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Résumé de l'article

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# Understanding Cognitive Engagement in Online Discussion: Use of a Scaffolded, Audio-based Argumentation Activity



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## Abstract

The purpose of this paper is to explore how adult learners engage in asynchronous online discussion through the implementation of an audio-based argumentation activity. The study designed scaffolded audio-based argumentation activities to promote students' cognitive engagement. The research was conducted in an online graduate course at a liberal arts university. Primary data sources were learners' text-based discussions, audio-recorded argumentation postings, and semi-structured interviews. Findings indicate that the scaffolded, audio-based argumentation activity helped students achieve higher levels of thinking skills as well as exert greater cognitive efforts during discussions. In addition, most students expressed a positive perception of and satisfaction with their experience. Implications for practice and future research areas are discussed.

*Keywords:* online discussion, argumentation, audio-based discussion

## Introduction

Asynchronous online discussion is an important pedagogical strategy used by instructors of online courses. Its pedagogical benefits in online courses include promoting learner interaction and perceived sense of learning community by seeking and exchanging resources together, along with sharing different perspectives and professional experiences. However, the literature regarding asynchronous online discussion indicates two major problems: learners' limited participation in online discussions (Hew,

Cheung, & Ng, 2010; Hewitt, 2005; Murphy & Coleman, 2004) and a lack of depth in thinking demonstrated in online discussions (Garrison & Cleveland-Innes, 2005). For a discussion activity to meaningfully facilitate collaborative knowledge construction, the quantity of participation, as well as the nature of interaction and discourse, is important. Indeed, online discussion itself does not automatically provide learners with meaningful learning experiences such as engaging in deep thinking and consequential conversations in a collaborative manner (Darabi & Jin, 2013; Dennen & Wieland, 2007; Garrison, Anderson, & Archer, 2001). Without effective design and facilitation, students may fail to engage in productive discussions, which can hinder not only their learning of the course material but also their development of critical thinking skills through interactions (Dennen & Wieland, 2007). In other words, learners' cognitive engagement is crucial for a successful learning experience in online discussions.

The purpose of this study is to examine how adult learners engage in asynchronous online discussions. To that end, the researchers designed and implemented scaffolded, audio-based argumentation activities in a graduate level online course. The investigation seeks to explore the following research questions: (1) How is learner discourse characterized in audio-based asynchronous discussion activities? (2) How do learners engage in audio-based asynchronous discussion activities? (3) How do learners perceive and evaluate an audio-based online argumentation activity?

### **Asynchronous Online Discussion and Cognitive Engagement**

The key to addressing the aforementioned issues in online asynchronous discussion is to promote learners' cognitive engagement in the discussion activities. Traditionally, cognitive engagement has been interpreted in a few different ways. Rotgans and Schmidt (2011) describe cognitive engagement as the extent to which students are willing and able to take on the learning task at hand. Corno and Mandinach (1983) understood it more from a self-regulated learning perspective and describe it as the amount of effort students are willing to invest in working on the tasks. Learners' cognitive engagement in an online environment is discernible from the quality and quantity of student participation in asynchronous online discussion activities. In studying cognitive engagement in asynchronous discussions in four different online courses, Zhu (2006) describes cognitive engagement in online environments as "the amount of students' effort in (a) analyzing and synthesizing readings, and (b) seeking, interpreting, analyzing, and summarizing information; critiquing and reasoning through various opinions and arguments; and making decisions" (p. 454). Also, Zhu (2006) concluded that the level of cognitive engagement in online discussions is closely related to the learning achieved in knowledge and skill acquisition. Therefore, cognitive engagement in online discussions is important to ensure students' high-level cognitive effort.

For learners to exert high-level cognitive efforts such as evaluating others' perspectives, reasoning through various opinions, and synthesizing their own thoughts based on evidence, online instructors should structure discussions in a way that allows students to experience cognitive dissonance and demands their cognitive collaboration (Akyol, Garrison, & Ozden, 2009; Darabi, Liang, Suryavanshi, & Yurekli, 2013; Zhu, 2006). Indeed, learners can only achieve higher-order thinking skills when they actually make cognitive efforts to engage deeply in discussions. Recent studies have investigated how different discussion strategies influence the level of cognitive skills demonstrated in student discussion postings (Darabi, Arrastia, Nelson, Cornille, & Liang, 2011; Richardson & Ice, 2010). Based on a meta-analysis of online discussions, Darabi and colleagues (2013) report that a strategic discussion is more

effective and productive for both undergraduate and graduate students and emphasize that it is important to offer a purposefully structured discussion strategy and continue to monitor the discussions.

### **Scaffolded Dialogic Argumentation and Audio as Communication Modality**

In this study, the researchers considered two ways to promote learners' cognitive engagement in the context of asynchronous online discussions: use of scaffolded dialogic argumentation as a pedagogical strategy as well as use of audio as a communication modality. First, the researchers have explored argumentation as an effective pedagogical approach to foster learners' cognitive engagement and collaborative knowledge construction in online learning environments (Jonassen & Kim, 2009). Argumentation is a form of dialogue involving demonstration of a point of view, exploration of evidence related to the domain of discourse, negotiation of meaning, and construction of convincing counter-arguments (Kuhn, 1991). Accordingly, participating in peer-led dialogic argumentation usually requires a series of cognitive processes that conventional online discussions would not. Learners put more cognitive effort into discussions and employ higher levels of cognitive skills (Jin & Jeong, 2013). They can also enhance their conceptual understanding (Means & Voss, 1996) and elaborate their arguments or rebut others' claims with assembled positions as they evaluate the different possible solutions of their peers. Accordingly, participating in argumentation can often help students think critically about complex issues as they elaborate and reflect on their arguments.

Second, video- and audio-based asynchronous technology has recently gained attention as it allows the same flexibility in time and space as traditional text-based discussions, yet adds more expressive, realistic, and lively discussions (Borup, West, & Graham, 2012; 2013; Ching & Hsu, 2013; Hew & Cheung, 2013). In particular, prior studies using VoiceThread for online collaborative learning activities recognized technological affordances of VoiceThread. Also, students like VoiceThread for its ease of use and option for multimodality asynchronous communication. Such prior studies present meaningful results on students' preferences for VoiceThread and its strengths through its audio modality in online discussion contexts. Taking a further step, research to examine how students cognitively engage in audio-based asynchronous discourse can add value to both research and practice in online learning as audio-based asynchronous discussion environments have much potential for promoting student engagement in argumentation.

## **Methods**

### **Research Context and Participants**

The study was conducted in a graduate-level online course in the college of education at a small liberal arts university in the United States. Six students were enrolled in the course and all participated in the study. The participants were professionals in education and included K-12 teachers and instructors in post-secondary institutions with teaching experience. Further information regarding participants is presented in Table 1.

Table 1

*Participant Information*

Team	Pseudo	Gender	Age	Online discussion experience	Occupation/Educational domain
1	Robert	Male	25-36	Yes	Teacher/K-12
	Calvin	Male	25-36	Yes	Educational professional/ Government
2	Joe	Male	25-36	Yes	Educational professional/Higher Ed
	Tina	Female	25-36	Yes	Educational Professional/Higher Ed
3	Mark	Male	37-45	Yes	Teacher/K-12
	Luke	Male	25-36	Yes	Teacher/K-12

This online course was asynchronously delivered; asynchronous discussion was an important course requirement for students to achieve learning goals. All participants had had experience with online courses and asynchronous online discussions.

**Discussion activities in the class.** In this class, the instructor provided two forms of online discussion: text-based threaded discussions using a forum provided through a Learning Management System (LMS) and an audio-based discussion using VoiceThread ([www.voicethread.com](http://www.voicethread.com)). For the text-based, whole-group discussions, the instructor posted discussion topics and open-ended questions, and then the students shared their thoughts and commented on the thoughts of others. Discussion topics included (a) the definitions and history of the educational technology and (b) program evaluation models and functions.

For the audio-based discussions, the six participants were paired and participated in two discussions with debate statements provided by the instructor. The debate topics were (a) the effect of media on learning (Clark, 1983; Kozma, 1991) and (b) the level of instructional guidance necessary for learning (Clark & Hannafin, 2012). The audio-based debate activities are grounded in the Scaffolded Online Dialogic Argumentation (SODA) framework created by the Kim and Oh (2014). In the audio-based discussion, students generated and shared their arguments, using the five types of scaffolds provided: conceptual, procedural, strategic, meta-cognitive, and social. Table 2 summarizes the activity phases and scaffolds. Most scaffolds were provided in a pre-recorded video format and distributed via VoiceThread. For example, to support student learning of the critical components of a sound argument, instructors created and provided a pre-recorded video orientation to a concept map of the argumentation components and examples of both sound and poor arguments. To help students review and respond to peers' questions, arguments, and counterarguments, the scaffolding included question prompts and a checklist to guide learners in thinking about and formulating arguments (Figure 1).

Table 2

*Argumentation Phases and Scaffolds*

Phases	Process	Scaffolding types	Example scaffolding strategies
1	Initial argumentation generation	Procedural Conceptual	Orientation-process/technology Concept map Examples/non-examples
2	Argumentative interaction	Procedural Strategic Social	Process facilitation Group composition Multimodal communication
3	Integration	Procedural Meta-cognitive	Reminder Question prompts

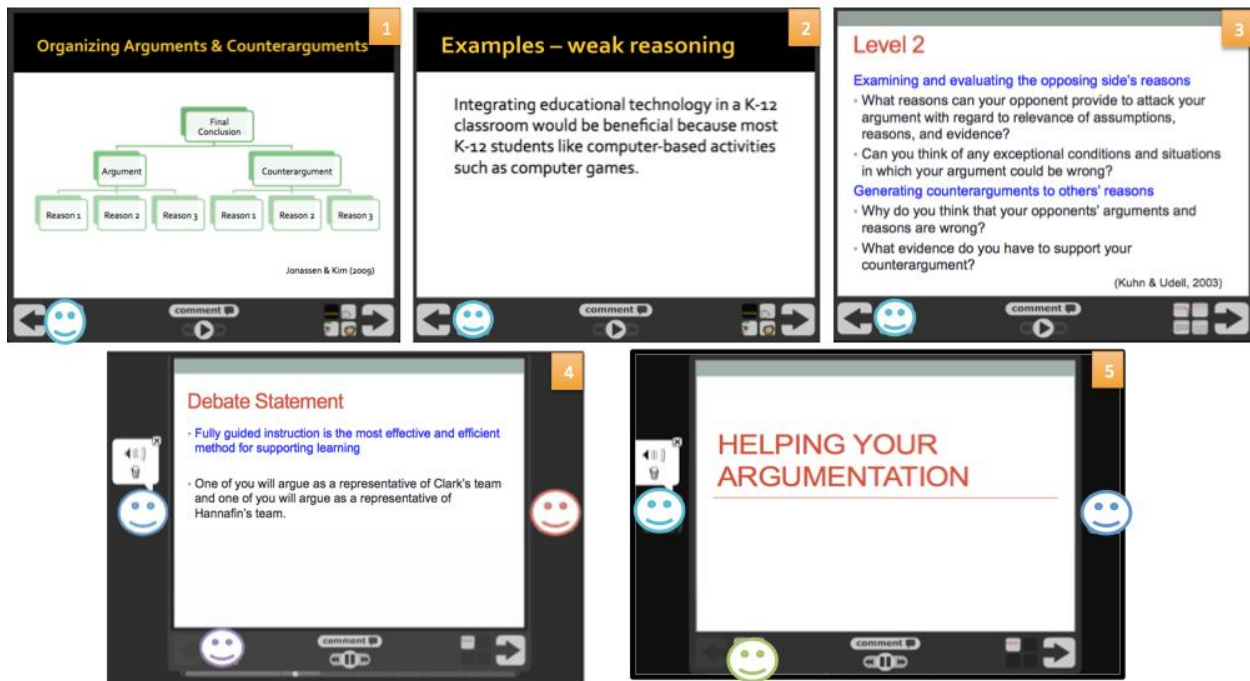


Figure 1. Screen capture of the VoiceThread interface displaying the video guides and argumentation activity. Frames 1 and 2 indicate conceptual scaffolding, 3 is strategic, and 4 and 5 are procedural.

**Data Sources and Procedures**

The researchers collected two sources of data: (1) online discussion postings, including both text-based discussion postings in the forum and audio-recorded arguments and (2) semi-structured interviews. The researchers collected two weeks of discussion postings for each type of discussion; thus, in total, four weeks of discussion postings were collected. After the semester had ended, the researchers conducted one-on-one semi-structured interviews with four participants via a web conferencing application or phone. The interviews focused on the experiences and perceptions of participants regarding the text-based online discussions and the scaffolded, audio-based argumentation. Each interview lasted for 60-90 minutes.

**Data Analysis**

The researchers used qualitative analytical methods to analyze participants’ skills, knowledge, and experiences in the online discussion. To analyze participants’ thinking skills and arguments, the researchers used a content analysis method. To analyze students’ experience in and perceptions of the discussion activities from interviews, the researchers used grounded theory analysis method (Creswell, 2007; Glaser & Strauss, 2012).

**Content analysis.** The researchers conducted content analyses of students’ text-based and audio-based discussion recordings. Audio recordings of argumentation were transcribed, and then data from both discussions were coded using *Mac Nvivo 11*. Content analyses were conducted in three areas: (1) levels of thinking skills, (2) components of arguments, and (3) overall quality of argumentation.

First, regarding levels of thinking skills, Bloom’s (1956) taxonomy of cognitive learning was used. We analyzed levels of thinking skills in both text- and audio-based discussions. The taxonomy included six levels of learning, including knowledge, comprehension, application analysis, synthesis, and evaluation. Analysis was conducted at the discussion message level. In total, 37 text-based messages and 59 audio-recorded messages were analyzed. Appendix 1 presents a description of the categories and examples of the postings. We used Jin and Jeong’s (2013) description of the categories in Bloom’s taxonomy.

Second, on the components of arguments, Toulmin’s (1958) adapted argumentation framework was used. We analyzed components of the arguments in the audio-based postings. The adapted framework included four components of arguments: claims, rebuttals, grounds, and explanations. In terms of the description of the components, researchers adapted Clark and Sampson’s (2008) analytic framework for dialogic argumentation grounded on Toulmin’s framework. The analysis was conducted at the semantic level. One message included multiple components of arguments. In total, 287 semantic units were identified. Table 3 presents the description of the components of an argument and example postings.

Table 3

*Description of the Components of an Argument and Example Postings*

Component	Description	Example
Claim	An initial comment or assertion made by a student	My argument’s stance is that fully guided instruction is more effective for learners than minimally guided instruction.
Rebuttal	An attack on or disagreement with the evidence and/or justification. 1) rebuttal against grounds 2) rebuttal against thesis Note: Only arguments that rebut the grounds of another person’s argument can undermine the beliefs of counterparts.	You made several good points about how minimally guided instruction can be beneficial. In an ideal situation, this type of learning can produce positive results, but often the ideal situation is not the case. There are many obstacles that can prevent this type of instruction from being more effective.
Ground	Information to substantiate a claim: 1) personal experience, 2) empirical data, 3) a reference book, 4) an example of a situation in which one’s ideas would be correct, and 5) another person’s arguments	Now, there’s an example from the text from the National Science Education Standards, which states that students should be able to describe objects, events, ask questions, acquire knowledge and be able to construct and test explanations. These standards,

	Note: Single or multiple sources of evidence can be used.	though, cannot be achieved through fully guided instruction alone. Instead, students must be able to learn some things individually and on their own.
Explanation	A statement to support the accuracy of the previous claim or rebuttal. The statement 1) voices agreement with peers' claim, 2) rewords the previous comment, 3) adds additional grounds in support, or 4) expands on the previous comment.	I don't think we're supposed to do that at all, and I think you'd agree with me. But what you're implying about minimum instruction is what Clark is trying to guard against, which is there has to be—if there is something new to be learned, there has to be a process that involves full instruction.

Third, to analyze the overall quality of dialogic argumentation, Clark and Sampson's (2008) framework was used. We analyzed the quality of dialogic argumentation in the audio-based postings. The analysis was conducted at the episode level. One argumentation of each group counted as one episode. A total of six episodes of three paired groups were analyzed. Table 4 presents the framework.

The researchers made a significant effort to avoid subjectivity in assigning to each unit the components of an argument structure, the quality of the argumentation, and levels of cognitive thinking at acceptable rates of inter-rater reliability (i.e., Cohen's Kappa, no less than .75) (Bannerjee, Capozzoli, McSweeney, & Sinha, 1999). Once the data were transcribed, the researchers first discussed the meaning of each code category. Then, they individually completed a small sample of coding and compared their analyses. This process has helped researchers strengthen their shared understanding of each code. Next, researchers individually completed the remaining coding using frameworks and together compared their codes. During the analysis process, each researcher maintained a reflective journal on the project with analytic memos (Ezzy, 2002), which helped their negotiation during discussions on coding comparison. In addition, their individual coding was a cyclical process that required them to repeatedly revisit their own coding work and recode the data. There was an explicit and continuous process of discussion and negotiation between the two researchers on any disagreement of their analysis (Sandelowski, 2003). The disagreements were resolved and full agreement between the two researchers was achieved. The calculated Cohen's Kappa for each level of content analysis was 0.864 (message), 0.903 (semantic), and 1 (episode) respectively, indicating near perfect agreement in each category (Landis & Koch, 1977).

Table 4

*The Overall Quality of an Argumentation Within an Episode Determined Using a Hierarchy Based on Opposition (Clark & Sampson, 2008, p. 304)*

Quality	Characteristics of the Discourse
Level 5	Argumentation involving multiple rebuttals and at least one rebuttal that challenges the grounds used to support a claim
Level 4	Argumentation involving multiple rebuttals that challenge the thesis of a claim but does not include a rebuttal that challenges the grounds used to support a claim
Level 3	Argumentation involving claims or counterclaims with grounds but only a single rebuttal that challenges the thesis of a claim
Level 2	Argumentation involving claims or counterclaims with grounds but no rebuttals
Level 1	Argumentation involving a simple claim versus counterclaim with no grounds or



	rebuttals
Level 0	Non-oppositional

**Interview analysis.** The purpose of the interviews was to understand how students perceived and evaluated the overall audio-based argumentation activities. Techniques borrowed from grounded theory perspectives were used to analyze interviews (Corbin & Strauss, 2008). First, the two researchers independently and repeatedly read through the interview transcripts. They selected sample interview transcripts and assigned codes. Then, they independently classified and grouped the codes into categories. Next, they completed an analysis of the remaining transcripts using *Mac Nvivo 11*. The researchers discussed and compared their analysis and organized the coding framework into themes relevant to research questions.

## Results

### How is learners' argumentation discourse characterized in audio-based asynchronous discussions?

Overall, students used sound arguments in their discussions during the scaffolded argumentation activities. Each separate posting included a combination of the structural components of argumentation. In two debate activities, researchers coded 287 semantic units in terms of components of individual arguments (e.g., claims, rebuttals, grounds, and explanations). The sum of grounds and rebuttals is more than 48% (see Table 5). Grounds are evidence to strengthen students' own claims or weaken their partners' counterclaims. Adapting ideas from Clark and Sampson's (2008) analytic framework for dialogic argumentation, in this study, grounds are considered as information to substantiate one's claims, and grounds include (a) personal experience, (b) empirical data, (c) reference to books and articles, (d) an example of a situation in which their ideas would be correct and (e) another person's arguments. During debate activities, it was evident that students focused on use of stronger grounds in justifying their claims such as "I understand what you're saying, but the research says. . . ." Accordingly, students' counterarguments included valid evidence, use of real examples, and elaboration with new information to justify their points of view.

Table 5

#### *Structural Components of Individual Argumentation (Semantic Unit)*

Components	Count	Percentage
Claims	33	11.4%
Rebuttals	81	28.2%
Grounds	58	20.2%
Explanations	115	40.1%
Total	287	100%

According to Clark and Sampson (2008), rebuttals are an attack on or disagreement with their counterparts' evidence and/or justification to undermine their colleagues' arguments. Rebuttals include statements opposing their thesis and grounds. Regarding the overall quality of the argumentation within an episode, participants had six argumentative episodes, and a single episode included an average of 9.8 arguments, meaning that each team exchanged over eight arguments per debate. For instance, in their assessment framework, Clark and Sampson describe level 1 argumentation as "a simple claim versus counterclaim with no grounds." In comparison, at level 5, the highest level of argumentation requires "multiple rebuttals and at least one rebuttal that challenges the grounds used to support a claim" (Clark & Sampson, 2008, p. 304). Using their framework to evaluate the amount of opposition occurring at the episodic level, all six episodes reached level 5, including multiple rebuttals and at least one rebuttal against grounds.

### How do learners engage in audio-based asynchronous discussion?

To explore learners' engagement in the discussions, researchers examined the level of thinking skills manifested in each argument posting, and it was relevant to examine learners' engagement in both text- and audio-based discussion activities. In weeks 1 and 2, in which learners participated in the whole class text-based discussion activities, students posted 37 messages in total. Each student made 3.1 postings per week on average, including initial and response postings. In text-based discussions, students wrote an average of 215 words per posting. An initial posting averaged 443 words, but a response posting averaged 105 words. In terms of the level of thinking skills, low levels of thinking skills (e.g., knowledge, comprehension, and application) were demonstrated. In particular, levels of thinking in response postings were lower than in initial postings. Students showed different levels of thinking depending on the questions provided by the instructor (Table 6).

For audio-based discussions, participants completed two pair-group debates and constructed 59 individual argumentative postings. Each debate activity lasted for one week, and each student made an average of 4.9 postings per week. In the audio-based argumentation, students spoke an average of 459 words per posting, which was twice that of the text-based discussions. More specifically, initial postings averaged 629 words, but response postings averaged 415 words, which were approximately four times longer than response postings in text-based open discussions.

Table 6

*Average Levels of Thinking in Discussion Postings (Message Unit)*

Format	Activity	Initial postings	Response postings	Overall
Text (N=37)	Open discussion 1	Comprehension < <b>2.17</b> < Application	Knowledge < <b>1.67</b> < Comprehension	Knowledge < <b>1.81</b> < Comprehension
	Open discussion 2	Application < <b>3.16</b> < Analysis	Knowledge < <b>1.6</b> < Comprehension	Comprehension < <b>2.2</b> < Application
Audio (N=59)	Debate 1	Application < <b>3.83</b> < Analysis	Analysis < <b>4.3</b> < Synthesis	Analysis < <b>4.2</b> < Synthesis
	Debate 2	<b>4</b> = Analysis	<b>5</b> = Synthesis	Analysis < <b>4.8</b> < Synthesis

Among the 59 audio-recorded discussion messages, approximately 78% were rated as higher-level thinking (e.g., containing analysis, synthesis, and evaluation). The higher levels of thinking skills can be seen as representing students' cognitive engagement since, without greater cognitive efforts, such levels of thinking cannot be achieved. When investigating levels of thinking skills in their initial and response postings, students demonstrated higher-level thinking in their response postings (Table 6). That is, students not only exerted cognitive effort in generating sound initial arguments but also in revisiting their own claims and counterparts' perspectives so that they could construct stronger and more developed arguments.

### **How do learners perceive and evaluate the audio-based online argumentation activity?**

Findings from the interviews revealed four main themes regarding student learning and engagement in audio-based argumentation experiences.

First, students reported *positive learning experiences* through the activities. They enjoyed learning from dialogic argumentation with a partner and shared a number of benefits that they perceived. Students appreciated learning from listening to each other's arguments. For example, Tina mentioned that "being able to go back and forth" with her debate partner "makes ideas and different concepts sit" with her more because she had to formulate her next rebuttal and next questions while listening to her partner's argument. Mark mentioned that having a debate partner who shared a different perspective was conducive to "fruitful" conversation as they were bouncing the arguments back and forth and analyzing them.

In particular, students felt that they learned more from paired argumentation activities with predetermined roles compared to their prior asynchronous online discussion experiences. Calvin shared:

I think it just gave me a better understanding. I felt like I had to be Clark [the partner's last name] for a little while. So I took in whatever it was that he was saying, and at the same time, I had to take in the Kozma information because I had to be able to debate his information. On the whole, I feel like I know more about the topic.

With such self-identification with the predetermined roles, students also experienced a sense of competitiveness against their opponents. Yet, they appreciated that they could argue asynchronously without an actual confrontation, which made them feel more comfortable engaging in the debate.

They also appreciated their partner's contribution to their own learning and motivation. Robert stated that what his debate partner explained was "mind-blowing" as the partner shared and challenged perspectives that he had not thought of before. He felt that his partner's questions helped him think more deeply about how to answer those questions and strengthen his responses with relevant grounds. Mark also mentioned how debate with his partner had even changed his initial perspective regarding the topic:

Having a partner that was what I deemed as very thorough and [a] worthy opponent because he dived into the assignment, and it allowed me to dive into the assignment further. My knowledge and perspective grew. I mean mainly because [partner's name] was teaching me even though we were debating. . . . My perspective changed....Kozma's perspective through [partner' name], it did sway my perspective.

In summary, these students said that through debate, they could learn both perspectives more thoroughly and also develop more confidence in argumentation.

Second, most students stated *strong preferences for audio-based discussion* over text-based discussion. One student expressed it as "Discussion 2.0," and as a classroom teacher, he began using VoiceThread and argumentation with his students once he realized the potential benefits of the tool and approach. Although these were asynchronous conversations, the participants felt that they were having conversations with "a real person" and that audio as a modality allowed more "intimate expression, emotion, and characters" of themselves as well as their partners. Calvin used an analogy of "a phone call versus a text message" in comparing his experience in audio-based versus text-based discussion. Tina also mentioned that having the argumentation in the audio "enhances the ability to decipher exactly someone's tone," which cannot be achieved in a text-based discussion.

Third, students reported *increased cognitive effort in preparation and participation* to construct valid and well-elaborated arguments. As mentioned above, students felt that the audio-based argumentation made their learning experiences more personal and real; accordingly, such a personalizing feature strengthens the communal aspect of an argumentation activity, which students also valued for their learning. Tina mentioned that she spent more time preparing her arguments because "it was more personal." Tina's comments describe her preparation process:

After reading the information, I went and made notes and highlighted different points that I thought stood out in a concrete way to support the stance that I was going to argue. So I made notes about those things and even while reading I went ahead and marked points that I knew could be used to counter-argue what my point was going to be. So after that, I used those things to formulate the basis of a general statement of a point I was going to take. Then after making that initial post, I followed up and would take notes on what [my partner] said, I would refer back to the readings and other sites that I visited and other articles and things to support or counter the arguments that [my partner] made and so I just did a back and forth trying to follow up if he made a point that I wasn't as comfortable with or if I didn't recall in the readings, I would set those things aside and then I would try to research those particular things to try to find more information to counter-argue that. I did feel like it was very beneficial to find outside sources as well because even though our reading provided a really good basis of that, a lot of things sometimes didn't go into detail in that chapter. So I was able to point out those things and research it so I could bring something to the table to support or counter that.

Other students also mentioned that they were more motivated and felt the pressure of greater accountability for an internalization of their own arguments. Mark felt that compared to text-based discussion, using VoiceThread forced him "to internalize concepts and then provide a perspective" and he

made sure that his points of view were based on much reading and forming his arguments. Calvin shared similar comments:

I think it takes more preparation. You actually have to know what you're talking about. You have to redevelop a theory about what you read, come up with an opinion. And one thing I noticed is once you listen to other people in the course, you want to be on par with what they're saying. You don't want to say just one sentence if they say a whole soliloquy. So I think it raises the bar of the participation of the class. And being that we are usually talking about something that we're studying, we learn more about the material.

Students thought that it was also important to present valid information and elaborate on it to support their own perspectives because they appreciated and acknowledged the importance of their partner's contribution to their learning and motivation. Students mentioned their increased cognitive efforts in the following activities: (a) revisiting readings, (b) researching information beyond the assigned readings, (c) listening to partners' arguments multiple times, (d) making notes, (e) organizing grounds, and (f) highlighting their points.

Lastly, students acknowledged the benefits of provided scaffolds. They said that it helped them in (a) understanding the topic, (b) constructing effective arguments and assessing their own and others' arguments, and (c) understanding the instructor's expectations for the activity. For instance, Calvin pointed out, "Without that guidance, we probably would have just taken turns talking." Tina found the scaffolds were very helpful because they gave her "an outline of the expectations," in terms of what the argumentative process would look like, what the instructor would be looking for, what made a good debate, and so forth. Mark mentioned that the scaffolds helped him to "pinpoint what he thought was [sic] the strongest viewpoints" of the stance that he argued for as well as to "figure out how [he] could actually attach [his] opponent's viewpoints using their words against them."

## Discussion

In this paper, we explored how scaffolded, audio-based online argumentation could improve students' cognitive engagement and perceived experiences in asynchronous online discussions. The findings of this study contribute to our understanding of how adult learners can engage in more and deeper discussions in online learning environments.

First, all the students in the study demonstrated a higher level of cognitive engagement in the scaffolded, audio-based argumentation activities than traditional text-only activities. Student learning from and engagement in the discussions were clearly manifested in the structural components (e.g., rebuttals and grounds) of their argumentation and in their higher-level thinking skills. Prior research on argumentation has reported that structural components like rebuttals, counterarguments, and grounds indicate higher levels of argumentation skills requiring more cognitive exertion such as analyzing and evaluating one's perspectives and those of others, gathering strong evidence, and synthesizing one's thoughts based on that evidence (Clark & Sampson, 2008). In addition, the structural quality of argumentative discourse is

determined by the inclusion of grounds and rebuttals in presenting arguments (Clark & Sampson, 2008). To include grounds, students should make a cognitive effort to deeply reflect on their own and their opponents' arguments, seek reliable and relevant information from readings and external resources, and articulate their ideas for applying them to relevant real-world situations. Also, students' use of rebuttals is not possible without deep reflection and evaluation of the validity of their own and their counterparts' arguments.

Study findings on conventional text-based discussions claim that asynchronous online discussions centered on open-ended instead of closed questions contribute to more knowledge-constructive interactions (e.g., Ke & Xie, 2009). However, in this study, despite the use of open-ended questions, students' initial postings still presented a lower level of thinking than the initial postings of audio-based argumentation. Particularly, response postings in text-based discussion presented a much lower level of thinking than the initial postings, which could not lead to collaborative learning. In terms of text-based discussions, these graduate students demonstrated only surface level thinking, such as simple information sharing and exploration, as reported in some of the prior studies (e.g., Garrison & Cleveland-Innes, 2005; Ke & Xie, 2009; McCrory, Putnam, & Jansen, 2008). Therefore, as argued in prior studies (Akyol, Garrison, & Ozden, 2009; Darabi et al., 2013; Zhu, 2006), based on this study's findings, the researchers also suggest that it is important to provide further structure and design of online discussion beyond conventional open-ended question prompts so that students can experience cognitive dissonance and engage in cognitive collaboration. Argumentation can facilitate such experiences by spontaneously challenging students to address the points of view their partners introduce (Brooks & Jeong, 2006). Also, participants need to put more effort into their response postings leading to a deeper engagement in discussions. Moreover, the use of a scaffolded, audio-based argumentation activity shows potential for students' individual learning (e.g., quality of argumentation and level of cognitive engagement) and collaborative knowledge construction: increased preparation, more active interaction, and increased cognitive effort (e.g., in-depth responses, use of rebuttals, and strong grounds) in developing multiple responses to peers' arguments.

Second, the students highly rated the unique and useful benefits of audio as a discussion channel and expressed a strong preference for audio-based discussions. Prior studies report the perceived usefulness of audio as a discussion channel, such as liveliness in encouraging participation (Ching & Hsu, 2013; Hew & Cheung, 2013). Hew and Cheung (2013) studied the use of audio- versus text-based asynchronous online discussions for undergraduates at an Asian-Pacific university. In their study, although students identified perceived affordances of audio-based discussions, in the end, they preferred text-based discussions, which was opposite to the result from this study. Hew and Cheung (2013) concluded that these results could be due to the influence of the culture among students at the university and the novelty factor of the Wimba Voice Board used. In the present study, students used the audio tool during the first week when participating in an ice-breaking activity, and this activity was useful to remove the novelty factor of the tool. As the focus of this study was not to understand the role of culture in learning preferences, it is not easy to conclude the discrepancy between findings of these two studies were due to cultural differences. Yet, cultural differences regarding technology, discussion, and learning may have contributed to students' preferences in a communication modality. It would be interesting to conduct a study involving multiple online graduate courses across different schools to see whether cultural aspects

affect students' preferences regarding a discussion modality. Ching & Hsu (2013) studied students' collaborative learning in particular using VoiceThread in an online graduate course. They reported that students addressed the perceived social and emotional benefits of the tool in their discussions. Yet, these students did not make greater numbers of discussion postings beyond the stated requirements, and the study did not examine whether the tool could contribute to the quality of collaborative learning. In the present study, we did not examine whether audio as a modality was the single factor contributing to deeper collaborative learning in online discussions. However, by using a scaffolded argumentation approach, students' overall participation in both quantity and quality improved. All the students perceived the affordances of VoiceThread as a discussion platform in promoting deeper engagement in the argumentation activities and stated that the audio element facilitated a higher quality of argumentation experience than they would have had in text-based discussions. Therefore, the findings of the present study suggest that the nature of and scaffolding of discussion tasks are important in maximizing the social and emotional benefits of VoiceThread.

Third, the study's findings suggest that adult learners in graduate courses needed scaffolds for constructing sound arguments and meaningful engagement in online argumentation activities. Shea and Bidjerano (2009) and Richardson and Ice (2010) suggest that students' comfort level and confidence in online discussions are important factors for promoting a higher level of cognitive presence. During the interviews, the study's participants shared their lack of experience in argumentation, and the scaffolds in different phases of argumentation promoted an increase in comfort and confidence by helping them understand the activity as well as the argumentation itself. Much of the literature on argumentation studies and scaffolds for argumentation is dedicated to the areas of K-12 STEM contexts (Clark, D'Angelo & Menekse, 2009) or undergraduate education (e.g., Cho & Jonassen, 2002) to support younger students in developing their critical thinking and reasoning skills. However, relevant designs and scaffolds can promote learning from effective argumentation for adult graduate students with academic and professional experience.

Fourth, we believe that scaffolded, audio-based argumentation activities can be used in other online classes as long as (a) the discussion is a mandatory activity and (b) the instructor places students in small groups. The study used a small-size sample due to class size limitations in the liberal arts university; however, general guidelines from the literature recommend dividing a class into smaller groups to facilitate the quality of online discussion (Hew & Cheung, 2011; Shaw, 2013) and avoid any possible information overload due to excessive numbers of postings (Jones, Ravid, & Rafaeli, 2004). In reviewing the current literature, although a small group approach is recommended, an ideal size for a discussion group has not been consistently or conclusively established [e.g., 2-6 students (Shaw, 2013), 2-10 students (Hew & Cheung, 2011), 8-10 students (Schellens, Van Keer, Valcke, & DeWever, 2007), & 25-30 students (Kim, 2013)]. The next step can be to identify what the ideal size of group would be when using this particular discussion approach and what scaffolds become more important when changing the size of discussion groups.

## Conclusion

Online discussion is a critical learning activity in online courses for helping students to build their sense of belongingness in the learning community, as well as to learn about class topics in depth from the multiple perspectives and experiences that their peers share. The argumentation activity described in this paper is the first step in an attempt to design a more effective discussion activity for graduate level online courses. When using a scaffolded, audio-based argumentation activity, students have demonstrated higher levels of thinking skills, important components of arguments to substantiate their claims, and greater cognitive effort during discussion. Students have also shared their positive experience and satisfaction with the discussion activities. By forming small discussion groups, designing argumentation topics, and providing multi-dimensional scaffolds, we are optimistic that online instructors may find our approach useful for their online graduate students' deeper learning.

One possible limitation is that the current study does not identify which scaffolds or what factors (e.g., levels of cognitive skills of argumentation partners) were more closely related to improvement in the quality of argumentation and levels of cognitive engagement. Accordingly, to maximize the applicability of the current approach, future studies can explore (a) the effects of different scaffolds on online argumentation and (b) the influence of argumentation groups or partners on the overall quality of argumentation episodes and level of cognitive engagement. In addition, exploring relevant scaffolding designs that depend on the intention of argumentation activity types can be useful for further promoting use of argumentation in asynchronous online discussion activities.

Finally, the use of audio-based discussions to enhance learning experiences in asynchronous online courses is still in early development (Hew & Cheung, 2013). Multimodal communication using audio-or video is not commonly used in online discussion forum in most course management systems. Also, despite its name, VoiceThread does not have the technology affordance for threaded discussions (Borup et al., 2012). If more researchers examine and identify the pedagogical value of audio-based discussion from different perspectives, they can contribute to the advancement of the technological affordances of such tools. The development of an online discussion environment enabling scaffolded audio-based argumentation activities and formative evaluations of such learning systems across different disciplines could be an interesting area to explore.

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## Appendix

### *Description of the Levels of Thinking Categories (Jin & Jeong, 2013, p.1146) and Examples of Student Postings*

Learning	Description	Example
Knowledge	Recall of factors, methods, processes, patterns, etc	The concept of instructional design was around long before the internet and new technology age. I like that there is flexibility within the field that allows for adaptations based on the practices of the current time.
Comprehension	The understanding of the materials or ideas being communicated	As an educator, this definition resonated with me. I believe instructional technology is not merely pieces of equipment but an ever-growing field of information and resources with which educators must become familiar. Educators must study the field of instructional technology and incorporate their learning into their daily classroom practices and lesson planning. Because our technological resources are constantly changing, educators must constantly change the ways in which we use technology in our classrooms.
Application	The use of abstractions in particular concrete situations	My arguments stance is that fully guided instruction is more effective for learners than minimally guided instruction. A fully guided instruction provides learners with a basic foundation of knowledge by utilizing a procedural and linear fashion while often modeling exactly what learners need to know. For example, in one of my training courses, procedures are modeled while walking trainees through individual steps. Once they have practiced and learned to apply the basic understanding, they are given opportunities to apply that knowledge in authentic problem-solving exercises. These trainees perform better because they have a foundation of knowledge that's provided by that fully guided instructional approach to build upon. As opposed to those trainees who take other standalone training courses that have a more of a minimal guidance approach, these trainees seem to not perform as well due to lacking the basic foundation that is required. They often seek out more guidance due to being more confused, also. So this is the reason why I support the fully guided learning approach and I think it's more effective.
Analysis	The breakdown of an idea into its constituent elements and make their relations explicit	I agree that various attributes influence learning. I guess the question that remains unanswered is whether attributes remain as surface features or are the attributes and the medium, one and the same. There are certain attributes that enhance instruction causing positive outcomes but can it be said without a doubt that those outcomes would not take place without that particular medium. The research continues to show that mediums do not have a significant impact on student learning. The meta-analytic evidence from some of the research initially seemed to show that the computer-based instruction causes a 20% improvement in final exam scores. This was later explained by the author of the research that it was indeed the method that caused this improvement. The opposing research seemed to be based on the concept that the medium and method be seen as one. This concept led to the results being opposed by some. Ultimately, the advancement of technology and the way that we use mediums may begin to have more of an impact, but the research still does not support the fact that mediums rather than methods have more of a substantial impact on learning.

Appendix (continued)

<p>Synthesis</p>	<p>Working with pieces, parts, elements, etc... and arranging and combining them into new patterns or structures</p>	<p>When considering the experiment done with students in Thinker Tools, I would have to question the variation in the methods used. Even though the high school students covered the same topic via textbook, the method and content was still different. The sixth graders covered a completely different unit altogether. The students using the Thinker Tools did perform better but how can it be completely validated that it was indeed the medium that caused the positive results instead of a well-thought out method? I think to be fair, the curriculum must be exactly the same for all groups. This is like saying let's conduct research on the outcome of students learning to change oil in a car. One group will view a step-by-step simulated video, one group would read a chapter in a book about changing oil, and one group would complete a unit about the importance of cars. Obviously, those who have the opportunity to view the simulation will likely have the most positive results. In the end, the question still must be asked whether given the exact same content just using a different medium, could it result in the same positive outcomes? I think the answer is likely to be yes. Which, therefore, it takes us right back to what Clark's original argument was: that it is the method that remains the common denominator when various mediums yield the same result.</p>
<p>Evaluation</p>	<p>Judgments about the merits of Materials and methods for given purpose</p>	<p>While I agree that minimally guided instruction can be beneficial in some situations, particularly those with learners that have a high skill set or some previous knowledge, I don't believe it's the most effective in general. As you pointed out, fully guided instruction is more standardized, but I think this standardization helps and has been proven to be more effective when dealing with learners on an anonymous level that do not have previous knowledge. Minimally guided learning is more situational and I think when given a variety of students, you will have an impact on fewer students whereas fully guided instruction provides more of the basic concepts that can appeal to everyone. Also, minimally guided instruction tends to focus more on the process of learning which can prove to be overwhelming and according to the cognitive load theory, this can lead to heavy working memory load, which can be detrimental to learners rather than beneficial. It also leaves learners without the foundation which most learners are expected to know. I feel that the one size fits all actually seems to be more, to logically make more sense. This process assures that everyone gets the basic foundation. Once they have the basics, then they can go through the application process, which they can practice in real, authentic situations that can help capitalize their skills in the problem-solving area.</p>

