INVESTIGATING STUDENT ROLES IN ONLINE STUDENT-CENTERED LEARNING

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ABSTRACT

In this study we used the technique of Social Network Analysis (SNA) to investigate the roles students take on in an online student-centered learning environment, and more specifically in an online Computer Aided Language Learning (CALL) course. SNA is the mapping and measuring of relationships and flows between people, groups, organizations, computers or other information/knowledge processing entities (Krebs, 2004). We studied the interactions and communications of the students in the discussion boards of the language course and carried out Equivalence Analysis. Equivalence of the network members shows when two actors have similar patterns of relations. In other words, students with similar communication behaviors are grouped together. Being able to define, theorize about, and analyze data in terms of equivalence is important because we want to be able to make generalizations about social behaviour and social structure (Hanneman, 2001). Two nodes are said to be structurally equivalent if they have identical ties with themselves, each other and all other vertices. The aim of equivalence is to classify actors with similar roles into role groups by embedding the actors in a certain role space, identifying clusters of students and then carrying out subsequent cluster analysis to identify their roles.

After the role types were identified we used a number of other methods in order to get more details and characteristics of the role groups. These methods included the Topic Relation Analysis (TRA) which is a content analysis tool used to group the students messages into conversation categories, the Attitudes Towards Thinking and Learning Survey (ATTLS) which is used to measure the quality of discourse within the course and the extent which a person is a 'connected knower' (CK) or a 'separate knower' (SK), and the Collectivist On-Line Learning Survey (COLLES) which measures students' perceptions and preferences and was designed to help teachers assess, from a social constructivist perspective, the quality of their online learning environment (Taylor and Maor, 2000). Our findings show that four main roles types (R1-R4) where identified and one of the students in particular (R1) had communication patterns that resembled those of a teacher in classroom settings. The student in R2 would provide his own lectures notes and was connected with a large number of his peer students who depended on him for this material, he was part of a high number of cliques and his contributions in the discussion boards were mainly on course related material. The R3 students interacted with a small number of their peers but at a higher frequency, thus working more in small teams. In addition, the majority of their usage of the discussion boards was about the course material and helping out their peers. Finally, the students in R4 made connections with a large number of their peers, their discussions were mainly on social topics and not course related, they prefer to learn on their own and were mainly using the discussion boards to make friends and socialize with their peers.

INTRODUCTION

In teacher-centered online learning environments, the students are part of a course where there is a teacher who presents the lectures and supervises the communication processes. The students assume different roles and are guided by the teacher to progress through the online course. However, there has recently been an increase in online student-centered learning environments where there is no teacher present and the students rely on each other to complete the course. In our paper we study one such course with the aim of investigating the roles students take on in student-centered online learning environments. One type of interaction used by the students in such cases is peer support. "Peer support is a system of giving and receiving help founded on key principles of respect, shared responsibility, and mutual agreement of what is helpful" (Mead, Hilton & Curtis, 2001, pp140). When people find others that they feel are like them, they feel a connection and a deep understanding based on mutual experience (Mead et al 2001). It is important to have tools that allow easy and straightforward ways for community members to interact with and support each other in a peer-to-peer fashion (Kurhila et al, 2004).

Online peer support occurs through the use of Computer-Mediated-Communication. The importance of students learning from their study peers is increasingly being recognized by the eLearning community. "In some instances eLearning can foster a greater degree of communication and closeness among students and tutors than face-to-face learning" (Sumner & Dewar, 2002, pp1). Furthermore, studies show that students would prefer to contact their peer students (rather than their tutor) when they have difficulty with coursework, difficulty understanding lectures and difficulty assessing facilities (Lockley, Pritchard & Foster, 2004). Thus the peer-support is an important aspect of e-Learning in both the findings of researchers and the opinions of students (Laghos & Zaphiris, 2006). Online courses are cited as having an average completion rate between 25% and 70% and it was found that a key driver for completion is codependency (Chi, Bassok, Lewis, Reimann & Glaser, 1989). Compared to individual and competitive learning, collaborative learning raises the students' achievement level and problem-solving activities and enhances the development of personal traits (Hamburg, Lindecke & Thij, 2003). Interaction benefits and motivates the learners and facilitates higher order learning (McLoughlin, 2004). In addition, studies show that interaction is a fundamental process for learning (Vygotsky, 1978, Vrasidas, 2000) and knowledge is constructed in Communities of Practice (Wenger, 1999) through social interaction.

METHODS

Our case study was 'Learn Greek Online!' (http://www.kypros.org/LearnGreek). Learn Greek Online (LGO) is an online Computer Aided Language Learning (CALL) course for learning the Modern Greek language. The course is hosted on Kypros.org, a non-profit organization for the promotion of the culture and language of Cyprus. It uses the Moodle (www.moodle.org) open source course management system. LGO is student-centered and facilities are provided that allow the students to engage in peer-support. We have used a combination of four methods to study the student roles in the course: Social Network Analysis (SNA), Topic Relation Analysis (TRA), the Attitudes Towards Thinking and Learning Survey (ATTLS) and the Collectivist On-Line Learning Survey (COLLES) and these are further explained.

Social Network Analysis
"Social Network Analysis (SNA) is the mapping and measuring of relationships and flows between people, groups, organizations, computers or other information/knowledge processing entities. The nodes in the network are the people and groups while the links show relationships or flows between the nodes. SNA provides both a visual and a mathematical analysis of human relationships" (Krebs, 2004, pp.1). Preece (2002) adds that it provides a philosophy and set of techniques for understanding how people and groups relate to each other. It is concerned about dyadic attributes between pairs of actors (like kinship, roles, and actions), and has been used extensively by sociologists (Wellman 1992), communication researchers (Rice, 1994) and others. Analysts use SNA to determine if a network is tightly bounded, diversified or constricted, to find its density and clustering, and to study how the behaviour of network members is affected by their positions and connections (Scott, 2000; Knoke & Kuklinski, 1982). The goals of SNA are (Dekker, 2002):

- to visualize relationships/communication between people and/or groups using diagrams
- to study the factors which influence relationships and the correlations between them.
- to draw out implications of the relational data, including bottlenecks
- to make recommendations to improve communication and workflow in an organisation

Topic Relation Analysis (TRA)
The TRA model (Laghos, 2005; Laghos & Zaphiris, 2006) is a content analysis tool. Content analysis is a technique used in qualitative analysis to study written material by breaking it into meaningful units (Babbie, 2004). The data is collected directly from the discussion boards of the class and then sorted into the TRA categories. The TRA is a newly developed tool where the units of analysis are the threads and messages of each of the discussions of the forum. The data collected includes the messages per

thread, the participants per thread, the discussion topic and its relevance to the course. TRA is compromised of 3 main categories some of which have sub-categories and were deduced by observations of e-Learning discussion boards and the different types of conversations that take place. The TRA categories are:

- Course Material related. Category A is broken down into:
  - o A1 - Related to current Lesson. Threads that belong in A1 are conversations that have to do with the course material of the current Lesson. Examples of such topics include questions and answers and correcting peers' mistakes.
  - o A2 - Related to course (but not current lesson). Threads that belong in A2 are conversations that have to do with the course, but their subject is not in the current lesson's syllabus. For example, a general question about mathematics (in an area that is not included in the Mathematics lesson's syllabus) would go in A2.
- Course Website/Technical Related. Category B is specific to conversations regarding the course website, and technical issues. Problems listening to audio files, accessing specific parts of the site, or usage issues are all in this category.
- Not related to course. Category C has two sub-categories:
  - o C1 - Peer socializing. C1 is a broad category that covers conversation types where peers socialize with each other. Examples include students introducing themselves, discussions about football games and concerts, making new friends and so on.
  - o C2 – other. Category C2 basically includes all the other off-topic conversations that are not about peers socializing with each other. Examples of posts that belong in this category are spam and advertisements.

Constructivist On-Line Learning Environment Survey (COLLES)

The Constructivist On-Line Learning Environment Survey (COLLES) measures students' perceptions and preferences and was designed to help teachers assess, from a social constructivist perspective, the quality of their online learning environment (Taylor and Maor, 2000). The COLLES electronic questionnaire was designed to support the use of the web for teaching programs for which social constructionism is a key pedagogical referent and can be used to monitor the quality of innovative online teaching and learning (Taylor and Maor, 2000). Social Constructionism is a sociological theory of knowledge focusing on uncovering the ways in which individuals and groups participate in the creation of their perceived reality (Berger and Luckmann, 1966). Taylor and Maor (2000, pp1) state that "the efficacy of innovative web based teaching for engaging distance learners in enriching their epistemological growth cannot be evaluated adequately without obtaining a measure of learners' perceptions of their online class room environment". In social constructivism the learner is portrayed as an active conceptualiser within a socially interactive learning environment. The theory describes an epistemology where learners collaborate reflectively to co-construct new understandings in the context of mutual inquiry grounded in their personal experience (O'Conner, 1998) by developing a communicative competence that enables them to engage in critical discourse with their peers (Taylor & Maor, 2000) and is characterized by an empathic orientation to constructing reciprocal understanding (Dawson & Taylor, 1998; Sfard, 1998). There are 24 questions arranged into 6 scales (Dougiamas and Taylor, 2003):

- Relevance – how relevant is online learning to students' professional practices?
- Reflection – does online learning stimulate students' critical reflective thinking?
- Interactivity – to what extent do students engage online in rich educative dialogue?
- Tutor Support – how well do tutors enable students to participate in online learning?
- Peer Support – do fellow students provide sensitive and encouraging support?
- Interpretation – do students and tutors make good sense of each other's communications?

Attitudes Towards Thinking and Learning Survey (ATTLS)

The Attitudes towards Thinking and Learning survey (ATTLS) is used to measure the quality of discourse within the course. It measures the extent to which a person is a 'connected knower' (CK) or a 'separate knower' (SK). People with higher CK scores tend to find learning more enjoyable, and are often more cooperative, congenial and more willing to build on the ideas of others, while those with

higher SK scores tend to take a more critical and argumentative stance to learning (Galotti, Clinchy, Ainsworth, Lavin, & Mansfield, 1999). The two different types of procedural knowledge (separate and connected knowing) were identified by Belenky, Clinchy, Goldberger & Tarule (1986). Separate knowing involves objective, analytical, detached evaluation of an argument or piece of work and takes on an adversarial tone which involves argument, debate or critical thinking (Galotti et al, 1999). "Separate knowers attempt to 'rigorously exclude' their own feelings and beliefs when evaluating a proposal or idea" (Belenky et al., 1986, p.111; Galotti et al, 1999). Separate knowers look for what is wrong with other people's ideas, whereas connected knowers look for why other people's ideas make sense or how they might be right, since they try to look at things from the other person's point of view and try to understand it rather than evaluate it (Galotti et al, 1999). These two learning modes are not mutually exclusive, and may coexist within the same individual.

Procedure
Data was collected directly from the discussion boards of the course Greek 101 (Elementary) of LGO. We have carried out SNA on the 618 actors (in this case the active students of the course) that used the discussion forums of the LGO course. The data collected for each posted message included the sender, the receivers, the topic of the message and the thread of the message. Once this information was obtained, the students' communication interactions were tabulated in the form of network matrices while the student names have been renamed S1 – S618 for privacy and anonymity reasons. In addition while collecting the messages to enter into the network matrices, we also documented the topic of the message and conversation threads into the predefined TRA categories. To obtain the students' Learning Styles along with their feedback on the course and online learning, the two questionnaires COLLES and ATTLS were used. They were both included on the homepage of Lesson 1 of the course and like everything in the course it was up to the students if they wanted to answer them or not. Once all of the data was collected we were able to carry out their analysis. For the SNA part of the analysis we used an SNA tool called "NetMiner for Windows" (Cyram, 2004).

RESULTS

Equivalence of the network members shows when two actors have similar patterns of relations. As Hanneman (2001) points out, "Being able to define, theorize about, and analyze data in terms of equivalence is important because we want to be able to make generalizations about social behavior and social structure". In these circumstances, actors must not be thought about as unique persons, but as examples of categories (sets of actors) who are in some way, "equivalent" (Hanneman, 2001). Two nodes are said to be structurally equivalent if they have identical ties with themselves, each other and all other vertices (de Nooy et al., 2005). In other words two nodes are structurally equivalent if they have the same relationships to all other nodes, and thus, the two nodes may be substitutable since they have the same social roles in the network

Figure 1 is a structural profile sociogram of the LGO network. These types of SNA sociograms illustrate the role of the students. As can be seen, "the analysis consists of embedding the actors in a certain role space" (Aviv et al, 2003), identifying clusters of students and then carrying out subsequent cluster analysis to identify their roles. In such sociograms, the actors that are closer to each other are the ones with the most similar patterns of communication. As can be seen, S7 and S157 are the actors furthest away from all the other nodes suggesting that their style of interaction in LGO was unique from the rest of the students. The other students are much closer to each other forming clusters of students. This tells us that these students had very similar interaction patters amongst them. Four main role types have been identified (R1, R2, R3 and R4) and have been analyzed in more detail.
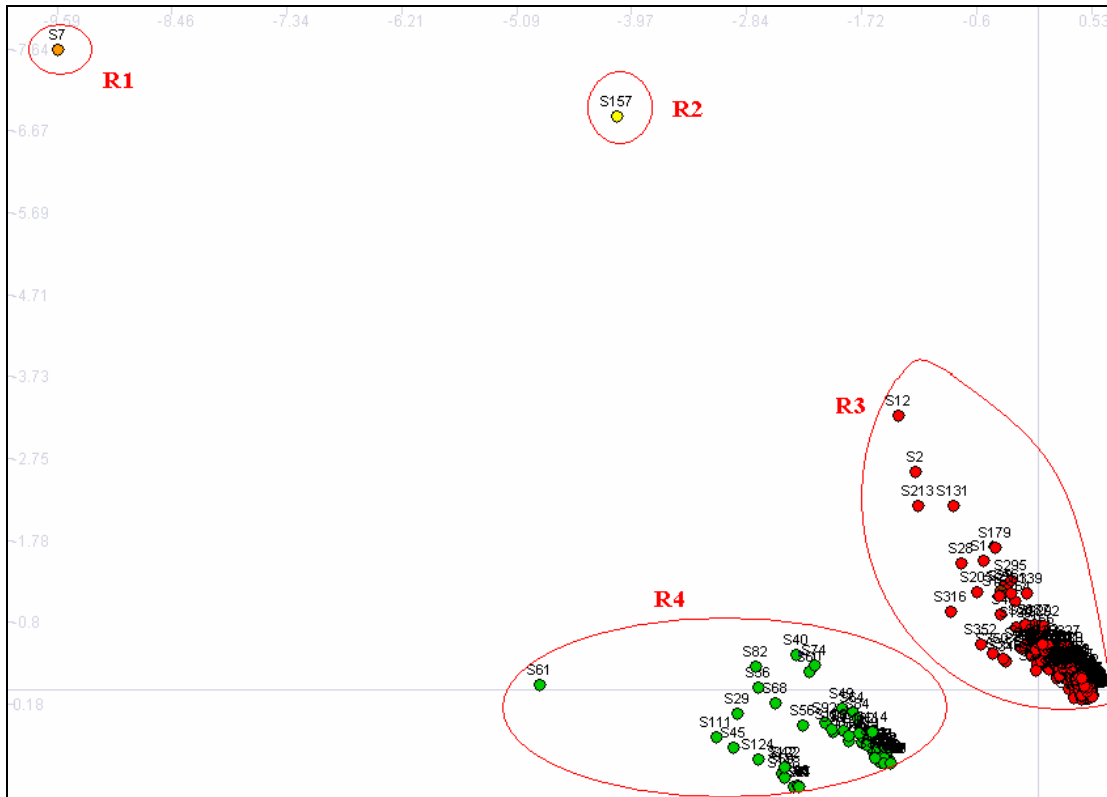
Figure 1. LGO Equivalence Sociogram

SNA of Roles

To analyze the role types we collected the ego-net social network analysis measures of the students which included their Centrality In and Out Degrees, their Neighbour In and Out degrees and the number of Cliques they were in. Degree centrality is measured by the portion of nodes that are adjacent to each node. The nodes with the highest degree scores are the ones who are more central (powerful) in the network. In a directed network like the LGO case, the in-degree centrality is the portion of nodes that are adjacent to each node, and out-degree centrality is the portion of nodes that are adjacent from each node (Freeman, 1979). When there is a line directly connecting two nodes (students) then these nodes are adjacent. When a node is one of a pair of nodes defining the line then this node is incident to the line. The number of lines that are incident with it is called neighbour degree (Wasserman and Faust, 1994). In-degree is the number of lines that are incident to a node while out-degree is the number of lines that are incident from it. In other words, in-degree is the number of incoming connections a student has, whereas out-degree is the number of out-going communications. A clique is a maximal complete subgraph of three or more nodes consisting of a subset of nodes which are adjacent to each other, and there are no other nodes in the network that are also adjacent to all of the members of the clique. Cliques may overlap, meaning a node can be a member of more than one clique (Bock and Husain, 1950). In the LGO case, we have carried out clique analysis on cliques with a minimum number of 3, 5, 10, 20, 50 and 100 members.

Table 1 compares the SNA characteristics of the four role types. It is obvious that the highest in and out centrality degrees belong to R1 with 0.55, followed by R1, R4 and lastly the students in R3. These values are in-line with the neighbour in-degree and out-degree scores of the students showing that the higher the participation frequency of the students, the higher their numbers of connections with other students.

Table 1. Comparison of Role Groups SNA

	R1	R2	R3	R4
Centrality In-degree	0.55	0.23	0.02	0.18
Centrality Out-Degree	0.55	0.23	0.02	0.18
Neighbour In-degree	338	144	12.91	109.79
Neighbour Out-Degree	338	144	12.99	109.36
Cliques n3+ (member in)	324	157	3.07	11.17
Cliques n5+	247	145	2.33	10.45
Cliques n10+	37	25	0.60	5.98
Cliques n20+	5	3	0.19	1.76
Cliques n50+	1	0	0	1
Cliques n100+	1	0	0	1

It can also be noted that a major difference between groups R3 and R4 is that the students in R4 have more connections with other students, and are in more cliques, whereas the R3 students are the least vocal and are part of much fewer cliques. The student in R1 is by far the one with the most messages sent and received and also has the highest number of connections with other students and is part of the majority of cliques. The student in R2 is the second most communicative person in the LGO course.

The in-degree and out-degree centrality score of S7 was 0.55 (that's 55% of the total contributions from all students in the course). This shows that S7 was involved in a little more than half of the overall communication that took place in the course, in both incoming and outgoing exchanges. His neighbour out and in degree were 338 messages sent and 338 messages delivered which was the highest out of all the students in the network. He/she is part of the only 50+ (and 100+) member clique, and part of over 60% of all the other clique categories. These factors make S7 a central figure in the class.

Like R1, R2 also only consisted of one student (S157). His in-degree and out-degree centrality score was 0.23 while his/her neighbour out and in degree were 144 messages sent and 144 messages delivered which was the second highest in the LGO network following R1. The student is actively participating with smaller groups of his/her classmates but is not part of the larger 50+ member clique. R3 is made up of 517 students (the largest of the four) consisting of approximately 84% of all the students in this course. These students are the least vocal. The average R3 student is only in 3 cliques of 3+ members, and this value falls even lower for the cliques consisting of more students. Furthermore the students in R3 are not part of the larger 50+ member clique. R4 is comprised of 99 students (16% of the students in the course). These students' participation rates are higher than the students in group R3, but lower than the ones in R1 and R2. The average R4 student is in 11.17 cliques of 3+ members, and in 10.45 cliques of 5+ members. It is also important to note that these students are connected with a larger variety of student and are also part or the large clique of 100+ members.

More information about the roles was identified following a deeper analysis into the students' TRA, ATTLS and COLLES scores.

TRA of Roles
To see the relevancy of what the students talked about, we analyzed their discussion board contributions using the Topic Relation Analysis (TRA) method. Table 2 is a comparison of the TRA scores of the role groups. The messages per thread for each category for each of the role groups ranges from 1.08 to 2 with the student in R1 having the highest rate (2 messages per thread) in category C. For the messages and threads in categories A1, A2 and B, R1 post the most messages, followed by R2 and R3 and the students in R4. The only case where this is not so, is in the C category where the students in role group R4 are more vocal then those in R3.

In addition, the table displays the contributions of the specific student roles with their postings in the TRA categories. As can be seen, the highest percentage of messages for R1, R2 and R3 are all in Category A (course related). The exception is R4 where the highest posting percentage is that in category C (social discussions).

Table 2. Comparison of Role Groups TRA

	R1	R2	R3	R4
Messages A1	56	37	0.8	0.4
Threads A1	42	20	0.64	0.31
Messages per Thread A1	1.33	1.85	1.25	1.29
Messages A2	48	22	0.55	0.43
Threads A2	39	13	0.42	0.35
Messages per Thread A2	1.23	1.69	1.31	1.23
Messages B	27	9	0.45	0.38
Threads B	25	6	0.4	0.29
Messages per Thread B	1.08	1.5	1.13	1.31
Messages C	42	5	0.67	1.85
Threads C	21	4	0.55	1.51
Messages per Thread C	2	1.25	1.22	1.23
% of messages in A	60.12	80.82	54.66	27.12
% of threads in A	63.78	76.74	51.46	26.83
% of messages in B	15.61	12.33	18.21	12.42
% of threads in B	19.69	13.95	19.42	11.79
% of messages in C	24.28	6.85	27.13	60.46
% of threads in C	16.54	9.3	29.13	61.38

S7's postings had to do with the course in question. Also, it should be noted in the beginning of he course S7 contributed many more messages in the Peer socializing category, than in the rest of the lessons, as a 'normal' teacher would when first meeting the students in a face-to-face classroom. We remind that contribution to the discussion board in this course is completely voluntary and thus S7 participated on his/her own will. Not only did he/she send the most messages, but was also the one who received the most messages. This is exactly how a teacher would interact with the students in a classroom, where the vast majority of communication that takes places is directed as: teacher-students, students-teacher, but less as students-students, as was the case in LGO with student S7. In addition from a closer examination of S7's postings we have discovered that the majority of this student's contributions were answers to his/hers peers' questions. Many of the other students are dependant on S7, thus making S7 the central figure in LGO. Thus we conclude that in this student-centred e-Learning community, one of the students' communication interactions resembled those of a teacher.

R2's TRA results show that the student discusses mainly issues that have to do with the course in hand, having over 80% of his/her messages posted relating to the course (category A). The student provides his own lecture notes and lesson transcripts for his peers. Although he doesn't answer many questions like the student in R1 previously, his fellow peers are still dependant on him for this material.

The average R3 student posts messages that fall under the A1 TRA category, followed by social posts in category C1. Over 50% of their conversations were related to the course material (category A). This outcome shows that the students in this role group collaborate and cooperate with each other and discuss topics where they help their peers or they get help from their peers.

Contrary to the R3 students the majority of the posts of the R4 students were in the social category of the TRA with over 60% of their messages and threads belonging in C1. Furthermore they post messages that are mainly of a social nature, thus TRA category C comprises of above 60% of all of R3 students' messages. Thus it seems that the students in role group R4 prefer to contact their peers for friendly conversations unrelated to the course material, and prefer to learn the actual material on their own and only ask for help, or help others themselves, when they really have to.

COLLES of Roles
In this section our goal was to analyse the students' feedback on online learning using the Constructivist On-Line Learning Environment Survey (COLLES). The first four questions of the COLLES deal with the relevance of the course to the students' professional practises. Questions 5 to 8 examined whether the course stimulates the students' critical reflective thinking. Questions 9 to 12 measure to what extent the students engage in online in rich educative dialogue (Interactivity 1). In addition questions 9 and 10 ask about the students outgoing interactivity (Interactivity 2) while questions 11 and 12 ask about their incoming interactivity (Interactivity 3). The next section of the COLLES is about Tutor Support, but this is not available in this case since LGO does not have a tutor. Following this are the four questions for peer support which examines whether fellow students provide sensitive and encouraging support. Finally, the last four questions in the COLLES ask whether the students and tutor make good sense of each others messages. However since there is no tutor involved, the focus was only on the first 2 questions of this section which ask about interpretation of the students' messages. The scale used on the questionnaire was 1 meaning 'almost never' to 5 meaning 'almost always'.

104 students answered the questionnaire giving a response rate of 18.83%. A key player of LGO, student S157, who was the only representative of Role Group R2 did not answer the COLLES survey therefore his results could not be obtained. Table 3 shows the results per COLLES category for each of the roles.

Table 3. COLLES roles groups' results

Role Group	R1	R2	R3	R4
Relevance	1	n/a	3.25	2.5
Reflective Thinking	5	n/a	3.75	3.5
Interactivity1	2.5	n/a	2.28	2
Interactivity2	2.5	n/a	2.2	2
Interactivity3	2.5	n/a	2.35	2
Peer Support	3	n/a	2.45	2.15
Interpretation	3	n/a	2.95	2.5

Figure 2 shows the COLLES score of the role types. The student in R1 has the lowest relevance rating but also the highest reflective thinking rating. This shows that although online learning is not very relevant to the student's professional practices, he still believes that it highly stimulates his critical reflective thinking. For all other COLLES sections, the highest scores are from role group R1, followed by the mean rating from students in R3, and finally R4 students with the lowest scores. These results illustrate that R1 students are more interactive (both with in-coming and out-going messaged), and believe more in peer support than their fellow students in R3 and R4. Furthermore, R1 and R3 students make better sense of their peers' messages in comparison to the students in R4.
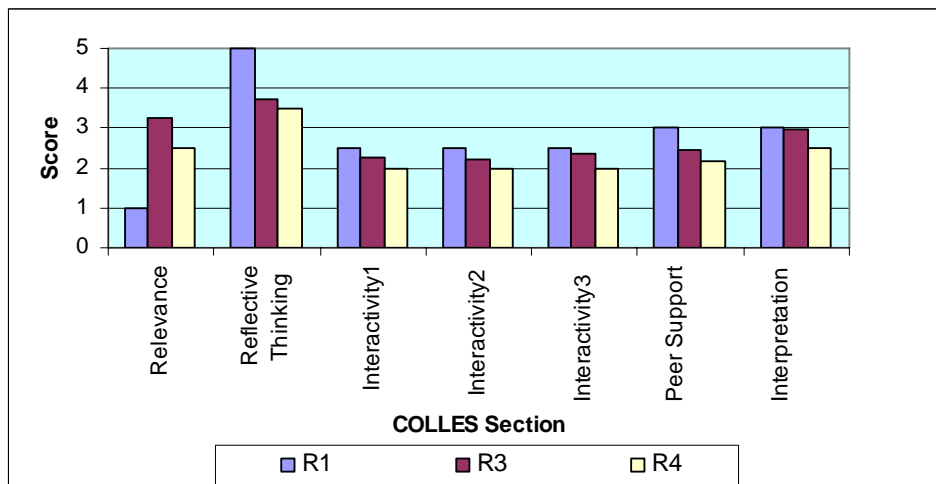
Figure 2: COLLES scores of the Role Groups

ATTLS of Roles

In this section we used the results of the students' replies to the Attitudes towards Thinking and Learning Survey (ATTLS) to identify their learning styles, whether they are connection knowers, separate knowers or both. The 20 questions in the ATTLS are displayed in the questionnaire in random order as not to reveal which questions are Connected Knowing (CK) related and which are Separate Knowing (SK) related. 104 students answered the ATTLS and like the COLLES the range for the responses of the ATTLS is from 1 to 5 for each question with 1 meaning 'Strongly Disagree' and 5 meaning 'Strongly Agree'. The higher the CK and SK scores, the higher the students' connected and separate knowing. These two knowing modes are not mutually exclusive as the same student may be both a separate knower and a connected knower. The only student in role group R2 did not answer the ATTLS survey so his results are not available. Table 4 and Figure 3 show the connected knower and separate knower results for each of the role groups.

Table 4. ATTLS roles groups' results

Role Group	R1	R2	R3	R4
Connected Knower	4.3	n/a	3.81	3.81
Separate Knower	4.3	n/a	3.70	3.87

The student in role group R1 has both a high Connected Knowing score as well as a high Separate Knowing score. As mentioned earlier these two learning modes are not mutually exclusive and a student may be both a connected knower and separate knower as it is in this case. The students in R3 are more of Connected Knowers (CK) than Separate Knowers (SK), while the opposite stands for the students in role group R4 which have higher Separate knowing scores. CK students are often more cooperative and willing to build on the ideas of others whereas SK students take a more critical and argumentative stance to learning. So the outcome from this analysis is that the student in R1 is both a CK and SK, the students in R3 are more CK and the students in R4 are SK.
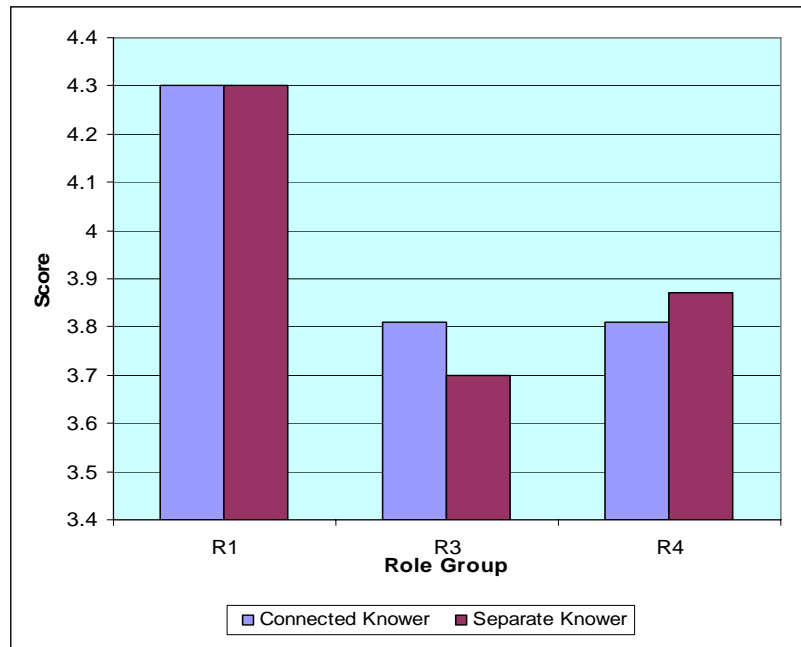
Figure 3. Connected and Separate Knowing Scores of the Role Groups

CONCLUSION

In this paper we applied SNA to an online student-centered course to identify the roles types the students took on. The results from the TRA, COLLES and ATTLS questionnaires were obtained and based on their outcomes, more characteristics of the role types were obtained.

Our results showed that one of the students (role type R1) had communication patterns that resembled that of a teacher in classroom settings. He was a central figure in the class contributing to 55% of the total postings in the discussion boards mainly helping out his peers. The next role type (R2) consisted of 1 student who was very vocal, however less than R1. This student provided his peers with course related information that only he had access to. He was connected with a large number of his peers, was part of a high number of cliques and the majority of his conversations were course material related. Students in R3 were the least participative, preferred to work more in small teams (they were part of very few large member cliques) and talked mainly about issues concerning the course. Lastly the students in R4 made connections with a large number of their peers, their discussions were mainly on social topics and not course related. They prefer to learn on their own and were mainly using the discussion boards to make friends and socialize with their peers.

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