidence, often in the form of a question that modestly advances thinking; often synonymous with getting the discussion back on track Challenge an assertion but without evidence Facts (beyond defining terms) relevant to the discussion but no argument, per se Simple explanations, e.g., giving an example Cite simple rules, “laws” as proof Do not address conflicts with opposing views or do not explore them
Level 3: basic analysis (3)	They make a serious attempt to analyse an argument or competing arguments and evaluate it/them with evidence Appeal to a recognized (appropriate) authority Casual observation, anecdotal, datum (vs. data) Assertions with explicit evidence offered: or a reasoned challenge of another’s assertion but without a clear logical framework A singular, Socratic-style question Often list numerous factors as evidence
Level 4: theoretical inference (4)	They employ the use of theory to make a cohesive argument Logical statements based on the discipline’s accepted model/school(s) of thought Identify assumptions Challenge a key assumption of another’s theory A series of logical, Socratic-style questions
Level 5: empirical inference (5)	Add to the level of sophistication by introducing empirical evidence to strengthen their theoretical argument Use appropriate, historical data to “test” the validity of an argument Use data to reach a clear conclusion or to choose between alternative theories Require at least an implicit logical framework Challenge the validity of another’s empirical measure/evidence

Table 2 continued

Level (points)	Description
Level 6: merging values with analysis (6)	<p>They are able to move beyond objective analysis to incorporate subjective interests</p> <p>They may argue that although there is (positive) evidence to validate the use of a particular policy, there are other (normative) consequences that must be considered</p> <p>They may select a particular policy on some normative basis, from several which have positive evidence to support them</p>

rather than on technical or social topics. It could be that the nature of asynchronous audio or text as a discussion tool imposes a level of formality that enables students to focus on content. It might also be that both discussion tools (Wimba Voice Board and the text discussion forum available at Blackboard) were user-friendly, thereby minimizing the technology problems that might have been encountered by students. It could also simply be that students did not really feel the need to talk about social issues through a computer-mediated format because they were taking the course in a blended setting, since there are enough opportunities to talk about such issues during face-to-face class time.

Overall, the results of the current study showed that asynchronous audio discussions were more likely to yield level 3 critical thinking occurrences, while text discussions were more likely to foster levels 1 and 2 critical thinking. Why is this so?

In an attempt to uncover the possible reason for this, we asked the students in group B to write their reflections about the possible benefits of using asynchronous audio discussion. Apparently, the use of asynchronous audio discussion can help students understand their peer's viewpoints better due to the presence of intonation and the expression of emotions. For example, Student A explained in her reflection, "We are able to interpret not only the ideas presented but how it is presented such as the intonations that may give us a clearer picture of the message posted." Another student wrote, "In my opinion, through voice-based discussions, participants will be able to portray their feelings through the tones of their voice. This will enable those who listen to them to better understand what they are trying to say about a certain issue."

Recall that level 3 critical thinking typically requires a student to make a serious attempt to analyse an argument or competing arguments and evaluate them with evidence. We suggest that the presence of intonation and the expression of emotions afforded by asynchronous audio discussion could help foster level 3 critical thinking because they add clarity and meaning to an individual's message (Durbridge 1984). This enables other participants to have a clearer picture of what the entire discussion is about. A clearer understanding of the discussion helps participants to better analyse arguments, and construct more thoughtful or in-depth responses to the issues at hand.

Table 3 Total critical points for each group

	Asynchronous text discussion (Group A)	Asynchronous audio discussion (Group B)
Total critical thinking (CT) points	106	106
Total number of posts	58	46
Critical thinking (CT) point per post (mean)	1.83	2.30

Table 4 Critical thinking levels exhibited by both groups

Level of critical thinking	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Total no. of Posts
Number of posts (asynchronous text discussion)	0	16	36	6	0	0	0	58
Number of posts (asynchronous audio discussion)	0	3	26	17	0	0	0	46

Table 5 More detailed analysis of critical thinking levels

	No. of posts exhibiting the level of critical thinking			
	Level 1	Level 2	Level 3	Total
Audio-input AOD				
Count	3	26	17	46
Expected	8.4	27.4	10.2	46.0
% of total	6.5	56.5	37.0	100.0
Std. residual	-1.9	-0.3	2.1	-
Text-input AOD				
Count	16	36	6	58
Expected	10.6	34.6	6	58
% of total	27.6	62.1	10.3	100.0
Std. residual	1.7	0.2	-1.9	-

Limitations and future research

The study was conducted with only two groups of participants, i.e., Group A with 23 participants and group B with 18 participants. We were unable to randomly assign each student to either group as the groups were already intact when the semester began. As the participants were different in group A and group B, one group of students may be more vocal than the other group.

Hence, the results of this study might not be generalizable. As the current study samples consisted of Asian students majoring in education at a large Asian-Pacific

University, it would be useful to replicate this study in other cultures to see if the reported findings still apply. Also, these samples are just a small proportion of the entire student population and should not be seen as representative of the whole student population.

Despite the limitations, it is believed that this study still served its purpose to enable other educators and researchers have a glimpse into the critical thinking level as exhibited by the students participating in different types of asynchronous online discussions. Future studies should be conducted using a larger cohort of students from various disciplines.

The study could also be conducted for a prolonged period of time, possibly stretching over 1 year of study, i.e., two semesters, and with the same group of participants involving in different types of asynchronous online discussion over the two semesters. The group of participants can stay constant while the topic for discussion can varies. Doing so could help the researchers better understand the impact or effect of different discussion topics on critical thinking levels across various types of asynchronous online discussion environments. It could also help the researchers to examine students' attitudes toward asynchronous audio discussion over a period of time, after novelty effects fade off.

Finally, future research could examine the use of asynchronous audio discussion in supporting other student outcomes such as social construction of knowledge and problem solving process (Hew et al. 2004). It may also be worthwhile to examine the use of asynchronous audio discussion on small screen mobile devices. Recently, some course management system providers such as Blackboard™ have announced the launch of Blackboard Mobile™ Learn which allows students to participate in threaded online discussions (Maurer 2011) on a variety of mobile devices including Android devices, Blackberry, iPhone, and iPad. Since it is not easy for students to post messages using a text-based input, asynchronous voice discussion via built-in microphones on mobile devices may be a viable alternative.

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