STUDENT-STUDENT ONLINE COACHING AS A RELATIONSHIP OF INQUIRY: AN EXPLORATORY STUDY FROM THE COACH PERSPECTIVE

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ABSTRACT

There are comparatively few studies on one-to-one tutoring in online settings, even though it has been found to be an effective model. This paper explores student-student online coaching from the coach perspective. The empirical case is the project Math Coach, where K-12 students are coached by teacher students using instant messaging. This research is an adaptation of the community of inquiry model to an online coaching setting, which we refer to as a relationship of inquiry. The adapted model was used to gain a better understanding of the practice of online coaching by exploring the extent to which cognitive, social, and teaching presence exists in this case of online coaching. A relationship of inquiry survey was distributed to and answered by all active coaches (N = 41). The adapted cognitive, social and teaching presence measures achieved an acceptable level of reliability. Differences between three presences, and their respective sub-categories, demonstrate a unique pattern of interaction between coaches and coachees in the online coaching environment. Findings suggest the online inquiry model fits as well for a relationship of inquiry as it does for a community of inquiry. The model provides valuable information for better understanding of online coaching.

KEYWORDS

online coaching, online learning, relationship of inquiry, community of inquiry, student-student online coaching.

I. INTRODUCTION

Many contemporary studies focus on interaction and learning in communities of students, such as the model outlined in the Community of Inquiry by Garrison, Anderson and Archer [1, 2]. However, there are comparatively few studies on one-to-one tutoring, despite that it has been found to be an effective model in both offline [3] and online settings [4, 5, 6]. This paper explores student-student online coaching from the coach perspective. Student–student online coaching is defined as "an online service where a student gets support on a specific subject matter from a more experienced student." [7] A detailed discussion regarding student-student online coaching can be found in Hrastinski and Stenbom [7]. The focus of this discussion is on how a student can be coached by a more experienced student. In such circumstances, it is likely that high levels of intellectual development, as prescribed by the zone of proximal development theory, can be achieved [8]. The empirical case of this study is the project Math Coach (www.mattecoach.se), which was initiated at KTH Royal Institute of Technology in 2009. Currently, the project includes three universities and seven municipalities. The Math Coach project offers K-12 students in the municipalities' online help with their mathematics homework by coaches that are available online via Instant Messaging. The coaches are studying to become K-12 teachers in mathematics.

Interest in creating online learning environments has emerged faster than relevant theory to support it. One exception to this is the Community of Inquiry Model [1, 2]. This conceptual model argues that students and instructors create a valuable educational experience online through social, cognitive and instructional actions. To date, hundreds of research articles have been published to assess and verify this model. General consensus suggests this model is a valuable representation of an effective online learning environment [9]. In order to develop an instrument to measure the Community of Inquiry a thirty-four item instrument was developed. It was found valid, reliable and efficient measure of the dimensions of social, presence and cognitive presence [10, 11].

This research is an adaptation of the community of inquiry model to an online coaching setting, which we refer to as a relationship of inquiry. The adapted model will be used to gain a better understanding of the practice of online coaching by exploring the extent to which cognitive, social, and teaching presence exist in this case of online coaching.

A. Inquiry-based teaching and learning

In the initial creation and implementation of the Math Coach program, it was agreed that the engagement between coach and coachee would be inquiry-based [12, 13]. In an inquiry-based design, direct instruction is minimized in favor of guided exploration. This practice was deemed to be the most helpful to the long term development of the coachee; rather than just providing answers to challenging questions identified by the coachees, coaches are to walk the coachees through a discovery process toward answers to questions. In spite of criticism of the inquiry-based model that suggests that the "advantage of guidance begins to recede only when learners have sufficiently high prior knowledge to provide "internal" guidance" [14, p. 75], we suggest that the internal guidance Kirschner, et al. [14] refers to, must itself be guided and practiced. Math Coach uses an instructional model which provides both.

The model of online teaching and learning constructed by Garrison, Anderson and Archer [1, 2] provides the conceptual order and structure needed to understand the complexities of online learning. The model is made up of three overlapping elements which, in combination, provide a learning opportunity for meaningful collaboration and purposeful teaching and learning activities. In Garrison et al.'s [1, 2] description of an online community of inquiry, collaborative, purposeful interaction among all students and the instructor create the learning opportunities. In the case of Math Coach, the coach is charged with creating a collaborative, purposeful relationship of inquiry. We suggest that the same three elements of cognitive, teaching and social presence (see figure 1) are important elements in the online coaching environment supported by a relationship of inquiry.

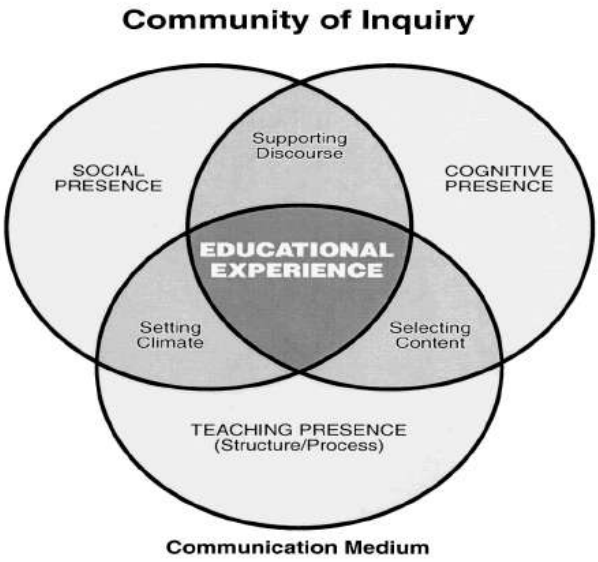

Figure 1. Community of Inquiry (used with permission)

1. Teaching Presence

To establish and maintain a discovery-based relationship of inquiry between coach and coachee requires the coach provide a focused, attentive and reflective teaching presence. In an online, text-based environment, this is demonstrated with cheerful, engaging language; clarification of meaning; immediate responses and emoticons. Teaching presence is defined as "the design, facilitation and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes" [15, p. 5]. Creating, organizing and leading the interaction is the first requirement of teaching presence. The second responsibility is to engage the coachee in a discussion of ideas around the problem at hand; facilitation of the discourse. Thirdly, when appropriate, the coach is to provide clear and direct instruction.

2. Cognitive Presence

Cognitive presence describes the intellectual engagement of both coach and coachee. Here the learning and inquiry process engages thinking. Originally defined by the Practical Inquiry model [2], four critical thinking activities move toward completion of a required learning outcome. These phases are 1) a triggering event or definition of a problem or task; 2) exploration of relevant information/knowledge; 3) consideration of and integrating ideas; and 4) testing possible solutions. This process plays out in an environment created by social and teaching presence with interaction, reflection, analysis and resolution. In the present study, cognitive presence is demonstrated by the coach and facilitated for the coachee.

3. Social Presence

The third element of an online inquiry framework is social presence. In this element, participants interact in order to project their individualism, communicate with the other person with purpose, and begin to relate in a meaningful, engaged discussion quickly. Social presence was the early focus of learning online and has yielded the most research [16, 17]. This research answered a pervasive question about online engagement: can meaningful relationships be established without the visual cues that accompanied face-to-face interaction. Research results provide evidence that social presence can and should be established in online learning [18]. Social presence is measured with three concepts: 1) open communication 2) affective expression and 3) relationship cohesion. It is a responsibility of the coach to use social presence as a function of teaching presence; this integration creates the optimal condition for collaborative engagement toward cognitive presence.

B. Math Coach and Instant Messaging

In the spring of 2009 the project Math Coach was started in Stockholm, Sweden. The Math Coach project offers K-12 students help with their homework in mathematics by coaching via IM. Today coaches are enrolled from the teacher training at the universities of Karlstad, Linköping, Stockholm and the KTH Royal Institute of Technology, also located in Stockholm. Hitherto, the coaches have conducted approximately 9600 conversations with K-12 students. The coaches of each project are co-located and work Monday through Thursday (Wednesday in Karlstad), between 5 p.m. and 8 p.m. They work sitting together at the three locations so they can help one another if a coach encounter problems in a conversation. They have computers and a variety of instructional materials, including textbooks currently used in the schools of the collaborating municipalities. To become a Math Coach one needs to have studied math and how to teach math. There is also a mandatory introductory course on math coaching that must be completed in order to get the Math Coach certificate.

The medium used to support online coaching in the Math Coach Project is instant messaging (IM). Nardi, Whittaker and Bradner [19] described IM as a near-synchronous computer-based one-on-one communication tool. They argued that a central use of IM is to support quick questions and clarifications about ongoing work tasks using an informal lightweight communication mode. However, written communication in IM and other forms of electronic communication have generated a "new language" with short cuts to speed up the conversation and pragmatic signals such as emoticons and words in order to make the communication more rich [20, 21, 22]. The potential of using IM to support learning has been showed in numerous studies [23, 24, 25, 5, 26].

To build on the research about inquiry models in online environments, the research considers the following research questions:

1) Do the concepts of social, cognitive and teaching presence, as identified and verified in an online community of inquiry, apply in an online relationship of inquiry?

2) To what extent is cognitive, social, and teaching presence supported in online math coaching?

3) How does cognitive, social, and teaching presence correlate with the characteristic of coaches?

II. METHOD

A questionnaire was distributed in order to collect data describing the respondents, descriptive data of their coach practices and their perceptions of being part of relationship of inquiry. We revised the established Community of Inquiry instrument [10, 11], in order to describe the specific context of this study, i.e. math coaching from a coach perspective in a relationship of inquiry. The respondents answered the questionnaire in a five-point Likert scale (1 = Strongly disagree and 5 = Strongly agree). All items are presented in the appendix.

Study participants consisted of all forty-one active coaches in the Math Coach program in spring 2012. Coaches were contacted and requested to complete the survey, personal reminders were sent resulting in a response rate of 100 percent (N = 41). The coaches had an average of 120 hours of experience from working as a math coach and had completed 70% of their teacher training on average. Presented in table 1 are data of the participants in this study.

		N	*%*
Gender	Female	20	49
	Male	21	51
University hub	Karlstad	7	17
	Linköping	16	39
	Stockholm	18	44
Student target group	Compulsory school (years 1-6)	7	17
	Compulsory school (years 7-9)	9	22
	Upper secondary school	25	61

Table 1. Descriptive data of the participants

III. FINDINGS

In this section we report our findings. First, we report on the reliability of the cognitive, social and teaching presence measures in our adapted relationship of inquiry survey. Then, we present results for each of the three measures and present correlations between descriptive data of coaches and their responses of the questionnaire.

A. Reliability

In general, a Cronbach's alpha of at least .7 is regarded as an acceptable level of reliability, although a value of at least .6 is accepted in explorative research [27, 28]. As table 2 shows, the teaching presence measure achieved a high level of reliability. The cognitive presence and social presence measures achieved acceptable levels of reliability, especially when considering that this is an explorative study and our first draft of the relationship of inquiry survey. Thus, in future research there is potential to increase the level of reliability by, for example, improving the wording of the statements in the survey.

Elements	*N*	*Cronbach's alpha*
Cognitive presence	12	.71
Social Presence	9	.68
Teaching presence	13	.85

Table 2. Reliability of the three types of presence

B. Cognitive Presence

As displayed in table 3, the means for the cognitive measures were quite similar. A Friedman Test showed no significant difference in categories $\chi^2(3, N = 118) = 6.36$, $p = 0.09$. It can be noted that mean for the concept 'integrate' was slightly higher that others concepts. We expect this is because a central aspect of coaching is to consider the previous experiences of the coachees and integrate these in conversations. The statement that was rated highest was "Coaching is shaped around problems posed by the student" ($M = 4.20$, $SD = 0.90$). In Math Coach the design of the service is that the coachees bring their problem to a coaching session.

Categories	*M*	*SD*
Triggering Event	3.75	0.87
Exploration	3.81	0.79
Integration	3.97	0.72
Resolution	3.79	0.76

Table 3. Mean and standard deviation for categories in cognitive presence

C. Social Presence

According to the Friedman Test, there is a significant difference in categories for the social presence measure $\chi^2(2, N = 117) = 45.30$, $p < 0.01$. The means and standard deviations are showed in table 4. Open communication is the category with the highest mean. This suggests that coaches perceive a level of comfort in the coachee during the coaching situation. The statement that has the largest standard deviation is "Getting to know students creates a connection important to the coaching relationship" ($M = 3.24$, $SD = 1.02$) which is in the affect category. Thus, there is a difference between coaches' attitudes regarding whether it is important to know the coachee or if the coachee could be anonymous.

Categories	*M*	*SD*
Open Communication	4.25	0.69
Cohesion	3.88	0.72
Affect	3.60	0.89

Table 4. Mean and standard deviation for categories in social presence

D. Teaching Presence

As displayed in table 6, there is a difference in means for the teaching measures. A Friedman Test showed a significant difference in categories for teaching presence $\chi^2(2, N = 118) = 6.33$, $p = 0.04$. The mean for facilitation was rated highest and organization was rated lowest. This indicates the importance for the coach to engage the coachee in a discussion of ideas around the problem at hand. The statement "I guide students toward understanding topics in a way that is helpful to students" was the statement with the highest score in the entire survey ($M = 4.53$, $SD = 0.60$) which also supports the coach as a guide in learning.

Categories	*M*	*SD*
Organization	3.76	0.86
Direct Instruction	4.09	0.78
Facilitation	4.12	0.71

Table 5. Mean and standard deviation for categories in teaching presence

E. Correlations

Table 6 presents the correlations between elements of presence correlated with coaches' descriptive data. In student target group all three elements were found to be correlating. Coaches that are training to become a teacher for higher grades rated higher in all elements than those for lower grades. The element with the strongest correlation was cognitive presence with in decreasing order explore, integrate and resolve. In teaching presence facilitation followed by direct instruction was the main contribution. A correlation was also found between university hub and social presence, where Stockholm and Linköping rated the social presence higher than Karlstad. This was mainly due to correlation in open communication. There is also a correlation between the coaches' experience from working as a math coach and cognitive presence where inexperienced coaches rated cognitive presence higher than experienced.

Noteworthy is that neither gender nor how much of the teacher training they had completed correlated with their answers. Within descriptive data there was only one significant correlation between University hub and experience from working as a Math Coach. This likely due to the fact that the Stockholm hub has been running for 3 years and the other two for only 1.5 years.

		Cognitive Presence	Social Presence	Teaching Presence
Gender	*r*	-0.08	-0.02	0.01
	p	0.07	0.70	0.75
University hub	*r*	-0.03	-0.11 *	-0.05
	p	0.55	0.04	0.28
Student target group	*r*	0.21 **	0.13 *	0.17 **
	p	< 0.01	0.01	< 0.01
Work experience	*r*	-0.10 *	-0.05	0.02
	p	0.04	0.33	0.60
Completed part of teacher training	*r*	-0.01	0.06	0.05
	p	0.82	0.28	0.31

Table 6. Correlations between descriptive data of coaches and the cognitive, social and teaching presence measures. The first row of each cell shows the Spearman's *r* and the second row the p-value. One asterisk indicates correlation at 0.05 level and two indicates correlation at 0.01 level.

IV. DISCUSSION

A. Research Questions

It is interesting to note that the categories which explicate online cognitive presence - triggering event, exploration, integration and resolution - demonstrate very similar mean scores, similar standard deviations and no significant differences between these multiple categories of cognitive presence. Cognitive presence is an application of the practical inquiry model originally created by Garrison [29]. "Garrison's model of critical thinking and practical inquiry [30] provided the substance" [2, p. 8] for the determination of the four categories supporting cognitive presence. In this application, findings suggest the online coaching process operates in all areas of the model equally. It is likely the triggering event occurs in the coachee's experience of studying or doing homework, and brings this event to the coaching session for assistance. The coach then determines what this event is, and engages in an exploration of the coachee's current thinking and his or her attempts to resolve the event. Integration involves the drawing in of other learning experience and material in reference to the event; "I provide learning activity that helps students construct explanations/solutions" (M = 3.95, SD = 0.68). Before the coaching session is over, it is expected that a resolution to the problem that triggered both the learning opportunity and the

call to the online coach is reached; "Students develop solutions to problems that can be applied in practice through online coaching" (M = 3.95, SD = 0.77).

Social presence develops in online interaction and provides a foundation on which the learning experience rests. In this case, the categories of social presence were disparate, indicating greater importance to some aspects of social presence than others. Open communication demonstrates the highest mean score and the lowest standard deviation. This is easily interpreted as in online coaching, social rapport must be quickly established. Cohesion yields a notably lower mean score and a similar standard deviation. Given the instrumental nature of the coaching exchange, cohesion is of less importance. Collaboration may support the teaching and learning exchange, but the relationship is very short in duration and for the purposes of solving a finite problem. Affective expression yields the lowest mean score but the highest standard deviation. Getting to know each other and respond at an emotional level is unlikely to be necessary. However, emotional tenure for the coachee, and the need for affective expression, may be high if frustration or sadness accompanies the need for assistance. Affect in response to any math problem is likely to be highly variable, and the need to express this affect to a stranger in an online platform will also vary widely.

Teaching presence in an online community of inquiry involves both peer-to-peer teaching, and instructor teaching. This expansion of the notion of teaching presence beyond the instructor does not apply in this one-to-one relationship of inquiry. However, items scores did demonstrate reliability and the theoretical categories of organization, direct instruction and facilitation are identified as separate categories with significant differences between means. The category organization yielded the lowest mean and the highest standard deviation. This seems reasonable given the short-term engagement between coach and coachee; the organization and preparedness is invisible to the coachee. The mean score of the statement "Students are coached regarding the use of time as it applies to learning" (M = 3.18, SD=0.80) was one of the lowest; coaches are less involved in the larger developmental structures related to time management and meta-learning. The invisible nature of the organization activities coaches prepare as a foundation to the coaching session. Direct instruction and facilitation center around discussion, engagement and feedback, and all are relevant and valuable in this online coaching setting.

The second research question addressed how cognitive, social, and teaching presence was supported in Math Coach. In the Findings section, the categories for cognitive, social and teaching presence were presented with mean and standard deviation for all categories. Significant differences between categories were found in both social and teaching presence. These findings can be a result of both the coaches' attitude to online coaching, how the coachees use Math Coach and the design of the service itself. In previous studies of student-student online coaching it was found that the reason for a coachee to initiate a conversation in Math Coach was mainly that the coachee had a specific math problem they needed help with [7, 31]. In this study the statement in cognitive presence with the highest rate was "Coaching is shaped around problems posed by the student". Another example with high rating is the statement: "I guide students toward understanding topics in a way that is helpful to students" in teaching presence. In the mandatory introductory course on math coaching that one has to complete in order to get the Math Coach certificate all coaches are introduced to a coaching model that focus on the coach as a guide for the coachee.

For the third research question regarding how cognitive, social and teaching presence correlate with the characteristic of coaches, the most interesting finding was that the factors that did not correlate. No correlation could be found in gender which indicates that male and female coaches have the same attitude to a relationship of inquiry in online coaching. According to this a conversation with a math coach should take place in the same fashion no matter the gender of the coach. Kopp et al. [5] showed a difference in e-tutors' support based on their experience and that experience had an impact on the way e-tutors supported online collaboration. In this study only a correlation between the coaches' experience from working as a math coach and cognitive presence where found. It indicated that inexperience coaches rated cognitive presence higher than experienced. No other significant correlation could be found neither from coaches'

experience from working as a math coach nor how much of the teacher training they had completed. But since coaches on average have completed 70% of their teacher training and the least experienced coach has completed 40% of teacher training they could all be identified as quite experienced.

B. Limitations

In this paper, we presented an adaptation of the community of inquiry model to an online coaching setting, which we referred to as a relationship of inquiry. We used the model to explore the extent to which cognitive, social, and teaching presence exist in this case of online coaching. The first research question was posed in order to investigate whether the concepts of social, cognitive and teaching presence, as identified and verified in an online community of inquiry, apply in an online relationship of inquiry. Considering that this was an exploratory study with a rather small population, and also the first time the relationship of inquiry survey was tested, the Cronbach's alpha reliability measures indicated that the community of inquiry model could be adapted to describe the one-to-one relationship between coach and coachee. That being said, our survey instruments could be improved in several ways. For example some of the statements could be improved. Since the respondents were non-native English speakers some linguistic problems occurred. The questionnaire was conducted in English accompanied with a very direct translation into Swedish. A small number of the coaches mentioned that it was hard to understand some of the statements in the modified 34 item survey. One example is the statement "Students are coached regarding the use of time as it applies to learning" which was only answered by 38 respondents.

V. CONCLUSION

In this paper, a relationship of inquiry model for online coaching has been proposed. It is an adaptation of the community of inquiry model to an online coaching setting. We suggest that the same three elements of cognitive, teaching and social presence are important elements to gain a better understanding of the practice of one-to-one online coaching. Researchers are encouraged to criticize, refine and extend this model. A modified version of the thirty-four item instrument was developed and tested. The empirical case used in this paper was the project Math Coach. It was tested for reliability of the cognitive, social and teaching presence and presented valuable information for better understanding of student-student online coaching.

The data source of this study is limited as we focused on the coach perspective and their perceptions of how they support online coaching. Future studies should include the coachee perceptions of online coaching and investigate the learning environment by using complementing data collection methods, such as log files and observations. As a future research endeavor, we also plan to complement this survey with interviews in order to be able to provide qualitative explanations that extend the quantitative findings of this paper.

VI. APPENDIX: THE RELATIONSHIP OF INQUIRY SURVEY

In the questionnaire the coachee is referred to as student.

Elements	Categories	Question	N	M	SD
Cognitive presence	Trigger	Coaching piques students' curiosity.	40	3.53	0.78
		Students asking for coaching are motivated to explore content related questions.	40	3.53	0.75
		Coaching is shaped around problems posed by the student.	41	4.20	0.90
	Explore	Coaches and students use a variety of information sources to explore problems posed.	41	3.90	0.89
		Brainstorming and searching relevant information helps students answer questions.	41	3.98	0.65

		Online discussion is valuable in helping students appreciate different points of view.	41	3.56	0.78
	Integrate	I provide learning activity that helps students construct explanations/solutions.	40	3.95	0.68
		Reflection on content and dialogue helps students understand fundamental concepts.	41	4.00	0.74
		Combining new information helps students answer questions raised in coaching discussions.	40	3.95	0.75
	Resolve	Students can describe ways to test and apply the knowledge provided when being coached online.	39	3.62	0.75
		Students develop solutions to problems that can be applied in practice through online coaching.	41	3.95	0.77
		Students can apply the knowledge gained in coaching to other areas of learning/work .	39	3.79	0.73
Social presence	Open Communication	Students feel comfortable interacting with coaches online.	39	4.23	0.67
		Students feel comfortable conversing through the online medium.	40	4.20	0.69
		Students feel comfortable sharing her/his need for assistance online.	39	4.31	0.73
	Cohesion	Students feel comfortable disagreeing with coaches while maintaining a sense of trust.	39	3.85	0.74
		Students' point of view is acknowledged during online coaching.	40	3.98	0.66
		Online discussions with coaches helps students develop a sense of collaboration.	41	3.83	0.77
	Affect	Getting to know students creates a connection important to the coaching relationship.	41	3.24	1.02
		Students are able to form distinct impressions of the coach and the coach role.	41	3.80	0.71
		Web-based communication is an excellent medium for coaching interaction.	41	3.76	0.83
Teaching presence	Organization	I clearly communicate important information required to assist the student learn while coaching.	41	4.29	0.64
		I clearly communicate important topics.	40	4.05	0.64
		I clearly communicate important content goals.	39	3.46	0.85
		Students are coached regarding the use of time as it applies to learning.	38	3.18	0.80
	Direct Instruction	I focus discussion on relevant issues in a way that helps students to learn.	40	4.03	0.80
		I provide feedback in a timely fashion.	41	4.24	0.73
		I provide feedback that helps students understand her/his strengths and weaknesses.	41	4.00	0.81
	Facilitation	I keep students engaged and participating in productive dialogue.	41	3.93	0.72
		I keep students on task in a way that helps students to learn.	39	4.10	0.55
		I guide students toward understanding topics in a way that is helpful to students.	40	4.53	0.60
		I help to identify areas of accuracy and error regarding content understanding that helps students learn.	40	4.20	0.72
		I encourage students to explore new concepts to solve problems.	41	4.07	0.82

	My actions reinforce the development of a working relationship with students.	41	3.88	0.64

VII. ABOUT THE AUTHORS

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