Examining Cognitive Attributes in Student-Teacher and Student-Student Online Interactions

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Abstract

This paper explores whether the source for cognitive attributes is in teacher-student interactions or student-student interactions. Quantitative data analysis suggests that there is no conclusive answer. However, there was a higher-level of cognitive attributes in the teacher-student interactions than student-student interactions, in particular in the cognitive category of *Sharing information,* but less so in other higher-level cognitive categories. When using qualitative discourse analysis, an interesting finding emerged. It appears that teachers can intentionally raise the level of cognitive discussion by providing certain types of stimulation, especially challenges, to the group of online learners, constantly presenting higher-level cognitive tasks.

Keywords: online learning, discourse analysis, cognitive attributes

Introduction

In my quest to understand the educational value of online learning to the learner as well as to the teacher, I researched my online practice. The literature suggests that online teaching does not fully utilise the advantages of technology and does not make the learning an interactive and student-centred experience as was expected or claimed (Bonk, Wisher & Nigrelli, 2004). The interactions that developed during online discussions did not naturally happen, but rather needed to be monitored and nurtured, something that Knowlton describes (2005) as dialogical participation, which involves substantial interactions among asynchronous discussion participants. With the intense use of online discussion as a main focus of my teaching activities, I proposed three-research questions that would tackle the challenges of online teaching and provide some empirical evidence about online teaching.

To answer the first research question: *what type of interactions exists in online learning? And what cognitive and social processes do learners experience in online learning*?, I examined the specific attributes of online interaction and a newly constructed framework based on three earlier studies (Hendricks & Maor, 2004; Heckman & Annabi, 2005; Penman & Lai, 2003) that analysed the social and cognitive processes in the online environment. These studies looked at interactivity as the most striking characteristic of Computer Mediated Communication and the element with the greatest potential to have an impact on student learning (Harasim, 1989). Content analysis into more refined categories suggested that effective cohesive and open interactive responses were part of the overall social processes and were essential to create a supportive learning environment. These social processes represent 23% of the online discussions (Maor, 2007). The analysis of the cognitive processes, which represented 77% of the total interactions, revealed five cognitive processes. The major one was *sharing information* (61%), and four components were identified as higher level cognitive processes and represented only 16% of the interactions among the students. One of these was *cognitive conflict* (15%) and the others were *negotiating meaning, testing and modifying new ideas* and *applying newly constructed knowledge* (1%).

To answer the second research question: *what role do discussion leaders perform and can a discussion leader replace an instructor in managing the discussion,* I used discourse analysis to better understand the role of the student and the teacher. This question was raised in previous research studies about online learning (Johnson, 2001; Aviv 2000). When peer learning is implemented as part of the pedagogy, students often take on the role of the teacher more often than do students in traditional classrooms (Twigg, 2001). Other studies (Johnson, 2001; Rogers, 2003) suggest that students tend to learn more from their peers than their teachers. In Maor's study (2003), students

were required to take rotational leadership roles to experience the role of the teacher in a peer-led discussion. Ikpeze (2007) used the same teaching pedagogy to achieve cohesive teams. Each contribution in the online discussion was analysed in relation to one of the seven facilitation roles (Maor, 2008). In the seven categories that were used to compare the discussion leader's role with the teacher's in facilitation, the discussion leader performed higher in *summing up and confirming, moving the discussing forward, focusing the discussion* and *debriefing*. The teacher demonstrated more frequent behaviour in *direct instruction*, *encouraging and giving feedback/content* and *scaffolding*. This suggests that in some areas the learner can replace the teacher; therefore, the teacher may utilise this as part of the online teaching strategies to enable more empowered learners and the development of a more cohesive community of learners. The role of the discussion leader enabled and promoted online interactions and changed the role of the teacher to facilitator and co-learner.

To compliment my research of online learning from the constructivist perspective, this paper focuses on the third research question: *whether student-student interactions contain a greater proportion of high-level cognitive indicators than student-teacher interactions?* To answer this question as in the previous research questions, I conducted discourse analysis of asynchronised online discussions that took place over three consecutive online courses involving postgraduate students. Offir, Barth, Lev and Shtenbok (2003) suggested that researchers should observe and categorise teacher-student interactions systematically so that the essential elements of the interactions could be 'teased apart' to investigate which interactions correlated with positive learning and attitudinal outcomes (p. 71). According to Heckman and Annabi (2005), student-student interactions in asynchronous learning discussions contain a greater proportion of high-level cognitive indicators than student-teacher interactions. According to them, two-thirds of students' utterances online were responses to other students and were longer while teachers' responses were shorter. As in previous publications (Maor, 2007, 2008), this examination of the interactions between learners and between the teacher and the learners enabled me to provide teachers with a formative evaluation of their online teaching.

Methodology

The third research question from the original project was to "test the claim that student-student interactions contain a greater proportion of high-level cognitive indicators than student-teacher interactions." To do this, the activity transcripts were examined for examples of cognitive discourses. The discourses considered as cognitive were analysed against an adapted framework based primarily on Hendriks and Maor's (2004) five progressive communicative strategies, but with the addition of some indicators from both Heckman and Annabi (2005) and Penman and Lai (2003). See the *Cognitive Coding Chart* in Figure 1.

The data coded against the cognitive processes needed to be further examined as to who specifically was involved in the various levels of cognitive interactions, using QSR NVivo software (Qualitative Solutions Research, 2007). This software has the capacity to store in a systematic and logical manner the data of qualitative research projects and build matrixes of the results. It assists the researcher in managing and analysing data by allowing coding, searching and testing. Specifically for this research, it allows 'intersections' to be made between the two major categories of student-student interactions and student-teacher interactions and the five levels of cognitive processes. The qualitative data were translated to percentages and calculated into subcategories (see Figure 2).

This study involved a postgraduate unit in an Australian university based on 13 weeks of online asynchronous discussion over three years of the same course. The participation in the online discussion was compulsory and was monitored and assessed. In addition, the participants were asked to be discussion leaders once or twice during the semester and promote learning in a way that was expected from the teacher/facilitator in this unit. About two thousands 'postings' were analysed from three semesters.

Results

The data were analysed and the interactions coded into five categories of cognitive processes (Fig 1) to test the claim that: student-student interactions contain a greater proportion of cognitive indicators than student-teacher

interactions. The categories of interactions, student-student, student-group, student-teacher and student-discussion leader, were condensed into two main groups: all *Student-Student Interactions* and all *Teacher-Student* Interactions.

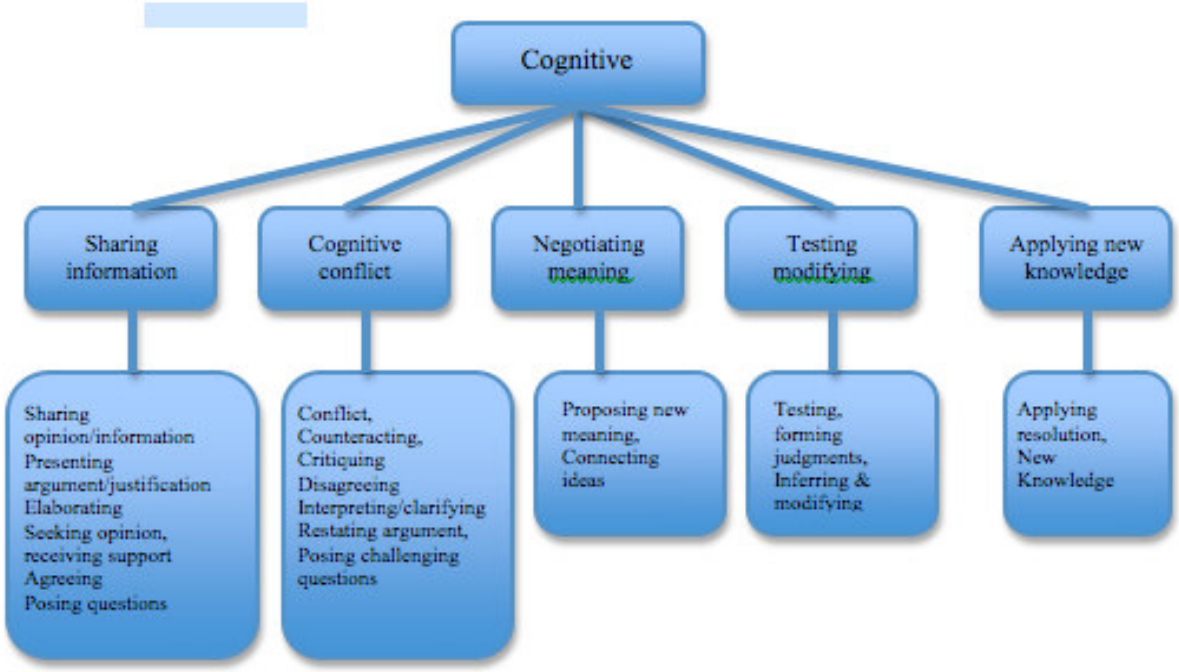

Figure 1: Cognitive processes in online interactions.

The next stage of the analysis involved examining the subcategories of the cognitive processes and whether they originated among student-student or among teacher-student interactions. Examining the cognitive categories suggests that there was a similar trend between them with a total of higher percentages of teacher-students cognitive interactions. However, in three cognitive strategies, teacher-student interactions produced higher levels of responses and in three other particular categories student-student interactions produced higher level of responses. For this purpose I looked at three cognitive processes: *Sharing information, Cognitive conflict* and *Applying new knowledge.*

Sharing information was the most frequently used cognitive category (71%) and there was a higher percentage of responses of the teacher-student interactions (41%) than the student-student interactions (30%) in this subcategory (see Figure 2). The second cognitive subcategory that presented more teacher-student interactions (10%) than student-student interactions (8%) (although not statistically significant) was *Presenting argument or justifying*. The subcategory of *Critiquing* in the *Cognitive Conflict* category was the third cognitive attribute, slightly higher in teacher-student interactions (9%) compared with student-student interactions (7%). *Sharing information* was initially the main cognitive activity demonstrated by the teacher with the other two subcategories frequently required by the teacher as demonstrated by the following student to teacher interaction excerpt:

> *In terms of a teacher having a social presence, I remember being extremely inspired by particular teachers, who when they stood in front of the classroom literally seemed to glow when teaching their passion. I think it would be a shame for all opportunities for this experience to be totally removed with a constructivist approach and with online learning in general. ... (Kate, 2006)*

As part of the first category, *Sharing information,* in the subcategories of *Seeking opinion* (5% versus 3%), *Posing questions* (7% versus 3%) or *Agreeing* (11% versus 8%), the numbers for student-student interactions were slightly

higher compared with teacher-student interactions. An example of the subcategory of *Seeking opinion* is demonstrated in the following excerpt that involved student-student interaction:

> *I understand that in pure constructivism I would allow the conversation to develop, pause, stop, digress etc in a natural undirected manner yet Tinkler notes the importance of teacher questioning/leading? So.... I would also be interested in examples of constructivism in practice. (Ada, 2005)*

In a different example of *extending an opinion* that involved reaction to teacher's probing, a student responded:

> *Thus I believe that I didn't properly engage in the learning until recent weeks. I believe that it is difficult to maintain the actual community aspect of the course, and this places huge demands on the course supervisor to ensure that the community is engaging in worthwhile learning experiences. (Chloe, 2004)*

A different student reacted to the teacher's posting by saying:

> *…for me, community has connotations of social connectedness, mutual commitment (beyond a shared function) and longevity. Whilst enjoyable, I don't think that some of these aspects are integral to learning. I think that academic rather than social cohesion is probably what holds this community together. (Susan, 2005)*

In the second category, *Cognitive conflict,* there was a slight difference towards the students-student interactions in all subcategories except *Critiquing,* which suggests that the interactions between the students and not necessarily between the student and the teachers created cognitive dissonance and generated further discussion.

> *Have I misunderstood your point or are you basing your thoughts on present knowledge and skill levels, perhaps forgetting how much you have learnt and how far you have come? (Catherine, 2004)*

An additional area, although low that was also clearly higher for the student-student interactions, was *Posing challenging questions* (3% versus 1%). This means that more probing questions were asked from other fellow students or the discussion leader and not necessarily from the teacher or directed to the teacher.

Student-Student Interactions

> *What are the characteristics of the interactions that most increased your learning? Are they postings where you were emotionally engaged at some level (opinion) or was the engagement purely intellectual? (Brad, 2006)*
>
> *Can the hierarchies of everyday living be abandoned in a constructivist classroom? What about issues of race, gender, peer group pressure, physical presence, etc.? (Tim, 2004)*

Student to Teacher Interaction

> *What this week's questions are raising is a much bigger question in my mind. How authentic are we as people in general and how much courage do we have to show this in the world? (Kate, 2006)*

Interestingly, the cognitive activity of *Elaborating* or *further emphasising* was similarly performed (about16-17%) in the interactions among students and among students and their teacher. This may suggest that the level of confidence and sharing information was encouraged and adopted by the group. A similar trend exists in *Negotiating meaning* category where no difference was seen between the interactions among the students or the one where the teacher was involved. In the last category of *Applying new knowledge,* there was a very low level of interactions but there was the same number of student-teacher interactions or student-student interactions. One student that tested and modified her perception suggested the following:

> *I am going to review (and reflect upon) my perception of my students' knowledge and experience level within my working area and make sure I am not undervaluing the students. (Catherine, 2004)*

In a different interaction, the following cognitive attribute of *Applying new knowledge* was expressed— the first excerpt involved a student-student interaction and the second involved a student-teacher interaction:

You must have read my mind. I am thinking along the line of using the toolbox's interactive component (words, sounds, pictures) and the resources, but then using an 'activity room' of sorts for students to discuss their responses to the scenario. This will hopefully use some of the constructive learning strategies and encourage students to engage others and build on their personal understanding. (Kath, 2005)

I felt I was taking these measures myself at the beginning of the course and only began to question myself when I got to the topics of social constructivism and community of learners. I found in my questioning that I was capable of not only ruining the course for myself but reducing its quality for others. It was then that I became more passionate about the type of learner I wanted to be in this unit. (Chloe, 2004)

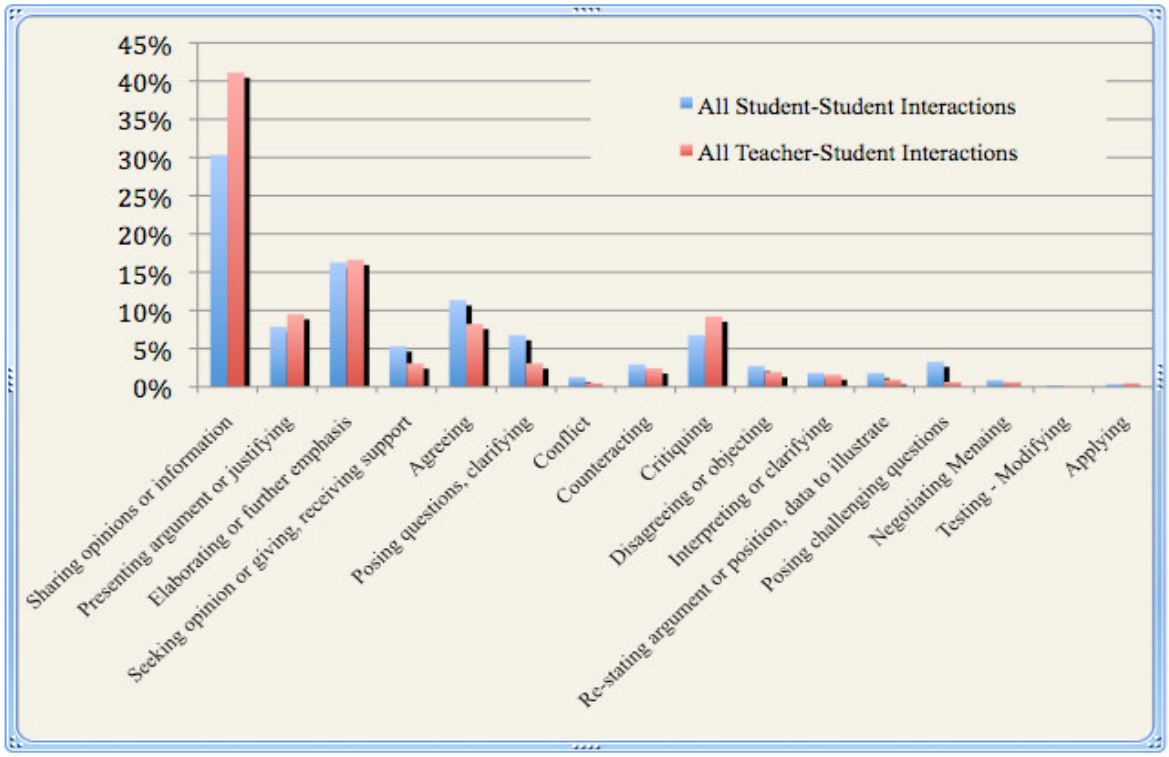

Figure 2: Student-student and teacher-students interactions in the various categories

Discussion/Conclusion

Although confronted with a large number of interactions between the facilitator and the students and among the students, careful analysis suggests that there is a risk of not modelling or not expecting high level cognitive attributes in the online discussion. This is not to say that the students do not perform or use high level cognitive processes in their online learning, but the data in this discourse analysis suggest that there is a tendency to stay in lower levels of cognitive discussion (61% of interaction) and less in the higher levels of cognitive discussion (16% of interaction). In addition, there is not a clear cut finding that the high level cognitive performance was demonstrated mainly in teacher-student interactions or in student-student interactions. This does not confirm or deny the claim that student-student interactions contain a greater proportion of high-level cognitive indicators than student-teacher interactions, but rather it raises the concern of whether facilitators can intentionally raise the level of cognitive discussion by providing stimulation and challenges to the group of online learners. The attempt to separate the interactions between the teacher and the students and the students themselves proved to be a difficult task and suggests that there are complex interrelationships between the participants, the material presented and the pedagogy employed by the online facilitator. Therefore, the answer to the question presented in this paper is not conclusive.

The content analysis of the cognitive discourses highlights the need for clear guidelines and pedagogical input from teachers to provide challenging online learning environments (Offir et al., 2003). Teachers should constantly present higher-level cognitive tasks to challenge students. There is evidence for the emergence of a strong community of learners but the promotion of higher level cognitive dimensions has to be generated within that community and may not occur without some prompting.

The online discussion in many instances became the key part of learning (Maor, 2003; McKenzie & Murphy, 2000). The interactions among the students and the teacher created a dynamic learning environment and opportunity for the creation of a community of learners as Garrison and Anderson (2003) found. However, greater emphasis on developing cognitive skills and constantly presenting challenges to the students to achieve high cognitive attributes during online discussion is required. To achieve higher-level learning, teacher's pedagogy needs to be challenged on both levels. On the one hand, the challenge of integration of the technology with the appropriate pedagogy and on the other hand, to push the envelope to keep a high level of cognitive discourse is required for the learners to develop higher level thinking skills. There is no question about the value of online teaching to promote social learning and creating communities of learners. However, the impact of online interactions on cognitive processes should be further examined and clear cognitive measures should be developed to ensure this.

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