Web-delivered, Problem-Based Learning in Organisational Behaviour: A New Form of C.A.O.S.

Dr Lea Waters
Department of Management,
The University of Melbourne,
Parkville 3010,
Australia.
Tel: +61 3 8344 0050.
Fax: +61 3 9349 4293
Email: l.waters@unimelb.edu.au

Associate Professor Carol Johnston
Teaching and Learning Unit
Faculty of Economics and Commerce
University of Melbourne
Parkville 3010 Australia
Tel: +613 8344 9699
Fax: +61 3 8344 3647
Email: cgi@unimelb.edu.au

Recent calls have been made for a fundamental reorientation in higher education from a curriculum that simply transmits information (learner as receiver) to one that encourages students to actively construct their own knowledge and practice using new skills and concepts (learner as constructor). The ‘Case Analysis in Organisational Situations’ (C.A.O.S) assessment tool was developed for use in teaching Organisational Behaviour as a response to these calls. It follows the principles of problem-based learning and group work, using an unfolding case design. A pre-test (n = 365), immediate post-test (n= 323), and delayed post-test (n = 129) design was implemented to evaluate the effectiveness of this new learning tool. The assessment of student approaches to learning revealed that students were more likely to adopt a deep approach to learning at the end of C.A.O.S than at the beginning. In general, the results show that C.A.O.S is a useful web-based tool that promotes learning in Organisational Behaviour. The benefits of C.A.O.S and some suggested improvements to the existing C.A.O.S format are discussed.

Introduction

The context in which learning takes place is changing rapidly and requires equally rapid and innovative changes in traditional approaches to teaching and subject delivery. With this in mind, many educators have called for a fundamental reorientation in higher education from a curricula that simply transmits information (learner as receiver) to one that encourages students to actively construct their own knowledge and practice using new skills and concepts (learner as constructor) (Bigelow, Seltzer, Hall, & Garcia, 1999; Davis, 1996; Mundell & Pennarola, 1999). The Department of Management, at the University of Melbourne, has responded to these calls by developing a web-based subject delivery and assessment module in its second year Organisational Behaviour (OB) subject. The current paper outlines the nature of the project and evaluates the effectiveness of the module on student skills and learning orientations.

Rapid change, exploding knowledge bases, increasingly sophisticated and wide-

Spread use of technology, and globalised markets are playing major roles in redefining the workplace in almost every industry (Cohen & Lippert, 1999; Dickenson, Fisher, Shaw & Southey, 1995; Hammer & Champy, 1993). As such, higher education students are likely to practice their professions during a period of acceleration and change. Researchers and employers have identified a number of skills that will be important in the workforce of the future. These include: 1) good communication skills, 2) ability to learn independently, 3) social skills, 4) team-work and collaborative skills, 5) ability to adapt to changing circumstances, 6) critical thinking skills, 7) problem solving skills, 8) knowledge navigation, 9) computer/technology skills, and 10) ability to deal with ambiguity and uncertainty (British Columbia Labor Force Development Board, 1991; Department of Education, Training and Youth Affairs, 2000; Hmelo & Ferrari, 1997).

Perhaps overarching these skills will be the ability to engage in self-directed, life-long learning and to continually identify gaps in one’s own knowledge (Bridges & Hallinger, 1995; Engel, Browne, Nyarango, & Akor, 1992).

In order to provide the skills required for future labor markets, educators and employers must encourage an active approach to learning in which the student or employee is able to reconstruct new ideas and knowledge within a personal framework. This approach to learning, which creates a network of meaningful connections between new information and previously established concepts, facilitates a deeper understanding and provides a framework for life-long learning (Schmeck, 1988).

Educators over the past two decades have been interested in facilitating the type of deep-level learning described above (Entwistle, 1988; Entwistle & Ramsden, 1983; Saljo, 1981; Watkins, 1982). Webb (1997) argues that “the notion of ‘deep’ and ‘surface’ approaches to learning has been a foundation stone upon which much of the research, theory and practice of higher education has stood” (p.195). Marton and Saljo (1976) articulated differences between deep and surface learning. Students who use a deep approach are personally involved in the learning task and seek to obtain some underlying meaning. In addition they aim to understand relationships between the immediate task and other tasks or contexts (Biggs, 1987). A surface approach to learning on the other hand, arises when the student sees learning as a means to achieve a short term goal which may be simply to do enough work to pass an assessment hurdle. Students who adopt this approach generally commit unrelated facts to their short term memory only. As such they are unlikely to be able to establish meaning or relationships between or within given tasks (Biggs, 1987; Entwistle & Ramsden, 1983).

Evidence in the empirical literature shows that the above approaches to learning are variable over situation and over time (Gow, Kember, & Cooper, 1994; Webb, 1997). Entwistle and Ramsden (1983) argued that the approach a student takes to learning is not only influenced by the characteristics of the student themselves but also by the nature of the discipline and the teaching received. Webb (1997) suggests that, in an attempt to move students from surface to deep approaches, many educational developments are now designed in such a way as to encourage students to be more actively involved in the learning process by providing direct experiences of new concepts (Candy, Crebert, & O’Leary, 1994). This is because a learning environment that mirrors the real world and provides students with concrete experiences is likely to promote the application of knowledge and, therefore, a deeper understanding. Bridges and Hallinger (1995) suggest that in the process of applying knowledge, students are able to discover gaps in their thinking, which stimulates them to revisit the conceptual material and to solidify their understanding.

One successful method of providing a more direct and active learning framework whilst still at university is the use of problem-based learning (PBL) (Mayo, Donelly, Nash & Schwartz, 1993). Hoffman and Ritchie (1997) describe PBL as “a student-centered pedagogical strategy that poses significant, contextualized, real-world, ill-structured situations while providing resources, guidance, instruction and opportunities for reflection to learners as they develop content knowledge and problem-solving skills” (p. 97). Barrows (1985) described it more simply as the learning which
results from the process of working towards the understanding or resolution of a problem.

Boud and Feletti (1991) argue that PBL is characterised by the presentation of problems reflective of professional practice and by the guidance of students’ critical thinking in order to help them develop resolutions to the problem. These authors also suggest that PBL is most effective when students work cooperatively in small groups (in and out of class). Enabling students to identify their learning needs and encouraging students to self-evaluate and self-validate their learning processes are also important elements of a PBL approach to learning.

Proponents of PBL assume that learning via ‘doing’ assists university students to bring forth the development of professional capabilities that were traditionally deferred for professional experiences (Barksy, Catanach, & Stout, 2002; Boud & Feletti, 1991). Moreover, by encouraging students to self-evaluate and self-validate their learning processes, PBL is thought to facilitate longer-term learning. Indeed, Gallagher (1997) found that PBL is better than traditional instruction on a number of learning outcomes including conceptual understanding, self-directed learning, and long-term information retention.

As demonstrated in Figure 1, C.A.O.S is divided into 4 major steps (See Appendix A for a case example). At step one, student groups are instructed to read the OB case and identify as many problems as they can find. At step two the groups are provided with a list of six major problems in the case as identified by the lecturer in Organisational Behaviour. The groups are required to choose two problems (from the list of six) that they consider to be the most relevant to the case and their resulting analysis of the case will focus on the two chosen problems. Once the two problems have been selected the C.A.O.S program provides the groups with three theories that relate to each problem. The student groups are then instructed to select two of the three theories to analyse each problem.

At step three, the student groups are instructed to generate a range of solutions that may either remove or reduce the problems in the hypothetical organisation covered in the case. The solutions must be linked to the theoretical analysis made at step two and the groups must also consider whether there are any possible negative ramifications to the solutions they provide. Groups are encouraged to integrate
aspects of different OB theories to provide realistic and comprehensive solutions. These solutions are then submitted electronically.

At step four, each group is required to select another group’s case analysis from the C.A.O.S system and to provide an assessment of the other group’s work. Through this step, students learn how to compare their performance with that of their peers and to identify their own strengths and weaknesses (Johnston & Olekalns, 2000).

At the end of each of these four steps, student groups are required to fill in a reflective diary. The diary is used as a way of encouraging students to consolidate what they have learned and to think about transferring their newly acquired knowledge to their assignments. The diary was introduced based on Wagner and Sternberg (1984) findings that intervention programs which involve training students to identify their learning strategies, and to assess the value of particular strategies for achieving goals, increased students’ general metacognitive abilities. The diary was also used as a way of recording each group members’ contribution to the case analysis.

The use of student groups in C.A.O.S was introduced following the findings in much of the literature that attest to the effectiveness of group work in improving learning outcomes (Damon, 1984). Astin (1993) reports that a student’s peer group is the single most important source of influence on growth and development during the undergraduate years. Light (1990) notes that students who form groups report that they enjoy their work more, feel they learn more because of the academic discussions within these groups, and in fact do learn more. This may be because the opportunity to interact in a structured way in a peer group setting encourages students to externalise their thoughts and make their ideas explicit. Enhanced understanding is likely to result from group work because students must think about the material, develop examples, and structure their explanations in order to discuss their ideas with group members. Other benefits of learning in small groups include improved communication skills, increases in individual self-confidence, and new levels of openness to ideas (Johnston, James, McDonald, & Lye, 2000).

In C.A.O.S, the groups also have the advantage of communicating with each other on-line. C.A.O.S provides a ‘group discussion function’ that enables students within their groups to interact at a distance with other members via conferencing. Individuals can send text messages to a central site at which they can be read and responded to by others in the group. In addition to the benefit of convenience of access, Harasim, Hiltz and Teles (1997) have identified several other benefits associated with ‘on-line groups’, including better access to group knowledge and support, a more democratic environment, where all voices are heard, increased interaction between group members, and increased motivation. Bigelow (1999) also suggests that the asynchronous nature of on-line interactions is beneficial in that it gives group members time to reflect on a topic before completing an on-line task (Bigelow, 1999).

The unfolding nature of C.A.O.S facilitates continuous communication. This is because the groups do not know all the elements of the assignment at the beginning and, hence, it is necessary for members to be involved in each step of the process. Moreover, because the collaborative groups are formed for the whole semester, it is likely that team skills are fostered to a higher degree than would occur in temporary groups.

Although the format of C.A.O.S and the reflective diary were designed to prevent free riding and social loafing, we were aware that the C.A.O.S groups might be subject to such group dysfunctions. In these cases, student groups are given the opportunity to use a differential- marking scheme that rewards group members on the basis of their input. The group can decide to award all group members the same mark or they can use the differential mark scheme whereby members apportion the marks according the proportion of work they did.

In order to facilitate the answering of student questions, an on-line tutor is provided as part of the C.A.O.S program. The on-line tutor enables students to ask questions of the tutor via the internet. The questions and answers are posted to a subject bulletin board for
all students to see. Questions are sorted by topic so that students can refer to the on-line bulletin board when they are revising for examinations or completing an assignment. Test and assignment results are sent to each individual student through this system so that students have a record of how well they are performing.

Overall, the students received feedback from four principal sources: a) through the mark given by the tutor, b) from the critique of their groups work by their peers c) through being able to read all other group’s work at step 3, and d) through the C.A.O.S on-line tutor.

Testing C.A.O.S for Learning Outcomes

Study Design

There is often a tension involved in evaluating an educational innovation such as this. This tension arises through the need to obtain evidence of the effect of the teaching innovation on student learning while at the same time not impinging too much on lecture/tutorial time and student patience. In designing the evaluation of C.A.O.S, care was taken that the learning environment for students was protected while, at the same time, sufficient data was obtained to evaluate the program properly.

It is difficult to ascribe a particular improvement in learning outcomes to specific educational innovations, particularly when considering the wide range of variables that affect the learner. Causality is difficult to establish with a high degree of certainty because the opportunity for a controlled experiment is typically limited. In fact, Shaw, Fisher, and Southey (1999) argue that most evaluations of educational tools rely on end-of-course reaction surveys, instructor’s impressions, or anecdotal evidence.

In order to obtain a rich picture of the effect of C.A.O.S on student learning, a range of evaluation strategies were employed: pre-testing of student skills and learning orientations via self-report surveys, post-testing of student skills and learning orientations via self-report surveys (immediately after completion of C.A.O.S), and delayed post-testing of student skills and learning orientations via self-report surveys (6 months after the completion of C.A.O.S). Quantitative analysis of these survey responses allowed patterns of relationships to be explored in a controlled and sophisticated way. However, because the dimensions studied were defined in advance, the possibility for new information to be obtained was restricted. As such, the current study followed Siberius, Sackin and Cappe’s (1987) suggestion to triangulate quantitative and qualitative methods. Qualitative data was obtained through open comments in the surveys, reflective diary observations, and interviews with the OB tutors. The use of qualitative methods in the current study provided a richer analysis by allowing further exploration of the trends observed in the quantitative analysis and by allowing new explanatory constructs to emerge out of the students’ own descriptions of their experiences of learning through C.A.O.S (Miles & Huberman, 1994).

Pilot test

Twenty students who had completed the OB course in 1999 were involved in a pilot test of the C.A.O.S assessment tool four weeks before the start of semester 1, 2000. These students were volunteers and were paid AUS$20.00 for participation. The aim of the pilot trial was to test the functionality of the program as well as to assess whether the students were able to cope effectively with the content of C.A.O.S. The researchers gave a brief introduction about the purpose of the C.A.O.S program and the IT programmer gave a demonstration of the steps involved in C.A.O.S. Students were then placed into five groups of four people. Group members were placed at remote sites across the room and then instructed to complete a mini-version of a C.A.O.S assignment. The two researchers and the IT programmer observed the student groups over the next hour and looked for both operational and content problems. The observation team noted that the students easily understood the processes/steps and content for C.A.O.S. However, the need for clearer instruction on the requirement to obtain agreement from all members of the group, before moving on to the next step, was highlighted.

Sample and procedure

OB students (n=365) were given a pre-test survey one week before the first
A post-test survey was conducted immediately after completion of the second C.A.O.S assignment (n=323; 88% response rate; 46% female; 44% male; 33% NESB). Chi-square analyses found no significant response bias between the pre-test and post-test responders for gender or language spoken (English as first language versus English as second language).

A smaller sub-set of OB students (n=129) were re-tested six months after they had completed the C.A.O.S program (47% female; 53% male; 29% NESB). This subset of students was enrolled in a second semester management subject (Human Resource Management). Chi-square analyses found no significant response bias between the pre-test with post-test responders and pre-test with delayed post-test responders on gender and language spoken.

**Measures**

The survey given to students at pre-test, immediate post-test, and delayed post-test was divided into two principal sections: 1) skills and 2) learning approach. Section One of the survey examined the following five skills: computer skills, internet skills, critical thinking skills, problem solving skills, and team-work/collaboration skills. Students were instructed to rate their degree of confidence in relation to the five skills using a five point Likert scale from 1 ‘Not at all confident’ to 5 ‘Extremely confident’.

Section two of the survey assessed approach to learning using a series of statements from the Approaches to Study Inventory (Entwistle & Ramsden 1983). More specifically, ‘deep/meaning orientation’, ‘surface/reproduction orientation’, and ‘achievement orientation’ were each assessed via two selected items from the inventory’ (see Table 4). Students were instructed to rate the extent to which they agreed or disagreed with each item along a five-point Likert scale ranging from 1 ‘Definitely Disagree’ to 5 ‘Definitely Agree’. These six items were then combined to form a scale that assessed the overall degree of surface or deep learning used by each student (α = .62).

The minimum score for the scale was 6 and the maximum score was 30. A higher score reflected a deeper approach to learning.

**Results**

**Section One: Quantitative Analysis**

**Skills Confidence**

Spearman Correlation analysis was performed to investigate the relationships between confidence in computer skills, internet skills, critical thinking skills, problem solving skills, and team-work skills. The demographic variables of gender and language spoken were included to determine whether they were related to confidence ratings.

The levels of confidence that students reported for the five skills were significantly inter-correlated. There was a significant correlation between confidence in computer skills and confidence in internet skills. Confidence in critical thinking skills and problem solving skills were significantly correlated. Gender was significantly associated with confidence in computer, internet, critical thinking, and problem solving skills. More specifically, male students rated themselves as more confident than female students. In addition, students who spoke English as their first language were more confident in their critical thinking, problem solving, and team-work skills than students who spoke English as their second language. Given that these demographic characteristics were significantly correlated with confidence in skills, they were used as covariates in the subsequent analyses (Tabachnick & Fiddell, 1996).

A multivariate analysis of co-variance (MANCOVA) was conducted in order to determine whether students reported significant improvements in their confidence with their skills between pre-C.A.O.S and immediate post-C.A.O.S tests. A significant global difference was found for the students’ confidence in their skills between the pre-test and the immediate post-test ($F_{(5,317)} = 4.24, p < .001$). More specifically, the univariate F tests revealed significant improvements over time in confidence with computer skills ($F_{(1,321)} = 21.01, p < .001$) and confidence with internet skills ($F_{(1,321)} = 11.49, p < .001$).
At the delayed post-test (six months after C.A.O.S), students were again asked to rate their confidence in relation to computer skills, internet skills, critical thinking skills, problem solving skills, and team-work skills. The baseline scores for the five skills of this sub-group (n = 129) were compared using MANCOVA to the baseline scores of the larger pre-test sample (n=367). No difference was found: F(5,359) = 1.79, p > .05. These results, combined with the fact that there were no differences in gender and language spoken between the two groups, suggest that the findings in the delayed post-test sub-group are reflective of the changes that occurred over time with the larger baseline sample.

Delayed post-test ratings were then compared to the students own ratings at pre-test and immediate post-test using a one-way repeated measures MANCOVA (see Table 3). This analysis revealed a significant main effect for time: F(10,434) = 7.13, p < .001. Planned comparisons were run within the MANCOVA to determine, or pinpoint, the specific sources of difference over time. Simple effect contrasts were made, these contrasts compared the mean at pre-test to the mean at delayed post-test and the mean at immediate post-test to the mean at delayed post-test (Tabachnick & Fidell, 1996). Results showed that the students’ ratings of confidence in all five skills significantly improved between pre-test to delayed post-test and between immediate post-test to delayed post-test.

Comparison of exam results in 1999 and 2000

The above tests have relied upon self-reports. As a more objective, or results oriented, test of C.A.O.S, comparisons of the OB students’ exam marks in 1999 (no C.A.O.S) and 2000 (C.A.O.S) were made. In both 1999 and 2000 the OB exam was made up of a short answer section, worth 30 marks, and a case analysis section also worth 30 marks. The same marking guide was followed in both years (with content adjusted).

In 1999 (n = 192) the average score for the short answer section was 20.49 (SD + 5.55) and the average score for the case analysis section was 17.46 (SD + 4.67). In 2000 (n = 358) the average score for the short answer section was 20.35 (SD + 5.25) and the average score for the case analysis section was 19.24 (SD + 4.60). Independent samples t-tests revealed that the students who did OB in 2000 scored significantly higher on the case analysis section of the exam than the students who did OB in 1999 (t(549) = -4.38, p < .001). The improvement in case analysis scores of the students in 2000 as

\[1\] Perhaps this was because the examination period was fast approaching and students were becoming more strategic and concentrated in the level and type of work they did in order to pass their exam and have time to study for their other subjects.
compared to the students in 1999 may have come about through the continual practice of case analysis skills encouraged in C.A.O.S. However, there are inherent problems in comparing two cohorts (Shaughnessy & Zechmeister, 1994) and it may be that the students who did OB in 2000 were more intelligent or more studious than the students who did OB in 1999.

In order to test this alternative ‘cohort hypothesis’ an independent samples t-test was performed to compare the short answer marks of the 1999 students to the 2000 students. If the cohort hypothesis is valid it would be expected that the students who did OB in 2000 would also score significantly higher on the short answer section than the students who did OB in 1999. However, the independent samples t-test revealed no significant differences (t(549) = 2.60, p > .01) on short answer marks between the two years. The results of both the above t-tests, combined with the strong similarity in the environment between the two years (same exam structure and same marking guide) may suggest that the improvement in case analysis marks for the exam in 2000 come about through the use of C.A.O.S. It must be noted here that a more valid comparison would have been to use exactly the same case in both years. However, given that the OB students had access to past exams this was not possible. Instead the lecturer ensured that, although the cases presented in 2000 and 1999 told a different story, the content of the cases was such that the same OB problems, theories, and solutions needed to be identified by the students in both years.

Comparison of HRM students who had completed C.A.O.S and HRM students who had not completed C.A.O.S

The improvements in skills confidence and approaches to learning found at the delayed post-test may be a result of the learning experience that students gained through their HRM course, rather than from the C.A.O.S tool used in the previous semester. In order to test for this possibility the self-ratings of HRM students who had completed C.A.O.S (n = 129) were compared to the self-ratings of HRM students who had not completed C.A.O.S (n = 101) at the end of the HRM course. This was done via MANOVA where the independent variable was cohort (pure HRM versus HRM & C.A.O.S) and the dependent variables were computer skills, internet skills, critical thinking skills, problem solving skills and total approach to learning score. If the HRM course was the driving force in student’s confidence ratings then we would expect that there would be no differences in self-rating between these two groups. If, however, the student’s confidence had improved as a result of using C.A.O.S we would expect to see higher scores from the HRM students who completed C.A.O.S in the previous semester.

Pillai’s trace test found a significant difference between the two groups of students (F(5,221) = 9.97, p < .001). Specifically, the HRM students who had completed C.A.O.S scored significantly higher on computer skills (F(1,225) = 32.03, p < .001), internet skills (F(1,225) = 33.03, p < .001), problem solving skills (F(1,225) = 30.72, p < .001), critical thinking skills (F(1,225) = 32.42, p < .001) and approach to learning (F(1,225) = 11.04, p < .001).

Section 2: Qualitative Data

Comments from section three of the student questionnaire were analysed under the two major themes of this multimedia project: skills and learning approach. A third theme also came out of the analysis and this theme centered around the use of on-line learning tools.

Theme 1: Skills

Consistent with the quantitative results, students reported that CAOS helped them to improve their computer skills and critical thinking abilities. Students reported that learning a new on-line program and the functions that went along with it was a valuable experience. They also felt that learning the theory through the process of applying it to a hypothetical case study was a good way to help them to see the ‘loop-holes’ in each theory. Critical thinking skills were also enhanced through the step of having to assess another groups’ work. This aspect of the assignment helped students to see the range of ways in which a case could be analysed.

The majority of student comments made in relation to skills were about teamwork.
In the first year of their degree the students do not get experience working in teams, hence for those students enrolled in the OB subject it was often their first tertiary-team experience. Generally, students reported that they enjoyed working in a team environment and getting to know their team members over the 12-week semester. They commented on the value they received from listening to the viewpoints of their fellow team members. However, some students identified the ‘free rider’ problem as a source of frustration. In addition, students stated that they experienced co-ordination difficulty when trying to arrange times for all group members to meet.

Theme 2: Learning approach

3. The way CAOS was structured appeared to assist students in their ability to apply theory to the practical problems presented in the case. Moreover, by encouraging a deep approach to learning, students reported that they were able to personalize and generalize the knowledge they learnt. Students reported that having two CAOS case assignments over the course of the semester encouraged them to keep up to date with new material in the course. They also reported that, after the first case, they were better prepared to read, plan, and reflect upon their learning during the second CAOS case. This facilitated a continuous approach to learning and helped students to be well prepared for their end of semester exam.

Theme 3: Use of multimedia

Students made many comments on the use of the on-line learning tool itself. A great number of comments were made about the ease and flexibility of submission, this was considered to be a positive feature of CAOS. Students also made use of the on-line tutor and liked the option of being able to ask questions at anytime of the day or night. Students reported that accessing the class wide answers assisted them to identify gaps in their own knowledge.

A number of students were uneasy with the unfolding nature of the cases and the uncertainty it generated. The unfolding case design was specifically adopted in order to demonstrate to students that, in practice, it is unlikely that they will be in full possession of all the facts prior to having to make decisions. Future instructors may combat some of the anxiety by explaining the rationale and benefits of the unfolding case design to students carefully at the outset.

1) Discussion

By implementing the CAOS program, the researchers aimed to provide students with skills that they would use in later employment and to assist students to establish the framework for life-long education by encouraging a deeper learning approach. The specific objectives of the CAOS project were to a) enhance confidence in computer skills, internet skills, critical thinking skills, problem solving skills, and team-work/collaborative skills, and b) encourage a deep approach to learning.

The results suggest that CAOS was largely successful in meeting the first objective. Pre-test to immediate post-test comparisons within the larger student cohort revealed that student confidence in computer skills and internet skills significantly improved over the time during which the CAOS program was used. These results were also mirrored in the smaller delayed sample where computer skills and internet skills improved from pre-test to immediate post-test and then again from immediate post-test to delayed post-test. The qualitative data indicated that most students made use of the flexibility that this online tool offered. Students arranged ‘virtual meetings’ on the CAOS group discussion board and submitted all their work over the internet. In fact, from the 367 students who used CAOS there were 13,380 internet logins (67% of the logins were by students using Microsoft Internet Explorer version 4 or above and 33% of the logins were by students using a Netscape product either Navigator or Communicator version 4 or above). In addition, there was a high use of the on-line tutor with 193 questions asked via this mode and 15,409 log-ons to the on-line tutor (either to ask questions or check the tutor’s answers/general messages). Students also reported that use of the CAOS computer program itself was relatively clear and that the steps were easy to follow. It seems that the pos-
itive experience that most students had with C.A.O.S has helped to improve their confidence in use of computers and the internet.

Interestingly, the immediate post-test scores for confidence in critical thinking skills, problem solving skills, and team-work skills did not increase from pre-test in the larger sample. Such results might suggest that C.A.O.S was not influential in promoting confidence in this set of skills. Yet, evidence from the delayed sample does not support this conclusion. Indeed, results from the group of students who were recaptured six-months after C.A.O.S found significant improvements in these skills from pre-test to immediate post-test and then again from immediate post-test to delayed post-test. Perhaps it takes a while for confidence in these ‘softer’ skills to develop. It may not be until the student needs to apply these skills again that they realise they have actually improved unlike computer and internet skills where students received immediate feedback that their skills had improved as the C.A.O.S program became easier to operate/navigate.

Of course, there may also be a cohort effect operating here. It could be that students who were continuing on within the management stream deliberately made better use of the C.A.O.S assessment tool as a way to improve their critical thinking skills, problem solving skills, and team-work skills (all of which they had been told they would need in order to be successful managers upon graduation). This explanation is speculative and could not be directly tested in this study.

It might also be that the improvements reported at the delayed post-test were a result of the learning experience that students gained through their HRM course, rather than from the C.A.O.S tool used in the previous semester. In specific relation to the improvements found for team-work, this seems unlikely given that the students did not conduct any team-based assignments in the HRM course. Moreover, the MANOVA results showed that HRM students who completed C.A.O.S scored higher on skills confidence and approach to learning than those students who completed HRM only. These findings help to dispute the notion of a cohort effect being responsible for the delayed post-test results.

Even with these inconsistencies in mind, the results of this study indicate that the C.A.O.S program is effective in providing students with confidence in at least some of the major skills that have been identified by employers and educators as necessary for working in future labour markets (Carter, et al., 1995; Cass, 2000; Conference Board of Canada, 1991; Hmelo & Ferrari, 1997).

In addition to measuring student confidence in skills, this evaluation also assessed student approaches to learning. The results of the current study were very promising and demonstrated that a large number of students moved from taking a surface approach to learning at pre-test to using a deep approach to learning upon completion of C.A.O.S. Moreover, the results from the delayed sample suggest that this deep approach continued over the following six-months. Specifically, upon completion of C.A.O.S, students made significantly more attempts to relate theory to real situations, put in greater efforts to do more than barely pass their exams, and were less likely to introduce irrelevant material into their assignments.

These results support previous research, which has shown that approaches to learning are variable across situation and over time (Renshaw & Volet 1995; Webb, 1997). C.A.O.S was designed to promote a deep learning approach by getting students more actively involved in the learning process. The use of PBL helped to provide students with direct experiences of new concepts in OB whilst providing resources, guidance, and instruction through the on-line tutor, course lecturer, classroom tutor, and fellow group members. In the process of applying OB theory to the cases in C.A.O.S, students were able to discover gaps in their thinking, revisit the conceptual material, and solidify their understanding (Bridges & Hallinger, 1995).

The reported value of self-reflection in PBL (Barksy, et al., 2002) was incorporated into C.A.O.S via the reflective diary, which provided opportunities for reflection from the students as they developed their knowledge in organisational behaviour. However, the qualitative data showed that students did not use the

reflective diary to its full advantage. Rather than using the diary to reflect on what they had learnt and how they had learnt it, students were more likely to simply use it as a record of group members’ contributions. While this type of record keeping was an intended outcome it was not the diary’s major purpose. In order for students to use the diary as an integral part of their learning, more information will be provided to future students in relation to the purpose of the diary.

The use of groups as an integral part of C.A.O.S may also have helped students to adopt a deep approach to learning. Previous research has shown that group settings facilitate deep-level learning by encouraging students to externalise their ideas and to explain them in ways that have meaning to other group members’ (Dimant & Bearison, 1991; Slavin, 1990). In the current study, students reported that their understanding of OB and of how to relate theory to practise was improved through the collaboration of ideas and discussion of alternative opinions.

However, not all groups worked well. The results show that around 10% of the C.A.O.S groups were dysfunctional. The major reason for dysfunction was the free-rider effect. A smaller number of groups experienced process losses through the inability to co-ordinate group member activities. Students in these groups found it difficult to negotiate a resolution to the problems. Typically, they also demonstrated an unwillingness to directly confront the issues that were frustrating them, as was evidenced by the low frequency with which they utilised the differential-marking system. Many students took the view that the system required them to ‘dob’ in their fellow students. This was not the intention and it is clear from this experience that we need to provide better guidance to students on how to document and negotiate appropriate rewards for contributions to the work completed. Effective negotiation is a skill required in the work place and is one that students should start to develop in their undergraduate years. To achieve this students in future will be provided with a tutorial early in the semester devoted to group formation, group goals, and negotiation skills. In addition a lecture will be devoted to the functions offered by the C.A.O.S system so that students are encouraged to make full use of the asynchronous discussion board assigned to each group when they are unable to co-ordinate face-to-face meetings.

A number of comments from students both in the open ended section of the survey and in the reflective diary indicated an uneasiness with the unfolding nature of the cases to which they were exposed and the uncertainty it generated. Students wanted to see the whole case at the start before they made their decisions. Students felt they should be able to reverse their decisions throughout the unfolding case design. We saw this constraint as a useful learning experience and will continue with this approach. We will, however, explain the nature of the unfolding case design to students more carefully at the outset.

C.A.O.S was structured in such a way as to encourage continuous and cumulative learning over the semester. OB knowledge was introduced repeatedly through the two cases and with increasing sophistication rather than following the traditional method of the topics being studied at one point in time. Hmelo and Ferrari (1997) argue that the capacity for continuous and cumulative learning is vital in today’s information age, where employees require higher-order thinking skills and flexible knowledge bases to continually gather new information. Evidence from the current evaluation suggests that this continuous approach assisted students to adopt a deep approach to learning and may be helpful in providing them with a framework for continuous/life-long learning.

Conclusions

There are two major ways in which the current C.A.O.S project contributes to the management education literature. Firstly, C.A.O.S is a successful example of the ways in which PBL, group work, and online learning tool can be combined to create an interactive learning environment. Secondly, C.A.O.S was implemented in a large undergraduate course using a pre-test/post-test design. The large sample size, the strong study design, and the triangulation of quantitative and qualitative data means that the conclusions drawn are quite
robust and are able to give future researchers a strong framework to build upon when designing, and evaluating, learning innovations.

Much has been gained in using the C.A.O.S system, most importantly in relation to the development of skills required in later working life and the encouragement of a deeper approaches to learning. As employers look more to employees for the ability to think critically, work collaboratively, and use new technology, the exposure to assessment tools like C.A.O.S becomes critical in preparing students for their future career. The road that the Department of Management at the University of Melbourne has chosen to take in adjusting its curriculum to foster these skills has been a challenging one. It is also one that requires persistence, a willingness to listen, and a capacity to adjust the route along the way. We have found evidence that the C.A.O.S system points us in the right direction.

References


Appendix A

1) The case of Cockatoo Cricket Supplies Limited

B.

C. Summary
The case-study outlined a hypothetical Australian company ‘Cockatoo Cricket Supplies Limited’, which was well known around the world for their manufacturing proficiency in the area of cricketing supplies. The case revolved around a major issue of appointing a new leader; consideration of three internal applicants for the job; and the recent hiring of three new external recruits at the ‘shop-floor’ level.

Problem 1: Possible replacement for CEO
   Theory 1: Situational Leadership theories (Fiedler’s Contingency leadership model or the Hersey-Blanchard situational leadership model)
   Theory 2: French and Raven’s Bases of power
   Theory 3: Upward and downward communication

Problem 2: Integration of new employees
   Theory 1: Tuckman’s five-stage model or Gersick’s punctuated equilibrium model
   Theory 2: Socialisation stages
   Theory 3: Team versus group

Problem 3: Communication problems
   Theory 1: Blocks to effective sending and listening (frame of reference, in-group language, selective listening)
   Theory 2: Integrated model of conflict
   Theory 3: Socialisation stages
Table 1
Intercorrelations between Demographic Characteristics and Skills Confidence

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<tr>
<td>1. Sex</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(female, male)</td>
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<td>1</td>
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</tr>
<tr>
<td>2. Language</td>
<td>-.06</td>
<td>.10</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(EFL, ESL)</td>
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<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Computer skills</td>
<td>.27**</td>
<td>.10</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Internet skills</td>
<td>.19**</td>
<td>.03</td>
<td>.77**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Critical thinking skills</td>
<td>.18**</td>
<td>.30**</td>
<td>.24**</td>
<td>.24**</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>6. Problem solving skills</td>
<td>.26**</td>
<td>.24**</td>
<td>.32**</td>
<td>.27**</td>
<td>.78**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7. Team-work skills</td>
<td>.05</td>
<td>.27**</td>
<td>.23**</td>
<td>.19**</td>
<td>.47**</td>
<td>.46**</td>
<td>1</td>
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</table>

* p < .05
** p < .01
*** p < .001
n=365
Table 2
Means and Standard Deviations for Skills Confidence at Pre-Test and Immediate Post-Test

<table>
<thead>
<tr>
<th>Skills</th>
<th>Pre-test M(SD)</th>
<th>Immediate Post-test M(SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer related skills</td>
<td>3.81(.88)</td>
<td>4.04(.78)***</td>
</tr>
<tr>
<td>Internet related skills</td>
<td>3.84(.88)</td>
<td>4.03(.81)**</td>
</tr>
<tr>
<td>Critical thinking skills</td>
<td>3.75(.83)</td>
<td>3.76(.79)</td>
</tr>
<tr>
<td>Problem solving skills</td>
<td>3.80(.81)</td>
<td>3.79(.80)</td>
</tr>
<tr>
<td>Team-work skills</td>
<td>3.75(.86)</td>
<td>3.77(.85)</td>
</tr>
</tbody>
</table>

* p < .05
** p < .01
*** p < .001

n = 323
Table 3
Means, Standard Deviations, and F Values for Skills Confidence at Pre-Test, Immediate Post-Test, and Delayed Post-Test

<table>
<thead>
<tr>
<th>Skills</th>
<th>Pre-test M(SD)</th>
<th>Immediate post-test M(SD)</th>
<th>Delayed post-test M(SD)</th>
<th>Pre-test to delayed post-test F(1)</th>
<th>Immediate post-test to delayed post-test F(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer related skills</td>
<td>3.67(.91)</td>
<td>3.94(.83)</td>
<td>4.62(.74)</td>
<td>44.18***</td>
<td>18.11***</td>
</tr>
<tr>
<td>Internet related skills</td>
<td>3.76(.83)</td>
<td>4.04(.85)</td>
<td>4.65(.69)</td>
<td>38.42***</td>
<td>10.38***</td>
</tr>
<tr>
<td>Critical thinking skills</td>
<td>3.74(.85)</td>
<td>3.71(.84)</td>
<td>4.59(.70)</td>
<td>15.92***</td>
<td>32.03***</td>
</tr>
<tr>
<td>Problem solving skills</td>
<td>3.76(.80)</td>
<td>3.76(.82)</td>
<td>4.54(.73)</td>
<td>20.96***</td>
<td>19.09***</td>
</tr>
<tr>
<td>Team-work skills</td>
<td>3.73(.84)</td>
<td>3.78(.86)</td>
<td>4.54(.75)</td>
<td>9.21**</td>
<td>21.77***</td>
</tr>
</tbody>
</table>

* p < .05  
** p < .01  
*** p < .001  
n = 129
**Table 4**

**Approaches to Learning at Pre-Test and Immediate Post-Test**

<table>
<thead>
<tr>
<th>Item</th>
<th>Pre-test M(SD)</th>
<th>Immediate Post-test M(SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Meaning</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I try to relate OB theory to real situations.</td>
<td>3.72(0.88)</td>
<td>3.86(0.82)*</td>
</tr>
<tr>
<td>I spend a good deal of my spare time in finding out more about interesting topics which have been discussed in class.</td>
<td>3.55(0.78)</td>
<td>3.06(1.70) ***</td>
</tr>
<tr>
<td><strong>4. Reproduction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I tend to read very little beyond what is required for completing assignments (reverse scored so that a lower score reflects a higher reproduction orientation).</td>
<td>3.36(1.15) 5)</td>
<td>3.29(1.03) ***</td>
</tr>
<tr>
<td>I often get criticised for introducing irrelevant material into my essays or discussion (reverse scored so that a lower score reflects a higher reproduction orientation).</td>
<td>3.21(1.05) 5)</td>
<td>3.42(0.96) ***</td>
</tr>
<tr>
<td><strong>A. Achievement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I certainly want to pass my exams this year, but it doesn't really matter if I only just scrape through (reverse scored so that a lower score reflects a higher achievement orientation).</td>
<td>4.03(1.06) 6)</td>
<td>3.73(1.11) ***</td>
</tr>
<tr>
<td>My habit of putting off work left me with far too much to do at the end of the semester (reverse scored so that a lower score reflects a higher achievement orientation).</td>
<td>2.67(1.11) 1)</td>
<td>3.02 (1.11) ***</td>
</tr>
</tbody>
</table>

* p < .05  
** p < .01  
*** p < .001  
n = 323
Figure 1: Steps undertaken during Case Analysis in Organisational Situation

1. Provide solutions based on theoretical analysis
2. Critique of other groups work
3. Equal distribution of marks
4. Differential mark scheme