Community building and virtual teamwork in an online learning environment

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ABSTRACT

In the world of OTIS, an online Internet School for occupational therapists, students from four European countries were encouraged to work collaboratively through problem based learning by interacting with each other in a virtual semi-immersive environment. This paper aims to explore the issues that (1) there was little interaction between students from different tutorial groups and (2) virtual teamwork developed in each of the cross cultural tutorial groups. Synchronous data from European students was captured during tutorial sessions and peer booked meetings and evidence suggests that communities of interest were established. It is possible to conclude that collaborative systems can be designed, which encourage students to build trust and teamwork in a cross cultural online learning environment.

Keywords

Occupational therapy, problem based learning, synchronous communication, virtual teamwork, immersive presence, cross cultural issues.

INTRODUCTION

The training of health care professionals, such as occupational therapists, must ensure that collaborative approaches are addressed since they are often required to work in groups to meet the needs of their clients. High level assistive technologies are used across Europe to support clients with physical or learning disabilities, but their application varies widely from country to country. In order to provide appropriate training for students the Occupational Therapy Internet School (OTIS) combined a collaborative learning approach with knowledge of high level assistive technologies for occupational therapy students in universities in Belgium, the Netherlands, Sweden and the UK (Armitt et al, 2001). In its development OTIS adopted a problem based learning style, in which students communicated online with their peers, tutors, patients and experts, to propose solutions to carefully designed case studies. The Internet environment, based on the Virtual Campus metaphor, was specifically developed to promote a problem solving approach through collaboration. The online environment used Virtual Rooms (Ginsberg et al., 1998) to facilitate meetings of members of the course and to hold different components of the course materials. It was also possible for both staff and students to book specific meeting rooms for formal invited meetings, which could be open so that anyone could attend, or closed, in which case only invited participants could participate.

The students worked in four tutorial groups of mixed nationalities to discuss and propose a solution for four different case studies. The course was designed to promote specialist skills in occupational therapy, while also developing generic core skills, such as the essential

ability to communicate effectively and collaborate with a wide range of clients and allied professionals. In the case of OTIS, the course sought to stimulate synchronous communication and collaboration within international student groups and also with 'patients' (tutors role-playing patients) and experts such as health care specialists or representatives of companies marketing assistive technology devices.

Both quantitative and qualitative evaluations were undertaken during the OTIS pilot course. The results indicate that the course and its associated technologies have provoked some strong reactions. For some students their active learning has been facilitated and learning objectives achieved. Other students however have struggled to understand and achieve the necessary course outcomes. The SOLO taxonomy (Biggs & Collis, 1982, 1989) was used to undertake a more detailed analysis of the transcripts and reported in a previous paper (Armitt et al, 2002). In this paper we continue to analyse the data by exploring two further issues:

(1) that there was little interaction between students from different tutorial groups

(2) that virtual teamwork developed in each of the cross cultural tutorial groups.

In OTIS, a semi-immersive virtual learning environment, it was seen that students used synchronous communication to support their teamwork and learning.

CONTEXT

Immersion and presence

The use of a virtual learning environment (VLE) technology for education implies that an individual student will have the experience that they are both located in an environment where they can find resources, including other students and tutors, to support their learning and that they are actually present in that environment. The first experience is known as 'immersion' and the second as 'presence'.

A fully immersive environment is normally presented by means of virtual reality (VR) devices such as head mounted displays and data gloves, which a student may wear to simulate their physical location in a virtual environment. The use of VR devices provides computer displays that give the student an inclusive and vivid experience of the VLE. Physical tracking allows the student to feel their orientation and provides sensory feedback as the student interacts with other people and objects in the VLE. Within this environment the student will normally perceive their presence by means of a virtual body (VB), where the VB is both part of the environment and represents the participant within the environment. Presence, therefore, is the student's psychological awareness of being and interacting in the VLE.

A number of research papers have explored the issues of collaboration and group working in immersive VLEs. Observing the behaviour of students carrying out collaborative decision making, it was noted that effective results came from groups who reported a strong sense of shared presence (Romano, Brna and Self, 1998). They defined 'presence' in a VLE as being both personal (relating to an individual's state of mind) and shared (a perception of

others in the same environment) and stated that: “Both aspects of presence are required for an effective training system for collaborative decision making, and the suggestion is that a strong sense of social presence may well reduce the requirements for a physical sense of presence” (Romano, Brna and Self, 1998). In their work, Jackson and Winn (1999) studied collaborative learning experiences in groups of students interacting in an immersive VLE and found that, although there appeared to be learning potential, technical advances were still required to improve the rather cumbersome VR devices used. They concluded that future applications of VR, in and out of educational organisations, would include networking of multi-participant, collaborative virtual environments. Slater et al. (2000) studied the behaviour of small groups as they carried out the same task in both a virtual environment (VE) and a physical environment. In the experiments only one person in each group was immersed — wearing a head-mounted display — while other group members explored the VE through a workstation display. The results indicated that there was a positive relationship between presence (being located in an environment) and co-presence (being with other people in an environment). It was also found that social responses, such as embarrassment, could be provoked in a virtual environment. Schroeder et al. (2001) explored collaboration between participants in a highly immersive VE and compared this with the same task carried out in face-to-face and immersive VE-to-desktop environments. They found that participants experienced little difference in collaborating with a partner in each of the three environments, but their experience of both presence and co-presence was lower in the desktop environment.

OTIS provided a VE through an Internet screen with no VR devices. However, it could be seen that the students experienced both presence and co-presence in the virtual environment.

Through the work of their professional body, occupational therapists are aware of the use of virtual reality and virtual environments, but only in terms of therapies for a variety of both physical and psychological conditions (Derwent, 2001). There appears to be no work on using VLEs for the training of occupational therapists. This paper, therefore, offers a unique insight into the educational use of a VLE for this branch of the health care profession.

Reflection in learning

Education and training programmes for health care professionals should relate strongly to a holistic approach to clients, with emphasis on quality of care. The use of realistic case studies explored through problem-based learning has been shown to facilitate deep learning in clinical education (Coles, 1989, 1990). McAllister et al (1997) suggest that "deep approaches to learning are found in students who are affectively involved in searching for personal meaning and understanding (their own personal practical knowledge), seeing the whole picture or person - not just the isolated features or disembodied problems - drawing on their personal experience to make sense of new ideas and experiences and relating evidence to conclusions." Learning through case studies and problem solving approaches provides students with a context in which they can experience a 'presence' in the situation (Romano, Brna and Self, 1998) and allows them to collaborate with others in the immersive environment. This, in turn, stimulates a reflective process where knowledge is synthesised

through a re-evaluation of the experience by undertaking association, integration, validation and appropriation (Boud et al., 1985).

DESIGNING THE STUDENT ENVIRONMENT

One of the major issues with developing distributed collaborative learning environments is to provide the structure in which students can meet online and learn together in a wide variety of different groupings that form naturally to support each stage of the learning process. The design within OTIS was for students to study course materials located in specific 'virtual classrooms' in which students could meet either as organized groups (for formal or informal tutorials) or simply because there were others studying the same topics at the same time. Since all conversations can be 'heard' by anyone with a virtual presence in the room anyone present can join in very easily. There are tools available that allow individuals to 'see' who is present in the room or elsewhere within the virtual environment and potential participants could be 'called' to the room so that they could participate fully. This allowed a level of classroom management within the virtual environment.

Figure 1: The Student Interface to the OTIS environment

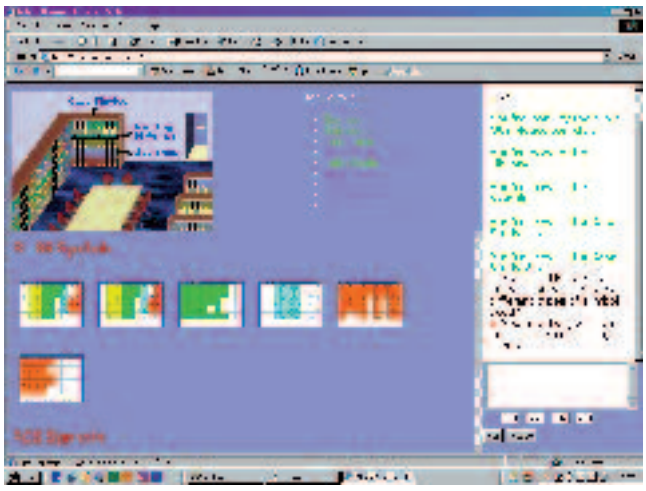
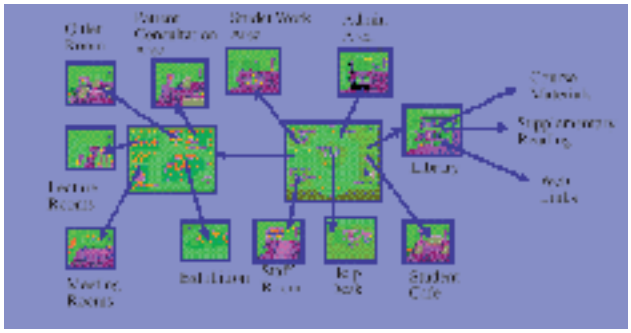


Figure 1 shows a typical student interface to the OTIS environment. The interface was divided into a number of areas that allow clear navigation and viewing of the virtual environment and was designed to give a clear immersive feel without the need for complicated equipment or expensive high speed network connections. On the left are a number of areas giving information and course materials, while the right hand areas deal with communication with other students and tutors. The picture on the top left changes to show the current location, and acts as an active map in most areas. In the entrance hall this is simply the map of the OTIS world and allows access to all the requisite rooms. Each room is 'furnished' with the appropriate facilities for the work to be undertaken in it. To the right of this is a menu, giving access to the materials in the current room. This allows students to select material, simply and effectively, as they require it. Once it has been selected, it is displayed in the lower window. Navigation out of the room is by means of the picture on the top left of the screen. Clicking on the various doors takes the student back, either to the main circulating area, or to various 'corridors' that give access to more specific areas as shown in Figure 2.

Figure 2: Overview of specific areas in OTIS



All the communications facilities are concentrated on the right of the screen. The large area at the top right is the display area where messages are viewed during conversations. These can be scrolled forward and backward so that the whole conversation can be readily viewed. In the bottom right is an area into which the student's own messages can be typed. The reporting area displays received Talk and Page messages, confirms the content and transmission of sent messages and the current position of the user, and reports on who is entering or leaving the user's current room. The buttons allow students to choose the recipients of the message, as shown in Figure 3.

Figure 3: The OTIS control buttons

Button	Action
Talk	Sends the typed messages to all participants in the same room. A popup window shows who is in the same room and will therefore receive the message. This is the normal means of communicating between groups of participants with similar interests.
Page	Sends the message to one or more recipients who are currently active within the course world. They can be anywhere not just within the same room. A popup window allows the student to select whom to page from those participants that are currently online. This is the usual way to call members of the group together so that they can take part in a group discussion.
Mail	Sends the message to the selected user's mail area. It may be read by the recipient in their private study area or they can select to have it forwarded to an external

	electronic mail account in which case they can read it in the normal way from that account. Again, a popup menu allows the selection of the recipients from all those participants who have current mail access.
Info	A popup window gives some basic hypertext help on using the system.
Map	Causes the map to be displayed immediately, allowing rapid traversal to a desired location, for example in response to a page request to join a meeting.

An example of the presentation of reference material within OTIS follows. One of the case study assignments required that students should have some knowledge of a set of symbols used with a client who had a communication disability. These symbols are used in different ways in European countries, depending upon local practice. Therefore, the material which explained the use of these symbols, while forming part of one case study, were also relevant to other students. This was made available, not only through the main access route, but also via a search mechanism. The idea was that students from different countries or professional backgrounds could meet and discuss their use of the symbols and learn from each other.

METHOD

Aims of the study

By examining synchronous communication between students on the OTIS course in group tutorials, peer-booked meetings and ad hoc peer meetings, this paper considers the students' sense of 'presence' and the degree to which they felt themselves to be immersed in the virtual environment. It is, therefore, the aim of the study to explore the issues that:

(1) there was little interaction between students in different tutorial groups

(2) virtual teamwork developed in each of the cross cultural tutorial groups.

The OTIS software allowed logging of all user activities, including all communications using the 'Talk' and 'Page' Internet Chat facilities, as described in the previous section. When registering to use the OTIS system, all users gave their written consent to their personal data being used anonymously for research purposes, including establishing patterns of activity. There was no specific intention until after the course had finished of using primary data from transcripts for evaluation of the course, so the behaviour of participants is unlikely to have been affected by the data collection.

It was not part of the OTIS study to record email communications; therefore no asynchronous data was available for analysis.

Sampling

Data was collected from several hundred pages of transcripts, concerning not only the solution of the case studies, but also the process of preparing the assignments, social interactions and discussion of how to use the OTIS system and various technical problems. In order to focus the analysis on collaborative learning in a computer supported environment, the following published learning outcome for the OTIS course was used to sample the data:

> *Upon successful completion of this course participants who have reached the required educational level will have:*
>
> - *displayed expertise in following a problem-solving process to match technology to individual client need.*

This learning outcome was chosen because, for a student to be successful in a problem-based learning scenario, it was important to collaborate with other members of the tutorial group to propose appropriate solutions to the case studies.

This sample provided transcripts of group tutorials, peer-booked meetings and ad hoc peer meetings, in which all statements in which students discuss the solution of the case study were extracted, plus intermediate 'linking' statements required to understand the flow of the conversation. Throughout this study, a statement has been defined as a sentence or group of sentences, which the student sends or broadcasts as a unit.

Qualitative analysis

Initial analysis of the sampled data explored the extent to which synchronous communication had enhanced deep learning in the students (Armitt et al., 2002). This added a qualitative dimension to the quantitative evaluation carried out through end-of-course questionnaires. Further analysis indicated the development of a community of interest (Wenger, 1998) in the OTIS environment (Beer et al., 2002). The analysis reported here has not used the SOLO taxonomy, but has focused on the qualitative constructs of 'immersion', 'presence' and 'reflection in learning' as identified in the supporting literature. This qualitative approach to the OTIS study means that results cannot be generalised to other CSCLIP applications. However, extrapolation from the findings can add to the body of knowledge concerning collaborative learning, community building and virtual teamwork in a VLE.

DISCUSSION OF RESULTS

Immersion

In the first few weeks of the OTIS course students explored the virtual environment and the resources available there. Often, when they logged into the system, they would find out who else was in the environment and then join that other person in one of the rooms for a Chat. As they tried to immerse themselves in the virtual environment they would interact with anyone else in the VLE. Figure 3 gives an example of a peer ad hoc meeting which took place in week 3 of the course between one student from group 1 and two students from group 3.

Figure 3: Example of student interaction between tutorial groups

Week 3: Peer ad hoc meeting
Student 1B asks "Which cases do you have now?"
Student 3C asks "I am doing case 3 in assignment 2 and case 2 in assignment 3. I don't heard a thing yet like choose a model??? You mean like MOHO… ?"
Student 1B says "Yes, alot of people seem familliar with MOHO and it seems suitable for these cases, but we are also looing at PEO etc."
Student 3C asks "What is PEO???"
Student 1B says, "Person-Environment-Occupation model. This environmental model is from 1996 and not so developed yet."
Student 3E asks "I haven't heard of MOHO either."

Students from different tutorial groups cross-fertilised their ideas and thoughts about OTIS and the assignments in the early weeks of the course. Later, however, they began to communicate only with students in their own tutorial groups. They used their time within the VLE to use materials and library resources, and to attend peer meetings and group tutorials. The initial experiences of wider community building were lost at the expense of

group working for the assignments. Immersion in the VLE changed from one of exploration to one of pragmatic group working. Consequently, there was little interaction between students in different tutorial groups after week 4 of the course.

Presence

Many examples of dialogue between the students within OTIS serve to indicate that they were well aware of both their own presence and of co-presence (or shared presence) with others. The development from an awareness of presence to a collaboration and establishment of virtual teamwork and trust did not come easily, however. The first example from group 1 shows how, even at the end of the course, the students were still aware of the stress of maintaining virtual relationships. But, the students did develop a working relationship and acknowledged the co-presence of their group members.

Figure 4: Difficulties in virtual relationships

Week 10: Tutorial group 1
Tutor1 asks "So our assumption that the medium and the posibility for international contacts would be attractive is not realistic?"
Student 1B says "Yes the whole concept is stilll great."
Student 1F says "I agree with Student 1D, I found it stressful to feel responsible for developing these relationships over the internet. In some ways it may relate to familiarity with the medium."
Student 1D says "I think it is realistic but the group size is too big. One on one with a tutor would work beter for me, with group sessions once in a while."
Tutor1 says "We had the assumption that by letting everybody free in their choices for cooperation, things would happen spontaneously."
Student 1A says "you say it would happen spontaneousely, but it is difficult when people don't know each other"

On the other hand, two students in group 2 maintained a dialogue in a peer booked session for 45 minutes, covering issues relating to the assignment. The level of their Chat indicates an easiness in the virtual environment and strong co-presence with each other. Figure 5 gives only a short section of the dialogue, but the whole shows an overlapping and interlinking of conversation which might well be found when two people are physically in the same room. Collaboration and virtual teamwork is clearly in evidence here.

Figure 5: Extended Chat between students 2A and 2C

Week 6: Peer booked meeting, group 2
Student 2C says "what do you think about offering Ester a electronic comm. aid with a dynamic system…"
Student 2A asks "that's good, it is always better to try them on your own than just reading about them. Have you found anything interesting comm aids?"
Student 2C asks "…with only few symbols, but therefore the possibility to change different levels very quikly?"
Student 2A asks "yes, definitely electronic, does dynamic mean that you can use different levels, that one word can be used for different meanings?"
Student 2C says "yes i guess so"

The example from group 3 shows students who recognised the holistic nature of the exercise and the context within which they were working. This supports the findings of Romano, Brna and Self (1998) who reported that contextual awareness fostered collaborative working towards problem solving. The students believed that the case existed and that they were collaborating to provide solutions for the problem.

Figure 6: Awareness of the context

Week 6: Tutorial, group 3
Student 3D asks “I agree Student 3C but we don’t have to write the same problem or do we?”
Student 3C says “No we don’t. As an OT i feel it like this: i think the holistic way about this case, i think others too. With his MND [motor neurone disease] for me it is important to take his and her worries away, so he fees OK (well behaviour)”
Student 3D asks “I think I will use MoHO to cover it all and to get a holistic way about the case. Then we don’t have to use the problem solving method in the welcome pack or do we?”

The example from group 4 is a short excerpt from a light-hearted social exchange where students were sharing and comparing information with each other. This kind of dialogue shows how trust and teamwork are being developed within the group. Slater et al. (2001) suggest that this kind of social exchange indicates presence — the participants believe that they are in the virtual environment.

Figure 7: Developing trust in teamwork

Week 5: Peer booked meeting, group 4
Student 4C says “sorry, I haven’t got any good ideas…”
Student 4B says “Yes, i found something in the library”
Student 4D asks “Can you share it?”
Student 4A says “I think we should help us together, we should make a short report of what everyone of us has found out so far. I have found some technologies and I will mailing you.”
Student 4C exclaims “thank you!”
Student 4D exclaims “Good idea!”

These few examples serve to indicate that the students, collaborating with their groups, believed that they were present in the VLE and that fellow group members were co-present with them. Together they developed a measure of trust in each other and established a virtual teamwork.

Reflection in learning

The problem-based learning approach in OTIS meant that students had to work together in groups. In order to do this, they had to use synchronous communication to contact their group members in tutorials and peer booked meetings. This helped them to become aware of their own presence in the VLE and the co-presence of their group members. In turn, this helped them to immerse in the virtual environment and use the resources at their disposal.

The comments quoted here come from the students' own reflections on their learning, which they submitted at the end of the course. They are, therefore, stated with hindsight.

"Concerning the international teamwork it was very interesting to learn new people. At the beginning cooperation was very laborious but it became better with the time. I think during the case there rose a fruitable cooperation between us peers and we had the possibilitiy to learn from each other how to work on a problem and also exchange some information regarding assistive technologies." (Student 2C)

It is interesting to see that, although there were some undoubted difficulties, both technical and conceptual, the students felt that they did derive some benefit from the experience of OTIS.

"I think though that one of the most positive things about taking this Otis course is to get to know students/teacher in other countries, and also the great opportunity to practice the English language." (Student 1F)

Collaboration and virtual teamwork developed in the groups as they contacted each other and began to build communities with some element of trust and responsibility for each other.

"Contacts with peers students? That was very nice. We mailed, helped and motivate each other. We were real group. I hope we will keep contact even after this course. That's something that I would really wanted." (Student 4B)

However, the small number of students enrolled on the OTIS course meant that the virtual environment was very sparsely populated, with individual students often being the only one in the environment. This made the experience of immersion more difficult to retain. It was also difficult to contact students in other tutorial groups.

"I have some contacts with other peers, but less. That's a pity! I wanted some contacts with other peers but every time I went to OTIS, there wasn't anybody. To book a room on a time is difficult because everyone has his own activities during the week and weekend. I also don't mail to anyone, because I don't feel I needed it." (Student 3C)

The students' own reflections on their experiences in OTIS have supported the evidence provided by the synchronous data samples and the literature of the area.

FURTHER WORK

Group projects give students an opportunity to discuss their understanding of the subject with their peers, as they apply the theory to practice. Successful group working requires that the maintenance roles as well as the task roles of the group are given attention (Hartley, 1997). Online courses can be solitary affairs, unless Summer schools, Saturday workshops etc. are included in the programme. A number of problems can arise when adapting a conventional approach to group projects for students working online:

- Students are working at their own pace and in their own time, so a timetable must be imposed either by the group itself or by the course leader;
- Organising conventional meetings is not possible, but a substitute is necessary, probably aided by technology;
- Sharing information must be enabled by technology, students must be able to express their opinions online, which may require different skills;
- Assessment is probably not possible on an individual basis, but a group mark may not be acceptable if students recognise that members of a group are not pulling their weight;
- Tutors may experience difficulties monitoring the progress of groups of students.

Managed learning environments (MLE) are being used for a variety of purposes for online learning. These incorporate different forms of computer mediated communication (CMC) to assist with some of the difficulties listed above. However, what is missing is the extra advice to students to help them to decide which of the many features are appropriate at any particular time. The MLEs provide a structure to enable communication, but little help in the process of communication to help form learning networks (Lawther and Walker, 2001). The alternative, or additional, approach suggested is that MLEs should have an extra layer of intelligent help incorporated to monitor the individual students and give individualised advice as required.

Drawbacks with using online technologies include:

- the time taken for a discussion and to reach collective agreement;
- the time it might take to recognise potential problems;

- getting all members to agree their responsibilities;
- knowing who can do which parts of the project;
- recognising when extra help with skills are needed;
- bringing the project together.

Within OTIS these issues were addressed by regular online tutorial sessions with a live staff tutor. This was effective, but extremely heavy on resources, particularly staff time. It required that tutors continuously monitored student interactions and facilitated the appropriate activities at each stage of the course.

As numbers of students rise, not only will there be difficulties in providing sufficient resources for such a model, but there will also be problems finding tutors with the appropriate knowledge mix of domain expertise and skills in mentoring online physically separated groups. Since much of the monitoring is reasonably mechanical, in that it is looking for the presence or absence of any interactions between the different members of the group, this would appear to be an ideal application for an agent based solution (Whatley and Beer, 2002). The objective is not to totally automate the tutor role, but to release the tutors from as much of the mechanical monitoring as possible and allow them to provide more academic leadership and support.

CONCLUSION

Collaboration, although not spontaneous, did occur within the groups, allowing students to achieve what Wenger (1998) describes as an “accountability to the enterprise”. There is a

good indication from the results that the groups did develop through the course to acquire a measure of shared trust and collaboration through virtual teamwork. There was less community building since, after week 4, there was little interaction between members of different tutorial groups. Nevertheless, the students in OTIS had a strong experience of both presence and co-presence within the VLE. They also experienced, to some extent, immersion in the environment — without the need of VR devices and simply through the medium of the desktop screen.

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