

# The cognitive and social processes of university students' online learning



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Online learning courses in higher education have increased steadily in popularity in recent years, with many higher education students and educators wondering about their direct value in terms of social and cognitive gains. This study reports on a careful examination of educational processes in an exclusively online asynchronous discussion of a university course in three consecutive years. The researcher used NVivo software as a tool for the qualitative analysis and as a way to establish performance profiles. The study first establishes a framework to identify social and cognitive aspects of online learning based on three models of interaction and then refines the framework to better understand these processes of interaction. The themes that emerged as social processes were categorised as affective, cohesive or interactive. The cognitive processes were categorised into five types of interaction: sharing/comparing information, experiencing cognitive conflict, negotiating meaning, testing/modifying and applying knowledge. This paper focuses on the type of social and cognitive processes that learners experience in a semester long asynchronous discussion environment. The qualitative and quantitative analyses (performance profile) derived from the frequency of responses suggest that students tend to use more lower-level cognitive processes and fewer higher-level cognitive processes in spite of the fact that the course was designed to maximise the opportunities to establish higher-level learning in a socially interactive community of learners. However, the data revealed that when the higher-level cognitive processes were achieved, these were powerful and significant for a small but passionate number of learners.

Keywords: online learning, content analysis, social processes, cognitive processes

## Introduction

This study explores the cognitive and social processes in Asynchronous Learning Networks (ALNs) that were formed during an online university course. The social and cognitive processes involved in online interaction are significant in creating a community of learners (Wenger, 1998) and are considered as a positive use of the social constructivist approach to learning (Bonk & Cunningham, 1998; Palloff & Pratt, 2005). Online courses often do not fully utilise the possibilities offered by the interactive nature of online learning (Dennen, 2001; Bonk, Wisher & Nigrelli, 2004). With an intense use of online discussion to create a greater impact on learning, this course gave me an opportunity to examine the specific attributes of online learning to provide a better conceptual understanding of its social and cognitive processes and clarify the educational benefits of ALNs (Aviv, 2000).

## Literature search

To understand the educational value of ALNs, Hiltz and Turoff (1993) suggested examining the educational benefit to the learner. There is a broad literature about ways that students engage in online learning activities, both to build their own understandings and to engage with others to create a community of learners (Aviv, 2000; Garrison, Anderson & Archer, 2000, Reeves, 2005). This required mutual responsibility between the student and the instructor to create and promote immediacy behaviour for the learners and the learning community itself. According to Wiener & Mehrabian (1968) immediacy refers to the degree of psychological closeness that exists between people who communicate with each other. The immediacy behaviours are especially important in the social role that the online instructor plays in creating a community of learners (Easton, 2003). Conaway, R., Easton, S., & Schmidt, N. (2005) who investigated the immediacy behaviour of online learning, suggests that in their study there were minimal affective responses and students did not provide high levels of immediacy in the form of supportive feedback or expressions of appreciation.

Interactivity is another important element of online learning. Harasim (1989) describes interactivity as the most striking characteristic of Computer Mediated Communication and the factor with the greatest potential to have an impact on learning. Interactivity refers to a dialectical relationship existing between the individuals contributing to the knowledge and the social dynamics of the community. This creates conversations that will not naturally thrive on their own; rather they must be monitored and nurtured throughout the entire length of the online course (Knowlton, 2001). Knowlton (2005) described this process as dialogical participation, which involves substantial interactions among asynchronous discussion participants. The interaction is operationally defined as the experience of which two or more parties engage in an effort to collaborate and negotiate meaning and to develop more informed knowledge.

Social interaction is one of the most prominent components of the learning experience that is underpinned by social constructivist pedagogy (Ernest, 1995; Jonassen, Davidson, Collins, Cambell & Hagg, 1995; Harasim, 2000). According to social constructivist theory (Bonk & Cunningham, 1998), when individuals come together, such as in an online learning environment, their construction undergoes continuous revision due to cognitive conflict. Therefore, students need to interact and negotiate meaning with each other (Pallof & Pratt, 2005). Two essential elements are important: the creation of a community of learners and opportunities for interaction to co-construct knowledge (Barab & Duffy, 2000).

According to Salmon's (2003) five stages, the social processes appear mainly in stage two that focus on giving learners opportunities to establish their identity through interacting with colleagues. Carabajal, K., LaPointe, D., & Gunawardena, C.N. (2003) advised researchers to focus on patterns, cycles and interrelationships of online groups. This study focuses on the quality and type of interactions that a group of graduate students engaged in during a semester long course.

## **Methodology**

The most common assessment of online interaction is frequency counts of different aspects of online teaching and other quantitative measures. Content analysis was implemented by a few studies. Initially content analysis frameworks, such as those of Gunawardena, Lowe and Anderson (1997), Aviv (2000), and Garrison and Anderson (2003), were utilised in this study and then other literature (Heckman & Annabi, 2005; Penman & Lai, 2003) was consulted to create a more refined framework. Frameworks are the conceptual tools researchers use to make sense of what they see and can help them explain the phenomena to others. The initial framework for this research was adapted from ones developed by Heckman and Annabi (2005) and Penman and Lai (2003) and subsequently a coding scheme was further modified to include ideas from Hendriks and Maor (2004). The analysis began only after the initial stage of coding was completed.

Mason in 1992 suggested that performance profiles of educational processes could be evaluated by content analysis of the messages exchanged between the participants in educational settings. After investigation, it was decided to achieve this through the use of QSR NVivo software (QSR, 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 of the five levels of cognitive processes and further refines them into smaller bits of cognitive attributes. The transcript analysis procedure consisted of reading each message and assigning it into a category. Sometimes messages that contained two or more distinct ideas or comments were coded into two or more categories. Only students' comments were categorised for this paper, even though the teacher actively participated in the discussion.

Based on this content analysis, performance profiles of all educational processes were also created. Performance profiles are calculated via the content analysis of the information flow exchanges between the participants (Aviv, 2000). The researcher used this methodology to analyse 13 weeks of asynchronous discussions over three years of the same course. The three cohorts, of 30 students in total, also completed a learning environment questionnaire about their actual and preferred learning environments and this will be used in another paper to compare with the content analysis findings.

## **Context and content**

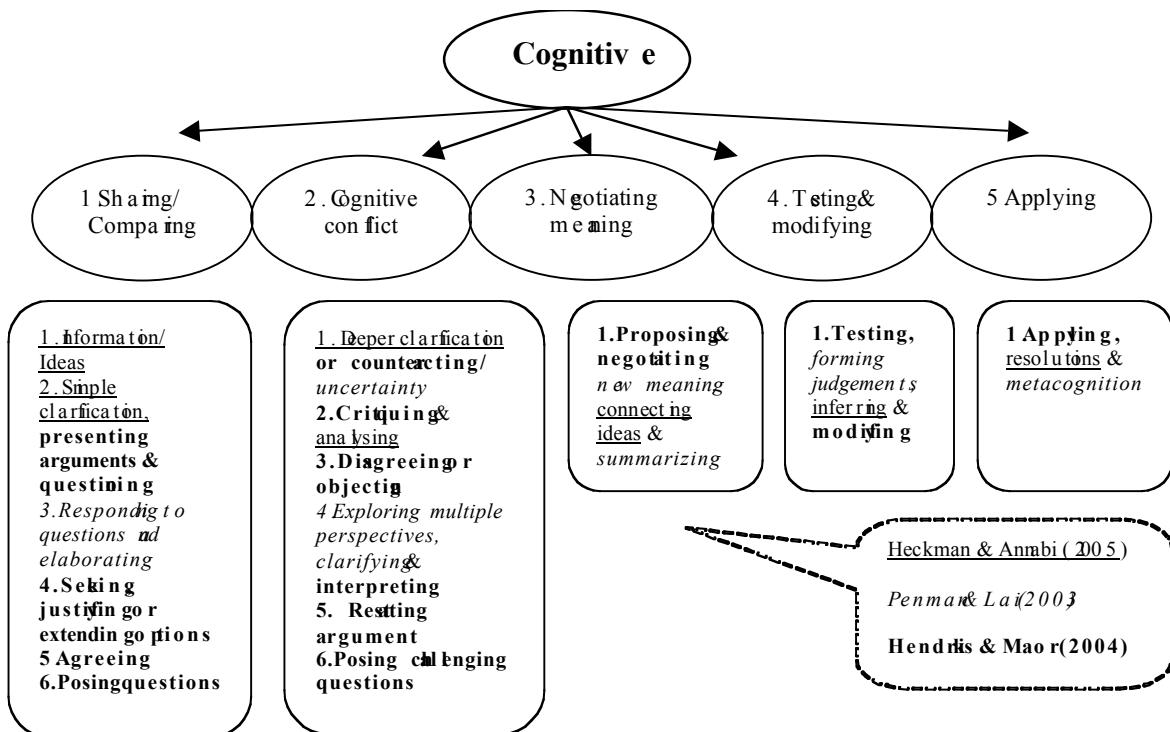
The course used for this research was a postgraduate course on e-learning in a school of education, conducted exclusively online involving asynchronous discussion with an average of 10 participants per cohort. The asynchronous discussions used the same format: background readings with focused questions

posted by the facilitator and students had the role of the discussion leader once or twice during a semester. The course was underpinned by social constructivist pedagogy and therefore included a strong emphasis on students engaging in interaction and dialogue (Maor, 2003). The instructor and students relied on these asynchronous forums to engage one another in ways that replaced face to face communication (Marra, 2006). About two thousand 'postings' were analysed from 2004 to 2006.

The analysis in this paper is representative of a large body of work in an attempt to answer three research questions. This paper focuses on the first research question: "What cognitive and social processes do learners experience and build in online learning, specifically in a semester-long asynchronous discussion?" To answer this question, the researcher examined the social and cognitive attributes of their discussions. Those considered 'social' were analysed using Heckman and Annabi's (2005) social processes categories of Affective, Cohesive and Interactive. 'Affective' responses were those considered to have primarily emotional content. 'Cohesive' responses were those considered to indicate the building of a sense of community or group commitment and cohesiveness. 'Open Communication and Attentive' responses (Heckman & Annabi's Interactive) were those considered to be interactive with attentiveness and openness to others rather than just contributing monologues.

The cognitive processes were identified using an adapted framework based primarily on Hendriks and Maor's (2004) five progressive communicative strategies, which was already an adaptation of Gunawardena et al. (1997) with the addition of some indicators from Heckman and Annabi (2005) and Penman and Lai (2003). The *Cognitive Coding Chart* below suggests that the primary content analysis of the cognitive attributes were divided into five major categories and then further refined into smaller 'bits' of cognitive attributes. For example, under level 2, cognitive conflict, there were six attributes. For one of them, Critiquing & Analysing, the data revealed 67 speech acts and four were used here as an example.

**Diagram 1: The cognitive processes in online learning**



The discussions were conducted in an 'Activity Room', which was the hub of the course in terms of developing cognitive skills and creating a community of learners. The large data source created a challenge for the analysis so the data source was reduced to analyse five topics of asynchronous discussion embedded in the course and that were common to all three years.

## Results

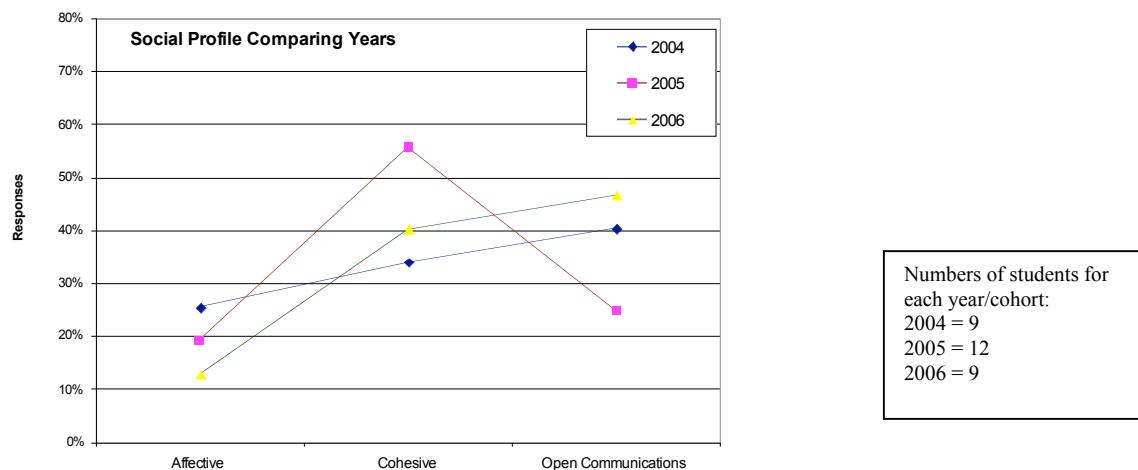
Specific meaningful responses or 'speech acts' were identified and assigned to categories of social or cognitive processes. The researcher and the research assistant verified the assigning of responses to

categories and on a number of occasions had to debate whether the statement belonged to the assigned category. Using professional judgment for making a decision has its own limitations, but it was consistent with the exploratory nature of this research (Denzin & Lincoln, 2000). In this particular case, professional judgment involved the achievement of consensus by discussion between two assessors, the level of agreement being 0.8. The number of meaningful postings or speech acts allocated to the different categories was translated into percentages by an excel spreadsheet. The content analysis of the social and cognitive processes was translated to performance profiles creating a group profile for the three cohorts as in Figures 1 and 2.

### The social processes

The profile of social processes of the three groups for the three years is presented in Figure 1. It demonstrates that the online interaction provided relatively high social support. A closer examination of the data will determine who provided this support, the learners in the peer learning situation or the teacher, but this will be the focus of another paper. Analysis of the affective processes, which were considered to have emotional content, showed from 12% to 28% of the overall social responses in the respective years. This was higher in 2004 and lower in 2006. The cohesive processes, reflecting the sense of building the community or group commitment and cohesiveness, were higher in 2005 (58%), lower (40%) in 2006, and still lower (34%) in 2004. This was surprising, as can be seen by the following excerpts of speech acts. The excerpts from 2004 indicate strong feelings of cohesiveness – confirming/disconfirming evidence – that were borne out by the higher percentage for the third category. The lower than expected percentage for cohesiveness in 2004 may well be the result of the limitation of a simple conversion of assigned speech acts to percentages. It does not allow for the strength of the speech acts or the interplay between the three categories.

Open communication and attentive, the third element in the social processes, indicated interactive types of relationships were higher in 2006 (48%) but lower in 2005 (25%) and amid (40%) in 2004. The 2005 results showing a plunge in open communications is in contrast to its high score in cohesiveness. This could indicate that, although the speech acts suggested cohesiveness and community for this cohort, the participants were not following this up with undertaking interactive types of relationships. It might have been the expectation that they would/should form some sort of community (actually one of the topics undertaken) rather than an indication of the real feelings of community.



**Figure 1: Social process**

#### *Analysis of students' interaction*

The result of the performance profile is supported by the qualitative data, except in the cases discussed above. The content analysis of the discussion was conducted to understand the processes and the specific utterances were classified under the appropriate categories as supportive evidence.

Students expressed their feelings broadly, ranging from being intimidated by the theory (constructivism) to being excited about the challenges ahead. The following excerpts describe some of the emotions by the participants, which support the *affective* element of the social process:

I must confess to feeling somewhat intimidated by much of the intellect and level of discussion undertaken on many constructivist websites. I needed to find a comfort zone that I could relate to and from that base begin to explore. (Gary, Topic 5, 2004)

Another student expressed her amazement about the usefulness of the course:

It's amazing to me that more units aren't online as it is so useful to many people, although it may not suit everyone. This course is great because of the fact that I am so far away and so are other people, but we can still have that interaction ... (Ruth, Topic 5, 2005)

The *cohesive* element that emphasises the identification of a sense of community is highlighted in the following excerpts:

All of these helped to promote a feeling of 'belonging' by developing our community that sustained our learning whilst doing this online course. (Mia, topic 12, 2004)

Also, it is a conscious attempt to share something of 'myself' - my reflections/observations on community include that, as well as a shared 'space' and a shared purpose, community includes sharing ourselves. (Susan, Topic 10, 2005)

Some students felt a strong sense of belonging; others emphasised a feeling of 'sharing themselves' to the extent of taking risks; and a few felt there was a lack of community that might affect negatively the type of interactions that were occurring.

The social aspect of community was raised by Gerald and Kate as being important. This may be an aspect of our community that is missing and may therefore affect negatively the interactions between members. (Brad, Topic 10, 2006)

The *open communication and attentive* nature of the social processes was demonstrated by a free flow of comments, which allowed extraneous remarks not always related to the topic being discussed. The following comments demonstrate how the students expressed their emotions openly.

It seems from your article I am a sandwich generation, a very interesting viewpoint. I might take up the new title. Thanks for the giggle. (Catherine, Topic 5, 2004)

I feel bad about this - I just haven't had time to look at the reading this week. I'm afraid I'll have to attempt 'duty posting' on the weekend. (Ela, Topic 11, 2005)

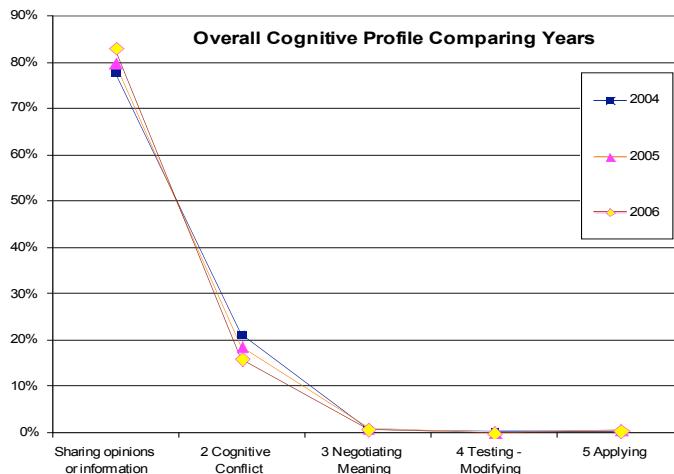
The qualitative data suggests that effective, cohesive and open interactive responses are part of the overall social processes and are essential to creating a supportive learning environment. Analysis of the threaded discussion transcripts provided evidence that learners can change from virtual strangers to communicative learners during 13 weeks of interactions.

### **Analysis of cognitive processes**

Of the five cognitive processes, the element of sharing and comparing information was the highest (80%) for all three cohorts (see Figure 2). The second cognitive attribute of experiencing cognitive conflict stands on around 20% of the total cognitive processes. The higher-level cognitive elements of negotiating meaning or testing and modifying new proposals and agreeing and applying newly constructed knowledge appeared very low or non-existent. These findings, although disappointing, are in agreement with the research finding of Gunawardena et al. (1997), conducted in a workplace setting that involved an online debate and with Hendriks and Maor (2004), conducted in a higher education setting with similar conditions to the current study.

These quantitative findings were unexpected because the emphasis in the course was on negotiation, peer learning, and co-construction of knowledge. Using the interaction analysis model, qualitative data may reveal more evidence for the development and use of higher cognitive attributes. In each category of

cognitive processes, they were further divided into subcategories according to Hendriks and Maor (2004). The subcategories are illustrated by the quotes and each one identified in bold in the next section.



**Figure 2: Overall cognitive profile comparing three cohorts**

#### *Analysis of students' interaction*

This section presents the qualitative data on **sharing and comparing information** that was the most commonly used category. The information came from personal experiences and from some of the readings.

I personally gain a great deal from the personal experiences shared that bring the theory to life and would not enjoy a community without the social interaction promoting encouragement and support. (Catherine, Topic 10, 2004)

A student in her reflections suggested that she shared the information outside of the domain of the course.

The study was of great interest and I found myself comparing the results with my family and associates. This resulted in my questioning and wanting additional information to the data collected. (Catherine, Topic 2, 2004)

However, some of the discussion revealed that although the dialogue fitted into this category, some of it demonstrated deeper reflection:

So, I think that the greatest challenge we all face as members of this online community is ensuring that our skills in engaging with the tools of our community's environment are good enough to ensure that we can participate and contribute to everyone's learning experiences, without losing anyone as we all tread the path to greater understanding. (Gerald, Topic 10, 2006)

In the second subcategory of **presenting argument or justifying with sources**, three examples representing the three years were selected.

However, I think that educational practice is looking at a major challenge and change in teaching, delivering and assessing information...as a consequence students (of all ages) will need greater, continuing and improved techno-literacy skills. (Gary, Topic 2, 2004)

I also think level and types of interactions are vital to a community's foundation. For example if only a few students responded, the community (I believe) would be less dynamic and unsuccessful in creating new knowledge and understanding. After all, that is why we enrolled in this course. (Edith, Topic 10, 2005)

Savery argues that online teachers need to be compassionate as the students have real world lives despite interacting online in the cyber world. (Geoff, Topic 12, 2006)

When students exhibited some of the third subcategory of ***elaborating***, they tended to refer to their classroom experiences as demonstrated by the following excerpts:

Similarly, your older students will have their own lifetime of experiences which will help/hinder them in the application of sound educational principles (if there is such a thing! - if one adopts a post-modern perspective, perhaps it would be hard to define good practice!). (Susan, Topic 5, 2005)

And that comes back to the nub or key-point of online teaching. Know and understand the technology. All its strengths and how to exploit them but more importantly understand its weaknesses, and how such a young medium can let students down and not deliver on expected outcomes. (Gerald, Topic 12, 2006)

When the students were ***seeking opinion*** or ***giving or receiving support*** sometime they tried to illuminate their theoretical undertaking or were searching for advice in relation to a classroom practice.

The scenario involved sending an email to a male student, and I wondered whether I had breached a "boundary" (for the want of a better description) or it was because it was a male. What do you think? It would be good to get some feedback from Andrew on this as well. Is there a noticeable difference in male and female online responses and how does this affect the online community? (Kaya, Topic 10, 2005)

Some of the examples in the fifth subcategory also fit into the cohesive category of social processes. There is overlap between these areas. The excerpts in the ***agreeing*** category ranged from teaching and learning issues to community issues, including practical issues in the current community.

I agree with her view and would empathise with her views. There is no doubt the relationships are different to face to face but once we got used to it, it is just as viable and productive a relationship if not more so. (Tim, Topic 10, 2004)

I completely agree with Ada, in the fact that teachers and students both learn together. Everyone has different experiences and can use this prior knowledge to share with each other, benefiting everyone and everyone is learning. (Edith, Topic 5, 2005)

I agree with Kate that modelling is an important factor for communities, especially online communities like ours. The community leaders have a responsibility to other members to ensure that the conditions for membership are clear and that approved behaviours are encouraged. (Brad, Topic 10, 2006)

***Posing questions:*** the following are only a small sample of the intriguing questions posed by the participants. It is interesting to note that in Hendriks and Maor's research, students did not directly challenge their colleagues with questions that would require negotiation, but rather they were reflecting openly their reactions.

I wonder how much we limit the opportunity to learn and understand due to the pressure of time, deadlines, exams, etc. Students studying for TEE exams and apparently also in VET are placed in an environment in which a full bucket is presented and they must tip it into their empty one without spillage!! (Rose, Topic 5, 2005)

I cannot help wondering how a more voluntary approach would work. Would the learners need some other link or purpose to hold them together e.g. like the professional networks that exist to support and answer the 'hard' questions, when there is no obligation to post? (Judy, Topic 10, 2005)

The most common strategies of sharing and comparing information enabled the learners to support and reinforce each other's ideas without challenging their belief systems. It appears that they became comfortable with sharing information but were not yet ready to challenge each other.

### *Cognitive conflict*

The first category of cognitive processes provided the largest amount of evidence. The second category of experiencing cognitive conflict was less identified (20%), which may suggest a lower level of cognitive challenges and less critical engagement during the online interaction. However, a closer look at the online discussions demonstrates a range of cognitive conflict attributes, where some of them were quite strong. For example some powerful interchanges of **counteracting** or offering different perspectives were evident and these usually promoted further reaction and discussion:

Although I still agree with one of the readings where the community had 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, Topic 10, 2005)

When you look at the characteristics of this Framework, I would contest that many have been represented in our experience of this unit. Curiosity and motivation have been encouraged and increased. (Judy, Topic 11, 2005)

**Critiquing** was relatively high (8%) on the cognitive conflict ladder and included some interesting interactions, sometimes cynical, among the group. They were used in particular when students wanted to provoke others into responding:

In undertaking this course we are part of an educated elite who can afford to study constructivism. (Gary, Topic 5, 2004)

Students were also concerned about the group's engagement in critical thinking:

If we are merely taking part in basic level communication, without questioning each other, challenging our fellow learners with new knowledge and requiring a search for new knowledge to answer the conflict, then we are not taking part in the critical stages needed for shared constructivist knowledge. (Chloe, Topic 5, 2004)

If our lecturer had given us the insight we now have in week one or two, would that have really helped? How would each of you have behaved/reacted differently? (Tim, Topic 12, 2004)

Others were concerned about their personal contribution to the group learning and experienced a personal dissonance:

I have realised that I do not feed back to the community my deepest experiences with the course content and discussion postings. I have had some angst all along about pitching to the discussion board and whether I should be sharing my thoughts online. (Rose, Topic 10, 2005)

In relation to **disagreeing or objecting** to a statement, this occasionally stirred up a discussion among the community that did not involve the facilitator. Each excerpt demonstrates a piece of a conversation that created some controversy:

This question again forces me to think of our group as a community and to be honest I struggle with that concept. (Gary, Topic 10, 2004)

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, Topic 11, 2004)

Your empty vessel picture, as you say, is one that comes up a lot, and one that makes me uncomfortable with my concepts of 'info transmission/acquisition'. Guess in my situation there are some facts that the students just gotta know... Fact: if you put a stomach tube into the lungs and pour fluid in, you'll probably kill your patient (especially if the fluid is oil); (Susan, Topic 5, 2005)

I do have to disagree that it is administrators who are trying to jump start integration of e-learning on campus. I think that it is teachers who are keen but without the support needed to gain control of the theory and technology don't know where to start. (Brad, Topic 11, 2006)

It is interesting to note that these excerpts appeared in the later weeks of the semester, which demonstrated some progression of development of critical thinking during the semester. This type of higher-level thinking was not as likely to appear at the beginning of the semester.

The fourth subcategory in the cognitive conflict category is ***clarifying and interpreting meaning***. The following segments are evidence of the challenges provided by the lecturer or other members of the group including the discussion leader:

Helen's answer here provides us with some challenges that constructivism may encounter or need to deal with. I must admit when I posed the question I was more thinking of criticisms or threats to constructivism, so Helen's interpretation is living proof of how a constructivist approach can step beyond the expected answers to produce growth in our learning environment! (Gary, Topic 5, 2004)

Or another student further elaborates,

I now realise I have tried to be a 'communicative learner' - i.e. "someone who participates regularly in forums", "generally competent but not especially skilled.... a sense of responsibility to the group and a willingness to take risks...." (Susan, Topic 12, 2005)

The fifth subcategory of the cognitive conflict demonstrated a ***re-stating of argument***. Students critiqued or disagreed with their colleagues' opinions and wanted to re-emphasise their views:

I still think this sharing is helped by being facilitated, monitored, modelled and given progressive feedback. Whether this sharing needs to be challenging or reflective primarily in nature to learn is still a question I am thinking over. (Kate, Topic 10, 2006)

The last subcategory in the group is ***posing challenging questions***. This subcategory is defined as higher-level thinking skills in the literature (Jonassen, 2000). Students posted some intriguing questions when there was conflict in their own understanding and they were looking for further stimulating discussions:

Inclusivity and collaboration are two great strengths of constructivism; what are some of its weaknesses? (Gary, Topic 5, 2004)

Although small in terms of appearance (total of 1% in each year), there were some significant postings in relation to the last three major categories of ***negotiating meaning, testing and applying***. One example of ***negotiating meaning*** that stands out is the following. This student negotiated from her perspective as a health professional and applied her knowledge and principles of community outside of the realm of the course into her work experience:

What she talks about is how 'plugged' in we are to our tribes and communities, so much so at times that we lose a sense of ourselves as individuals, this of course is all about how much personal power we give to our community and how much we preserve for ourselves. For instance, to make choices that are authentic to ourselves and to speak our truth, often means going against what our community may think is best for us. It is at this critical point that people often get sick and find an imbalance in their health. Not because they are speaking something that is different to others and being different to a community, but because we lack tools for how to do this without feeling guilt, shame, fear and at times a lot of self doubt. (Kate, Topic 10, 2006)

There were very few explicit postings that refer to ***testing or modifying*** new proposals. One of them suggested:

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, Topic 12, 2004)

Another student's comments demonstrated the ability to **form judgements**:

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. It 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, topic 5, 2006)

The last excerpt demonstrates the subcategory of **applying** newly constructed knowledge about herself as a learner and shared this understanding with the community:

I felt I was taking these measures myself at the beginning of the course, and only began to question myself when I got to 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 course. (Chloe, Topic 11, 2004)

This passionate posting demonstrated a high level of reflection as part of the cognitive processes that was shared with the rest of the learners in this community.

## Discussion

Following previous research, including my own work, this study analysed online discussions to understand their cognitive and social processes. To do this, it focused on student interactions using the NVivo analysis tool to develop a multidimensional representation. Integral to understanding these processes was the creation of a community of learners. In previous research (Barab and Duffy, 2000; Wallace, 2003), this was seen as essential to avoid the online course becoming a mere transmission of information. There was clear evidence that a community was created and the social processes involved represented 23% of the online discussion. One student aptly pointed out the importance of the sense of social inclusiveness in building an online community. She commented that participants in online learning are not free to leave their community when they want to, short of withdrawing from the course, and therefore inclusiveness is vital to social cohesiveness.

Through the social processes the students began to form a community even though they did not express all types of emotion that might be revealed in more intimate or close communities. This initial stage of creating a community appeared to help them form the basis for later cognitive learning. Encouraging students to express themselves socially enhanced the communication between the facilitator and participants. This in turn facilitated knowledge construction and other cognitive processes. The level of cohesiveness and interaction indicated that the group evolved with a sense of openness and a level of comfort that enabled them to express themselves freely. Nevertheless, there was some degree of criticism about the ability of online learning to develop the depth of learning necessary for higher cognitive processes. A small number of students expressed that there was no replacement for face to face learning. Another noted with some fear that the wave of new technologies in this next generation of learners had the potential to sweep away face to face teaching that could be detrimental to deeper learning.

The social comments and the fact that they comprised almost a quarter of the educational responses suggest a high level of value was attached to them, which could in turn enable cognitive processes to take place. It may be that the affective responses are equally important in increasing learning. A student asked the questions: *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, Topic 10, 2006). These questions are often difficult to determine in an educational process but further research that concentrated on this type of interaction might yield interesting insights into how to move students towards higher cognitive processes.

Most of the interactions in the online discussion were cognitive that represented the other 77% of the educational processes. Four components were identified as higher-level cognitive processes and represented only 16% of the interaction among the students. One of these was *cognitive conflict* (15%) and the others were *negotiating meaning, testing and modifying* and *applying knowledge* (1%). The major component (61%) was *sharing and comparing information*. According to Wallace (2003), many subjects are difficult to learn on one's own without discussion so this sharing of knowledge and experience may be the first step in the learning process. One of the aims of the course was to move the students beyond this level to a more challenging level of co-construction of knowledge. It was thought that through social

negotiation and reflection they might arrive at higher-level cognitive processes. However, only a few students experienced cognitive conflict and other higher-level cognitive processes that might have moved them towards more co-construction of knowledge. It was easier for them to avoid conflict and stay at their comfort level in sharing information rather than confronting each other's arguments. This confirms Wallace's conclusion that: "Students are willing to share ideas but not to challenge each other's thinking or press for deeper understanding" (2003, p. 271). It is not clear, however, whether the nature of the subject matter, assignments, the practices of the teacher or other factors hindered the movement of students toward higher-level cognitive processes.

## Conclusion

By using quantitative and qualitative analyses, it was possible to see the strength of expression that students used in describing their feelings, their progression into higher-level thinking and the development of a strong sense of community. Rather than trying to achieve precise figures that represent these social and cognitive processes, this study has been able to indicate the type of trends evident in speech acts. Through content analysis of the information flows exchanged between the participants, it became easier to identify the elements of social and cognitive processes and draw a performance profile of these processes.

This study suggests that cognitive and social processes are mutually interactive and overlapping in online learning groups. One student pointed out how important the sense of responsibility to the group was and this along with the willingness to take risks in expressing themselves openly helped to create a good, interactive community of learners. At the same time another student pointed out that it was the academic exchanges that held the community together more than the sense of social interaction or social cohesion.

These findings are important for teachers who have to think about their role in facilitating the creation of a community of learners and also in their role as probers of knowledge to enable students to attain higher-level cognitive learning. The role of the teacher was not covered in this paper nor was the role of students as discussion leaders. These will be the focus of another paper. Nevertheless, in this study, certain comments from the students indicated how important the role of the teachers was in developing the sense of community and in scaffolding the students' learning. One of the ways that a teacher can do this is to engage students in a dialogue rather than one-sided communication (Waltonen – Moore, 2007). Another possible role that was suggested by one of the participants in this study was for the teacher to lead the students towards the required learning outcomes in an indirect way without the learners' awareness that they were being guided in a new direction. To achieve this purpose, students need to be given progressive feedback and constantly monitored and facilitated to ask more probing questions. These types of interactions could be a fruitful area for further research. Another challenge for students was to apply the knowledge they learned not only in their online community but also in their work situations. Even though a few students talked about applying their knowledge in the workplace, an interesting study would be to follow the students into the workplace over the next year to determine if they were able to apply any of their online learning to their workplaces.

In the end, this research demonstrated that higher-level cognitive learning is difficult to achieve, given the restriction of time and perhaps in any setting. Certain learning tasks might have achieved higher levels of cognitive learning if they were to create greater collaboration. This is an area of research that needs further investigation. Importantly, this exploratory study revealed that when higher-level cognitive learning was achieved, it was powerful and significant for a small but passionate number of learners.

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