# 'CHEATING' ENGINEERS: A VIEW ACROSS THREE COUNTRIES

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## INTRODUCTION

All forms of academic impropriety are areas of growing importance within HEIs internationally. The present study forms part of a large-scale survey aiming to address the prevalence of a range of forms of academic practice in university students from the UK, Malaysia and Bulgaria. The present article addresses self-reported experience of such practices and student's views regarding the acceptability of a range of academic practices. The current sample includes 90 students from the UK (undertaking programmes in the fields of Electrical, Electronic or Computer Engineering), 197 from Malaysia (studying Electronic and Control Engineering), and 37 students from Bulgaria (taking Computer Engineering). Students sampled came from Foundation Level, all three levels of an undergraduate degree, and Masters level.

There is growing evidence that University students do '*cheat*', that is, engage in academic practices considered improper by their University(1). There is also considerable belief(2), and some empirical evidence(3) that such cheating is on the increase. Self-reported rates of academic impropriety vary somewhat in published research studies. To some degree, such variation might be expected given differences in populations considered and measurement tools utilised. Typical estimates are, however, higher than many academics might expect on the basis of their personal experience, and are much higher than estimated detection rates (1.3%[4]). Park(1) reports data from 6000 US students, indicating between 63% and 87% (depending on academic discipline) admitted cheating during their college career. In the UK, Franklyn-Stokes and Newstead(5) reported rates of academic impropriety varied from 54% of students admitting having made up references, to 72% admitting to having copied coursework. In contrast, data from the academic faculty of one of the authors indicates that only some 2% of students are detected 'cheating' annually.

Over recent years, there has been increasing concern amongst academics over the amount of academic impropriety undertaken by students, and in particular the number of plagiarism cases. This concern happens to coincide with the proliferation in the use of the Internet as a tool for academic study and research. McCabe(3) noted '*there is evidence that cheating has increased in the last few decades, and the Internet is likely to intensify the problem*'. Various authors have addressed the worry that the Internet provides students with increased opportunities for cheating (e.g.[6]), possibly combined with a perceived decreased risk of detection. The apparently limitless volumes of material available render the source material more difficult to identify, particularly in the absence of good IT skills. In discussing student plagiarism from Internet sources, however, Wood(7) proposes an alternate view - that student experiences with electronic media may lead them to develop attitudes towards the ownership of academic work that are different from established wisdom, and at variance with the conventions of academic writing. From this perspective, therefore, in the eyes of students copying or plagiarism from the Internet may not be 'cheating' – the material is seen as being in the public domain and without ownership. Countless authors have addressed the definition of plagiarism by different stakeholders in the academic community.

The authors' personal experience of hearing cases of alleged plagiarism, as well as reports in the literature, suggest that to some degree academics and students do not share the same conceptualisations of cheating. The more obvious and extreme forms of academic impropriety will be viewed as cheating by staff and students alike. However, other unacceptable practices may be regarded by

students as not cheating and not particularly serious. Park(1), for example, reports that students judge cheating on exams to be 'blatant', while other forms of academic impropriety are thought as less serious, or 'not really' cheating.

## QUESTIONNAIRE METHOD

A questionnaire was designed expressly for gathering data for this study. The questionnaire invited participants to self-report on a collection of different academic practices. The questions asked were generated from existing literature on academic impropriety and from the authors' personal experiences and beliefs about academic practices. The questionnaire also contained practices that are ambiguous with regard to acceptability. Questionnaires were distributed to students in lectures, with participation being anonymous, voluntary and no incentives offered. Owing to the manner in which questionnaires were distributed, it is not possible to calculate a response rate. Questionnaires were presented in the language of tuition in each University.

## QUESTIONNAIRE RESULTS

### Descriptive Statistics

**Table 1** illustrates the frequency of self-reported experience of forms of academic impropriety in relation to coursework. Figures represent the percentage of respondents reporting having engaged in the practice listed on at least one occasion. **Table 3** illustrates the attitude students have toward particular academic practices with respect to coursework (that is, those who consider it Unacceptable or Highly unacceptable). The same data related to examinations is shown in **tables 2 and 4** respectively.

Overall, the survey data are both interesting and surprising. Self reported rates of engagement in individual acts of academic impropriety cover a significant range. Considering the most prevalent activities in each data set, one result that does stand out is the 37.8% of the Bulgaria group admitting to '*offering incentives*'. This has serious implications for academics when detecting individual work. Another illuminating comparison is the level of 91% of Malaysia respondents '*making up references to make an assignment look more impressive*', which is around nine and four times that for Bulgaria and UK students. There is a similar contrasting level of engagement when considering '*citing references you have not consulted*'.

An overall view of the results, in relation to coursework, indicates that students in Malaysia more readily engage in copying and plagiarism; while the Bulgaria respondents are more likely to engage in other forms of academic impropriety such as making up excuses, providing/receiving undue assistance and so on. UK respondents appear more likely to engage in copying and plagiarism than other forms of academic impropriety, although they admit to this much less than the Malaysia respondents. The results for the UK sample indicate that they frequently '*copy sentences out of a text book without crediting the source*'. Having studied the responses, it must be made clear that UK students are far from blameless.

In relation to examinations, there is once again no overwhelming conclusion; however, it appears that students in Bulgaria are highly active in cheating, notice that some 35% have used unauthorised material during an examination and 32% have copied from others. One item that academics should be concerned about is '*seeing another students look at unauthorised material in an examination but not reporting it*', with values of 14% UK, 25% Malaysia and 92% Bulgaria having witnessed the practice. Taking into account that each student engaging in this activity can be observed by a number of classmates, let's say four, this equates to observed engagement level of approximately 3%, 6% and 23% which are significantly greater than those caught by academics (around 1%).

The results show that between 30% and 62% of respondents have plagiarised from text books at least once, whilst between 24% and 40% have copied from another student's course-work. These figures highlight the disparity between detection rates and apparent 'cheating' rates. Students, particularly in the UK sample, will produce many items of assessed coursework during their degree programme. The number of individual acts of plagiarism

| Item | UK | Malaysia | Bulgaria |
|---|---|---|---|
| Making up references to make an assignment look more impressive | 24.2 | 91.3 | 10.8 |
| Offering incentives to a friend to write an assignment for you | 3.3 | 10.0 | 37.8 |
| Copying some sentences out of a text book into an assignment without crediting the source | 37.8 | 61.7 | 29.7 |
| Copying from a friend's coursework assignment | 35.2 | 40.3 | 24.3 |
| Citing references you have not consulted | 18.7 | 41.7 | 5.4 |
| Cutting and pasting material from an electronic journal into an assignment without crediting the source | 18.7 | 40.8 | 10.8 |
| Copying parts of a friend's old assignment into a current assignment | 20.9 | 37.6 | 24.3 |
| Cutting and pasting material from a website into an assignment without crediting the source | 31.9 | 51.3 | 19.4 |
| Allowing a friend on your course to read your coursework assignment prior to submission | 73.6 | 79.1 | 83.8 |
| Reproducing material from an old assignment and submitting it in a current assignment | 35.2 | 34.2 | 29.7 |
| Failing to cite references you have consulted | 36.3 | 46.0 | 27.0 |
| Copying some sentences out of a journal article into an assignment without crediting the source | 15.4 | 46.7 | 8.1 |
| Providing undue assistance to a friend in the production of their coursework | 41.8 | 54.2 | 69.4 |

**Table 1: Self-reported experience of academic impropriety related to coursework (% frequency)**

| Item | UK | Malaysia | Bulgaria |
|---|---|---|---|
| Taking unauthorised material into an exam but not using it | 9.9 | 7.7 | 56.8 |
| Using an unauthorised calculator in an examination | 8.8 | 1.6 | 5.7 |
| Seeing another student look at unauthorised material in an exam and not reporting it | 14.4 | 25.4 | 91.9 |
| Using unauthorised material in an examination | 7.7 | 4.6 | 35.1 |
| Copying from another student in an examination | 3.3 | 9.2 | 32.4 |
| Making up excuses in order to defer an examination | 0.0 | 7.7 | 13.9 |

**Table 2: Self-reported experience of academic impropriety related to examinations (% frequency)**

may therefore be much higher that the data immediately suggest.

The results on attitudes towards academic impropriety appear to have more commonality across the three data sets than the self-reported experience results. The majority of results are below 70% implying that only two thirds of respondents consider that the major forms of academic impropriety are unacceptable, which is a rather worrying level. Some 30% of the Malaysia sample considers it unacceptable to '*make up references*', which is much lower than the other two sample sets, and not surprisingly they frequently engage in the activity. '*Providing undue assistance to a friend*' is something that only 16.7% of the Bulgaria respondents consider unacceptable, and interestingly it is an activity they engage in quite often. For the UK sample, only 16.6% think that 'allowing a friend to read your coursework' is unacceptable, which might explain why so many respondents admit to this activity.

The results on student viewpoints for all three sample sets are particularly interesting. In essence, the respondents consider that academics have a lack of concern about student engagement in academic impropriety, and are not vigilant in detection. Furthermore, penalties imposed by the University do not offer a sufficient deterrent. Additionally, respondents appear to have a

| Item | UK | Malaysia | Bulgaria |
|---|---|---|---|
| Making up references to make an assignment look more impressive | 50.0 | 19.9 | 81.1 |
| Offering incentives to a friend to write an assignment for you | 74.7 | 76.7 | 59.5 |
| Copying some sentences out of a text book into an assignment without crediting the source | 50.5 | 44.8 | 64.9 |
| Copying from a friend's coursework assignment | 68.9 | 60.5 | 58.3 |
| Citing references you have not consulted | 55.7 | 44.1 | 62.2 |
| Cutting and pasting material from an electronic journal into an assignment without crediting the source | 59.8 | 45.8 | 61.1 |
| Copying parts of a friend's old assignment into a current assignment | 56.2 | 56.9 | 45.9 |
| Cutting and pasting material from a website into an assignment without crediting the source | 64.3 | 54.0 | 67.6 |
| Allowing a friend on your course to read your coursework assignment prior to submission | 16.6 | 18.4 | 10.8 |
| Reproducing material from an old assignment and submitting it in a current assignment | 30.0 | 53.4 | 40.5 |
| Failing to cite references you have consulted | 45.9 | 32.4 | 62.2 |
| Copying some sentences out of a journal article into an assignment without crediting the source | 57.9 | 42.4 | 64.9 |
| Providing undue assistance to a friend in the production of their coursework | 31.0 | 32.1 | 16.7 |

**Table 3: Student attitudes to academic impropriety related to coursework (% frequency unacceptable)**

| Item | UK | Malaysia | Bulgaria |
|---|---|---|---|
| Taking unauthorised material into an exam but not using it | 68.5 | 73.6 | 30.6 |
| Using an unauthorised calculator in an examination | 64.0 | 79.9 | 62.2 |
| Making up excuses in order to defer an examination | 73.1 | 81.5 | 73.0 |
| Seeing another student look at unauthorised material in an exam and not reporting it | 47.1 | 57.7 | 8.1 |
| Using unauthorised material in an examination | 81.6 | 84.2 | 45.9 |
| Copying from another student in an examination | 89.9 | 84.8 | 67.6 |

**Table 4: Student attitudes to academic impropriety related to examination (% frequency unacceptable)**

view that 'cheating' produces improved marks, while considering that they are likely to get caught.

## DISCUSSION

One possible reason for the increase in cheating has been attributed to uncertainty over what does and does not constitute plagiarism. It is important to have an accurate definition of academic impropriety, and in particular plagiarism. One UK University uses the definitions listed in **table 6**.

In this survey, a significant number of respondents considered it unacceptable to copy from a source without giving credit to the original author. This result is consistent with the suggestion that claims of naivety by students in 'plagiarism hearings' are situation specific. This does not support Wood's(7) proposal regarding students' understanding of the ownership of such material. The data from the 'Attitude scale' therefore indicate that respondents fully understand that copying from any source without credit constitutes academic impropriety.

| Item | UK | Malaysia | Bulgaria |
|---|---|---|---|
| Tutors are not willing to check sources to establish plagiarism | 29.6 | 35.4 | 61.1 |
| My marks would improve if I gained the odd advantage unfairly | 56.8 | 42.8 | 64.9 |
| Most plagiarism goes undetected | 47.0 | 59.8 | 81.1 |
| It is acceptable to 'recycle' work if tutors cannot be bothered to update assignments | 62.7 | 56.1 | 51.4 |
| The penalties for plagiarism are serious | 7.3 | 22.9 | 54.1 |
| Tutors know how to identify internet sites used by students | 19.3 | 23.0 | 63.9 |
| Assignments with extensive reference lists get better marks | 58.0 | 75.4 | 48.6 |
| If I took unauthorised material into an exam, I would get caught | 25.3 | 12.6 | 54.1 |
| Tutors know cheating goes on but are not motivated to address it | 28.0 | 45.3 | 51.4 |
| Cheating does not help your academic development | 73.5 | 88.5 | 86.5 |
| Other people on my course plagiarise | 57.8 | 60.0 | 89.2 |
| Material on the web is open access and so you do not have to credit the source | 27.7 | 46.6 | 48.6 |
| People who cheat in exams get higher marks | 51.8 | 48.7 | 81.1 |
| The University takes little action even when cheating is established | 18.3 | 42.9 | 54.1 |
| Taking unauthorised material into an exam is unlikely to improve performance | 53.7 | 64.6 | 64.9 |
| If I thought I would get away with it, I would plagiarise in order to increase my mark | 39.0 | 37.6 | 45.9 |
| Cheating is a risk worth taking | 25.6 | 50.5 | 35.1 |

**Table 5: Student viewpoint on academic systems (% frequency agree/strongly agree)**

**Plagiarism:** *A student incorporates another person's or body's work by unacknowledged quotation, paraphrase, imitation or other device in any work submitted for assessment in a way that suggests that it is the student's original work*

**Collusion:** *The collaboration without official approval between two or more students (or between student[s] and another person[s]) in the presentation of work which is submitted as the work of a single student; or where a student(s) allows or permits their work to be incorporated in, or represented as, the work of another student.*

**Falsification:** *Where the content of any assessed work has been invented or falsely presented by the student as their own work.*

**Replication:** *Where a student submits the same or similar piece of work on more than one occasion for assessment to gain academic credit.*

**Taking unauthorized notes or devices into an examination.**

**Obtaining an unauthorized copy of an examination paper.**

**Communicating, or trying to communicate, with another student during an examination.**

**Being a party to impersonation in relation to an examination.**

**Table 6: Practices deemed to constitute cheating (taken from[8]).**

The attitude results (**table 5**) suggest that academics need to put more effort into educating students about the importance of honesty. Closer inspection of the attitude results reveals that while some actions are clearly seen as unacceptable, such as '*offering incentives*', while actions are not viewed with the same conviction, such as '*failing to cite*

*references you have consulted*'. This confirms the view in the literature(1). It would seem appropriate that academics clearly define acts of academic impropriety and convey these undesirable acts to students. The results from the attitude survey which suggest that acts of academic impropriety requires clarification are supported by the viewpoint result for '*material on the web is open access*' with between 27% and 48% agreeing that crediting the source is not required.

It is often suggested that one way to address the rising incidence of academic impropriety in students is to undertake assessment by examination only. The results obtained from this work would suggest that this might not be the answer to the problem. Whilst self reported rates of academic impropriety in this context are low in the UK and Malaysia data, the figures are much higher for the Bulgaria data, where assessment is more heavily dependent on examination. It may simply be that where marks go, student attention follows. This notwithstanding, the Bulgaria data indicate that students may benefit from tuition regarding acceptable practices in examined work. 'Cheating' is unacceptable irrespective of an individual student's opinion regarding specific activities but increased awareness and a shared understanding of what is thought appropriate are desirable.

One result that does give some hope is that for all three sample sets, the vast majority of respondents consider that cheating does not help their academic development.

## CONCLUDING REMARKS

One thing is clear, in relation to both examination and coursework: the process of deterring cheating will always be far more effective than the act of detection. Furthermore, time and effort spent in informing students of correct academic practice is appreciably less than that needed to identify and pursue cheating students. The data suggest that there is plenty of work to do, and it highlights some areas that would benefit from publicity and clarification in published University regulations.

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# ASSESSMENT FOR LEARNING WITHIN ENGINEERING

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## ABSTRACT

*Mechanical Engineering is a core subject area within the Northumbria Centre for Excellence in Teaching and Learning (CETL) which aims to integrate assessment into student learning. Assessment for Learning (AfL) sets out to use assessment to foster student development, using feedback to enable the student to take responsibility for evaluating, judging and improving their own performance. Through balancing formative and summative assessment the learning process is not obstructed by an unhealthy focus on accumulating marks.*

*This paper will discuss the six key conditions which have been identified as contributing to AfL and development of the autonomous learner. These conditions establish the place and purpose of both formative and summative assessment activity to promote complex and authentic learning required to meet the needs of employers and professional bodies.*

*Examples of the use of AfL will be described which illustrate how it may be used to support learning during computer modelling and design activity at undergraduate and postgraduate levels. These examples employ a range of techniques which set out to support learning through formative feedback allowing summative assessment tasks to be rigorously applied.*

*Guidance will also be given as to how the six key conditions for AfL may be applied to other activities suitable for engineering education.*

## INTRODUCTION

Assessment has a pivotal role within higher education, '*Assessment is the most powerful lever teachers have to influence the way students respond to courses and behave as learners*'(1).

But is not free from challenges, it may swallow time and resources and improvement in assessment was identified by Subject Review(2) as: '*The single intervention by universities and colleges that would improve the quality of the student experience*'.

Assessment for Learning (AfL) looks to:

- employ the formative function of assessment, enabling all students to understand their achievements
- verify student performance whilst reducing the dominance of summative assessment over learning and teaching
- encourage the use of a wider range of authentic assessment methods
- enable students to become active participants in their assessment, developing autonomous learners

As part of the Centre for Excellence in Teaching and Learning (CETL) at Northumbria University the authors are employing and evaluating AfL within the engineering curriculum. This activity recognises the challenges described above and the wider need for this activity acknowledged in the draft revised Engineering Benchmark Statement:

'*Assessment is the means by which students are measured against benchmark criteria and should also form a constructive part of the learning process. There should be an holistic programme level approach to assessment that ensures output standards are met. You may find that this approach reduces the assessment load for students*'(3).

The CETL team have identified six key conditions which support AfL within the learning environment; these are illustrated in **figure 1**.

## AfL IN ENGINEERING

The principals of AfL sit well within an engineering teaching strategy that is supported

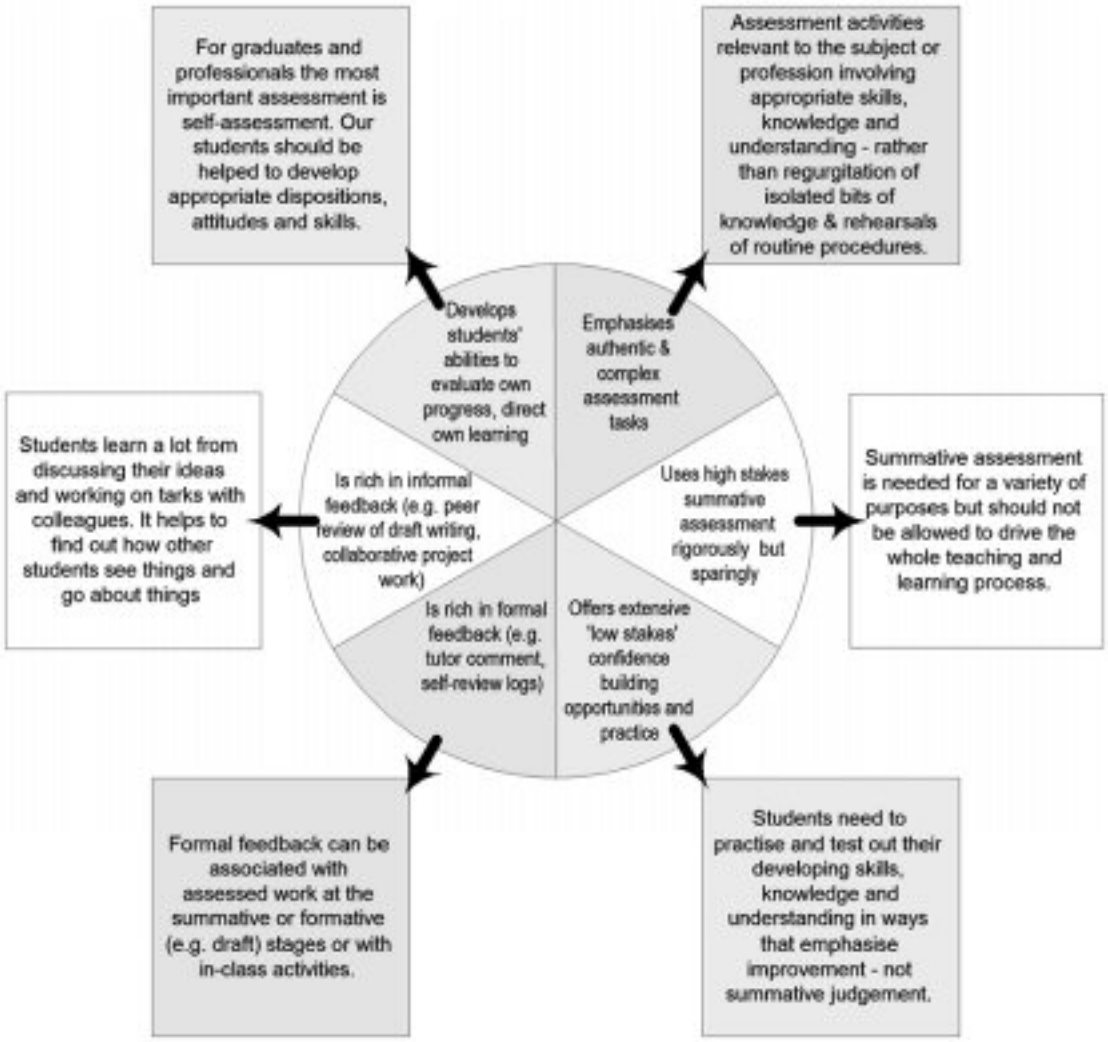


**Figure 1: The six key conditions which support AfL**

by a curriculum which is compatible with the engineering benchmark statement and the requirements of UK-SPEC. Assessment methods currently employed in the wider engineering community are explored by Moore and Williamson(4) who develop a guide to principals, policies and practices that will help to ensure that assessment is effective. In developing their guide they not only consider how programmes need to be designed to encourage good assessment practice but to also how to take a holistic view to the way assessment may support student learning.

The need to take a holistic view of the part assessment plays within a programme and the students' response to it are two of the issues which currently tax academics. Resolution is needed in the conflicting demands of reducing the assessment burden, on both staff and students, and the trend of less confident learners to become only driven by summative assessment.

It is suggested that AfL has a part in this holistic view of assessment, setting out to support rigorous summative assessment whilst motivating students through authentic and varied complex formative methods of assessment. This is not to say that much current practice is not good, but '*There is considerable variety of practice between departments (as well as within departments), which raises further questions about fitness purpose*'(4). Therefore it is entirely appropriate that consideration is given to how assessment is used within programmes to support learning as much as it is used to assure that learning outcomes are achieved.

## EXAMPLES OF AfL IN ENGINEERING.

A range of AfL techniques have been employed within engineering modules at Northumbria and examples of some of these are given here.

### Laboratory Teaching

During laboratory based practical sessions which support traditional engineering science subjects for first year students, individual or small group formative discussions take place during each class. These may develop from the results obtained during the practical or how this activity relates to their wider programme. This activity allows the student to gauge their own progress and develop their understanding of how these tasks support their achievement of both the module and programme learning outcomes. It has been found that to remove to traditional constraint of the laboratory write-up from the class activity allows the student to focus on the task knowing that they may discuss any difficulties that they have in an environment which emphasises improvement not judgement. It was observed that students were becoming overly interested in laboratories as a source of marks rather than as a learning experience which offers wider stimulation than the traditional lecture, becoming frustrated when they did not obtain model results as their main objective was to replicate what they assume the lecturer is looking for. Two of the six key conditions which support AfL are the opportunity for students to build their confidence through opportunities to test their developing knowledge and skills and for students to engage in activity which supports discussion and enables to see how their peers 'go about things'. When reflective discussion is incorporated with technical reporting of the laboratory outcomes the value of observation and reasoning are reinforced. Summative assessment takes place through the submission of a written report which includes a reflective summary and through an individual or small group oral exam which may include a problem solving activity.

### Creativity in Design

To foster creativity and innovation within design projects which run over several weeks the final objective is not revealed at the start of the project, just a series of 'development tasks' which provide the scaffolding for the main activity. A summary of the teaching plan for such an exercise, an electromechanical device for foundation year students based upon the use of servo motors, is given in **table 1**. In this way it is not possible for the student to entirely short-cut the design process by observing existing products or processes. During this developmental stage regular face-to-face reviews are held to support the student as they work in unfamiliar territory. These reviews are based upon short paper based templates which require the student to summarise their progress on the weekly mini-task, drawing out achievements and also targets for improvement in subsequent weeks. The time limited task of completing these templates immediately prior to the face-to-face review was initially a challenge to the students but with encouragement they were able to reflection upon and consider the role that the knowledge of engineering science developed elsewhere in their programme played within the design tasks being undertaken.

The key conditions of AfL support the development of creative thinking through problem solving activity, as the level of learning progresses it becomes important that students extend their conceptualisation of ideas beyond the familiar. In addition to fostering creativity and innovation this approach prevents the student from focussing on the output of the project which was traditionally summatively assessed and encourages the keeping of a reflective learning log which may be assessed as part of the final portfolio. The use of informal feedback, from peers and through collaborative working, is a key condition of AfL and when linked with formal feedback, which need not always be written, supports the development of a student who may be able to appreciate and direct their own learning. It is recognised that the summative assessment of creativity presents difficulties(5), the employment of the reflective logs adds assurance to the summative assessment of the dialog between lecturer and student.

| Week | Student activity | Staff activity | Specific task |
|---|---|---|---|
| 1 | Form groups, carry out specific task and complete log | Introduce the project, *describe assessment process* and resources available | Investigate motion transmitted through gears, cams and levers |
| 2 | Report back on gears, cams and levers, reflect on progress in log. Move onto servo motors | Review meetings with each group – explore their understanding of the previous specific task, specifically their understanding of torque and power. | Investigate servo motors, characteristics, uses and limitations |
| 3 | Report back on servo motors, group reflection, continued development of log. | Review meetings with each group – explore their understanding of the previous specific task, introduce the groups to the detailed task – 'a walking device' | Investigate 'walking motion devices' |
| 4 | Design process begins, brainstorming etc., initial draft specifications. | Monitor group discussions. | |
| 5 | Report on initial designs, reflect on 'practical issues' of the design | Review meetings on initial designs – probe the practical issues, loadings etc. of the designs and also build issues | |
| 6 | Build stage | | Begin manufacture of prototype motion components etc. |
| 7 | Build stage with some testing and reflection | Review meetings of initial build and test | Specifics of final performance test given out |
| 8 | Build of final design | | |
| 9 | Build of final design | | |
| 10 | Testing and programming, reflection on device performance | Review meetings 'will you complete the performance test?' | |
| 11 | Testing, rebuild? | | |
| 12 | Performance demonstration of device | Final assessment and feedback session | Submit log 'as is' i.e. no requirement to tidy-up or summarise, therefore full learning process should be captured. |

**TABLE 1: Summary teaching plan of a design exercise**

## Addressing Plagiarism

Plagiarism is a widespread concern, particularly where a summatively assessed assignment requires the student to develop an argument where their research relies upon electronic resources. It has become clear that two factors influence student plagiarism; a lack of understanding of appropriate academic conduct amongst students and inconsistent approaches to plagiarism in continuously assessed coursework across different modules.

As part of an MSc module on applied modelling techniques, students are expected to conduct a critical literature review and synthesis of a technology implementation strategy. It is becoming the norm for students to immediately turn to the internet looking for straightforward answers to coursework, the ultimate approach to surface learning?, whereas employing an AfL approach may mitigate against this. Two steps are taken; development exercises based upon generic approaches to problem solving by modelling, followed by use of the JISC Plagiarism Detection Service (http://www.jiscpas.ac.uk/). Although often used to police summative assessment this software tool may

also be used to allow the students to 'self-review' drafts of their reports prior to submission. The reports generated by the service not only provides basic feedback highlighting deficiencies but significantly reinforces good practice by giving positive feedback where quotations are correctly acknowledged. Many students have commented that the use of the system to self-review drafts has given them confidence in their own abilities and use the feedback from the system as the basis of discussions with the lecturer about their work at the draft stage. The use of electronically submitted drafts may also be used to encourage better time management and planning for submission of assignments. For example if two drafts are encouraged they may be scheduled for six and three days prior to the final submission deadline, where generally fourteen days may be given for an assignment. Faced with the option of receiving no feedback or making an earlier start the student is, in addition to the feedback, given more time to develop their thoughts and hopefully develop a deeper understanding of the subject. This builds the students' confidence in their writing and the submission of their own work, thereby reducing plagiarism. This approach has been well received by students who are often more confident undertaking numerical analysis and factual reporting rather than expressing engineering judgement.

## CONCLUSION

The examples above illustrate how assessment may be configured to add to the learning process, as always further examples exist and also other techniques meet these objectives but consideration of the six key conditions which support AfL assist the design of any teaching and assessment strategy. Assessment for Learning recognises good practice in assessment(6), with a additional focus on fostering student development, where the student takes responsibility for evaluating, judging and improving their own performance through a dialog of feedback. It also supports the following requirements of good assessment;

**supporting learning** – building confidence through an understanding of 'how they are doing' and developing the students' ability to direct their own learning,

**validity** – chosen methods must be aligned to programme learning outcomes, reflecting benchmark statements, output standards etc,

**reliability** – for learners and staff to have confidence methods must be objective, accurate and repeatable,

**affordable** – activity must be time and cost efficient, particularly where the need, effectiveness or added value of moderation/ double marking has not been evaluated.

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# THE PORTFOLIO: CONTINUOUS EVALUATION TOOL FOR THE LEARNING PROCESS OF NON TECHNICAL COMPETENCES

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## ABSTRACT

*Consider a project-based engineering education programme where a few master students, called team leaders, lead bachelor student groups in charge of the design and the manufacture of a given prototype. The team leader has to develop own competences in project management including team and planning management.*

*The team leader is evaluated through a 'portfolio', a bundle of learning evidence selected by the student to show the progress his/her skills. Using the portfolio allows the teaching staff to associate the student to his/her learning process and evaluation.*
*This paper presents:*

- *the theoretical background to build a portfolio,*
- *the portfolio details (aims, contents, analysis of some examples),*
- *the analysis of the survey results on the 1st implementation year.*

*The portfolio seems to be an adequate tool to assess continuously the learning of non technical competences. This tool promotes the reflexive thinking with the aim of developing professional reactions in real-life situations.*

## THE CONTEXT

One of the major difficulties in the implementation of teaching innovations is assessing the students' achievements. In the case of the learning by project, the objective is not only the knowledge acquisition but also the development of competences, such as the project or team management for instance. In this case, the objectives are completely related to the learning process, while evaluating an end product (a report, a presentation and a prototype) accounts only very imperfectly for it.

To this question, the portfolio appears to give interesting answers. It is of common use in primary or secondary schools, and in the continuous adult training, but the experiments in university education seem very rare.

This paper describes the use of the portfolio within the framework of a project-based engineering education programme at university (Bachelor in 3 years, Master in 2 years). The portfolio is used to assess the competences acquired by 4th year students (1st Master year), leading of groups of 6 first-year bachelor students.

The 1st year students, in groups of 6, have the task of producing, over 20 weeks, a prototype following specifications based of the first year courses (a catapult and a Galileo's telescope). The role of the senior student, i.e. the team leader, is to lead the team through the end of the project. Based on this, the students, all volunteers, are trained technically and scientifically as well as in project and group management. The team leaders are supervised on a regular base by a teacher or an assistant and by the Bureau for Pedagogic Support.

At the end of the project, the team leaders are being assessed during an interview with a committee in the most real-life possible situation (compared to a real professional one) where they will account for the way they managed the project. The committee consists of the supervisor, two other members of the teaching staff and a representative of the industry. The portfolio has been read thoroughly by the supervisor prior to the interview and is used as a support.

## WHAT IS A COMPETENCE PORTFOLIO?

The competence portfolio(1) is defined as a bundle of learning evidence selected by the student related to a given task

| Personal learning tool | Marking evaluation tool |
|---|---|
| Free form, the portfolios are very diversified. | Standard form for more equity. |
| The portfolio records both the learner's successes *and* failures. | The portfolio is a selection in which the learner tends to keep the evidences of his/her successes only. |
| The uninformed evaluator may assess the learner's failures negatively. | The evaluator is likely to be deceived on the competences really developed by the learner: *either* while extrapolating that the learner did not make any failure, *or* by underestimating the learner's capacity to be aware of his/her failures and to analyse them. |
| The learner feels free to write personal things. | The student does not feel free to write personal things. |

**Table 1: The competence portfolio: personal learning tool vs. summative evaluation tool**

- showing the development and progress of the student at work,
- implying the student taking part in the compilation and the selection of the relevant evidence according to given criteria,
- implying the student's personal thoughts concerning his/her learning process.

In practice, the competence portfolio shows the student how to

- cast a critical look on his/her work, to work steadily and to be self-assessing,
- select information according to defined goals,
- report of his/her competences in the portfolio but also orally during the interview.

The portfolio meets two assessments types: formative and summative assessments leading to a degree. In the first case, during the project, the portfolio mainly aims at the learner training. In the second case, it aims at the evaluation by an external structure (teacher, committee and employer). It is an adequate tool to approach the learning process and not only its end-product; this is why the portfolio is used as a learning as well as a marking assessment tool. This double role implies some ambiguities described by authors(1,2) as summarised in **table 1**.

In order to limit the negative effects described in **table 1**, the following Behrens recommenddations(2) were implemented:

- a summary, a kind of self-assessment allowing him/her to highlight the analysis of the learning process,
- an assessment interview at the end of the project where the learner can show the quality of his/her reflexive thinking on the difficulties he/she experienced.

Based on the literature(1,8), we have designed the following framework to create and evaluate the competence portfolio:

*Continuous work during the project:*

The team leader, helped by the supervisor if needed, collects all the documents to be more efficient. There are three types of documents:

- evidence of the project scientific work out, i.e. related to the disciplinary knowledge required for the project,
- evidence of the project technical work out, i.e. related to the prototype manufacturing,
- evidence of the team leading (scientific, technical and team management).

| N = 33 | Y | N |
|---|---|---|
| The portfolio has been used since the beginning of the project; it was with the team leader throughout the project. | 32 | 1 |
| The portfolio contains a lot of information but well selected. | 20 | 13 |
| The portfolio correctly reflects the work progress on both aspects: – team management, – technical and scientific aspects. | 21 | 12 |
| The information shows the team leader's added value. | 21 | 12 |
| The organisation of the information is visible and consistent. | 27 | 6 |
| The portfolio presentation (form, support, lay-out) makes the portfolio easy to use. | 27 | 6 |

**Table 2: Evaluation of the competence portfolio by the supervisors.**

*Before the assessment interview:*

- the team leader selects the documents which he/she finds most significant of the development for his/her competences. He/she organises the port folio in the most adequate and the most ergonomic way to him/her.
- He/she also prepares the summary of the project development on the three different aspects: scientific, technical and team management.

So, the work to be carried out for the evaluation implies:

- a selection of information,
- a reflexive thinking on his/her work,
- a communication on developed competences.

The evaluation criteria have been given at the beginning of the project and are a reference during the assessment interview. The teaching staff chose the double function of the portfolio: both formative and marking.

The final mark includes several elements:

- the competence portfolio,
- the assessment interview (10 minutes of free talk, personal project assessment and 10 minutes of questions and answers),
- the supervisor's opinion on the student's progress,
- the summary (3 pages).

## END OF THE FIRST YEAR: WHICH PROVISIONAL ASSESSMENT?

The suggested assessment focuses exclusively on the portfolio practice.

### Follow-up during the project

The pedagogical advisers watched 26 of the 33 team leaders interacting with their groups and provided at least once consultancy to 20 of the team leaders. An adviser attended all the assessment interviews. This framing aimed at controlling the learning innovative process and at identifying the difficulties, not to make a systematic assessment of it.

So, the collected information cannot be regarded as completely valid and cannot be applied generally. Based on the collected information, the following assumptions can be made:

- there is a significant disparity in the portfolio: some of them largely reach the goals, others miss them,
- the aspect of team management does not seem more difficult to formulate than the technical and scientific aspects.
- despite all the precautions, the double role of the portfolio, formative and marking, generates ambiguities in the elaboration of the portfolio and its evaluation.
- the reflexive thinking seems to be a difficult objective to reach for the students.

| | |
|---|---|
| **Level 1** *The off-track portfolio* | 3 |
| disordered collection of evidence<br>without any selection or organisation<br>no or little reflexive thinking or self-assessment on developed competences | |
| **Level 2** *The emerging portfolio*<br><br>starting selection or organisation of the evidence<br>no or little reflexive thinking or self-assessment on developed competences | 8 |
| **Level 3** *The on-track portfolio*<br><br>poor organisation or selection of the evidence<br>reflexive thinking and self-assessment on developed competences<br>(gives the history of the learning process) | 15 |
| **Level 4** *The outstanding portfolio*<br><br>consistent and reflexive evidence for both contents and learning process | 7 |

**Table 3: Definition of 4 levels of increasing quality(2) and assessment of the portfolios (N=33).**

**Analysis of the 33 competence portfolios**

Two kinds of evaluation were processed:

*1. Defined criteria subject to the team leaders' and supervisors' approval:*

The evaluation of the portfolio (**table 2**) has been performed by the supervisor, key witness of the students learning process, checked by a pedagogical advisor who has read all the portfolios.

*2. A classification suggested by Behrens (2) based on the Paulson's work*

See **table 3**.

**What are the characteristics of a 'good' competence portfolio?**

Based on our evaluation, we can draw four positive main tendencies which:

- the learner uses his/her portfolio as a communication tool: he/she organises the information and explains his/her choices. The headings are clearly indicated and the most important information is highlighted.
- the learner creates his/her own tools to organise his/her work, saving time and getting to the essentials: a personal classification, prepared forms for meetings and minutes, team watching grids and work hour grids
- the learner designs documents to help the bachelor students: support to the document writing, technical chart model, agenda and task division forms
- and, above all, the learner self-assesses the project and his/her personal development on specific or free portfolio forms.

Some examples of evidences included in a portfolio:

- plans of different prototypes
- descriptions of the different ways to solve the scientific or technical problem
- self-evaluations of the team leader
- evaluations of the group
- personal template to lead the meetings
- personal template to report the meetings
- how the project was planned and managed

**What are the most difficulties faced by the learner during the elaboration of the competence portfolio?**

The difficulties described here have raised during the reading of the portfolio. For the learner's point of view, see the survey results § 3.3.

- The learner may tend to restrict him/her-self to the chronological and subjective narration: he/she cannot take the appropriate distance to characterise in a global way the team work assessment or some of his/her own behaviours. This provides poor quality analyses and makes it difficult to transfer the experiment to a future situation.
- The learner makes a confusion between the learning and the assessment tool:

| According to you the portfolio: | Agreement frequency Absolute value and % | | | |
|---|---|---|---|---|
| | Team Leaders | | Supervisors | |
| made it possible to take distance from the course of the project | 19/31 | 63 | 13/30 | 43 |
| appears to be an appropriate learning tool | 17/31 | 55 | 22/30 | 73 |
| appears to be an appropriate assessment tool | 14/31 | 45 | 23/30 | 77 |
| was easy to understand | 11/30 | 37 | | |
| was easy to elaborate | 13/30 | 43 | | |
| took you plenty of time to elaborate | 25/31 | 81 | | |
| was an open task which you appreciated | 22/30 | 73 | | |
| gave you the opportunity to follow the progress of your team | | | 14/30 | 47 |

**Table 4: General perception of the portfolio**

despite our theoretical knowledge of this issue, several learners had difficulties to handle this double objective.

## Analysis of the survey results

One month after the students' evaluation, an assessment of the programme was proposed to the team leaders and to the supervisors, based on a survey. The survey questionnaires were prepared by a work group of 10 people: 6 team leader students, 3 supervisors and 1 pedagogical adviser. The answers rate was 94% for the team leaders and 91% for the supervisors.

First of all, the authors note that, although the portfolio seems to meet the requirements of the marking evaluation, the team leaders are not very enthusiastic about it; the following results will confirm this tendency. The most positive result relates to the open nature of the task: 73% of the team leaders appreciate that the portfolio contains a significant part of freedom (**table 4**). The work group estimates that this does not make sense: although the team leader appreciates this autonomy, it is be the principal cause of the portfolio negative image.

Still according to the working group, the learners are not familiar with this kind of autonomy and do not have any template generating uncertainty or discomfort.

| What was the most difficult in the elaboration of the competence portfolio | Agreement frequency Absolute value and % | | | |
|---|---|---|---|---|
| | Team Leaders | | Supervisors | |
| From thinking to writing. | 16/31 | 52 | 13/30 | 43 |
| Formulating the team management. | 13/31 | 42 | 11/30 | 37 |
| Accepting the idea of the PF. | 11/31 | 35 | 14/30 | 47 |
| Analyse the project development. | 11/31 | 35 | 16/30 | 53 |

**Table 5: Difficulties encountered during the elaboration of the portfolio**

It should also be noticed (**table 4**) that only a third of the team leaders states to have understood from the beginning what really is a portfolio.

The team leaders and the supervisors do not share the same opinion concerning what was the most difficult in the elaboration of the portfolio (**table 5**). For the team leaders, the transition from thinking to writing is the most difficult task, which is confirmed by the literature(2) but is contradicted by their performance. According to the supervisors, the most difficult task was to analyse the project development.

In the assessment of a learning programme, the items related to the evaluation are rarely positive. Indeed, the evaluation remains very often an issue of tension between learners and teachers (**table 6**). However, the written comments of the students and the interpretation of the work group suggest that

| Regarding the team leader assessment, according to you: | Agreement frequency Absolute value and % | | | |
|---|---|---|---|---|
| | Team Leaders | | Supervisors | |
| The PF gives the opportunity to enhance the learning process. | 13/31 | 42 | 19/30 | 63 |
| The assessment interview gives the opportunity to enhance the learning process. | 17/31 | 57 | 20/30 | 67 |
| The final mark matches accurately the accomplished work. | 17/29 | 59 | 25/30 | 83 |

**Table 6: The portfolio as an assessment tool**

| The most difficult task for the team leader during the project was: | Agreement frequency Absolute value and % | | | |
|---|---|---|---|---|
| | Team Leaders | | Supervisors | |
| The elaboration of the PF | 20/31 | 65 | 19/30 | 63 |

**Table 7: General appreciation of the projects and its difficulties**

adaptations must be done to the present assessment process, especially because the answers of the supervisors state that the current process does not give sufficient opportunity to the student to highlight his/her learning process. We will discuss this issue later in the conclusion.

Finally, the team leaders and their supervisors seem to agree to consider that the elaboration of the competence portfolio was the most difficult task for the team leaders (**table 7**). The written comments and the interpretation of the working group suggest three possible interpretations:

open tasks generate *sui generis* uncertainties, the portfolio is a learning tool with a 'delay effect'. Only at the end of the project and even later, in professional life, the student realises the meaning and the interest of the process, we did not clearly formulate the expectations with respect to the portfolio and did not define any procedure.

## CONCLUSIONS AND PERSPECTIVES

As a conclusion, both the students and the supervisors have to accept the concept and the assessment of the portfolio. It is indeed a continuous work of reflexive thinking in which the student not only agrees to report the successes or the failures, but also to self-assess. If the student does not agree with this principle and does not believe in its effectiveness, the competence portfolio is likely to appear to him/her a loss of time, a heavy and useless administrative constraint which is definitely not the case.

As a closing word, let us quote a comment given by one of our student about his competence portfolio:

*'As a person having a task to perform, I keep thinking that so much rigour harms the creativity and the effectiveness of my activities. But as a leader, and the distinction is essential, my role should not be to innovate, to create or to stand out but to have the rigour and the structure, to be the reassuring framework in which the others blossom. To be a leader is to be the most constrained of the free human being.'*

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# SKILLS AUDIT AND COMPETENCY ASSESSMENT FOR ENGINEERING PROBLEM SOLVING COURSES

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## ABSTRACT

*This paper describes a strategy for auditing existing skill levels, and assessing achievement of course objectives, by students enrolled in Engineering Problem Based Learning (PBL) courses.*

*Our method involves initial auditing of existing skills and competence of each student, and continual assessment to monitor progress. The initial skill assessment will facilitate the effective allocation of students with different levels of skill in various discipline areas, into well balanced teams. This balance will facilitate effective mentoring within the teams and, because improvement by individuals and the team collectively will be formally assessed, mentoring within the teams will be encouraged.*

*The formal assessment of objectives will be tailored to individual student's existing skill levels. The emphasis will be on advancement of skills and competence rather than simply achieving a minimum standard. This novel strategy will provide the flexibility for equitable assessment of students with different initial skill and competency levels; particularly relevant to students studying in the distance mode who may have considerable professional experience and advanced skills and competence.*

*By tracking progress towards the achievement of objectives, students can be provided with an individual portfolio of achievements through the suite of PBL courses.*

## INTRODUCTION AND BACKGROUND

The University of Southern Queensland (USQ) has developed an international reputation for offering high quality academic programmes in the on-campus (internal), off-campus (distance), and on-line delivery modes. The university's principal campus is situated at Toowoomba, approximately 130 kilometres west of, Brisbane, Australia.

The Faculty of Engineering and Surveying (FoES) is one of five Faculties at the University. In 2002 FoES introduced a problem-based learning (PBL) approach for several courses to ensure that graduates develop problem-solving skills and the ability to work effectively in multidisciplinary teams. This was consistent with the university's vision and the faculty's philosophy that engineers and surveyors (spatial scientists) are predominantly problem solvers. They must be able to use the latest technology to find creative solutions to multidisciplinary problems throughout their professional lives. It was considered that PBL would be a preferred strategy to achieve this since it purposefully creates situations from which learners broaden their perspectives and acquire new skills(1).

The use of PBL provided a mechanism to demonstrate that participants had developed the necessary professional skills required by professional accreditation bodies (2,3,4). It was also an opportunity to establish an innovative teaching practice in Engineering education at USQ that was outside the dominant transmission model normally used in universities(5), and that recognised that learning may be more effective when undertaken in groups(6).

The PBL strand consists of a series of four consecutive courses, with an additional final year research project seen as the capstone of the strand. The main objectives of the first two PBL courses, which are compulsory for all students in the Faculty, are to develop the fundamental skills needed by students for participating effectively in multi-disciplinary teams, and to expose students to a wide range of problem-solving tools and skills. The subsequent problem-solving courses are designed, in terms of structure, content and pedagogy, to expand and improve these skills,

and to impart fundamental technical content in several discipline areas. In all problem-solving courses student teams are presented with open-ended technical problems for which they must develop, justify and present solutions. The problems are developed to construct technical knowledge and skills as required by the course specifications.

Students enrolled in the initial PBL course are placed into teams of eight members. Current practice is to randomly allocate students to teams, but it is recognised that a better system would be to balance members' existing skills within the teams. Furthermore, each team is allocated a staff member to act as a facilitator. The role of the facilitator is explained in Gibbings and Morgan(7). An examiner is also appointed to the course who has overall responsibility for administration and assessment of the course, and staff training and coordination.

At USQ, students may elect to study in the on-campus (internal) or off-campus (distance) modes. Distance students study from various geographic locations around the world, which enriches the learning experience due to the cultural diversity, but also creates its own set of logistical problems. These problems are further complicated in the problem solving courses by the fact that students in the same team may be studying at Associate Degree (two year degree), Bachelor of Technology (three year degree), or Bachelor (four year degree) levels. Students enrolled in the PBL courses may also be studying any of the 9 majors offered in the faculty – Agricultural, Civil, Environmental, Electrical and Electronic, Computer Systems, Mechanical, Mechatronic Engineering or Surveying and Land Information. Because of this diversity (different disciplines, different study modes, and different programs), existing knowledge, expectations, level of interest, and other cultural and personal differences, the difference in learning objectives of each individual student can be profound. It is interesting to note that most of these elements were also identified as core principles that need to be considered when designing education for adult learners(8).

Most students studying in distance mode do so because they are already employed in some capacity in industry and the distance mode allows them to study and work at the same time. Because they are already in the workforce, many have different skill levels and personal competency attributes compared to internal students. In addition, an increasing number of internal students do not come directly from school and do not have the traditional prerequisite studies usually associated with undertaking technical university courses. School leavers do not necessarily possess the maturity levels and skills to be independent learners.

It is clear that during the setting of objectives and assessments, especially for the first two PBL courses, there needs to be some recognition of prior learning or skill. It seems logical that the assessments should be individualised for each student, and at the same time peer assisted learning within and between teams must be encouraged and rewarded – but the current assessment strategy does not achieve this.

At present the assessment strategy varies slightly for each of the four PBL courses. Formal course evaluations by students, quality audits and reviews by staff, and anecdotal evidence from stakeholders have recently identified some deficiencies with the existing assessment strategies. Some shortcomings identified with the current assessment in the first PBL course are that:

- some students want to do all of the work themselves. The most common reason is that 'high achievers' don't want to rely on others to carry out tasks that could ultimately affect their 'marks'.
- some students are not motivated and contribute very little to the team effort. Thus the assessment strategy must ensure that the individual only, and not the team, is disadvantaged – this may not be the case under the present assessment scheme.
- there is no real incentive for students to learn new skills. For example, under the current system, those who are proficient or excel at a particular skill (for example, report writing) will tend to adopt this role in all projects because this gives the team its best chance of receiving a 'good mark' for the projects.

- there is little or no *incentive* for mentoring within the teams. Assessment should require that teams provide evidence of mentoring – if it is important and in accordance with learning goals, then it should be assessed(9,10).
- greater incentive must be provided to individuals to encourage the assessment of other teams' proposals (mentoring between teams) and to provide constructive feedback. Evidence must also be provided by teams of action taken as a result of this feedback.
- more personal reflection should be encouraged and better direction should be provided to students on the requirements of the individual portfolio (used as part of the assessment). At present too much emphasis is placed on the team mark for the projects and on the project solution, rather than on what the individual has learned and how and why the individuals' skill and competence levels have increased.

This paper outlines a revised assessment strategy for the first PBL course to overcome some of these shortcomings, and to effectively assess achievement and advancement of skills and competence, in a way that recognises diversity and prior skill and learning, and that does this in an equitable manner. This assessment strategy will address the course objectives and ensure that minimum standards are met. It will also provide students with guidance and encouragement to:

- take responsibility for their own learning: this is generally referred to as 'constructive alignment'(11,12), or 'constructivism'(13),
- identify their own individual learning objectives that allow them to extend and build on existing skill and competence,
- develop suitable strategies to achieve these individual learning objectives,
- provide a mechanism for students to monitor their own progress throughout the strand of PBL courses

This strategy is entirely in accordance with the 'constructivist paradigm'(13), since PBL is much more facilitative in nature than prescriptive, and 'collaborative learning'(14,1).

## METHOD

### Initial Skills Audit

A strategy was devised for the development and validation of a method of auditing initial skill levels. This will allow the continuous assessment of students against course objectives as they progress through the PBL strand of courses in both the on campus and distance modes.

The first part of the method involves the initial auditing of existing skills and competencies of each student, while the second part involves continual skill assessment to map student's progress throughout the full suite of PBL courses. The skill assessment will be used to allocate students with different levels of skill in various fields into well balanced teams. This will encourage mentoring within the teams. Individual students will be able to use their skill assessment as an introduction to other team members, and provide facilitators with a standard of comparison against which later skill levels can be assessed to monitor both student and team progress.

Although the initial skills audit will not form part of the formal assessment, it will be the starting point for the student's individual portfolio of skill achievement. It will assist with developing the overall assessment strategy and individual learning goals. The results of the skills audit will be available in digital form to course facilitators and the individual student. It will be the student's responsibility to make this document available to other interested parties, including members of their allocated project team.

### Formal Assessment of Skills – Portfolio

Assessment will depend more on the process, reflection, and self-evaluation rather than on specific quantitative criteria(13) and the emphasis will be on advancement of skills and learning new skills, rather than simply achieving a minimum standard. This will be achieved by each student individually negotiating and being assessed on, objectives and goals for each project within the PBL courses. The direction will be determined by the learner within the constraints of the

problem to be solved, which is seen as desirable for adult learning(13). Students will have to negotiate suitable roles within their team for each project. This is in accordance with research that suggests that adult learners want control over learning based on personal goals, and that learning and better outcomes will increase as a result(8). There is convincing evidence that those who take some initiative and become involved with their own learning in this way will learn more than those who take a more passive approach(15).

Teams will be required to submit a plan, similar to the system noted in Isaacs(16) for the project incorporating each team member's individual learning objectives. These must be agreed by team members, must be consistent with course objectives (and graduate attributes), and be aligned to areas in which the student requires improvement rather than an area of existing high level skill and competence. This will encourage development of new skills since the students will be assessed on these negotiated objectives alone – teams whose plans demonstrate the development of new skills by its members will potentially receive higher marks. By tracking progress in the achievement of objectives, the students can maintain an individual portfolio of achievements throughout the suite of PBL courses. This improvement by individuals and the team collectively will be formally assessed, and mentoring will be improved. This will lessen the reliance on a 'team project mark' and allow for more individual assessment than currently occurs.

This strategy for formal assessment of objectives will provide documentary evidence that each student has achieved the minimum standard expected of a graduate as dictated by PBL course objectives, program attributes, accreditation bodies, professional associations, and defined graduate attributes.

The novel assessment approach, involving tailoring to individual student's existing skill and competence levels, will also provide the flexibility for equitable assessment of students with skill levels that are already well above the required minimum standard. Students who may have highly developed skills in some areas, as is often the case with mature age distance students, can now be assessed on an equitable basis with students who may not have the same starting level of skill. Students will basically be assessed on rates of improvement rather than final achievement level.

In essence, students will develop an individual log to record their progress in skill and competence achievement. This approach is similar to what has been adopted by several professional associations in Australia that have the responsibility, often under legislation, of assessing individual members against national competency standards before granting professional registration with their associations. It has also been successfully used in various forms in education for example Albert and Morrison(18, p.292), and(19), although it is not common in engineering or technical education. The log or portfolio will provide a structured record, in condensed but specific form, of the student's progress in the skills development through the student, facilitator, and examiner signing off on milestones as they are reached.

**Formal Assessment of Team Projects**

Each team will be required to prepare a plan that will include an individual's role and responsibility within the team and their learning objectives. This approach recognises that not all students will have the same learning objectives, nor will they be faced with the same issues (particularly considering the student diversity), so it is necessary to be flexible(17). It also recognises that true 'engagement' can come from students negotiating their own learning objectives and constructing them within their own context. This may also lead to a sense of 'ownership' and enhanced motivation(17).

Teams will be required to publish preliminary project reports on a web site by a designated date. Teams will be awarded marks for work done to date. Facilitators and other teams will have the opportunity to provide feedback on what has been submitted. Individuals will be given formal credit for this activity based on their participation as assessed by the facilitator. Teams will then have the opportunity to alter their submissions in light of the feedback and resubmit the final project report,

which will again be assessed. This final submission must provide evidence of changes or actions subsequent to the feedback, and outline how and why the initial report was improved as a result. This reflection and collaboration within the team are seen as critical to the learning process(16). In this way, the assessment will become an integral part of the learning process. The system will also encourage students to engage in the learning tasks associated with the problem solution, which is one of the most fundamental tasks of education(18).

This process also acts as a quality audit and review for facilitators. It provides an early opportunity for troubleshooting any possible problems within teams and to provide pastoral care. It also provides valuable insights into the instructional design of the course, how well the general pedagogy is working with respect to course learning objectives, and if changes are needed to the project/problem design.

## RESULTS, ANALYSIS AND DISCUSSION

The primary outputs from this strategy will be the initial skills and competency assessment and the strategy for the design of the skills and competency portfolio.

### Initial Skills Audit

The skills audit will be an online self-assessment carried out by the student personally. This will involve subjectively answering a set of questions regarding team work, problem solving, and other technical skills. Questions will be written in easy to understand language to overcome potential problems with cultural diversity, and expressed in terms of how well the student believes they can perform certain defined activities.

These initial skill audit questions will also be linked to the course objectives wherever possible. For example, suppose a course objective was: 'Communicate information in a professional manner'. A corresponding task that describes one of the skills that students are expected to achieve might be: 'Prepare a professionally written technical report in English on a word processor'. The corresponding questions that would appear in the initial skill audit might be:

1. How would you rate your ability to use a word processor?
2. How would you rate your English expression, grammar and spelling?
3. How familiar are you with standard referencing styles?

Students will grade their performance of each of these activities by checking a box against a five point scale where one denotes little or no knowledge and five denotes experienced and expert in all or most aspects.

There is a possibility that some students may either under or over estimate their skill levels. Students are advised that:

- the audit is not part of a formal assessment,
- all students will ultimately have to prove their skills, so there is no benefit in under or over estimating skills,
- if students underestimate skills, they may be placed in a team with someone who is supposedly strong in this same area and may be charged with the responsibility of mentoring them in this skill. This will be ineffective and inefficient, and their team will be disadvantaged due to not having well balanced skills.
- if they overestimate skills, then they may be asked to mentor a team member in this area. In this case mentoring won't be effective and they and the team will consequently be penalised.

### Formal Assessment of Skills – Portfolio

Most skills and competencies that will be assessed in the portfolio will be directly linked to course objectives and graduate attributes. They will be subdivided similarly to the initial skills audit, into the general fields of: team skills, problem solving skills, and technical skills. Most skills will also have a level of achievement attached to them. This portfolio of skills will essentially be a professional development audit and will provide a status report of the students' progress at any particular time.

Following on from the earlier examples of course objective, task statement and skill audit questions, the corresponding competency/ skill assessment questions might be:

1. Professionally structured report
2. Consistent and appropriate format of report on word processor
3. Spelling, grammar, and punctuation
4. English expression, syntax, vocabulary, sentence structure
5. Illustrations, figures, and graphs used appropriately in text
6. All information correctly referenced
7. Harvard referencing style and Bibliography used correctly (including electronic sources)

Students will again grade their performance in each of these activities by checking a box against a 5 point scale (starting or default level will be zero where no skill level has yet been demonstrated). They will be able to judge how well they have performed in these areas after receiving feedback on their initial team reports. They will also be provided with guidelines on how to self-assess their performance.

Students will first nominate objectives (and skills/competencies) for each assessment project after negotiating their individual roles and responsibilities within their teams. After the final project report is submitted they will request, and provide documentary evidence in their individual portfolios for, certain levels for the competency or skill addressed.

The skills portfolio will demonstrate and formally record the practical realisation and advancement of skills and competencies. Despite the initial skills assessment and negotiating project objectives based on existing skills and competencies, the default position for *formal assessment* of all students entering the PBL strand is that they have not met any skills or competencies until this has been 'demonstrated'. Each individual student must formally demonstrate the achievement of the skills and this must be verified by their peers, facilitator and the course examiner. Evidence of achievement of skills and competence is presented and assessed in the student's individual portfolio. There are several ways that students can demonstrate the achievement of a particular skill level:

- Peer assessment/agreement and documentation of performance during team projects (in accordance with the peer agreed team roles and predetermined individual learning objectives),
- Evidence of effective mentoring within the team in these skills,
- Individual requests supported with documentary evidence of conduct during the project (this should not occur often as this is not peer assessed), and
- Exemptions for students who have enrolled with advanced standing and have been granted exemptions.

The student will only be recognised as having met the standard if the facilitator and examiner are satisfied the student is competent and has the capacity to maintain a high level of performance in all aspects at the requested level of the skill being assessed.

This process records the achievement of the skills and competencies and tracks the student's competency in the identified skill areas. The portfolio will provide formal recognition of the status of individual skill achievement, and will be available to course facilitators and examiner. Like the initial skills audit, this individual portfolio will be disclosed to other students at the individual's discretion. However, it will be prepared by the individual with supporting documentation, peer assessed by other members of the project team, assessed/checked by the team's allocated facilitator, and finally moderated by the examiner to ensure consistency and as a final 'due diligence' quality check.

This process allows facilitators to recognise existing areas of specialisation but still provide documentary evidence of the students' achievement of all skills and competencies. It also allows the examiner to identify areas of specialisation where a student has achieved higher than minimum levels of skills, knowledge and competency, since the process provides a mechanism whereby achievement above the minimum required can be recognised, assessed and credited. This encourages students to attain skills and competencies in excess of the mandatory requirements for graduation.

The formal assessment strategy will also encourage students to develop new skills in areas in which they have previously identified a weakness. The opportunity for feedback and mentoring within and between teams will be enhanced. Formal credit will be given to individuals for providing feedback to other teams' work (although this will be assessed on participation rather than quality). Both inter and intra team mentoring will be assessed in the individual portfolios. It is believed that this increased mentoring will have the added advantage of encouraging better intra-team communication and should therefore foster better teamwork.

This strategy provides a mechanism to separate individual and team assessment. It also provides the flexibility to equitably assess the attainment of skills and competencies at a higher level than the minimum requirements because the assessment is concerned with the attainment and advancement of skill level, rather than assessment against some predetermined minimum criteria.

Consistency of assessment between facilitators is achieved by staff training and documentation of requirements in a course facilitator's guide(7). The examiner performs a moderation role to further promote consistency between facilitators and to ensure due diligence has been applied to crediting individual skills and competence.

Detailed information on how to complete the log and address the documentation of skills and competencies will be provided to students. An up to date copy of the full skills portfolio will be kept by both USQ and the student, but the system will be largely self-managed by the students as there is no advantage to be gained from 'cheating'. Operational details of how the system is administered are beyond the scope of this paper. It is recognised that the system will be trialled with a pilot study. It is also accepted that existing facilities and infrastructure will have to utilised as much as possible to minimise extra staff time needed to execute the revised assessment strategy. It will then be implemented, monitored and reviewed, and the results will be reported in subsequent publications.

## CONCLUSION

The strategy of an initial skill and competency audit for students offers several major benefits. It allows the tailoring of assessment to individual needs and will cater for prior learning and existing skills. This will enable more effective use of student diversity and encourage mentoring. The portfolio will encourage an increase in skill levels rather than just meeting a minimum standard. It will provide a continuous assessment strategy throughout the 4 courses, allowing the student to demonstrate, not only the achievement of graduate attributes, but progression and final competence level. Self directed learning and life long learning skills will be fostered; these in themselves are desired graduate attributes.

A skills audit and assessment package will significantly increase the ability of students to direct study and energy into self identified areas which will most benefit their future careers.

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# PLENARY
# TRUST AND ACCOUNTABILITY AS A BASIS FOR PROFESSIONALISM IN HIGHER EDUCATION

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## ABSTRACT

*When I put myself professionally into the hands of a doctor, a lawyer, an engineer or a plumber, I expect them to do a professional job, ie I trust them to do this. At the same time I expect them to be accountable for their work not only to me, but also to the professional association to which they belong and which has assured itself that they are professionally qualified, ie that they have been properly and successfully trained and received appropriate continuing professional development. All of this, which is so obvious in all other professions, is rejected by the majority of the profession of university teachers regarding their 'training' as teachers. (See eg Anthea Lipsett, 'A master class in avoiding training', Times Higher, 23.09.05, p.1).*

*This extraordinary attitude makes it impossible to establish a proper balance between trust and accountability which is so essential for professional work. Thirty years ago, the balance was biased towards trust, now it is biased towards accountability. Neither is desirable, as Oona O'Neill argued so forcefully in her Reith Lectures in 2002. The purpose of my presentation would be to try to break that Gordian knot.*

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**Lewis Elton,** '*Continuing Professional Development in Higher Education: Trust and Accountability*', Higher Education Digest 49 (2004), Digest Supplement, pp5 - 7

# KEYNOTE PLENARY
# INNOVATIONS IN THE CURRICULUM

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Abstract not available