



Problem-based learning: Student engagement, learning and contextualised problem-solving

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About the research



Problem-based learning: Student engagement, learning and contextualised problem-solving

Mark Mossuto, RMIT University

Building the research capacity of the vocational education and training (VET) sector is a key concern for the National Centre for Vocational Education Research (NCVER). To assist with this objective, NCVER supports a Community of Practice scholarship program, whereby VET practitioners without any research experience are given the opportunity to undertake their own work-based research project. Scholarship recipients are supported by a mentor, and NCVER publishes their research results.

Mark Mossuto participated in the 2008 Community of Practice. Mark is a Senior Educator and Teaching and Learning Coordinator in the Business College at RMIT University. His research investigates the level of student engagement with problem-based learning, a teaching method where students learn through solving real-life situations or problems. RMIT University in Melbourne adopted this teaching approach for the advertising and public relations programs offered by the Business TAFE School in 2007 and 2008.

Through the use of a survey and interviews with students, this project sought to examine whether engagement, questioning, critical thinking and problem-solving skills are enhanced using the problem-based learning approach.

Key messages

- ❖ Overall, students reported that the problem-based learning approach was beneficial to their engagement with learning.
- ❖ The success factors integral to this approach include the quality of the teacher, the student's willingness to participate, and industry support of the program.

The author also provides guidelines for assisting teachers adopting a problem-based learning approach and makes some suggestions on how problem-based learning can be used for the delivery of training packages.

Tom Karmel
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Contents

Tables and figures	6
Introduction	7
What is problem-based learning?	7
Is there a need for problem-based learning?	8
Why problem-based learning in the Australian VET sector	9
Context for this project	9
What do others say?	11
Findings	17
The participants	17
Student perception of teacher–lecturer influence in problem-based learning	17
Analysis of the survey data	19
Success factors	24
The effectiveness of problem-based learning in the VET sector	24
Successful problem-based learning implementation	25
Principles for effective teaching	25
Professional development for staff	26
Conclusion	28
References	29
Appendices	
1	31
2	33
3	42

Tables and figures

Tables

1	Aggregation of data indices	13
2	Mean score for creative thinking	13
3	Theme 1: student engagement	20
4	Theme 2: Student learning	21
5	Theme 3: Contextualised problem-solving	22
6	Sample size and questionnaire responses received	32

Figure

1	Problem-based learning in VET	16
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Introduction

What is problem-based learning?

Most people learn:

- ✧ 10% of what they read
- ✧ 20% of what they hear
- ✧ 30% of what they see
- ✧ 50% of what they see and hear
- ✧ 70% of what they talk over with others
- ✧ 80% of what they use and do with in real life
- ✧ 95% of what they teach someone else (attributed to Glasser 1988 cited in Biggs 2003, p.80)

Problem-based learning is a pedagogical strategy for posing significant, contextualised, real-world solutions and providing resources, guidance, and instruction to learners as they develop content knowledge and problem-solving skills (Mayo et al. 1993).

As Duch, Groh and Allen of the University of Delaware (2001) posit, problem-based learning is an instructional method that challenges students to ‘learn to learn’, as they work cooperatively in groups to seek solutions to real-world problems. It is commonly acknowledged that problem-based learning prepares students to think critically and analytically, and to find and use appropriate learning resources (Duch, Groh & Allen 2001). The aim of problem-based learning is to help students to seek out solutions and objectives that can set them on the road to lifelong learning. Problem-based learning supports and helps effective adult learning, no matter what discipline students choose to pursue (Engel 1998).

It is widely acknowledged that problem-based learning allows students to learn the fundamental principles of a subject or competency in the context of needing to solve a real-life situation or problem (Hmelo-Silver 2004; Norman & Schmidt 2000; Barrows & Tamblyn 1980; Duch, Groh & Allen 2001). Students analyse the problem and look at what they need to do in order to solve the problem at hand effectively and efficiently. It is all about practising, using and developing processing skills, group skills, critical thinking skills, and self-directed learning skills, which then leads to problem-solving. The success of problem-based learning is dependent on the student’s ability to combine all of these skills under the guidance (facilitation) of a teacher–facilitator. Their level of engagement in their learning will have a profound effect on their eventual ability to perform and provide a solution to whatever problems they face in the real world.

This research project aims to investigate and report on the level of student engagement in a learning environment where a problem-based learning approach has been implemented in a competency-based training program in the vocational education and training (VET) sector. Is this the appropriate teaching and learning pedagogy in which to set students on a path to lifelong learning and enrich their learning experience? Can they experience in the classroom what is experienced in the workplace—at least in part—and does this experience better prepare them to enter the

workforce? It would appear to suit the needs of the industry areas of advertising, public relations, marketing, international business, business administration, and law and so on.

Is there a need for problem-based learning?

Increasingly, our students, who are being taught by Baby Boomers using traditional methods, appear disconnected from their studies. Generation Y uses existing and emerging technologies with ease and comfort and will be frustrated with Baby Boomer teachers if they can not keep up with their expectations (Eubanks 2006). How do we connect with them on their level if we don't use technology to engage with them? What provides the link between Generation Y and education? How do we accommodate their personal technology—iPods, wireless laptop PCs, mobile phones and the like—in their education?

Characteristics of the millennium generation include 'digital literacy, experiential and engaging learning, interactivity and collaboration, immediacy and connectivity' (Barnes, Marateo & Ferris 2007). We can no longer be exclusively the instructor, 'disseminating information/knowledge through lecturers and PowerPoint slides' (Skiba & Barton 2006); we need to shift away from the teacher-centred learning paradigm to a more student-centred constructivist paradigm of education. The student now needs to focus on understanding, constructing knowledge, discovering and active engagement such that they view the teacher/lecturer as a mentor/guide (Brown 2005).

Generation Y needs and wants experiential and engaging learning. Learning is not done in isolation; students learn by doing (Skiba & Barton 2006). They prefer to work in groups and they embrace collaborative learning (Skiba & Barton 2006). They actively participate in the learning process, but more importantly, they are looking for direction, mentoring, guidance, feedback and good communication channels (McCrinkle 2006). Problem-based learning incorporates this approach by offering a holistic approach to teaching and learning and may well provide for greater flexibility in teaching design.

Donnison (2007, p.9) notes that 'there is no doubt that the onus is on the teacher/educator to develop pedagogically appropriate teaching and learning strategies for their millennium students'. To do this effectively, we need to understand this student cohort, including their learning needs and styles, and contextualise teaching and learning so that they can apply theory through practice to enhance their learning and study abilities. Our focus as educators should be on engagement, discussion, allowing students to contemplate the material put forward, as well as to comment and question. Problem-based learning allows us to do just that. As Biggs (2003, p.13) notes:

What people construct from a learning encounter depends on their motives and intentions, on what they know already, and on how they use their prior knowledge.

In competency-based training, why is there a need for the implementation of problem-based learning as a teaching and learning pedagogy for tertiary students? Why is there a significant emphasis on student engagement and participation, the incorporation of employability skills in assessments? Why do we look at whether or not graduates are ready for the workforce, and the experiences they bring to a business learnt in the classroom? The answer to these questions is that industry wants graduates who can be productive in the workplace from day one, so there is a need for problem-based learning in the VET sector to ensure that the needs of industry are fulfilled. Industry is telling us that they need graduates who are job ready, graduates who are able to be productive immediately and who have a good understanding of the business they are about to be employed in. Industry advisory committees in both the advertising and public relations areas at RMIT University, the institution in which project data were collected, have advocated strongly for the introduction of real-world experiences with real clients to the classroom, which allows for learning to take place in a controlled environment that stimulates the necessary experience—but without costly mistakes for the agency and the client. For this to happen, and in the light of discussions with each respective industry committee, an increasing emphasis has been placed on

problem-based learning for students. Real agency clients interact with students, who work to provide a solution to the problem facing each agency. In this way, students get a feel for real-life situations contextualised to their field of study.

Why problem-based learning in the Australian VET sector

The key requirement for registered training organisations delivering training programs based on national industry training packages is to ensure that they are focused clearly on the competencies required for effective work performance and that they are to the standards specified in units of competency. This means that theory is taught in the context of its application in a real-life situation. Assessing a student is now not only based on theory but also on the practical application of that theory: how it is applied to problems presented. Not all students learn the same way and to the same level, and finding a good balance of various learning styles and techniques applicable to specific groups of students is not easy.

This project has set out to examine students' experiences and attitudes towards problem-based teaching and learning strategies. Research has been focused on the advertising and public relations programs at RMIT, in which problem-based learning was practised.

Context for this project

The project reported here is set in the context of experiential learning in TAFE colleges in Victoria and, more broadly, to the vocational education and training sector. My many years of industry experience have given me the scope to experiment with different forms of delivery to meet industry expectations and I have found that a problem-based learning approach in the framework of a competency-based training system gives the students the knowledge and skills they need when they graduate to enter the workforce and be productive from the outset.

The chief purpose of this investigation therefore is to confirm whether or not my teaching practice has achieved those goals and those of the student. To this end, the investigation is guided by the following question:

What impact will implementing the pedagogy of problem-based learning within the VET sector have on student engagement, their learning experience and their ability to solve a problem contextualised to reflect the workplace?

A problem-based learning program was introduced as part of the Business Services Training Package (BSB01) in 2003 at Victoria University and again between 2006 and 2008 at RMIT University to students in the advertising and public relations training programs. At these dual-sector institutions, the competencies that comprise the Advanced Diploma of Business—Advertising and Public Relations are assessed according to a competency-based approach, which also affords a grade for academic purposes for those who want to articulate into higher education.

By evaluating the delivery of this innovative program implemented during 2007 and 2008 at RMIT University, this research project seeks to determine if student engagement, questioning, critical-thinking skills and problem-solving skills are enhanced using the problem-based learning pedagogy. The research project focused on students enrolled in the TAFE sector only.

In the first instance, this paper will consider various arguments found in the literature that discuss the benefits and pitfalls of problem-based learning in various educational contexts and the effects it has on student learning. Then the paper intends to explore in the context of the VET sector here in Australia, namely RMIT University, TAFE Business School, the role of problem-based learning in study in the Advanced Diplomas of Advertising and Public Relations.

This study involved the use of both quantitative and qualitative research methodologies to gather data on which the findings in this paper are based. A total of 71 quantitative questionnaires were sent out to graduating students, and 32 returned, with 15 students—ten from the Advertising program and five from the public relations program—volunteering their time to participate in semi-structured face-to-face interviews. More detail on the methodology can be found in appendix 1.

This project appears to be the first empirical study of the effects of problem-based learning on students and programs in VET in Australia, and more specifically in the TAFE system.

Its findings suggest that problem-based learning does improve and enhance a student's ability to learn in the contextualised environment in which the problem is set. It also considers the teaching and learning approaches conducive to problem-based learning pedagogy in VET and the implications for staff development, since staff need to fully understand the implications problem-based learning has for student learning and engagement. However, problem-based learning might not be suitable for all programs. Indeed, the selection of the program for the application of problem-based learning as a teaching and learning strategy is crucial to its success and will allow students to commence on a journey of lifelong learning in their chosen discipline. The goal is to involve students with all aspects of their learning.

What do others say?

This literature review investigates the influence of problem-based learning on student engagement, student learning and problem-solving. A number of papers largely addressing university education in the fields of medicine, engineering, nursing and dentistry were reviewed to substantiate the rationale for the investigation and introduction of problem-based learning in the VET sector as a strategy for delivering training based on national industry training packages. Research papers from polytechnic colleges were also reviewed and incorporated into this discussion. The key questions guiding the review of the research literature are: does problem-based learning enhance/strengthen student engagement?; does it enhance student learning experience; and does it give students the ability to solve contextualised problems reflecting the workplace more efficiently?

Literature from a number of education and training journals (both Australian and international) spanning the past ten years was reviewed.

Anecdotal evidence collected during my experience with a problem-based learning program has shown that involving real clients in the advertising and public relations industries in problem-setting has been a most successful approach, producing a range of solutions to the industry problems that industry did not believe students would have been capable of. Through in-depth analysis of the problem and methodically tackling each issue, students developed the ability to discuss, explore and eventually provide a solution that enabled the client to achieve their stated objective. Industry clients involved in those programs that employed problem-based learning as a teaching and learning strategy stated that 'students were presenting solutions comparable to those that could be achieved in the workplace but without the experience of a supporting professional team behind them.' The students were the team, with their facilitators guiding them along the way.

The pedagogical role of the VET educator is changing. The teacher is now a facilitator, not there to impart theory, but to think out loud with their students, and to practise the behaviour they want their students to use (Stepien & Gallagher 1993). The teacher-facilitator poses questions, for example, what is the situation students are facing thus far, what is known to date, and what do they need to research further and what solution should be proposed that answers the problem set by the client? As students come to understand the problem better, they hypothesise about possible solutions and in doing so, they then identify possible gaps in their learning. These gaps then become the focus of students' self-directed learning, the process by which students fill those gaps (Hmelo-Silver 2004). The problem then becomes the centre of problem-based learning, and the learning is as authentic as it can get (Stepien & Gallagher 1993).

So what does the literature say about this approach to learning? In researching problem-based learning policies and research papers, it was found that there are varying degrees of research undertaken in this area. Most material on problem-based learning is specific to an individual university and the faculty in which the problem-based learning program or curriculum was developed or is being used.

Research literature has shown that the success of problem-based learning depends on group work (Stepian & Gallagher 1993; Fenwick 2002; Hendry, Ryan & Harris 2003; Tan 2004; Kumar & Natarajan 2007). Fenwick (2002, p.7) describes group work as where students 'read, diagnose, discuss, explore strategies to solve the problem'. Kumar and Natarajan (2007, p.91) claim that 'problem-based learning encourages students to work collaboratively in teams to seek out solutions

through authentic instructional situations'. They cannot choose with whom they work, so in the classroom, groups are randomly chosen for each problem set. For effective group work to be instigated, the facilitator lays the groundwork, firstly by initiating discussion in which students describe their experiences (positive and negative) of working in groups. He/she then suggests behaviours to promote beneficial aspects and discourage unproductive ones. Once groups have formed, the groups themselves set their own ground rules for what is acceptable and what is not, with all members agreeing in writing. Group-based learning is about fostering and challenging students to learn how to learn.

In problem-based learning, students take on particular roles in the context of the problem posed—whether it's scientific or business-oriented. For each problem, students need to allocate roles that reflect the situation/problem. Through problem-based learning, students learn how to use an iterative process of assessing what they know, identifying what they need to know, gathering information, and collaborating in the evaluation of the hypotheses formed in light of the data collected. Teachers act as coaches and mentors, probing findings, hypotheses and conclusions and sharing their thinking when students need direction or guidance (Stepien & Gallagher 1993).

No matter how small or how elaborate the evaluation, the design involves deciding what is to be evaluated, for what purpose and by whom. These in turn will determine what questions need to be answered and of whom these questions should be asked. (Wadsworth 1997)

If students are to learn desired outcomes in a reasonably effective manner, then the teacher's fundamental task is to get students to engage in learning activities that are likely to result in them achieving those outcomes. It is helpful to remember that what the student does is actually more important in determining what is learned than what the teacher does.

(Shuell 1986)

If we are to move away from a teacher-centred to a more student-centred model of education, then students need to take ownership of their own education through self-directed learning. Yeung et al. (2003) conducted a study in which they set out to evaluate student learning and self-directed learning practices. Their study was designed to prove that there is a need to 'change a student's learning from passive to active'. Yeung et al. (2003) went on to say 'that learning in the problem-based learning format can lead to long-term retention of knowledge, enhance the integration of basic science concepts into clinical problems and result in an increase in intrinsic interest in the subject' (Young et al. 2003 quoted in Norman & Schmidt 1992, p.237). Evaluation of the qualitative data revealed that students had experienced benefits associated with the development of self-directed learning skills, although some had doubts about the benefits. These data also suggested that students showed a shift towards independent learning by establishing more regular self-directed learning practices and by increasing their confidence in searching for information relevant to learning using problem-based learning (Yeung et al. 2003)

In their paper, Mary Thomas and Lai Pheng Chan (2002) from Temasek Polytechnic in Singapore describe how problem-based learning was implemented in the Business School with students undertaking diploma studies. A survey was administered after the problem-based learning to gauge student reaction to this approach. Results of the survey showed that 74.3% of students found the problem-based learning methodology challenging, and 88.7% found that the problem-based learning approach made them more independent learners. Around 70% of respondents felt that problem-based learning enabled them to find new knowledge, and slightly more than 50% of respondents felt that problem-based learning made them confident and enlightened learners. In a survey conducted before a problem-based learning approach was implemented, it was interesting to note that 99% of all respondents were negative about the approach; by the end of the learning process, however, 85.4% of students found problem-based learning had made them more committed, confident and gave them the ability to become independent learners (Thomas & Chan 2002).

In evaluating problem-based learning students against traditional students Hmelo-Silver (2004) points out that the former scored slightly less than traditional curricula students in multiple-choice measures, but in clinical problem-solving, this group of students performed slightly better than

traditional curricula students. It is interesting to note that the paper suggests that errors in the problem-solving process are a necessary step in learning to apply new knowledge. In a later paper, Hmelo-Silver, Duncan and Chinn (2007) point out that scaffolding is required in a problem-based learning program for students to engage in sense-making, managing their investigations and problem-solving processes. This scaffolding encourages students to discuss their thinking and to reflect on their past learning; they learn by reflecting on the knowledge they possess, applying it and then assessing the knowledge required to solve the problem at hand and researching the gap (Hmelo-Silver Duncan & Chinn 2007, p.100)

Graduating medical students from 1980 through to 2003 were asked to participate in a study conducted by Schmidt, Vermeulen and Van Der Molen (2006). The study, which was conducted via a questionnaire, looked at the long-term effects on graduates learning under a problem-based learning program in a medical school in the Netherlands and compared these findings to learners in a more traditional school. Graduates of the problem-based learning school rated themselves overall much better in three of the four aggregated indices, the four being interpersonal competencies, problem-based learning-related cognitive competencies, general academic competencies and task-supported competencies (Schmidt, Vermeulen & Van Der Molen 2006, p.565). With respect to the third item, there was no sizable difference between respondents from the traditional school and those who undertook learning in a problem-based learning program (table 1).

Table 1 Aggregation of data indices

1	Interpersonal competencies	Ability to work in a team, interpersonal skills, and skills required for running meetings
2	Problem-based learning-related cognitive competencies	Problem-solving, self-directed learning and information gathering
3	General academic competencies	Writing reports, presenting papers and doing research
4	Task-supported competencies	Producing new ideas, helping colleagues, being productive, being able to work independently, planning one's work adequately, being efficient and being able to work under pressure

Source: Schmidt, Vermeulen and Van Der Molen (2006, pp.564–5).

Awang and Ramly (2008) set about to measure 'creative thinking' in Malaysian Polytechnic institutions that employed problem-based learning. Increasing numbers of polytechnics in Malaysia are modifying their education system to match requirements of industry and commerce. They advocate that curriculum should challenge the student to think creatively, to understand, to analyse and to apply knowledge gained. Working both as individuals and collaboratively encourages students to engage, to share, evaluate and to critique each other's work during group meetings. To measure creative thinking, Awang and Ramly (2008) administered the Torrance Tests of Creative Thinking, both before and after students had completed their program. As illustrated in the table below, the test measures three areas, originality, fluency and flexibility. Results showed that there were significant increases in creative thinking across all three areas.

Table 2 Mean score for creative thinking

Method	Originality		Fluency		Flexibility	
	Pre	Post	Pre	Post	Pre	Post
Problem-based learning	38.27	46.77	48.45	58.91	35.18	39.19
Conventional	34.58	40.22	41.56	49.88	29.51	30.51

Source: Awang and Ramly (2008).

Further to the development of creative thinking, Albanese and Mitchell (1993) state that 'outcomes-based studies of students in various problem-based learning programs provide evidence that problem-based learning is effective in developing knowledge and skills required for clinical practice, [for example]: improved diagnostic competence, enhancement of behaviours such as deep-

processing, methodical study and self directed learning' and add that 'other studies have reported evidence of improved employment, student interaction, and the flexibility of problem-based learning programs' (Albanese & Mitchell 1993 quoted in Greenwood et al. 1999) In contrast to these studies, Muller (2008, p.27) highlights the problems that can be found when moving to a problem-based mode of the medical curriculum. With the emphasis on contextual problems to be solved rather than the disciplinary knowledge to be learned, students can 'end up with gaps in their knowledge'. Designing the curriculum 'in terms of external contextual coherence instead of internal conceptual coherence' can flout 'the sequential requirements of the vertical parent knowledge structures (anatomy, for example)'. From a curriculum point of view, there are limits to contextualising the curriculum. Perverse knowledge effects can appear.

An argument exists that states 'minimally guided instruction is less effective and less efficient than instructional approaches that place strong emphasis on guidance of the student learning process designed to support the cognitive process necessary for learning' (Kirschner, Sweller & Clark 2006, p.76). Their argument is related to the structure that constitutes the human cognitive architecture, which looks at the intricate relationship between the working memory and long-term memory. These authors argue that 'instruction is there to alter long-term memory store, if nothing has changed in long-term memory store, then nothing has been learned' (p.77). They add that 'most learners are able to construct knowledge when given adequate information and there is no evidence that presenting them with partial information enhances their ability to construct a representation more than giving them full instruction' (p.78). They cite a research study conducted by Clark (1989), whereby Clark reviewed some 70 aptitude-treatment interaction studies and found that, with lower-aptitude students, unguided, weaker instruction treatments received lower scores on post-tests than on pre-tests measures. Clark argued that failure to provide strong learning support for less experienced or less able students resulted in a measurable loss of learning (p.81). By contrast, Kirschner, Sweller and Clark (2006) also cite a study by Albanese and Mitchell (1993), in which students studying medicine via the problem-based learning method did in fact receive better scores for their clinical performance (p.82).

In response to the Kirschner, Sweller and Clark (2006) paper, Schmidt et al. (2007) argue that problem-based learning 'is an instructional approach that allows for the flexible adaptation of guidance' (p.91). It can be seen that the tutor is now the facilitator of student learning, sharing knowledge and being the subject matter expert, guiding them through the problem, no matter whether they're novices or experienced problem-solvers. These authors argue that cognitive load theory strongly influences problem-based learning, which is flexible enough to be adapted to the level of learner expertise. Hmelo-Silver, Duncan and Chinn (2007) also entered the debate, in that they refute points of Kirschner, Sweller and Clark's (2006) paper on minimally guided instruction. According to these authors, problem-based learning provides data to students, which the students analyse and explore for further information applicable to the problem. Kirschner, Sweller and Clark (2006) discuss providing direct instruction in a just-in-time fashion, facilitated by mini-lecturers, where key information is presented. They argue that this promotes knowledge construction available for future use. These authors use the term 'scaffolding' to describe how the learners are presented with opportunities to engage in complex tasks that would be beyond their current abilities (p.100). They argue that 'scaffolding' in problem-based learning makes disciplinary thinking and strategies explicit, that it embeds expert guidance and structures complex tasks and reduces cognitive load on students (pp.101-2).

Further to the argument on the effectiveness of problem-based learning, Hamdy (2008, p.739) posits the notion of 'hybrid' problem-based learning and questions whether a 'pure' problem-based learning pedagogy really exists, since various medical schools have long been implementing problem-based learning through lectures, labs and the like. The key is to know when to provide guidance and to what level it should be provided to students. Hamdy goes on to say that the guidance should encourage interactive discussion amongst students and the dissemination of information related to the problem. Critical to this approach is interaction between the subject matter expert and the groups of students in which the problem is discussed and resources given.

This allows for the newly identified knowledge to be linked to the problem students are facing (p.740). Hamdy also argues that we can not separate problem-based learning as one of the strategies for learning of curriculum from other activities. The effectiveness of problem-based learning is still an issue, but as Norman and Schmidt (2000, p.724) state, 'problem-based learning does provide a more challenging, motivating and enjoyable approach to education'.

Pross (2002) describes the characteristics of the problem-based learning process as follows:

- ✧ It is usually based on real-life cases, which are relevant to the students and their discipline.
- ✧ Cases are characterised by 'progressive disclosure'.
- ✧ Students come in 'cold' for the first tutorial.
- ✧ Students determine the learning issues.
- ✧ Sessions are open-ended to allow learning in the interval.
- ✧ The tutor is a facilitator and not necessarily an 'expert' except in the process.

These characteristics allow each student to fully participate in all aspects of their learning experience. Having students follow a step-by-step procedure (figure 1) enables the facilitation of learning at each level. Allowing classroom discussion before moving on means that any unresolved issues can be clarified before progressing onto the next step. It is assumed that students have the knowledge required to proceed and if they have not, then it must become a learning issue. As the facilitator, this can involve asking a few more questions or even requesting further investigation before moving to the next issue or step. Problem-based learning provides an environment for promoting these skills.

In conclusion, the literature reviewed shows that problem-based learning, when implemented contextually, delivers learning outcomes for students superior to traditional methods of teaching in a program, although some commentators debate the claims and still question the effectiveness of this approach. Some of the studies referred to in the literature have focused on an objective evaluation of the performance of graduates from problem-based learning courses. This research project does not intend to evaluate performance, but seeks to investigate how student engagement in learning is enhanced (or not) through the use of problem-based learning pedagogy. This project is concerned with investigating the effect/outcomes of a problem-based learning program in relation to student engagement, students' learning experience and the problem-solving abilities students need for the workplace.

Findings

The participants

For the quantitative component of this study, 48% of all questionnaires distributed to advertising and public relations students were returned to the researcher. In the detailed breakdown, 52 questionnaires were distributed to students from the advertising program, with 26 completed and returned. The split was ten male and 16 females. In the public relations program 19 questionnaires were distributed with six returned. The split was two male and four female. Over both programs 12 males and 20 females returned questionnaires.

Given that both programs have a business focus, the imbalance of male to female students is not surprising: in these fields of employment, students traditionally are predominantly female.

For the qualitative component of study, it was surprising that five males volunteered their time to be interviewed. The gender balance was equal in advertising, five male and five female interviewees and in public relations, all interviewees (five in total) were female.

Student perception of teacher–lecturer influence in problem-based learning

The data presented in this report are descriptive. In this way the student’s perspective is presented—what did they think, feel and understand about problem-based learning.

Four open-ended questions contained in the quantitative study were first piloted with students. This was done to gain an insight into students’ perceptions of the problem-based learning program and its objectives. From the responses gathered, an in-depth set of questions was developed that allowed for the deeper exploration of students’ thoughts, experiences and knowledge acquisition through a problem-based learning approach. Further investigation was needed of the underlying factors influencing their answers. As evidenced in the responses, the initial findings showed that those participants who had been involved had enjoyed the experience and apparently preferred this mode of study. Most indicated that problem-based learning had challenged their mode of thinking in relation to problems set in the classroom. Students found that their interactive skills had improved through their close association with other group members. The approach presented them with the opportunity to explore their own skills and to work on their weaknesses, for example, confidence, presentation skills, working in a team environment and problem-solving skills. The data reflected that students identified the need to become self-directed learners working for the group, not just for their own personal goals.

Problem-based learning problems produced the right environment to stimulate problem-solving, critical thinking etc., however, creating that environment is not enough for optimum learning. The participants’ ‘willingness’ to be involved is as important, if not more important than using the problem-based learning methodology. (Student comment)

Fun and interesting way to learn and understand the advertising industry and the processes agencies use in the current workplace. (Student comment)

Pushes students to achieve goals that go beyond a purely theoretical teaching program.
Enables students to experience team work, stretches student skills allowing them to apply what they have learned into 'real-life situation'. (Student comment)

Students are exposed to many different teachers who are teaching a variety of competencies, and not all of these students have embraced problem-based learning as a teaching strategy. Nevertheless, from the survey responses, it is evident that students see a problem-based learning class as more engaging than the lecture style of delivery of content/learning materials. They see it as enabling them to become involved, to interact, and to discuss issues that affect the problem at hand. It gives them the ability to employ the theory in a practical sense, to see whether the decisions they made affect the outcome of the problem set by the client.

You learn more by applying yourself and getting more involved with the theory aspect compared to just learning theory. (Student comment)

Problem-based learning definitely taught me much more than a lecture alone could teach, though I do still think there is a happy medium where both should co-exist. (Student comment)

It provides hands on, practical situations that you would encounter in a real job. It's like a job with training wheels. (Student comment)

Critical to making a student's experience more enjoyable, the teacher/lecturer needs to be able to bring their industry experience into the classroom. Students see this as living the experience of their teachers/lecturers in the classroom through the stories and experience they share with their students. Several students commented positively on the ability of the teacher/lecturer to make the learning real and contextualised to their course of study.

The fact that most of my teachers were ex-industry personnel with up to date knowledge meant it was relevant to today's industry. You won't find that in any American text book. (Student comment)

We were given free rein of our own study and how much we wanted to learn from our own experiences, but at the same time our lecturers were teaching us the tools we needed to complete the tasks at hand. (Student comment)

Industry experience as well as a solid understanding of current industry practices and requirements, this gave us an understanding of how things would be applied in industry. (Student comment)

A facilitator's role is one of encouragement and of providing information, to keep students on track, and to positively reinforce their findings, but more importantly, to become a fellow learner. Direct instruction can therefore be reduced in problem-based learning, allowing students to assume greater responsibility for their own learning (Bridges & Hallinger 1991). For problem-based learning to succeed, the facilitator has to have sound knowledge of the strategy and have the ability to innovate in their classroom in order to change the dynamics of student learning. It would appear that the facilitators in the problem-based learning program under investigation were largely successful:

They taught me problem solving skills that I am implementing almost every day. Group work is now second nature, and my ability to think critically is assisting in the acceleration of my grades. (Student comment)

I felt we learnt as we worked. While the base knowledge was taught beforehand, most of the learning came from practice, do the work for real. (Student comment)

They are seen more as a guide to give us knowledgeable feedback to ensure we were heading in the right direction in our learning. (Student comment)

It is evident that this group of graduating students enjoyed their experience in a problem-based learning classroom. This approach to learning could be introduced in the first year of the program, but not before the underpinning knowledge and skills have been introduced into the classroom. As implied in the second quotation above, students need to understand what is required of them in the first instance before they tackle any problem introduced via problem-based learning.

Analysis of the survey data

This second part of the questionnaire allowed students to rank in order of importance the issues set down in each of the sections. Using a Likert scale—1 ‘strongly disagree’ to 5 ‘strongly agree’—it was the intention to produce statistical results with respect to the following areas:

- ✧ teacher-centred questions
- ✧ student-centred attitudinal questions
- ✧ student-centred skills questions
- ✧ student-centred knowledge questions.

After aligning of all questions in the four sections, the quantitative survey questions were grouped into themes that reflected the writer’s research project, namely:

- ✧ student engagement
- ✧ student learning
- ✧ contextualised problem-solving.

Findings are reported with respect to each of these themes. To further test these findings, one-on-one interviews were conducted with 15 students. Ten from the advertising program and five from the public relations program will be reported on to enable triangulation of both research methods used in the study. The advertising students had completed five problem-based learning scenarios in 2007 and the public relations students were completing three in 2008.

Theme 1: Student engagement

It is evident, from the data gathered, that students regarded the teacher/lecturer as the conduit for effective learning under the problem-based learning model. Contextualising learning to reflect the real world by the teacher/lecturer has its benefits in student engagement. Contextualisation of assessments shows students the relevance of the course in relation to their chosen career and, from the data gathered, they would appear to embrace the knowledge and skills of their teacher/lecturer as a true reflection of the particular industry today. Students see their teacher/lecturer as their mentor, industry expert or CEO (dependent on the problem at hand), guiding them but more as facilitating their learning through a maze of theory and information to enable them to devise the best possible solution to a problem posed by their client. Through this, students experience industry in the classroom, have the ability to make the mistakes and reflect upon them, including the capacity to ask why a particular approach did not work and why the client did not like their proposal. Students also have the opportunity to learn from their mistakes.

Table 3 Theme 1: student engagement (n = 32), percentage

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1 For problem-based learning to work effectively, the teacher/lecturer needs to be able to engage students within the classroom.				28	72
2 For problem-based learning to work effectively, the teacher/lecturer needs to stimulate student participation.			6	44	50
3 The teacher/lecturer needs to have extensive problem knowledge.			9	41	50
4 The teacher/lecturer needs to have extensive knowledge of the problem-based learning process.		3	6	41	50
5 The teacher/lecturer presented a problem that motivated me to learn.			9	41	50
6 Problem-based learning gave me the ability to voice my ideas effectively to the group.			16	43	41
7 Problem-based learning gave me the ability to build group interaction that enhanced my learning.			13	49	38
8 The teacher/lecturer needs to treat all group participants equally.	6	3		16	75
9 The teacher/lecturer needs to be well organised and enthusiastic about teaching.				34	66
10 Problem-based learning gave me the ability to effectively understand my course of study.			13	53	34

What characteristics did problem-based learning possess to engage students in their learning? The qualitative data demonstrated that students saw client/industry involvement as a critical aspect of a problem-based learning pedagogy in VET. They also commented that it challenged their individual thinking and that of their peers, since having a different point of view enabled them to see the other side of the argument. That the client/industry brief posed a challenge which was, for the student, as close to real life as possible meant it contextualised the problem to the industry. Their experience was such that they saw this type of learning as more valuable than learning from a text book, as they were able to share their experience with their group members and the rest of the class. They developed the ability to interact and share knowledge gained together, which allowed them to collaboratively propose a solution to the contextualised problem set by industry. Overall, they found problem-based learning challenging and engaging with their peers and industry.

Very engaged and I'd say that probably more engaged than any other work integrated learning program or campaign that I've ever worked on, because there was so much input from the client and the other side of it was that my particular group worked really well together so we became really involved in it. (Student comment)

Probably you know what probably made that more engaging more than everything else was the trophy at the end of the road, and also having the actual agency playing such an integral role in the whole process. We had a SWOT [strengths, weaknesses, opportunities and threats] meeting with them and so forth [it] just ensured that, you know that we had to put together a good campaign. (Student comment)

Theme 2: Student learning

Table 4 Theme 2: Student learning (n = 32), percentage

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1 The teacher/lecturer needs to be able to distinguish between relevant and irrelevant information.			3	38	59
2 The teacher/lecturer was able to mediate group discussion effectively.		6	13	53	28
3 The problem-based learning process stimulated my learning.			16	38	46
4 Problem-based learning stimulated my ability to work better for the group and myself.			13	38	49
5 Problem-based learning gave me the ability to become aware of my limitations and to address them.		16	16	31	37
6 Problem-based learning gave me the ability to respect others within the group.	3		28	41	28
7 For problem-based learning to work effectively, resources for self-directed research need to be easily available and relevant to the problem at hand.		3	3	44	50
8 Problem-based learning gave me and the group a balanced workload.	6	19	25	28	22
9 The problem-based learning process stimulated my information-processing skills.	3		22	53	22
10 Problem-based learning gave me the ability to work collaboratively and as an individual.		3	3	53	41
11 Problem-based learning gave me the ability to enrich my learning by working in small groups.		3	13	53	31
12 Problem-based learning gave me the ability to better understand group process.		6	3	60	31
13 Problem-based learning gave me the ability to reflect upon my learning.		15	12	47	26
14 Problem-based learning makes me responsible for my own learning.		3	19	50	28
15 Problem-based learning gave me the ability to understand the ethics involved in decision-making.		6	31	35	28
16 Problem-based learning gave me the ability to communicate effectively, both one on one and within a group environment.			16	25	59
17 Problem-based learning gave me the ability to become a self-directed learner.		6	13	50	31

Students need to be deemed competent in a specific task by using contextualised, real-world assessments in their chosen field of study. Using real-world assessments enables educators to measure students' understanding and application of theory according to the requirements of training package.

Learning by doing with problem-based learning has, as indicated by the data gathered, given students the ability to be responsible for their own learning in a simulated environment, working with fellow students to achieve an outcome. It gave them the required knowledge to better understand group dynamics, deal with group issues and it stimulated their learning because of its capacity to engage them. The skills in collaboration, communication and research gained through problem-based learning projects enabled students to immerse themselves in finding solutions to each problem in preparation for presentation of their findings to real-life clients. Interestingly, however, the data indicate that tackling numerous problem-based learning problems at once can disrupt a student's workload, although this could be a consequence of students having poor time-management skills at this point in their studies.

The qualitative data revealed that students were challenged more by their peers in the information they brought to the table for each problem set before them and that they questioned everything put on the table and, in doing so, developed a greater understanding of the problem they had to solve. It was also revealed that students reflected more on the information and discussed and consulted more in the group, a practice which gave them the ability to question and critically analyse all pieces of information, therefore better preparing them for the workplace. They saw the competitive nature of each brief as a challenge for the group and for each other, in that they had to put forward a solution to the client/agency to win the pitch. Answering directly to a client was far more challenging than answering to a lecturer—they had to get it right!

I definitely question and enquire a lot more, try and get as much information as you can even if you're asking stupid questions. Always trying to get as much information as you can ... a brief isn't everything. (Student comment)

You have people you can bounce answers off, ask questions to in more of, I think, a relaxed forum and also you have to think differently; you can't ... it's not like ... one standard answer to every question. Like there's a question and there's oodles of answers so you've got to whittle it down to the most appropriate answer I guess. (Student comment)

From the first one that we did, you learned from the mistakes made, you look into it deeper next time. You had a project that was problem-based learning so everything you maybe did wrong the first time, the questions that you didn't ask, you were aware of them for next time which was really beneficial. (Student comment)

Theme 3: Contextualised problem-solving

Table 5 Theme 3: Contextualised problem-solving (n = 32), percentage

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1 For problem-based learning to work effectively, problems set need to be realistic and current.			3	22	75
2 Problem-based learning gave me the ability to seek the appropriate information for the task at hand.			25	56	19
3 Problem-based learning gave me the ability to critically analyse other members' information brought to the group for discussion.		6	25	35	34
4 Problem-based learning gave me the ability to structure my learning based around the problem.		3	25	53	19
5 Problem-based learning gave me the ability to develop new skills in problem-solving.		3	13	43	41
6 Problem-based learning gave me the ability to become a critical and analytical thinker.		3	13	50	34
7 Problem-based learning gave me the ability to tackle complex problems.		6	16	53	25
8 Problem-based learning gave me the ability to reflect on a wide range of problems introduced during my course of study.			13	68	19
9 Problem-based learning gave me the ability to experience different techniques and strategies in solving problems.			16	53	31
10 Problem-based learning gave me the ability to formulate and implement solutions to real-life problems set by teaching staff.			3	38	59
11 Problem-based learning gave me the ability to reflect on decisions made for the problem posed.		3	22	56	19

In the context of theme 3, contextualised problem-solving, the data indicate that problem-based learning gave students the opportunity to experience extensive problem-solving skills. The number of problems (five in the advertising program and three in the public relations program) meant that the students developed the ability to develop, reflect and further refine those skills that problem-

based learning pedagogy is known for. Research, discussion, questioning, thinking skills and preparation for the workplace all came to the fore in the research. Having industry involved in the design of contextualised assessments gave the students the drive to seek out solutions, explore options and develop them both collaboratively and individually. Students saw that it was not just an assessment to measure knowledge of theory, but also to measure their understanding of the issues facing their client and, using underpinning knowledge and skills along with acquired skills developed through problem-based learning, to produce a solution that met the client's objective.

It was evident from the qualitative data that students saw problem-based learning as 'learning by doing'; tackling problems that had industry relevance and that had been set by industry (it established links to industry). It was 'real life learning through putting theory into practice' that promoted team work and the development of practical problem-solving skills. Because they had to be competent and 'courageous' in problem-solving and research, students gained confidence to tackle any problem put before them. One student was more focused on the disciplinary knowledge rather than the teaching and learning method undertaken.

Problem-based learning for me, that just meant having people who are in the industry come to us with a problem and have us present back to them a solution to the problem, like it was just a way for us to experience what the industry might be like. (Student comment)

My understanding was the problem-based learning was basically getting, I guess, a brief for a real life project and kind of working with our group and solving it ourselves, the problem, so working through it with the team and going through the different kinds of channels to kind of get an answer. (Student comment)

When it was actually happening I didn't really pay too much attention to those learning details—I was more focused on the advertising side so to be honest, I didn't really know anything about problem-based learning whatsoever. (Student comment)

It increased my confidence a lot, it improved my research and analytical and critical thinking skills, it gave me confidence in dealing with clients in a professional capacity and I've taken that onto real life experiences. (Student comment)

I think it made me job ready and confident to enter the workplace. It just gave me the tools to be able to produce something as a professional. (Student comment)

It instituted confidence in me to tackle problems I didn't think I could tackle; made me more professional in my attitude to the industry. (Student comment)

The data also revealed that students experienced issues in their respective groups, such as members not doing their share of the allocated tasks, producing sub-standard work, missing meetings and so on. The data show that it was a steep learning curve for students in learning how to deal with these issues. The majority of students indicated that issues were dealt with in the group first, by having an open discussion and, if no resolution was achieved, it was then passed to the teacher/lecturer to resolve the problem/issue. They reported positive experiences in learning how to deal with group dynamics. It gave them the ability to learn from each other, how to be professional towards one another and to adapt to various situations as they changed roles and groups for each problem. All reported that problem-based learning had in fact enhanced their ability to work as a coherent team; the approach taught them how to handle people issues and to respect each other's strengths and abilities and highlighted the benefit of learning from each other.

Yeah, I'd say forced yes! It's not always pretty but you don't get to obviously choose who you work with in real life so I think that was something that was good, it showed you how it was going to be once you get out in the real world. (Student comment)

Yes why, because I knew it was a real brief; it impacted on me a lot more than if it was what the teacher wrote up. But because it was real, like we needed to sort of prove ourselves for it would make us look like pretty silly if we didn't do it properly, and because it was a real client we took action to make sure it would be right. It put a lot of pressure on everyone to do really well, and to also work like it's not a brief anymore, it's our client and we have to do the best we can. (Student comment)

Success factors

The effectiveness of problem-based learning in the VET sector

In this research paper the successful application of problem-based learning was found to be related to several factors. Fundamentally, the success of problem-based learning depends on the quality of the problem-based learning tutor. This means he or she must have sound knowledge of the problem-based learning process, a commitment to student-centred learning and the ability to generate a non-threatening environment—while acting to promote discussion and critical thinking—and the willingness to make a constructive evaluation of each individual student and of group performance.

It is not just the tutor who will dictate the success of problem-based learning; it will also depend on the student's willingness to take part in the process. Students must have the underpinning knowledge and skills of the discipline before they can tackle any problem set under problem-based learning. They must have a sound knowledge of what problem-based learning is and what it strives to achieve as far as student outcomes are concerned. They also need to be committed to self-directed learning, be an active participant in discussion and critical and analytical thinking, while contributing to a friendly, non-intimidating environment and be willing to constructively evaluate and criticise themselves, the group and their tutor.

The success of problem-based learning depends on problems presented to students; they must be 'ill-constructed', reflect the real world and contextualised to the field of study being undertaken. By an 'ill-constructed' problem is meant one that is presented to the students outright, where there is no one answer to the problem but several, and where students negotiate the desired outcome with the client. Success is also dependent on having industry engagement and support for the program. Allowing industry to set the problem or to give industry the opportunity to have input into the program via an advisory committee and the like gives the program both currency and relevance. It allows them to act as judges or be in attendance at the presentations where they witness first hand the solutions put forward by students. This research has shown that this adds an element of competition to student groups: who will do the best job in a competitive situation to win the ultimate prize for the best pitch?

For problem-based learning to be a success in the VET sector, programs need to be developed that look at the function of the program and its implementation, as well as the teaching and learning approaches conducive to problem-based learning in TAFE programs. Problem-based learning might not be suitable for all programs and the selection of programs for this approach is crucial for its success. There must be a move away from teacher-centred learning to a more student-centred learning strategy. This approach to learning is based on discovery and by having a facilitator to mentor the student through their learning journey, which allows for the movement away from teacher-centred learning to student-centred learning, where students have the ability to demonstrate their capabilities. What are the attributes employers are looking for in VET graduates? Work-ready, active and lifelong learners, expert problems-solvers, innovative and socially responsible? It is now our responsibility to prepare them for employment and lifelong learning (de la Harpe & Radloff 2008) and problem-based learning allows us to do just that.

Staff and students must be made aware of what is expected of them and they must be equipped to carry out their designated roles. Therefore the following information must be given to all participants at the onset:

- ✧ a brief description of the problem-based learning process and a timeframe for each stage
- ✧ a description of how group meetings are structured
- ✧ the required response to problem-based learning tasks, whether presentations or written reports etc.; the minimum requirements are also stipulated
- ✧ the assessment process, including the assessment criteria used to grade assessments
- ✧ stipulation of every problem-based learning task, including learning outcomes/competency guidelines
- ✧ the penalties imposed on 'free-riders'.

Successful problem-based learning implementation

So what process would need to be undertaken for staff to be comfortable to undertake a problem-based learning strategy in the classroom?

Firstly, a clear and concise explanation of problem-based learning will have to be put forward, how it works, its application and outcomes. Secondly, the principle of 'constructive alignment' (Biggs 2003), why we need to design the task that reflects the competencies to be assessed, would need to be explained. Once the assessment that meets the elements of the competencies has been designed, we need to look at what students need to know to complete the task in order for them to be deemed competent. We separate their learning into various topics that reflect the competencies to be assessed, arrange them in order of importance and set the students tasks that allow for questioning, research and discussion aligned to the task.

Vital to all of this is consistency in the way each teacher–facilitator deals with his or her groups. Consultation and moderation must occur between all staff in the program area in relation to the content and the tasks for each competency to be assessed during each semester. Constructive alignment in any program will look at the objectives, teaching and learning activities and the eventual assessment (Biggs 2003).

Principles for effective teaching

In order to further implementation of problem-based learning in a classroom, it is suggested that staff undertake the 'teaching goals inventory' (TGI) to fully understand their own teaching objectives and, more importantly, reasons why they teach (Angelo & Cross 1993). The objective of the teaching goals inventory is to identify the sets or clusters of items in the minds of teachers that guide their teaching. A set of 52 questions was developed by Angelo and Cross (1993) that looked at six segments to identify why teachers teach and what they want their students to take away from the classroom.

The six sets are as follows, in no particular order:

- ✧ higher-order thinking skills
- ✧ basic academic success skills
- ✧ discipline-specific knowledge and skills
- ✧ liberal arts and academic values

- ✧ work and career preparation
- ✧ personal development.

This assists in planning the task of what the teacher/lecturer want their students to be able to do on completion of the course.

Without clear objectives, how can we as teachers/lecturers measure the effectiveness of our teaching? What do we want our students to take away from the classroom and how can we make sure that those goals are being met for each student? Once teachers/lecturers know what their instructional goals are, they can begin to assess how well students are learning what they are trying to teach them. Completing and analysing the teaching goals inventory allows the teacher to link their assessment efforts to their own teaching goals by asking ‘What knowledge and skills do I want my students to have once they have completed the task set?’ and ‘Does my teaching practice complement my goals and those I have for my students?’

Biggs (2003, p.26) proposes five principles of alignment for effective teaching and engagement of students. These are:

- ✧ the curriculum (competency) we teach
- ✧ the teaching methods we use
- ✧ the assessment methods we use and methods of reporting results
- ✧ the climate we create in our interactions with the students
- ✧ the institutional climate, the rules and procedures we have to follow.

Are our desired outcomes for students meeting the objectives of our assessments? By getting students to engage in meaningful activities conducive to learning, we are teaching them effectively (p.26). Taking these five principles into account when introducing problem-based learning into courses means helping students to seek out solutions and objectives for real problems, which sets them on the road to lifelong learning and influences effective adult learning. Our goal is to integrate theory with practice, and problem-based learning allows us to do that.

Professional development for staff

In order to assist teachers to incorporate problem-based learning into their teaching practice, professional development will need to be provided. It is suggested that the format for such development take the following form:

- ✧ have all program areas come together for an information session that looks at problem-based learning—the strategy, the method of application, assessment design and facilitation
- ✧ explore the realms of ‘constructive alignment’ for assessment design and delivery of theory
- ✧ explain the design of the assessment and the model of facilitation by the lecturer/teacher
- ✧ have staff examine their program semester by semester and allow them to decide where they could implement co-assessment (the grouping of competencies for which they could design just one assessment task, which would also pass an audit in which the assessment criteria for each competency are met)
- ✧ trial one or two teams in problem-based learning for the first semester of the year using problem-based learning as a teaching and learning strategy, with close supervision and regular contact from the supervisor
- ✧ have selected teams showcase or report back to staff their evaluation of the success or otherwise of problem-based learning, after which they become the champions in their own program area and subsequently mentor others.

Undertaking the cultural change that problem-based learning requires would be a dramatic and complex task for teachers/lecturers to achieve, particularly those in advanced stages of their careers. Many see themselves as the experts, but are familiar with only one (teacher-centred) way of teaching, even if this does not accommodate how the current generation of students wants to and does learn. Teachers need to be encouraged to explore different strategies that can and do make their lives easier and which allow them to work smarter not harder, not as individuals but as part of a team having the same teaching and learning objectives.

The important questions are: what are the objectives of the competency and what level of understanding is required at the different Australian Qualifications Framework (AQF) levels of certificate IV, diploma or advanced diploma? What activities can be adopted to enable students to achieve the stated objectives to the standard outlined, and, finally, what assessment tasks can be used to determine whether or not the students have met the necessary objectives? In problem-based learning students construct their own knowledge and decide what they need to know, how and where they find it and how to act upon it, a process which enables them to do real work, with the teacher/lecturer simply a facilitator between the student and the learning environment that supports the learning activities (Biggs 2003). The introduction of problem-based learning to first year students requires careful monitoring, since they may lack self-discipline, which can lead to the breakdown of the group. Starting off with simple problems and gradually building to more complex situations is exemplified by this comment from an advertising graduand:

What I understand [was] in the first year, we were given a bunch of tools, if you like; coming into second year, we were given lots, there was still probably problem-based learning projects in the first year, but first year was more about learning a bunch of skill sets and understanding. (Student comment)

Conclusion

With any training package being delivered today an important question that needs to be answered is whether the outcome/s of the competencies listed in the training packages are being achieved and whether student learning/engagement is meeting student expectations and that of the industry they serve. We as teachers–facilitators need to ask ourselves whether we have moved away from a teacher-centred to a more student-centred teaching model, in which students are actively involved in their learning. Have we given them, in the environment of the classroom, the ability to marry theory with practice? Do they have the ability to interact with industry, and does industry have the ability to give feedback to the students on the solution they have offered to the problem set? Problem-based learning achieves all of this. It integrates theory with practice, moves towards student-centred learning and cements links with industry.

Given that the VET sector is concerned with preparing students for the workforce, we now have the ability, through the implementation of problem-based learning pedagogy, to set students on the road of lifelong learning, enabling them to become problem-solvers, critical thinkers and self-directed learners. Undertaking this research into problem-based learning has shown that students do in fact engage with their learning when ‘ill-structured problems’ set by industry are put to them. We now see staff becoming part of the student team, learning along with them, and staff now facilitate student learning rather than merely disseminating theoretical information.

Based on the data collected and its interpretation, the following suggestions are proposed as a basis for discussion, whereby problem-based learning can be effectively evaluated as an alternative strategy for all programs that deliver competencies from any of the endorsed training packages. It is suggested that:

- ✧ schools in TAFE colleges in the VET sector set up communities of practice that look at the implications of problem-based learning and the suitability of this approach to learning for selected programs as either a trial or as an enhancement to current practice
- ✧ individual schools in TAFE colleges or communities of practice investigate and research the benefits and pitfalls of problem-based learning for their own situations
- ✧ individual schools in TAFE colleges or communities of practice form a working party and collaborate to devise an implementation strategy for problem-based learning in courses that have been recognised as suitable for the problem-based learning pedagogy
- ✧ professional development programs be developed and conducted for staff in TAFE colleges or communities of practice interested in implementing problem-based learning with the assistance of current problem-based learning practitioners
- ✧ programs be selected in which problem-based learning can be trialled as a teaching and learning strategy
- ✧ current practitioners become champions in the use of problem-based learning and promote its benefits to all staff in schools in TAFE colleges and in communities of practice across the VET sector in Australia.

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Appendix 1

Research methods

In order to collect student opinions on the ability of problem-based learning to engage students in their own learning, a mixed-methods approach, using both qualitative and quantitative research methods, was adopted for this research study. Using mixed methods for the study enabled the triangulation of the data in order to corroborate one set of findings with the other, allowing for the convergence of both sets of data into one single proposition (Massey 1999, p.186). Triangulation also establishes the validity of the methods which are used to research those propositions (p.187). Qualitative research methods allow for the researcher to be located within the research world, making the world visible. It is an attempt to make sense of or interpret the phenomena in terms of the meanings people bring to them (Denzin & Lincoln 2005, p.3). The qualitative researcher can be seen as a person who brings together a variety of images, scenes that go together to make a film; the researcher is seen as a 'bricoluer' piecing together various pieces of data fitted to a specific complex situation (p.4).

The use of a mixed-methods approach divides inquiry into dichotomous categories, exploration verses confirmation, locating qualitative in exploration and quantitative into confirmation (Denzin & Lincoln 2005, p.9). Qualitative research emphasises the nature of the reality and the value-laden nature of the inquiry method, whereas quantitative research emphasises the measurement and analysis between variables not processes (p.10).

In order to collect student opinions on the potential of problem-based learning for better engaging students in learning, a questionnaire, 'Student evaluation of engagement using problem-based learning' (appendix 2) was used. This questionnaire is in two parts: part one utilises four open-ended questions and part two uses closed questions, divided into four sub-sections. The four open-ended questions in the first part allowed students to express the feelings, attitudes and experiences learned through a problem-based learning strategy. The analysis of those questions was aligned to the overall question posed for the study. Using qualitative approaches (for example, qualitative content analysis) in this research study allowed for a more personal and deeper probing of respondents through the data gathered. These approaches enabled the writer to analyse the level of student engagement from an attitudinal and self-directed learning perspective, as well as the knowledge and skills acquired.

To further supplement the four open-ended questions contained in the questionnaire, face-to-face semi-structured interviews were conducted. Fifteen students (five from public relations and ten from advertising) volunteered to participate in these interviews with the researcher. This method was chosen to enable students to provide more qualitative descriptions of their experiences and attitudes towards learning via a problem-based learning approach (appendix 3).

In the second part of the questionnaire, a 5-point Likert scale of measurement was used. This sought information on students' understanding and expectations of problem-based learning, along with their experience of learning through this approach. This questionnaire was administered to second year (2008) public relations students (student population, 19) and 2007 advertising graduates (approximately 52 graduates) from RMIT. The total number of advertising and public relations students who chose not to participate in the study was 39. The final version of the questionnaire

was emailed to all 2007 advertising graduates in semester 2 of 2008. For those students still on campus, the questionnaire was distributed in hard copy form. Upon completion, all questionnaires were returned to the researcher via the Teaching and Learning Manager, RMIT University, College of Business TAFE School. Those questionnaires emailed to graduates were returned either via email or in hard copy. Email responses were printed out by the Teaching and Learning Manager and handed to the researcher in hard copy form.

Responses to the quantitative questionnaire were obtained from 26 of the 52 advertising graduates and six of the 19 public relations graduates from RMIT University.

Table 6 Sample size and questionnaire responses received

Program	Sample size	Respondents	Male	Female
Advertising	52	26	10	16
Public relations	19	6	2	4
Total	71	32	12	20

A number of advertising graduates did not respond in time for the collation of the data; therefore, the response rate to the questionnaire was not as expected. Those who participated in the interviews had also filled in the questionnaire. The public relations graduates were in the last semester of their program and were focused on finishing off the year successfully, which affected the response rate to the questionnaire. Once the deadline for submission of the questionnaire had passed, no attempt was made to gather the questionnaires that had not been submitted.

All student questionnaire responses were anonymous and were submitted to an independent authority that scanned each questionnaire for any identifying marks. If any identifying marks were found, that particular questionnaire was destroyed and not included in the analysis.

Ethical considerations

Ensuring anonymity for participants was paramount to the writer. It was explained to all students that this study was to reflect on the teaching practices associated with a problem-based learning pedagogy, the consequences of those practices in the classroom and the students' engagement with each problem set before them. It was clearly stated that no student names or student ID numbers were required for this study and so none was forthcoming. Participation in the study was purely voluntary, so all participants could freely give their individual views about problem-based learning and the teaching practices they had experienced. All students were given the right of refusal and if they did not wish to participate, their decision was respected and no further participation was sought. The questionnaire was constructed in a manner to give participants the ability to express their feelings/attitudes towards problem-based learning as a learning strategy.

The questionnaire was emailed to the all advertising graduates of 2007 during semester 2 in 2008 and was supplied in hard copy form to all public relations students prior to the completion of studies in 2008. Once the questionnaire had been distributed to students, the researcher had no further contact with students or involvement in the collection of the questionnaire.

Once the collation of the data was complete and the records of interviews analysed, all transcripts, voice recordings and the completed questionnaires were scanned and stored on CD and will be kept for future reference.

Appendix 2

Problem-based learning Student Engagement Survey 2008

About this study

Thank you for taking part in this study which looks at ***Student Engagement in the Classroom Using Problem-Based Learning Pedagogy***. This study seeks to understand the following three questions: *Does problem-based learning assist students to become cooperative learners? Does it improve inquiry skills so they become critical thinkers, problem-solvers and more self-directing? Do students engage with learning more productively within a problem-based learning environment?*

It seeks to explore student attitudes towards their participation in current problem-based learning education so as to formulate a method of delivery for the Business Services Training Package in Advertising and Public Relations. It is envisaged that the results of the study will enable those delivering competencies within the Business Services Training Packages to look at problem-based learning as an alternative delivery strategy, thus enabling students to be challenged to undertake a course of study that reflects current workplace demands.

Your participation in the survey questionnaire is purely voluntary. Any information you provide will remain confidential. Summary information will be documented, with all completed surveys destroyed after the study has been completed. The Research Administrator will also be calling for volunteers to participate in personal interviews at a time suitable to those willing to be interviewed. If you would like to take part in the qualitative phase of this study, please email the Research Administrator at mark.mossuto@rmit.edu.au to indicate your willingness to be interviewed.

The success of this study very much depends on your support. Your contribution is greatly appreciated.

Questionnaire Instructions:

- Please read all sections carefully before responding to the questions.
- Answer the questions in the order they appear in the questionnaire.
- Answer all items in the questions.
- When you have completed the questionnaire, please review all items to make sure that no question is left unanswered.
- Commonly, you are asked to circle a number or write a short answer to the question asked.
- If you make a mistake, cross out the mistake clearly and respond by circling your answer.
- Return the Questionnaire to the address given on the last page either via hard copy or email.

Thank you for your time and effort in taking part by completing this questionnaire.

Section A: Course Undertaken using problem-based learning

Please list the discipline in which you experienced problem-based learning.

Duration of problem-based learning course: *(please circle your selection)*

A: 1 year **B:** 2 years **C:** 3 years **D:** 4 years **E:** Continuing

Is this the first problem-based learning course you have experienced?

A: Yes **B:** No

If **NO**: list your previous course experience: _____

Section B: Open-Ended Questions on Teacher/Lecturer Influence within problem-based learning

Note: If you require more space to write your answer, please attach a separate sheet to the questionnaire.

1/. What are your thoughts on the problem-based learning problems posed to you within your program?

Section C: Teacher Centred Questions: (Utilising the Likert Scale)
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Assessing the ability of a teacher/lecturer to implement and monitor a problem-based learning program.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
For problem-based learning to work effectively, the teacher/lecturer needs to be able to engage students within the classroom.	1	2	3	4	5
For problem-based learning to work effectively, the teacher/lecturer needs to stimulate student participation.	1	2	3	4	5
The teacher/lecturer needs to treat all group participants equally.	1	2	3	4	5
The teacher/lecturer needs to have extensive problem knowledge.	1	2	3	4	5
The teacher/lecturer needs to be well organised and enthusiastic about teaching.	1	2	3	4	5
The teacher/lecturer needs to have extensive knowledge of the problem-based learning process.	1	2	3	4	5
The teacher/lecturer needs to enhance a student's information literacy skills.	1	2	3	4	5
The teacher/lecturer needs to be able to distinguish between relevant and irrelevant information with respect to the problem under investigation.	1	2	3	4	5
The teacher/lecturer presented a problem that motivated me to learn.	1	2	3	4	5
The teacher/lecturer was able to mediate group discussion effectively.	1	2	3	4	5
The teacher/lecturer provided timely feedback to the group.	1	2	3	4	5

Section D: Student Centred Attitudinal Questions

Assessing student attitude and perceptions when participating within a problem-based learning program.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
For problem-based learning to work effectively, problems set need to be realistic and current.	1	2	3	4	5
For problem-based learning to work effectively, resources for self-directed research needs to be easily available and relevant to the problem at hand.	1	2	3	4	5
The problem-based learning process stimulated my learning.	1	2	3	4	5
Problem-based learning stimulated my ability to work better for the group and myself.	1	2	3	4	5
Problem-based learning gave me the ability to voice my ideas effectively to the group.	1	2	3	4	5
Problem-based learning gave me the ability to build group interaction that enhanced my learning.	1	2	3	4	5
Problem-based learning gave me the ability to become aware of my limitations and to address them.	1	2	3	4	5
Problem-based learning gave me the ability to identify my ethical and moral obligations to other group members.	1	2	3	4	5
Problem-based learning gave me the ability to structure my learning based around the problem.	1	2	3	4	5
Problem-based learning gave me the ability to respect others within the group.	1	2	3	4	5
Problem-based learning gave me and the group a balanced workload.	1	2	3	4	5
The problem-based learning process stimulated my information processing skills.	1	2	3	4	5
Problem-based learning gave me the ability to enrich my learning by working in small groups.	1	2	3	4	5
Problem-based learning makes me responsible for my own learning.	1	2	3	4	5

Section E: Student Centred Skills Questions

Assessing student development of skills within a problem-based learning program.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Problem-based learning gave me the ability to become a self-directed learner.	1	2	3	4	5
Problem-based learning gave me the ability to develop new skills in problem solving.	1	2	3	4	5
Problem-based learning gave me the ability to become a critical and analytical thinker.	1	2	3	4	5
Problem-based learning gave me the ability to work collaboratively and as an individual.	1	2	3	4	5
Problem-based learning gave me the ability to become a life-long learner.	1	2	3	4	5
Problem-based learning gave me the ability to tackle complex problems.	1	2	3	4	5
Problem-based learning gave me the ability to reflect upon my learning.	1	2	3	4	5
Problem-based learning gave me the ability to seek the appropriate information for the task at hand.	1	2	3	4	5
Problem-based learning gave me the ability to critically analyse other members' information brought to the group for discussion	1	2	3	4	5
Problem-based learning gave me the ability to communicate effectively, both one on one and within a group environment.	1	2	3	4	5

Once you have completed this questionnaire, please forward it to:

Mr Laurie Costabile
Department Manager – ICT
RMIT University
Level 14 – 239 Bourke St
Melbourne 3001

Via email: laurie.costabile@rmit.edu.au

Or drop it off at level 13 Reception of the Business TAFE School.

Thank you

Problem-based learning

Student Engagement Survey 2008

*Student Engagement in the Classroom Using Problem-Based Learning
Pedagogy*

Qualitative Research Study – 2008

Questions for face-to-face participants:

A student's perspective on problem-based learning:

- 1/. What do you understand problem-based learning to be?
- 2/. In what program of study did you first experience problem-based learning?
- 3/. What were the problems put forward to you under the problem-based learning strategy?
- 4/. Did they vary in their complexity of the problem?

Student engagement under problem-based learning pedagogy:

- 5/. Which problem tackled did you feel that you were most engaged in?
Please explain as to why you have identified this problem.
- 6/. Describe your experience in working with the identified problem.
- 7/. That experience, did it challenge you to seek out different solutions to the problem?

Questioning, critical thinking skills enhancement:

- 8/. How did problem-based learning enhance your inquiry/questioning processing skills with relation to each problem?
- 9/. What would you say were the abilities problem-based learning was trying to foster in students?
- 10/. Did problem-based learning foster the development of those abilities in your case?

Collaborative skills within the group:

- 11/. Did problem-based learning encourage you to work more collaboratively with other students?
- 12/. If not, what issues arose and how did you handle those issues?
- 13/. Did problem-based learning enhance team work and the completion of tasks within your group?

Student experience under problem-based learning:

- 14/. What were your experiences in working with other students tackling the same problem?
- 15/. Were there any negatives experienced during any of the problems investigated in problem-based learning?
- 16/. With what you are currently doing, did problem-based learning prepare you better for your current role/HE?
- 17/. Would you advise future Advertising/PR students to take part in a problem-based learning type program?
- 18/. What three pieces of advice would you give in order to help them decide?
- 19/. What did problem-based learning do for you as student?