

# Can Critical Thinking be Fostered by Museums through Virtual Conferences? And Can It be Assessed?

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## **Abstract**

Virtual Conferences (VCs) that employ social networks are becoming popular and efficient educational tools for museums. The scope of this project was to evaluate whether participation in the VC could foster critical thinking and communication skills. A mixed methods approach based on conversation analysis revealed that critical thinking could be fostered even though the conference was mostly used for problem identification and definition rather than for problem exploration, application and integration. Furthermore, the importance of conference facilitators was confirmed. Further studies are needed to elucidate the role of the reciprocal interaction among participants.

## **Introduction**

The new educational frontier in the 21st century global context is represented by cyber-learning (CL), defined as "the use of networked computing and communications technologies to support learning" (National Science Foundation 2008). Among the spectrum of CL initiatives, Virtual Conferences (VCs) are a method recently adopted by museums that employ social networks to disseminate information and engage target audiences. While

most of the attention and the economic support have so far focused on creating cyber-learning infrastructures, very little is known about what kind of learning occurs by using them, especially in informal learning settings (Di Blas and Poggi 2006).

In the 21st century learning scenario in the United States, one of the most desired outcomes for higher education and professional development initiatives is critical thinking (CT; Garrison 1992; Garrison 1991). As pointed out by Dr. Garrison, the CT process can be conceived as a cycle of thinking activities: problem identification, problem definition, problem exploration, problem application and problem integration (Garrison 1991). Within formal learning settings, scholars have investigated to what extent CT, which may be developed through online learning opportunities using content and discourse analysis of written conversations/posts (Bai 2009; Perkins and Murphy 2006; Maurino 2006; Henri 1992). However, studies of this kind are still missing when related to informal learning environments.

Coherently with this conceptual framework and the broad areas of research previously described, this study addresses: (1) to what extent can CT be fostered through VCs within an informal learning setting? And, (2) are measurably different levels of CT fostered by different types of questions? The goal of this research is twofold: on the one hand, it aims at providing information that would help the conceptualization and implementation of more effective future VCs; on the other hand, it aims at providing an original perspective to the emerging world of informal learning settings and new technologies and the development of new competencies, with special reference to the educational role museums want to play in the 21st century global context.

## Methods

In 2009, the Smithsonian Center for Education and Museum Studies organized a free three-day VC, entitled "*Climate Change*". Each day hosted four fifty-minute-in-length educational sessions for a total of twelve sessions led by Smithsonian Institution (SI) professionals (<http://www.smithsonianconference.org/climate/>). The quasi-synchronous online format allowed participants to

interact with SI experts and among them regardless of their geographical location. ⓧ During each VC, SI experts presented a specific topic through a multimedia virtual lecture, involving audio, videos and slides. A moderator was always present in order to facilitate discussion among the experts and the logged-in users and encourage participation through written and verbal questions. Active participation by the audience was enabled by the provision of interactive tools: a Questions & Answers (Q&A) Chat Box was permanently available during each session. Participants could use these boxes for texting messages addressed to the presenter, the moderator and/or the other people attending the conference, enabling different types of interaction. Posts were filtered by the moderator. Pop-up opinion and poll boxes aiming at collecting participants' views were also used as a means of interactivity. Furthermore, educational resources and ideas for activities to be conducted before and after the VCs were made available on the website in order to allow participants to deepen their VC experience, link it to personal interests and everyday life, and provide a platform for pre- and post-conference discussion and connection among participants.

By adopting a mixed-methodologies approach, this study considered only messages posted in the Q&A Chat Boxes as objects of research. An evaluation matrix was developed and divided into two broad areas of analysis: logistics and conversation analysis (Fig. 1). Both logistics and conversation analysis were organized into two main dimensions (Participation Rate/Participation Type, respectively); each dimension had various sub-dimensions that were analyzed with reference to different categories. Critical thinking was investigated in accordance to the five-stage model developed by Garrison (1991) and the five matching reasoning skills identified by F. Henri (Henri 1992). A rubric of key-indicators based on examples provided by the existing literature (Hara, Bonk and Angeli 2000; Henri 1992) was developed to guide the process of analysis and enhance the internal validity and coherence of the research. Two researchers independently coded the transcripts according to the dimension and the categories described in the paragraphs above. When coding the posts according to the

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ⓧ The Computer Mediated Communication (CMC) allowed by these tools can be defined as quasi-synchronous, meaning that messages were composed before transmission by participants but would be firstly filtered by the conference moderator and eventually visualized. Messages appeared on the screen in chronological order, with an indication of their authors next to the typed text message. The CMC defined as asynchronous communication allows users to post and read messages at anytime, with no necessity for senders and receivers to be simultaneously online in order to make the communication occur.

critical thinking categories, the range of agreement registered by the two researchers was 75% - 96% .

LOGISTICS					
Participation Rate			Participation Type		
			<b>Comment Type</b>		<b>Interaction Among Participants</b>
			Phrase( 1)		Administrative ( 1 )
			Sentences( 2)		Technical ( 2 )
			One word( 3)		Social ( 3 )
			Combination( 4)		Content ( 4 )
#of participants logged in	#of participants who posted	#of messages	Punctuation/Symbol( 5)	#of sentences per message	How many messages per each single post?
			Not Applicable( 6)		Social/Content Combination ( 5)
					Not Applicable ( 6)

Conversation Analysis			
Interaction Type		Critical Thinking	
	Presenter to Participant( 1)		
Explicit/ Direct Response( 1)	Participant to Participant( 2)		Elementary Clarification/Problem Identification( 1)
Explicit/ Direct Commentary( 2)	Participant to Presenter( 3)		In Depth Clarification/Problem Definition( 2)
Implicit/ Indirect Response( 3)	Moderator to Participants( 4)		Inference/Problem Exploration( 3)
Implicit/ Indirect Commentary( 4)	Participant to Moderator( 5)		Judgment/Problem Application( 4)
Independent( 5)	Moderator to Presenter( 6)	Self originated post( 1)	Strategy/Problem Integration( 5)
Not Applicable( 6)	Not Applicable( 7)	Follow-up response( 2)	Not Applicable( 6)

Figure 1 The evaluation matrix

## Results

### Logistics

The exact number of participants exceeded the initial 2,027 registrations because multiple people could access the conference from a single computer. The total number of participants who posted during the VC was 462, for a total of 1,127 messages. The percentage of multiple posts by the same person was 50.2% , meaning that nearly half of the people who actively engaged with the VC environment posted more than once.

The analysis of the **comment type** illustrated that 44.8% of the posts were sentences, followed by phrase (38.3% ), one word ( 14.2% ), combination ( 2.3% ) and punctuation/symbol ( 0.2% ). More than 80% of the posts were

content-related. Messages having a social function represented nearly the 15.3% , whereas the social/content combination was registered in less than 1% of the posts. Technical and administrative messages were filtered out for the most part by the moderator, for this reason, they were limited to 0.3% .

The analysis of the posts according to the **interaction among participants** sub-dimension pointed out that the great majority of the posts (93.5% ) belonged to the category Participant to Presenter, whereas the percentages of Participant to Participant posts were just around 4.6% . The posts that reflect the other possible types of interaction among participants/the presenters/the moderator represented less than 2% .

#### Conversation analysis

The data referring to the **interaction type** showed that 52.1% of the posts were coded as explicit direct responses to a question posed, whereas responses to a prior message ( Implicit; Indirect Response ) were about 1.2% . Commentaries stood between 5.2% ( Implicit; Indirect Commentary ) and 6.5% ( Explicit; Direct Commentary ). Independent messages, i. e. posts related to the subject under discussion but not referring to a prior contribution, represented 21.3% . Coherently with the data presented above, follow-up responses represented the vast majority of the posts (62.4% ), whereas self originated posts were 37.6% .

The analysis of the **critical thinking** (CT) dimension showed that the majority of the posts were coded as elementary clarification/problem identification ( phase 1; 51.5% ). In depth clarification/problem definition ( phase 2 ) and inference/problem exploration ( phase 3 ) categories were 8.3% and 2.8% , respectively. Judgment/problem application ( phase 4 ) registered for this VC was 15.5% , whereas only 1% of the posts belonged to the strategy/ problem integration ( phase 5 ) category. Finally, the 21.1% of the messages was not possible to attribute a specific level of CT, for not related to the issues of the educational sessions of the VC ( Fig. 2 ).

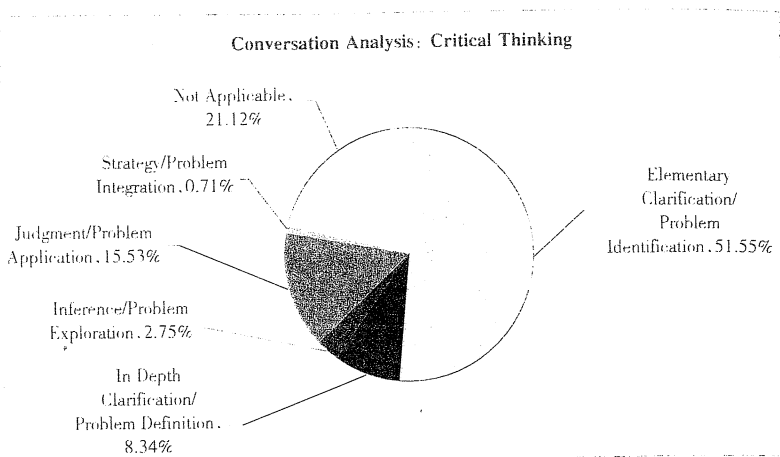


Figure 2 Conversation analysis: critical thinking

In order to investigate whether different levels of CT were fostered in relation to different types of questions proposed by the presenters/moderator to participants, an in-depth analysis of four randomly selected sessions ( ES1, IS1, SSS2 and SR3 ) was conducted ( Fig. 3 ).

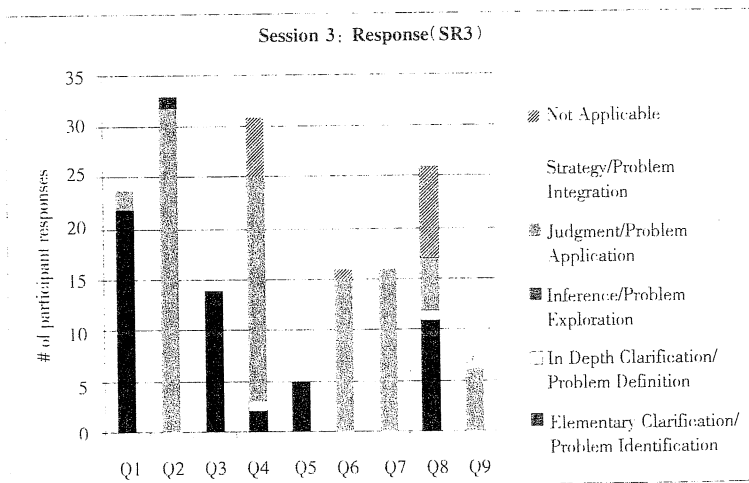


Figure 3 Critical thinking phases achieved per specific session questions ( Q ) in session SR3. The bar charts clarify that different phases of CT were registered in relation to different questions

The analysis showed that high percentages of problem application/judgment level following questions such as, "How are you working to reduce your carbon footprint?" (SR3, Q2), whereas posts coded as belonging to the problem integration/strategy phase following question, "Think about how you use energy at home, work or school and think about ways you can use less energy or energy more efficiently. Can you think of anything you can invent or would like an inventor to invent?" (SR3, Q9) The identification clarification and exploration phases were encouraged in participants through the formulation of questions such as "Can you identify the well-known artist in this photograph?" (SSS1, Q1), "Have we reached an irreversible point?" (ES1, Q6)", "Include why in the chat box" (SSS2, Q4), respectively.

## Discussion

Our data showed that hundreds of people actively participated with one or more posts; however, a comparison of these data with the total number of registrations (2,027) clearly indicated that just a portion of the public actively participated in the conference. Literature points out that participation in cyber-learning (CL) activities may be limited by difficulties in learning how CL systems work, by privacy reasons (Curran, Kirby, Parsons and Lockyer 2003) and learning styles preferences (Bullen 1998). Furthermore, people may prefer to be involved in VCs just by observing others' comments and interaction, rather than directly participating themselves (Maurino 2006). Our data showing that nearly half of the participants posted more than once suggest that self-confidence and personal attitude may play a role too.

The coding of the comment types showed that 44.8% of posts were sentences with a subject and a verb; this result seems particularly noteworthy, since the literature has highlighted that messages posted in synchronous communication environments are frequently short, not having a characteristic discourse structure (Čech and Condon 2004). In interpreting these data, it cannot be excluded that the length and complexity of the posts could have been influenced by the mind-on approach held by participants during the VC; in fact, about 83.5% of the posts were content-related, whereas just the 15.3% had social functions. Moreover, our data showed that social messages were concentrated at the beginning and at the end of the sessions, mainly representing

self-introductions, greetings and expressions of gratitude. This observational pattern could suggest that participants focused on content during the VC. However, the role of social and emotional interactions among VC participants is still open to discussion (Garrison, Anderson and Archer 2000; Sproull and Kiesler 1986) and requires further investigation.

A further analysis of the posts confirmed that the VC environment was not perceived as a space for social exchange and for explicitly relating to the people logged in: in fact, the great majority of the posts (93.5%) belonged to the category Participant to Presenter, whereas the percentage of Participant to Participant posts was just around 4.6%. Interestingly, this data seemed reinforced by the opinions collected through a survey conducted among participants after the VC: in fact, only 10% of the people who participated in the survey rated communication with other participants during the event as one of the things found most useful about the VC. Ability to pose questions to Smithsonian facilitators was mentioned by 44%, instead (Learning Times 2010; unpublished report) the data referring to the interaction type reinforced the considerations already made about the interaction among participants: in fact, more than 50% of the posts were explicit direct responses to a question posed, whereas responses to a prior message were only 1.2%. Commentaries were less present than responses, and this pattern was in line with the low percentages of Problem Application/Judgment CT category registered for the VC and that will be discussed in the next paragraph. Independent messages, i. e. posts related to the subject under discussion but not referring to a prior contribution, were 21.3%, suggesting that VC may stimulate new points of discussion. Coherently with these data, follow-up responses represented the majority of the posts (62%), but self-originated messages were present as well (38%).

When addressing critical thinking (CT), our data confirm the patterns frequently described by the literature. Several authors have pointed out that the majority of posts usually fall into the first phases of the CT cycle and show a minimal amount of critical reflection—problem exploration, problem application and problem integration. This is particularly true in a quasi-synchronous computer-mediated-communication (CMC) environment, as the one analyzed in this paper when compared to an asynchronous CMC (Bai 2009; Maurino 2006; Garrison, Anderson and Archer 2001; Curran *et al.* 2003). However, the relationship between CT and the synchronicity of the posts is still under



investigation. Some authors affirm that both synchronous and asynchronous CMCs are potentially valuable (Lincoln, Stockhausen and Maloney 1997 in Armit, Slack, Green and Beer 2002), with synchronous communication usually valued for its potential to allow immediate clarification (Armit *et al.* 2002) and to facilitate brainstorming sessions instead (Finkelstein 2006).

The low percentages for problem exploration, problem application and problem integration can be interpreted as evidence that these phases of the CT process were not fostered by the VC environment. In addressing this point, the limitation of conversation analysis as the only assessment tool must be recognized since the development of different levels of CT may not be *perceivable* to the coders just through the analysis of the posts. As noted by Garrison (1991), the phase of problem integration is particularly hard to assess, because it represents the adoption of an idea in the concrete world. On the other side, since synchronous communication platforms are usually deemed as encouraging a type of interaction that aims at immediate clarification and at allowing participants to ask questions to experts, it may be possible that even if deep learning has happened in participants, they may have not been enough facilitated to post messages reflecting later phases of CT.

An in-depth analysis conducted for two sessions suggests questions that excite participants to give replies that involve their factual and previous knowledge are mainly linked to CT phase 1 and 2, whereas “Why” and “How” questions that challenge participants’ thinking process may encourage participants to write posts belonging to phase 4 and even phase 5. The data provided seems thus to confirm what the literature has highlighted about the importance of the presenter/moderator in mediating the discussion and the levels of questions posed for the learning process (Bai 2009; MacKnight 2000; Hara *et al.* 2000). As proposed by Dr. Garrison, effective text-based computer conferencing environments should be characterized by a “teaching presence” valuable not only for his/her/their instructional management, but also for his/her/their capacity to help the building of understanding (Garrison *et al.* 2000).

Finally, further investigation is required in virtual environments to study the reciprocal interaction among participants. This is necessary considering that almost the totality of the posts were addressed from the participants to the presenter, therefore, the role of different types of interaction among participants in influencing the development of different levels of CT remains unknown.

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