

Team-Based Learning Communities in Virtual Space*

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This paper examines how a learning management system (LMS), coupled with sound pedagogical approaches, is used to develop learning communities for students undertaking a problem-based learning university course. Students use the LMS to undertake team-based work, including meetings, communications, and submission of assessments. Data collected on students' usage of the LMS communication technology, and quotes from students' reflective portfolios, demonstrate that effective learning 'communities' are being created in virtual space. Despite never meeting in person, off-campus students formed functional teams and reported developing a great sense of 'community', which fostered mentoring and collaborative learning. The LMS supported the development of an online learning environment that encouraged reflective thought and dialogue with others, both of which are critical to transformative learning and social constructivism. The learner was compelled to become an active participant in the learning process, which allowed students to appreciate the value of participation, trust, mutual respect, and diversity.

Keywords: learning communities; learning management system; WebCT; problem based learning, teamwork

INTRODUCTION

THE UNIVERSITY OF SOUTHERN QUEENSLAND (USQ), in operation since 1967, is a regional university that has developed an international reputation for offering high quality academic programmes in the on-campus (internal), off-campus (distance), and on-line delivery modes. The USQ operates several satellite campuses throughout the world with the main campus located at Toowoomba, Australia.

The Faculty of Engineering and Surveying (FoES) is one of five Faculties at the USQ. This faculty is unusual in that it offers nine majors (agricultural, civil, computing/software, environmental, electrical/electronic, mechanical, mechatronic, surveying (spatial science), and GIS) with no departmental subdivisions. Approximately 75% of the faculty's 2500 students study by distance education.

In 2001, FoES introduced a problem-based learning (PBL) approach for several courses to ensure that graduates developed problem-solving skills and the ability to work effectively in multi-disciplinary teams. In these PBL courses, students learn to work together in teams to solve open-ended problems [1–3]. This paper concentrates on the first of these PBL courses (ENG1101), which is compulsory for all students in the faculty. The main objectives of this course are to develop the fundamental skills needed by students to participate effectively in multi-disciplinary teams, develop communication skills, and to expose

students to a wide range of problem-solving tools. The aim of this paper is to demonstrate how the electronic communication features of learning management systems (LMS) are used to facilitate the effective formation of PBL student teams studying in the distance mode, and to create learning communities [4–8] in virtual space.

BACKGROUND

Problem based learning

Problem Based Learning (PBL) is a specific instructional approach that was first implemented by Howard Barrows in medical education in the early 1970s and has since been further developed and refined [9–11]. PBL is based on engaging the learner in activities that simulate the demands of real life professional practice and, consistent with the goals advocated long ago by Dewey (1916), PBL moulds and prepares students for self-directed, life-long learning. One of the main goals of PBL is to develop thinking and diagnostic skills that not only provide the ability to solve the specific problems presented, but to provide skills that can be applied to the solution of new problems.

The educational and philosophical theories underpinning PBL were not explicit in early PBL literature [12, 13] and the pioneers simply thought that learning in small teams using authentic cases and problems would make medical education more interesting and relevant for their students [12, 14]. From these beginnings, PBL has been incorporated into a wide range of professional studies

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including nursing, dentistry, social work, management, engineering and architecture [15] and has spawned a plethora of educational terminologies with an almost unclassifiable array of categories [14]. Consequently, numerous instructional models that focus on PBL are popular today though most agree that the PBL strategy is entirely in accordance with the 'constructivist paradigm' [7, 16, 17] and 'collaborative learning' concept [18, 19]. There seems to be strong support for the notion that computer-based learning environments can be effectively used to support constructivism and transformative learning [20, 21] and may even offer some advantages over other educational contexts [22] but this does not seem to have been extended in the literature to PBL in the fully online mode.

At the most elementary level the problems in the PBL model involve a multidisciplinary exploration of a subject [23] in which learners examine the topic from several perspectives over a short period of time. At a higher level, the instruction usually begins with a goal or action oriented decision that the learner must make. The difference being that while the goal based scenario uses problems from the past, or specially created problems, action based learning focuses on a real life problem that needs immediate action from the learner. Greenwood and Parkay [24], Merseeth and Lacey [25], and Wasserman [26] have all identified that perhaps the most popular approach is that modelled along the traditional lines of the business and law schools as described by Christensen [27], Spizizen and Hart [28] and Stevens [29]. In this approach the instruction centres round a description of some event that took place, which is relevant to the professional activities of the learners. For the purpose of this paper, PBL will be defined as a constructivist learning paradigm where small groups of students engage in cooperative learning and collaborative problem solving to solve complex problems in authentic project contexts. As explained by Gibbings and Brodie [30], ENG1101 teams are given a number of smaller scale open-ended *problems* to solve, hence the strategy is truly PBL. This is slightly different from project-led education (PLE) or project-organised learning (POL), which involve *projects* supported by theory based lecture courses [31]. These methods usually focus on team-based activity relating to large scale open-ended problems [32].

Interest in PBL arose in engineering higher education in response to criticisms that programs failed to equip graduates with collaborative problem-solving skills required for life long learning and the reality of the work place [15, 33, 34]. In many cases educational outcomes focused on the technical and quality aspects and neglected the necessary professional skills. The need for problem solving skills, teamwork and communication skills, as well as technical skills and knowledge acquired through problem based learning, have been highly

prioritized in recent reports from major engineering accreditation and professional bodies [36–39]. In response, PBL is now becoming popular in disciplines such as engineering and surveying where students must learn to apply knowledge, not just acquire it. Additional attributes identified by Thoben and Schwesig [40] of sharing work tasks on a global and round the clock basis; working with digital communication tools; and working in a virtual environment, are ideally suited to online education.

Distance education

Distance education is not a new phenomenon in higher education. As far back as the late 1800s, correspondence programs were used in the United States to deliver educational material to students. Initially materials were print based but, as technology evolved, so too have distance education programmes and methodologies. In the rush to develop new markets, many higher education institutions have used the latest electronic communication technology and turned to distance education [for example, 41]. This has been supported by the recent maturing of research into learning in an online environment [42], and consequently modern online courses are usually designed and modelled on stable and well recognised theoretical and practical foundations. PBL however does not seem to have fully made the transition into online education [43]. Stacey [cited in 21] reported that an electronic environment can be structured to facilitate effective social constructivist learning in small discussion groups, but again this did not involve PBL.

Limited references are available in the literature to online PBL, online group-based cooperative learning, or even what constitutes an effective online learning experience for adult learners. The majority of references to PBL report the need for some face-to-face team meeting. A notable exception is Kilpatrick, Barrett and Jones [4] who report a recent growth in learning, including online learning, through participation in 'communities of common purpose' facilitated by developments in communication and information technologies, though these authors were not strictly referring to higher education and PBL.

It is the authors' opinion that physical meetings are not necessary to successfully conduct PBL in the distance mode, provided effective use is made of electronic communication features such as discussion boards, chat facilities and web resources that are available in a modern LMS. ENG1101 is a fully online PBL course for first year engineering and surveying students. It relies entirely on electronic communication and resources, and requires no face-to-face meetings of teams enrolled in the distance mode. In this course, students located in different time zones and geographic locations around the world successfully communicate and solve a range of contextualised engineering problems. The course successfully uses appropriate

technology (chat, discussion and web) to enable students to participate in team-based activities in virtual space. In the process, students learn teamwork, communication skills, use of internet technology, as well as discipline specific technical knowledge.

Student diversity

In Australia, student demographics have changed dramatically in the last 10 years, with only 41 percent of university students being the traditional school leavers, and 37 percent of students having attendance patterns other than internal full time modes [44, 45]. This contrasts with USQ where, largely due to the broad range of entry and study options, around 15 percent of students enter undergraduate university courses directly from high school and only 15 percent are internal full time students [46]. As noted by Gibbings and Brodie [2, 3, 30] this has led to a very diverse student population in FoES, including people with trade backgrounds or other tertiary qualifications and many mature age students because:

- students may elect to study in the on-campus or distance modes,
- distance students study from various geographic locations around the world,
- students may study at Associate Degree (two year), Bachelor of Technology (three year), Bachelor (four year), or double degree (five year) levels, and
- students may study any of the nine different majors offered in FoES.

Most students studying in distance mode at the USQ do so because they are already employed in some professional capacity, and the distance mode allows them to study and work at the same time. Owing to the great range of prior experience, and cultural and age differences, these students have different skill levels and personal competency attributes, and their '*learner context*' [47, 48] differs. Gibbings and Brodie [2, 3, 49] report that this rich student diversity is seen as an advantage in the PBL context and they describe how it is used to assist in the learning process by encouraging mentoring within and between PBL teams. This is in accord with Kilpatrick, Barrett and Jones [4] who describe the 'profits that can accrue from building on the synergies' in teams of individuals with a common interest', and Flora, Flora and Wade [50] who contend that, by accepting diversity, teams are demonstrating they are willing to accept new ideas and change, both of which are necessary for community development and learning.

To take advantage of this diversity, students enrolled in ENG1101 are placed into teams of up to eight members selected so as to balance members' existing skills within the teams [2, 3, 49]. Each team is allocated a staff member to act as a facilitator as explained by Gibbings and Morgan [51]. An initial skill assessment is used to

allocate students with different levels of skill in various fields into balanced teams, which in turn encourages mentoring within the teams [3]. It is important from a professional perspective that students in these diverse teams learn to work together. In a global society they will have to work and interact with others who are different from themselves and who, in many cases may, be dispersed nationally or globally.

Use of an LMS

Students in the PBL teams who are enrolled in the distance mode are dispersed across Australia and the world and can only meet 'virtually'. Student teams have generally found asynchronous communication is preferable to enable effective communication across different time zones. The course is managed through use of the WebCT Vista ©[™] learning management system (LMS). This platform provides access to web-based resource material, online quizzes and surveys, and communication facilities such as electronic mail, discussion boards, and synchronous chat sessions.

Initially students must indicate they are active in the course by completing an online 'permission to release email address' form. Once this has been received and acknowledged, teams are formed of up to eight students and each team is allocated a USQ academic to act as a facilitator. An email is sent from the course examiner to each team providing information on members' and facilitator names and email contact details. Students are then directed to USQStudyDesk, which is the portal for the (LMS), for further details on the course.

The LMS provides: a general discussion board for administration and general enquiries; a team discussion board that only the team and the course administration staff, including their facilitator, can access; a combined discussion board to facilitate between-team communications; a chat and whiteboard for each team (if requested); electronic submission for both team and individual assessments; and a link to the course resource page. The course resource page is a separate web where students find assessment details, general information about the course and resources for each specific problem.

Several discussion threads are placed on the team discussion boards to get teams started with the communications that are crucial to success in the course. Individual student responses to these threads are compulsory and they include:

- Introduce yourself
- Team code of conduct and responsibilities
- Team communication
- Times and strategies
- Key learning concepts for problem 1.

Facilitators in ENG1101 are required to make contact with their teams on the discussion boards at least twice a week, though for most facilitators daily contact is the norm. Facilitators ensure that

all students are actively participating in discussions and other activities. This participation is also monitored by the teams and reported weekly in a team progress report. The tone of the communications is scrutinised to ensure that students do not lose their personal identity through the discussions being dominated by any individual. This ensures that students maintain their identity, noted by Smith [52] as a major issue, and therefore students in ENG1101 generally don't employ the defence mechanism of withdrawal that was observed by Smith in her teams. This facilitation in ENG1101, coupled with the continual upgrading of the teams' code of conduct, alleviates the problems of frustration, fear and the 'cyclical movement' in and out of the communication discussions that were noted as major problems by Smith [52].

Team code of conduct

One of the first assessable tasks required of the teams is to negotiate, agree, and document a team 'code of conduct'. Teams are guided by their facilitator to investigate and reflect on teamwork and the requirements and characteristics of successful teams, and to consider what is expected of their team mates and facilitator. They then formulate a list of 'rules', which are essentially individual and team rights, roles, responsibilities, and consequences, that govern the way in which their team will operate. Over the course of the semester, teams revisit this code and modify it as their team matures and different situations arise.

The code of conduct includes team communication protocols. Teams are encouraged to consider not only appropriate methods of communication, but also strategies to ensure these methods are effective and efficient. In light of the vast student diversity mentioned earlier, teams are encouraged to tailor their communication strategies to suit individual requirements. Some teams work entirely on the discussion board, others supplement this with chat sessions, on MSN (or similar) and email, that are outside the LMS. Very few teams work entirely from one technology and such teams tend to struggle with the course requirements [43]. Owing to age, background, and socio-economic diversity, some students have poor keyboard skills and limited knowledge of computers and communication protocols. Many teams mentor members on the installation and use of MSN or other chat facilities. They also agree on specific 'rules' in their codes of conduct to ensure that all members have equal opportunity to contribute during online team meetings. Where teams meet outside the LMS and the overview of a facilitator, they are encouraged to place a summary of meetings on the discussion board. This enables the facilitator to monitor team participation and progress, and allows students who were unable to attend a 'meeting' to keep up with team progress. New threads appear for each problem on the teams' discussion boards, which are

designed to stimulate discussion and student thinking on teamwork, conflict resolution, individual learning goals, mentoring and technical concepts. Responses to these threads form part of the course assessment. Students can also initiate their own new threads to enable team discussions on the current problem.

Assessment of communication

The assessment scheme involves individual contributions to the team effort, self and peer assessment, and team output, and includes a mix of summative and formative assessments. The assessment scheme was recently changed, as detailed by Gibbings and Brodie [2, 3, 30], to more effectively monitor and encourage self directed learning by setting and meeting individual learning goals, mentoring within the team and individual participation and contribution to the team effort. Four main sections contribute to a student's individual mark:

- Team submission of project reports
- Peer assessment of contribution within the team
- Individual contributions
- Individual portfolio of set work and individual reflection on learning.

The authors reported that, under the revised assessment scheme, mentoring within and between teams was improved, since it formed part of the formal assessment, and the subsequent increase in mentoring had the added advantage of encouraging better intra-team communication and therefore fostered better teamwork.

As suggested by Wild and Omari [53], if the web is considered as a learning environment in only a conversational framework, it must still include interactive and reflective components. Whilst the web itself can facilitate some of the necessary conversational framework, or stimulate some of the elements of instructional dialogue, it is necessary to emphasise some type of dialogue or interactivity between the student and the object of learning, and to provide facilities for this interactivity and subsequent feedback to occur [53–55]. This view is consistent with [56], which identified that narrative was both a desirable and necessary method of representing most knowledge types. Consequently the use of the communication features of the LMS to facilitate within-team and between-team communications is seen as a critical element to the success of PBL in virtual space.

As recommended by [57], students are also required to maintain a portfolio of set work and individual reflections on their learning within the course so the assessment depends more on the process, reflection, and self-evaluation than on specific quantitative criteria. This strategy is supported by Laurillard [58], who identified reflection as one of the four main components of effective teaching. Gilbert [59] made a similar assertion, but he interpreted it, in the context of web-based teaching, as trainees needing the oppor-

tunity to reflect on their learning and adapt their learning and conceptions in light of that reflection.

RESULTS

Teamwork and communication

In Semester 1 of 2006 a total of 309 students enrolled in ENG1101, of whom 113 were in on-campus mode and 196 in distance mode. Students spent a total of almost 10 000 hours in 155 000 sessions on the LMS, and they posted a total of nearly 16 000 messages to the discussion boards. This communication accounted for 67.5% of student time (6750 hours) spent on the LMS. Figure 1 shows the average number of postings on discussion boards for distance and on-campus teams. The average number of postings per student was equally shared between on-campus and distance students. This is an interesting result as it was assumed that on-campus students would make significantly less use of the ‘virtual’ communication methods, however these statistics indicate that on-campus students appreciate the flexibility offered by electronic communications and virtual teamwork.

Figure 2 shows the distribution of sessions and

percentage of total sessions spent on all the functions offered by the LMS. It should be noted that, for administrative reasons, the email addresses provided by students on their enrolment forms were used in preference to the email facility offered by WebCT Vista ©™. The chat rooms within WebCT were poorly utilized, with many teams using other mechanisms for chat such as MSN.

The electronic communication methods used in this course develop skills that engineering and surveying graduates of the future will require in professional life. Professional consultancies are increasingly using dispersed multi-disciplinary teams on large projects [60]. The ability to communicate effectively electronically and solve problems at a distance is currently missing in the attributes of many university graduates [60]. This course is ensuring USQ graduates can meet these demands, evidenced by student comments:

I work in the construction industry and team work is essential. The biggest problem we have with the [qualified] consulting engineers is their inability to communicate with each other, especially at a distance. We have to get them to site and face to face to work through design issues. I believe you should do at least one project [at university] where all the teams work remotely from the other team members. (Student comment)

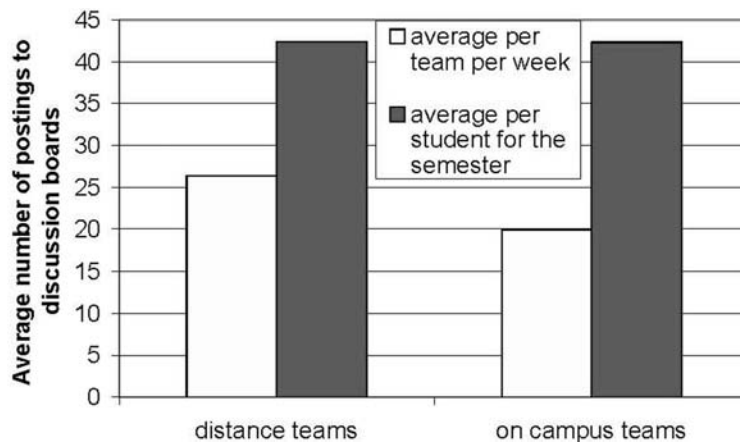


Fig. 1. Discussion board activity for off-campus and on-campus students.

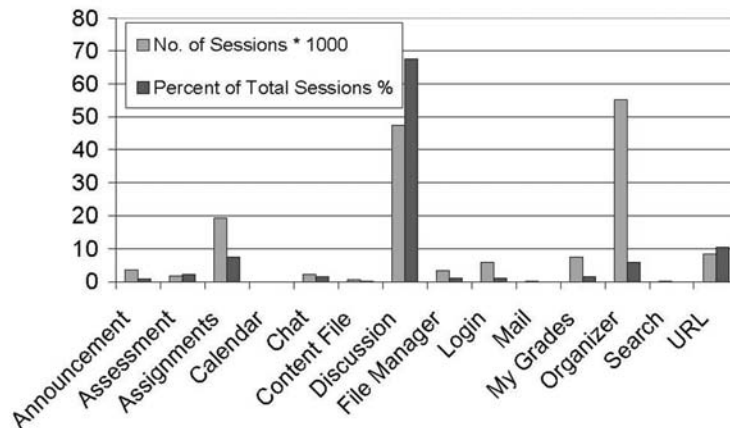


Fig. 2. Activity on the learning management system.

. . . it will become common for an individual engineer to have a working relationship with many companies simultaneously and to receive and present work over a secure Internet connection (Student comment)

. . . I feel that working externally [distance mode] and communicating solely via the internet, exacerbates the issues that can arise when working in a team. You have to put in extra effort to communicate effectively. i.e., correctly word your statements so that they cannot be misinterpreted. It's from this aspect of the subject that I feel I have learnt the most thus far. I am surprised at how I am actually using these communication skills in my day-to-day work now with success. (Student comment)

The technical 'content' in ENG1101 is only part of what the students are required to learn. The process of forming and working in functional teams in virtual space is one of the main objectives of the course and results demonstrate that this is being achieved. This is evidence that the focus on a common interest by all members in the teams can indeed 'transcend geography' [4].

I am beginning to understand that problem based learning is not just a topic within this course; it is the whole concept of the course. (Student comment)

Community

For distance students, working in a student team is a novel experience. For most, the course offered by FoES provides their first opportunity to work actively with other students. Even though some students from different time zones and geographic locations on Earth meet 'asynchronously', the authors believe that virtual team meetings for distance students are as effective as physical meetings for on-campus students and foster the desirable attributes of teamwork, conflict resolution and negotiation of tasks.

I also found that it was easy to communicate within a group via email and the Internet. I enjoyed this part of the course, as it allowed members to join in discussions at different times of the day and this suited the group as we all work different hours and have a range of internet access times available to us. (Student comment)

. . . we all have a lot of fun together even though we have never met face to face. Our team has found common interests and all show a genuine concern for each others welfare. (Student comment)

I enjoyed working with most members of my team and it was good to be able to talk to other students in the same position as me, I was also able to get help with other subjects from some of my team members. (Student comment)

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'Having other students who can mentor can be a lot less stressful. I guess being in a team there is sense of connection between members and so they feel happier to help those they know. I've found just by having

people there to talk with, a lot of stress is reduced and the feeling of being alone with no one to help is diminished. (Student comment)

These quotes highlight the social aspect of learning in the PBL course, the importance of which has been well documented in the literature with respect to human learning in general [for example 4, 5, 6–8]. There is evidence of the formation of learning communities within the teams, and that learning by the students has moved away from an individual constructivist focus as described by Paiget [60], to something much like 'social constructivism' [62, 63]. The existence of this social construction aspect to student learning in communities was also recognised by Pea [64] when he noted that the acquisition of knowledge can be socially constructed when there is a collaborative effort toward a shared goal and that this can occur through dialogue prompted by differences in individuals' perspectives. In contrast to Brown and Duguid [5], evidence from ENG1101 indicates that this social aspect to student learning is occurring in the online environment and it is being improved by the judicious use of the communication features of the LMS. This ability of the internet, provided it is used appropriately, to significantly improve the learning experience in virtual space is a view supported by Tu and Corry [65], and Reushle [20, 22].

It is recognized that ENG1101 and other web-based courses will build a different type of community from an informal learning community than might be expected in traditional classrooms. A sense of community can come about as a result of activity by those brought together by a common purpose [41], but in this case all doing the same course. Much like the situation described by Misanchuk and Anderson [66], ENG1101 students are assembled into teams and practically 'forced' into this 'community'. Their common interest is passing the course and (we hope) learning something in the process. In the beginning this learning community exists within the boundary of the course, but evidence suggests that the community within the teams develop into more than this. Increasingly throughout the course, teams display evidence of communication as social interaction on a personal level as well as academic discourse: noted by [66] as the most important indicator of the existence of a learning community. This sharing of personal information leads to a 'shared emotional connection' [67], which in turn leads to greater trust and sense of support from the team. Figure 3 demonstrates that ENG1101 provides an opportunity for this social interaction to occur, an opportunity that most external students might not have had if it were not for this course using group work and being offered in virtual space through a reliable LMS.

Mentoring within the team has resulted in students learning from each other and valuing the diversity of the team. As recognised by

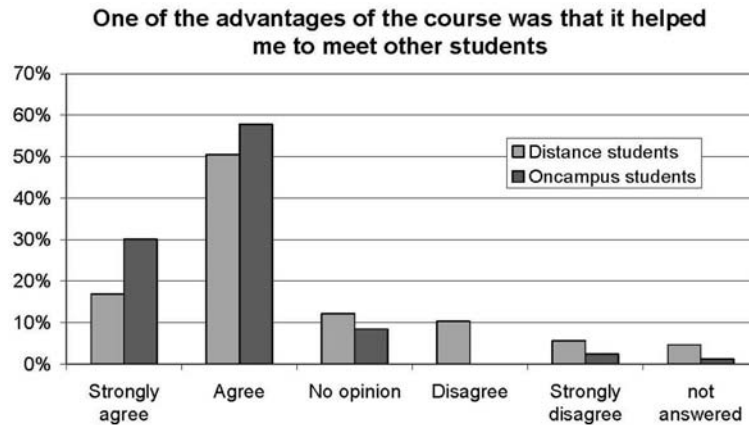


Fig. 3. The course provided an opportunity to meet other students.

Brown and Duguid [5], this has allowed teams to produce more creative solutions than would be possible from an individual. The sense of community within the teams has led to true collaboration since it involves the sharing of creation, understanding and discovery [68].

One of my team mates had suggested that he would like to learn more about PowerPoint, so we have been paired for this task. As I am quite comfortable with the use of PowerPoint, I developed a simple training package for my team mate to show him the basic tools that you can use with this software. We have also collaborated via MSN Messenger on the content of the presentation. I have enjoyed the opportunity to help a team mate learn a new skill. (Student comment)

Diversity works for the team because we: Solve a problem using different viewpoints; Use each others' skills to increase the team's output; Learn skills from one another. (Student comment)

One good thing about the course is that I can see how the other students tackle these things and learn from them. (Student comment)

With so much interaction between other students in this course, it is hard not to learn a great deal. Each person has a large amount of useful information and with this combined into a team environment; this collective information can almost seem endless. (Student comment)

Schrage [cited in 4] sees this collaboration as essential because our society is so complex its intricacies can't possibly be understood without accepting the contributions of peers.

In late 2006, 27 initial student portfolios (submitted after week four of the semester) and 25 final student portfolios (submitted at the end of the course) were investigated. Three common threads were found in most final individual portfolios. Interestingly, these three are criteria used to identify the development of 'learning communities' [4].

1. Students recognised the importance of a common goal, and a commitment to succeed.
2. They realised they needed to respect and take advantage of the great diversity within the team

to enhance potential outcomes. If it is accepted that the ENG1101 teams are indeed a learning community, then this view is supported by Kilpatrick, Barrett and Jones [4] who suggest that 'respect for diversity enhances the learning capacity of a community'. This required them to adapt to this diversity and to identify and use individual strengths and weaknesses. They also identified that helping others and mentoring is a powerful contributor to team success and individual goals.

This course has also taught me that a variety of opinions in a team is often beneficial to its success, as it promotes in-depth discussion which leads to well thought out decisions. As well as this, it encourages team members to think about the concepts being learned more deeply, which helps in understanding and remembering them in the future. (Student comment)

I have learnt that a team of people can accomplish much more than one [of] the individuals by themselves. (Student comment)

3. Trust (and ability to rely on others in the team) is a critical element for efficiency within teams. This was also recognised by Kilpatrick, Barrett and Jones [4] and Rovai [41] as essential to success of collaborative work.

I have learnt how to trust other team members and use their gifts to enhance the team. (Student comment)

Contemporary adult education literature calls for a transformative approach (based on constructivism) where the student is empowered to reflect on and transform their own beliefs, attitudes and opinions. Reflective thought and dialogue with others are critical to this transformative learning [20, 22]. It is important that students have an opportunity to not only reflect on the social dialogue but also on what learning has occurred [20] and how this has taken place. Accordingly, it appears that students in ENG1101 found that the reflection required to complete their individual portfolios helped their learning, and they also acquired knowledge about how they learn as

individuals. Since students in ENG1101 are required to document this reflection in a visible text-based portfolio, this should encourage them to provide 'well reasoned reflective contributions involving disciplined and rigorous higher order thinking processes of analysis and synthesis' [20, 22], and quotes from student reflective portfolios should therefore be reliable sources of information about the student experience.

The individual side of the course should help me in my academic and professional career by making me a more efficient learner. It will achieve this by helping me to 'learn how I learn. (Student comment)

Reflection helps learning, it helps me realise exactly what I've learnt during the process of completing the report/s. (Student comment)

With careful design of learning objectives, support mechanisms and communication strategies, the course enables team PBL to be effectively delivered to students who study in virtual space. A longitudinal study carried out over the last five years indicates the following.

- 84% of students agree or strongly agree that the course increased their appreciation of how prior knowledge and skills of their colleagues and themselves can be used to effectively solve problems.
- 85% of students believe the course improved their problem solving skills.
- 81% of students agreed that the course increased their ability to work in a team.
- 73% of students agreed that the ability to learn independently increased.
- 79% believed their communication skills had increased.

Qualitative data from student portfolios also supported this assertion:

I now believe a virtual team can work if the right individuals are put together, despite their diverse professions, cultures and geographies. If a virtual team can work I believe a face to face team cannot fail. I will use the same negotiating skill, project task identification knowledge, the same focus to a specific goal, strength and weakness identification skills and the same effective communication skills we have used in this project in my everyday team work. (Student comment)

Recent research suggests that the physical separation of adult learners in distance educational programmes is a major contributor to high drop-out rates [Morgan & Tam, cited in 20]. It appears that this separation leads to a decrease in the sense

of community, increased feelings of disconnection, isolation, distraction, and lack of engagement [41]. The LMS used in ENG1101 creates an online learning environment that supports the critical concepts of sharing, reflection, and rational communication, all of which are highly valued by advocates of transformative learning [20]. An effort has been made to create learning communities in virtual space by using the LMS to cultivate a climate that is, as recommended by Reushle [20], supportive, safe, tolerant, respectful, nurturing and participatory.

CONCLUSION

This paper has described the successful matching of the communication power of an LMS with established pedagogical principles to produce enhanced learning outcomes. The communication features of the LMS have been used to create an online environment that takes advantage of a diverse student profile and supports student learning as a social community activity. The shared purpose of completing the ENG1101 PBL problems and passing the course have encouraged collaboration and mentoring within and between student teams, while the LMS has provided the vehicle for students to socially construct learning.

There is evidence that students in ENG1101 are learning through jointly 'constructing' knowledge through dialogue on the LMS with other students and facilitators. This is in line with the adult learning concept of transformative learning, the essence of which is grounded in constructivism. Students have ample opportunity to critically reflect and to validate new ideas to interpret these learning experiences in their own contexts, all of which is important for adult learning. The virtual e-learning atmosphere created through the use of the LMS in ENG1101 for distance students has been shown to offer an environment that is conducive to this type of learning.

It has been demonstrated that by appropriate application of both technology and sound teaching principles, PBL can successfully deliver the required educational outcomes when offered to distance students in the online mode. Provided that sound pedagogical approaches are entrenched in the course design, it is possible to use an LMS to create effective learning communities in virtual space.

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