Challenges for Research into Open & Distance Learning:
Doing Things Better – Doing Better Things
Proceedings of the European Distance and E-Learning Network 2014 Research Workshop
Oxford, 27-28 October, 2014
ISBN 978-615-5511-00-4
ISSN: 2707-2819
doi: https://doi.org/10.38069/edenconf-2014-rw-0010

THE INFLUENCE OF EMOTION ON COGNITIVE PRESENCE IN A CASE OF ONLINE MATH COACHING

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Abstract

The Math Coach program provides help with mathematics instruction using online coaching. Instructive communication using text-based CMC with additional whiteboard capacity is used. Coachees range from sixth to ninth year of compulsory school, and upper secondary school (aged 12–19). Coaches are enrolled from students at teacher training colleges. Stenbom, Cleveland-Innes, & Hrastinski (2012) introduced a framework for analyzing online coaching called the Relationship of Inquiry. That framework is a modification of the well-researched and verified theoretical framework the online Community of Inquiry (Garrison, Anderson, & Archer (2000, 2001). Transcript analysis of Math Coach conversations indicates that emotional expression is a natural part of the practical inquiry process that constitutes cognitive presence.

Introduction

Wood, Bruner and Ross (1976) described the coaching or tutorial process as "the means whereby an adult or 'expert' helps somebody who is less adult or less expert" (p.89). Bloom (1984) found that average students in an individual tutoring condition obtain test scores as high as the top 2% students in a classroom condition. In a meta-analysis of findings from 65 evaluations of school tutoring programs, Cohen, Kulik and Kulik (1982) showed that the programs had positive effects on academic performance and attitude to the subject matter of those receiving tutoring. They also found that the children who served as tutors had better understanding of and more positive attitudes to the subject matter.

A model entitled the Relationship of Inquiry (RoI) framework was developed to provide a deeper understanding of one-to-one online tutoring. It is built on the widely accepted online Community of Inquiry (CoI) framework (Garrison et al., 2000; 2001), is based on the work of Peirce (1955) and put in an educational context by Lipman (1991). The RoI framework is based on four interdependent elements: cognitive, teaching, social, and emotional presence. The framework and elements is described below. To date, the RoI framework has been tested and verified in an online math tutoring setting. The adapted cognitive, teaching, social and emotional presence measures achieved an acceptable level of reliability (Stenbom et al., 2012).

Findings suggest the adapted online inquiry framework is a good fit for describing one-to-one online tutoring.

Emotional presence has been suggested as an element worth exploring in online environments. It has been suggested that the present location of emotions in the CoI, currently defined as a part of social presence, can be questioned (Garrison & Akyol, 2013). Cleveland-Innes and Campbell (2013) suggested a possible four element framework adding emotional presence as "the outward expression of emotion, affect, and feeling by individuals and among individuals in a community of inquiry" (p.283). As described above, this additional presence is included in the RoI framework, and is a central element in this study.

Central for critical higher-order thinking is the component of cognition. Cognitive presence has been defined "as the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry" (Garrison, Anderson & Archer, 2001, p.11). If emotions are considered as a natural component of inquiry, critical higher-order thinking includes emotion, affect and feeling. It is therefore reasonable to further investigate the influence of emotion on cognitive presence.

This study is guided by the following research questions:

1. To what extent is a combination of cognition and emotion present in online math tutoring?
2. Are there differences between the amounts of emotion expressed during different parts of the cognitive process of inquiry?

Background Information

Denis, Watlan, Pirotte and Verday (2004) reviewed literature on online tutoring and defined the e-tutor as "someone who interacts directly with learners to support their learning process when they are separated from the tutor in time and place for some or all these direct interactions" (p.1). Kopp, Matteucci and Tomasetto (2012) surveyed 76 online tutors from 17 European countries. Experienced online tutors were defined as those that emphasized the importance of collaborative activities. They used specific cognitive activities to support online collaboration and were more familiar in detecting and intervening to avoid dysfunctional social behaviour. Hampel and Stickler (2005) suggested a number of skills necessary for successful synchronous online tutoring: "dealing with the technology and using its advantages, the social skills of community building, language teaching skills, and the skills to teach creatively and develop a personal teaching style in an online medium" (p.311).

This personal style is likely to include expressed emotion, a normal part of the human experience and a likely response to experiencing challenges in the math skill development process. This relationship between emotional expression and cognitive processes is of central interest to this segment of our research. For centuries the dispassionate thinker who applies logic and reason to pursue truth has been the ideal towards which learners are encouraged to

ISBN 978-615-5511-00-4

strive. Emotion is perceived, at worst, as a hindrance to learning, and, at best, a learning outcome in the affective domain. Dirkx (2008) made a case for the integration of feeling into adult education. That impassioned argument is the impetus for our work on the role of emotion in online learning.

Palloff and Pratt (2003) recognize that emotion plays a role in online communication. They advise the use of emoticons – participant generated symbols intended to represent emotions – as a tool to compensate for the absence of tone of voice and body language during text-based Internet-mediated learning. However, the affective domain and emoticons address only indirectly the pervasive presence of emotion in online learning.

Conrad (2002) vividly recounted the tumult of feelings, including anxiety, which accompany the online experience. Garrison, Anderson and Archer (2000) proposed a theoretical construct for online learning that entailed three "essential elements" (p.88): cognitive presence, social presence and teaching presence. Those authors posited that emotional expression is an inherent aspect of social presence. In their Community of Inquiry (CoI) model, emotion evolved from an outcome to an essential quality of online learning. Although the model is intuitively satisfying, the position that emotion is merely a domain-specific component, and not a process that serves as a sub-text for learning, fails to go far enough in dealing with the role emotion plays in online learning environments.

Also indicated by Garrison, Anderson and Archer (2000) and represented in the RoI model, is the actual process of learning labelled cognitive presence. This element is outlined by the practical inquiry model, which describes the process of critical thinking and consisting of four vital components: triggering event, exploration, integration and resolution (Garrison et al. 2001). For the RoI where there is one-to-one online coaching, a triggering event is something that motivates a learner to contact an educator to get help – as well as the stating of the problem or issue in a conversation. The exploration is characterized by a review of the learner's previous knowledge, brainstorming and the exchanges information. Integration involves the connection of these two events. In the resolution phase, ideas are put together to form an accepted meaning. A typical example in math tutoring is the math calculations. Resolution includes the actual solving of the problem or issue and analysis of solutions.

Data Collection and Analysis Methods

This case study tests the use of an adapted theoretical model of interaction in online teaching and learning. The case involves an instructional opportunity for students who require just-in-time assistance completing their math homework, as assigned by their own math teacher at their own school. We used content analysis of electronic logs in order to get a more thorough understanding of how emotional presence is articulated in online math coaching.

A total of 60 logs from math coach conversations were selected out of the 7640 logs from the year 2012. Logs were analysed using the individual message as the unit of analysis as a message usually contains a few words with one joint intention (Garrison, Cleveland-Innes, Koole &

ISBN 978-615-5511-00-4

Kappelman, 2006). A coding scheme, displayed in Table 1, had been developed following the CoI coding template complemented with emotional presence. In the coding procedure logs were coded for with cognitive, teaching, social, emotional presence along with their sub-categories.

Table 1: The Relationship of Inquiry coding scheme

Element	**Category**	**Indicators (examples only)**
Cognitive presence	Triggering event	Stating a problem, changing direction.
	Exploration	Brainstorming, broad search for insights, information exchange.
	Integration	Connecting ideas, computations.
	Resolution	Achieve solution, analysis of solution, implementation.
Teaching presence	Design & Organization	Establishing interaction, setting parameters for the inquiry.
	Facilitating discourse	Stimulating constructive inquiry, assessing process.
	Direct instruction	Providing steps to solution, summarizing the discussion.
Social presence	Open communication	Acknowledging, trivial expressions.
	Relationship cohesion	Greetings, praise, vocatives, building links.
Emotional presence	Activity emotion	Emotion about the inquiry.
	Outcome emotion	Emotion about the consequence of the inquiry.
	Directed affectiveness	Emotion towards the other person.

Two persons independently coded half of 60 logs each. Then 10 logs were coded by both coders for reliability calculations. A message was coded, when applicable, with more than one category to follow the idea of overlapping elements in the framework. After performing the coding procedure all messages coded with emotional presence and coded with more than one code was chosen.

Findings

A total of 3109 messages were coded in this analysis. Out of the 3109 messages, 2241 messages were coded with one element, 832 were coded with two elements and 36 were coded with three elements. The number of double-coded messages including emotional presence was 480. Out of the 36 triple coded messages 30 included emotional presence. The distributions with the other elements are presented in Table 2 and Table 3.

Table 2: Number of double-coded elements including emotional presence

	Cognitive	**Social**	**Teaching**	**Emotional**
Emotional	135	58	281	6

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Table 3: Number of triple-coded elements including emotional presence

	Cognitive	**Social**	**Teaching**	**Emotional**
Cognitive	1			
Social	4	1		
Teaching	0	19	2	0
Emotional	0	3	0	0

In order to investigate the interactions between emotional presence and cognitive presence the specific combination of these elements was selected. Since only 5 messages were triple-coded with combinations of emotional and cognitive presence it was decided to only include double-coded messages in the further analysis. For double-coded messages a total of 135 messages were found. Table 4 displays the number of messages and outline the distribution of the messages among the four categories of cognitive presence and the three categories of emotional presence.

Table 4: Number of double-coded elements of cognitive and emotional presence

	Triggering event	**Exploration**	**Integration**	**Resolution**
Activity emotion	9	49	4	7
Outcome emotion	0	1	0	0
Directed affectiveness	8	47	5	5
Total	17	97	9	12

The final step of the analysis was to examine the occurrence of emotions throughout the four elements of the cognitive process outlined by the practical inquiry model. This was done using messages double-coded with emotion and the categories of triggering event, exploration, integration and resolution presented in Table 4. That data was then normalized by dividing with the total number of messages that was coded with the categories of cognitive presence during the coding procedure. The comparatives were calculated as the percentage of the total presence per category that was double-coded with a category in emotional presence. The result is displayed in the Table 5.

Table 5: Percentage of messages coded with categories of cognitive presence also coded with emotional presence.

Category	**%**
Triggering event	12.84
Exploration	17.24
Integration	4.93
Resolution	10.53

These findings indicates that emotion is a part of all the four categories of cognitive presence, hence a part of the entire practical inquiry process. The distribution is, however, uneven throughout online math tutoring. Most emotional is exploration where 17.24% of the total number of messages coded was also coded with emotional presence while for integration 4.93% of the messages included emotions.

ISBN 978-615-5511-00-4

Discussion

These findings provide more evidence that emotions are evident in an online learning environment (Brookfield, 2006; Zembylas, 2008; Dirkx, 2008) by revealing emotions associated with all three other presences identified in an online RoI. Although text-based communication is a more limited medium to express emotions compared to face-to-face communication, online students develop new ways to express themselves emotionally. Similar to other studies, the students in this study used paralanguage (i.e. emoticons, punctuation, capitalization), adopted a less formal more personal and expressive tone or used figurative language (e.g. Meyer, 2003; Swan & Shih, 2005; Delfino & Manca, 2007; Lord & Lomicka, 2008) to exhibit both positive and negative emotions related to all areas of cognitive presence, but during exploration in particular.

Conclusion

The identification of emotional presence as a substantive, significant influence in online learning environments is an important finding in this study. More important is the relationship suggested by the combination of emotional presence in reference to cognition. Emotion was identified more often in cognitive presence than social presence, but less so than in teaching presence. Across elements of cognitive presence, as identified by the practical inquiry model, emotional expression varies. Emotion is more prevalent during the early phases of cognitive processing: the experience of a triggering event and the exploration toward understanding. The integration of this experience into past learning demonstrates the least amount of expressed emotion. The resolution of a cognitive event involves greater expressed emotion than during the integration phase, but less than during the triggering event and exploration phases of cognitive presence.

Further research is needed to continue to verify and explicate the existence of emotion in online learning. Beyond acknowledging its existence, the amount, character, and impact of emotion in reference to online learning must be identified. From this research, practice implications for online instructional design, facilitation and instruction with consideration to possible emotion response and expression can be outlined.

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