# Adjusting the community of inquiry approach to a synchronous mathematical context

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This paper applies the Community of Inquiry (CoI) framework previously used in asynchronous discussion forums to synchronous chats in a mathematically-based undergraduate course. While the three presences described in the CoI framework - cognitive, social and teaching presence - are still identified, it is argued that categories and indicators tailored for coding asynchronous discussion may need adjustment when applied to this new context. Preliminary results based on the transcript analysis of one chat log and using two coders are presented in this paper.

Keywords: synchronous chat, undergraduate, mathematics, community of inquiry

## Introduction

In an e-learning context mathematics students tend to panic and give up quickly, because there is generally too much time between contacts in an asynchronous online environment (Smith & Ferguson, 2005). Immediate feedback from an instructor or peer can alleviate this, give confidence and keep students engaged with the content. Realising the need for a new pedagogical approach to teaching mathematics at a distance, the authors trialled weekly MSN Messenger tutorials utilising electronic handwriting for two undergraduate introductory mathematics/statistics courses over a one semester period. Student and instructor perceptions of these tutorials have previously been reported (Loch & McDonald, 2007). Chat logs from this trial are now evaluated using transcript analysis. In this preliminary study, one chat log is used to develop CoI categories and indicators specific to this context, while another chat log is used to test the framework.

## Community of inquiry

The Community of Inquiry (CoI) model (Garrison, Anderson & Archer, 2000) provides a framework for describing the learning that takes place in online asynchronous discussion forums by considering three core elements: cognitive presence, social presence and teaching presence (see Figure 1).

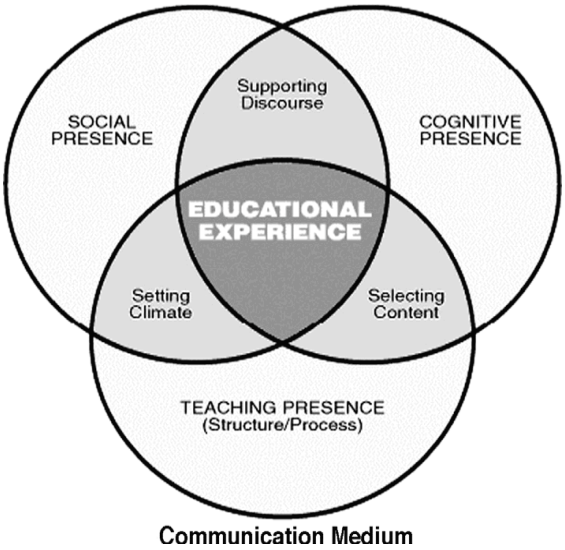



**Figure 1: Community of inquiry framework (Garrison et al., 2000)**

Cognitive presence is characterised by "exploration, construction, resolution and confirmation of understanding" (Garrison, 2007, p. 65) through practical inquiry. Social presence requires the participants to establish personal and purposeful relationships to foster effective communication (Garrison, 2007). In order to keep interactions focused in a specific direction, teaching presence is seen as essential in balancing cognitive and social issues (Garrison et al., 2000). Teaching presence includes instructional design and organisation, facilitating discourse and direct instruction (Garrison & Arbaugh, 2007). Within this CoI framework, the challenge is to recognise and assess indications of meaningful collaborative learning in the transcripts of computer mediated discussion forums (Garrison et al., 2000). In a review of the CoI framework, Garrison and Arbaugh (2007) suggest that to test its generalisability to fields beyond the education discipline, the CoI framework needs to be further applied to online learning in other disciplines than the limited few that have been reported. While this framework was developed for asynchronous discussion forums, it can also be applied to synchronous chat sessions.

## Transcript analysis

Transcript analysis informed by the CoI framework is a powerful method that can be used to understand text-based educational conferencing and discourse (Garrison, Cleveland-Innes, Koole & Kappelman, 2006). De Wever et al. (2006) identify two important issues that need to be addressed: the unit of analysis and inter-rater reliability. They conclude that the unit of analysis which can range from an individual sentence to a complete message is dependent on the context. For the synchronous chat the obvious unit of analysis is a single message, as it is easily defined without ambiguity. The simplest and most popular way of measuring inter-rater reliability is the percent agreement. Alternatively, Garrison et al. (2006) suggest a negotiated approach to coding transcripts. After independently coding transcripts, the coders discuss their codes and work towards a consensus. This negotiated approach is particularly useful in exploratory research where the main focus is on gaining a deeper understanding of the learning taking place.

## Preliminary analysis and discussion

Transcript analysis was applied to a chat log from early in the semester to gain insight into the types of interaction taking place. Through discussion between the authors, an understanding of the categories and indicators described in Garrison et al. (2006) was developed. Taking into consideration the synchronicity and mathematical context, categories were modified accordingly and indicators elaborated to fit the new purpose. Table 1 shows a complete list of categories and indicators identified.

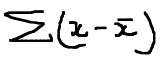
**Table 1: Community of inquiry coding scheme adjusted for synchronous mathematical chat**

| Elements | Categories | Indicators |
|---|---|---|
| Cognitive presence | Triggering event | New topic |
| | Exploration | Confirming no understanding, Confirming understanding, Student repeats, Student proposes (low level), Not commenced work, Question on topic |
| | Integration | Connecting ideas |
| | Resolution | Apply new ideas |
| Social presence | Affective | Apology, Thank you, Emotions |
| | Group cohesion | Social, greeting, Encouragement, Building community |
| | Organisation | Technical (student), Class management (student), Time out (student) |
| | Acknowledge receipt | Nodding |
| Teaching presence | Design and organisation | Time out, Technical, Course management, Class management |
| | Facilitating discourse | Clarification, Focused question, Giving task, Confirming understanding, Steering in direction |
| | Direct instruction | Explanation of content, additional explanation/definition |

A log from a different week was selected to test the transcript analysis categories that had been developed. This time the authors coded the chat log independently and then met to negotiate a consensus of the coding. Using simple percentage agreement, inter-rater reliability was 79%. After negotiation, it rose to 99%. Extracts from the chat log with accompanying negotiated code for presence, category and indicator (see Table 2) illustrate the more conversational style of synchronous chat which necessitates an adjustment of the original CoI coding scheme.

**Table 2: Examples of coded chat logs**

| Chat message | Presence – Category | Indicator |
|---|---|---|
| Sam says: | | |
| hang on, by squaring the bit in the brackets, you eliminate any negatives under the square root | Cognitive - Integration | Connecting ideas |
| Christine says: | | |
| yes Sam!! | Teaching - Facilitating discourse | Confirm understanding |
| Jack says: | | |
| OK it is the distand not the direction | Cognitive - Exploration | Confirm understanding |
| Christine says: | | |
| why do we do that | Teaching - Facilitating discourse | Focused question |
| Christine says: | | |
| yes Jack | Teaching - Facilitating discourse | Confirm understanding |
| Carla says: | | |
| hard one to grasp | Social - Affective | Emotion |

| Chat message | Presence – Category | Indicator |
|---|---|---|
| Christine writes: | | |
|  | Teaching - Direct instruction | Explanation |
| Christine says: | | |
| but what would you get then | Teaching - Facilitating discourse | Focused question |
| Sam says: | | |
| negatives | Cognitive - Exploration | Propose |
| Jack says: | | |
| zero | Cognitive - Exploration | Propose |
| Christine says: | | |
| some negatives and some positives | Teaching - Direct instruction | Explanation |
| Christine says: | | |
| yes Jack zero | Teaching - Facilitating discourse | Confirm understanding |

## Conclusions and future directions

The results from this preliminary study demonstrate that with some adjustment the Community of Inquiry framework can be applied to synchronous chat in a mathematical context. Future work will include analysis of all logs for a semester to identify any change in the balance amongst the presences over time.

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