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Six-Week introductory programme of Activity Led Learning to improve student engagement and retention

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Abstract: *The Faculty of Engineering and Computing at Coventry University is currently operating a number of initiatives to improve student satisfaction and retention. For new students, early assimilation and engagement are seen as key to successful study.*

Previous teaching innovations involving ‘problem-based’ methods were employed in the Automotive Engineering Design course in the early 1990’s and much of the ethos and activities supporting it have remained embedded in the course and also practiced more widely in allied courses. This approach was developed and packaged into a six-week introductory Activity-Led-Learning (ALL) programme. 100 first year students from courses in Mechanical Engineering, Automotive Engineering and Automotive Engineering Design, organised into six groups, underwent a series of six Monday – Friday exercises, each assessed on completion. A team of 16 staff delivered the programme which accounted for 18 hours (of 27-29) on the student timetable.

A subsequent student survey demonstrated a net improvement in satisfaction compared to a 2006/7 survey, and particular acclaim for ‘activity’, ‘group work’, and ‘teaching methodology’. Indeed, 74% of student indicated a preference for more of this kind of learning. The exercises formed the major part of a core module for which the pass rate at first exam board was 96% (78% the previous year). Subsequently, student progression to stage 2 was 76% (72% previous year). Staff identified ‘enthusiasm for competitive elements’ and ‘attendance patterns’ as notable aspects of behavioural engagement. The results will guide the application of the ALL approach across the Faculty.

Key words — Activity led learning, Engagement, Engineering, Learning, Retention

Introduction

The Faculty of Engineering and Computing at Coventry is currently operating a number of initiatives to improve the student experience. Previous teaching innovations involving ‘problem-based’ methods were employed in the Automotive Engineering Design course in the early 1990’s and much of the ethos and activities supporting it have remained embedded in the course and also practiced more widely in allied courses. In recent years the changing profile of the faculty, caused by increased diversity in student cohort, a reduction in resources and increased staff/student ratios, has presented challenges to these activities and increased concern at the levels of student satisfaction and retention. An upcoming £60 million investment in a new building to house the Faculty from 2012 is providing an opportunity, and will, to reassert a teaching and learning practice appropriate to the student cohort, as well as the developing needs of industry. To this end, the wide development and use of Activity Led Learning (ALL) methods across the Faculty is sought. By definition,

‘Activity Led Learning is a pedagogy in which the activity is the focal point of the learning experience and the tutor acts as a facilitator. An activity is a problem, project, scenario, case-study, enquiry, research question (or similar) in a class-room, work-based, laboratory-based or other educational context and for which there a range of possible solutions or responses. Activities may cross subject boundaries, as activities within professional practice often do.

Activity Led Learning requires a self-directed process in which the individual learner, or team of learners, seek and apply knowledge, skilful practices, resources (personal and physical) relevant to the activity being undertaken.’ (Wilson-Medhurst, 2008)

This paper reports on a six-week intensive ALL introductory programme, operated in the department of Mechanical and Automotive Engineering from October 2008. The trial was

specifically targeted at improving engagement and retention within three, first year undergraduate BEng programmes, namely those of the Mechanical Engineering, Automotive Engineering and Automotive Engineering Design (all accredited at CEng by IMechE). Within this combined group, in 2007/8, 28% failed to progress from level 1 to level 2 (27% due to failure and 1% due to withdrawal). The progression rate of 72%, at this stage, is set against an internal target of 80%.

A UK national study by Yorke and Longden (2008), identified 44 reasons for non-completion among UK first year undergraduate students: 'programme did not meet expectation', 'wrong field of study', 'suitability of learning style', 'lack of personal engagement' and 'the amount of contact with academic staff' were the top five reasons offered by students for non-completion (Table 1). Within the sub-set of students identified as Engineering and Technology, 'contact with academic staff' appeared less important whilst 'insufficient academic progress' was ranked 3rd highest.

Table 1: Reasons for non-completion, Yorke and Longden (2008)
Percentage identifying each item

Item	All Undergraduate Programmes (n = 312)	Engineering and Technology (n = 19)
Programme did not meet expectation	48	41
Wrong field of study	42	50
Suitability of learning style	42	33
Lack of personal engagement	39	33
Contact with academic staff	36	22
Insufficient academic progress	35	42

The ALL six-week programme attempted to address these issues, including 'wrong field of study' as any student suffering this realisation should do so earlier, and could potentially transfer to a more appropriate course within the same academic year. Generally, the activities, based on 'real' engineering tasks, also complements the Faculty commitment to developing communities of learners through employer and profession focussed, activity led education (Wilson-Medhurst et al, 2008). This approach concurs with Zepke, Leach, and Prebble (2006), who suggest 'a learner-centred approach, improves retention'.

In this pilot, the aim of the six-week programme is to use an intensive learner-centred, activity led approach to explicitly demonstrate the nature of the subject, match with 'idealised' learning styles, promote student engagement, and assure close, regular and varied contact with a range of departmental staff at an early stage. In addition, assessment with immediate feedback and results on a weekly basis and the potential to complete a module in six weeks would strongly demonstrate early academic progress.

The term 'engagement', as Chapman (2003) observes has been used to depict students' 'willingness to participate in activities, attending class, submitting required work, and following teachers' directions'. Other definitions of engagement also cited by Chapman (2003) recognise the behavioural, cognitive and affective aspects of engagement. Within its' activities, the six-week ALL programme aimed to create a strong sense of student engagement by stimulating thinking, activity, problem solving and group interaction, with the incentive of competitive elements, short deadlines and regular feedback. Levels of engagement would be assessed through feedback from students and staff and, later, the completion of assessment requirements as this ultimately determines the prospects for progression. This feedback includes student satisfaction ratings as an indicator of affective and cognitive engagement with staff feedback providing indications of behavioural engagement.

Method

Following a departmental (but non-course specific) induction week, students embarked on the six-week course induction period, based mainly on ALL. Within the ALL activities, 100 students were divided into six groups maintaining Mechanical, Automotive and Automotive Design group identities. Six activity led exercises, mainly extracted from the 'Engineering Application' requirements of the course and constituting 75% of a 20-credit core module, were set up and undertaken in weekly rotation by the students over the six-week period. The six exercises focused on Design and Build, Metrology, CAD Modelling, Materials Testing, Reverse Engineering and Product Marketing. (The two remaining exercises completing the core module, Spreadsheets and Engineering Skills, were also delivered within the six weeks but to all students on a continuous basis) A 16-strong mixed discipline team of academics, development officers, technicians and interns facilitated and assessed the exercise. Each activity was timetabled for 18 hours across the 5-day week and typically contained 2 or 3 hours of key note instruction, 14 or 15 hours of facilitated activity and 1 hour of assessment. Students were given their mark and feedback before departing for the weekend. Each of the six groups completed the six ALL exercises in a weekly rotating programme over the six week period.

In addition to the ALL programme and completing their timetable (Table 2), each week students engaged in a visit to an engineering skills training provider (3 hours), spreadsheet exercises (2 hours), a tutorial (1 hour), a mathematics module (2 hours), a mathematics diagnostic test re-assessment for those students requiring it (1hour) and, optionally, a free choice module (2 hours). The aim was to produce a full timetable to fully occupy students in the 'normal' working week.

Table 2: Six-Week intensive programme including Activity Led Learning (ALL)

	0900-1100	1100-1300		1400-1600	1600-1800
Mon	Mathematics lecture	ALL Task Introduction		ALL	
Tue	ALL	ALL		Spreadsheet Exercises	
Wed	Engineering Skills				
Thur	ALL	ALL	Tutorial	ALL	Option Module
Fri	ALL	ALL		ALL Assessment	Maths Diagnostic Assessment

A review of the six-week programme was undertaken to assess outcomes and to inform future development. To assess the broad level of student satisfaction and engagement, including aspects of cognitive and affective engagement, a questionnaire was produced and targeted at the full student cohort. In addition, focus groups were operated to capture student experiences in more depth.

The questionnaire comprised closed and open questions. To enable comparison to previous student experience and satisfaction, the closed questions formed a subset of questions from a 2006/7 Coventry University student satisfaction survey. (The 2006/7 survey summarises the assessment of a sample of all three stages of all undergraduate programmes within the Department of Mechanical and Automotive Engineering, n=36). The author selected the questions to assess student satisfaction and engagement, appropriate to its early application within the academic year. Key themes explored related to course organisation and assessment, and teaching and learning which included questions related to cognitive engagement.(Appendix A) The questionnaire was administered to all participating students in the week following the completion of the six-week programme and completed anonymously. Closed question were answered on a five point Likert scale. In keeping with the 2006/7 survey, the closed questions were analysed as means and re-interpreted into a grade in the range A – E, as table 3.

Table 3
Conversion of Mean questionnaire scores to grades

Mean score range	Corresponding Grade
$X \geq 3.75$	A
$3.75 > X \geq 3.25$	B
$3.25 \geq X > 2.75$	C
$2.75 \geq X > 2.25$	D
$X \leq 2.25$	E

The open-ended responses were analysed by independent Student Advocates (Coventry students employed part-time in administrative and/or academic support roles) who identified the number of responses around repeated themes. The occurrence of each theme was presented as a percentage of total responses.

From the students completing the questionnaires, recruits were gathered on a voluntary basis, later forming two focus groups (8% of cohort). The key areas for exploration for the groups centred on the stronger issues arising from the questionnaires, and general areas selected by the author to inform future development of the programme. The focus groups were run by independent Student Advocates. The discussions were tape-recorded by the advocates and afterwards transcribed by the author who identified emerging themes.

The views of participating staff were gathered in a structured discussion led by the author and recorded by an academic colleague. Themes emerging from the transcripts were identified and summarised by the author.

Following the six-week ALL exercise, and for the remainder of the year, the course progressed with a 'traditional' timetable and style of delivery. This comprised of the parallel delivery of 2-hour lecture sessions in science, mathematics, design, materials and manufacturing, and half modules in electrical and a half module of free choice. In addition students undertook a series of 6 science laboratory exercises assessed on alternate weeks in a formal tutorial session. This accounted for 12 hours of formal timetabled commitment per week.

At year-end, retention (measured as the proportion of students successfully progressing to stage 2) was determined by the ongoing course assessment process, ratified at the Programme Assessment Board in July 2009 and the re-sit board in September 2009.

Results

The questionnaire was completed by students attending a timetabled lecture and resulted in a response rate was 79% of full cohort. Resultant grades are shown in Appendix A with an indication as to how the grade compared to the 2006/7 survey. Within its 38 closed questions there were 15 items of higher satisfaction, 5 items of lower satisfaction and 18 items of unchanged satisfaction compared to the earlier survey. Relating the results to the selected Yorke and Longdon (2008), reasons for non-completion: addressing the issue of '**programme did not meet expectation**', student satisfaction responses indicated improvement in the 'range of topics offered' but this was countered by a reduction in 'development of subject knowledge'. Improvement in the '**suitability of learning style**' was very strongly supported by increased satisfaction in a range of responses including, 'usefulness of feedback', 'how you are being taught', 'ability to learn from others', 'practical sessions', 'support staff' and 'access to equipment' but unsupported by a decline in 'appropriateness of class size' and 'development of subject knowledge'. Improvement in student '**personal engagement**' is supported by increased satisfaction in 'opportunities to feedback views', 'self confidence' and 'practical' and 'time-management skills'. Evidence to support any improvement in '**contact with academic staff**' is mixed; there was improvement in 'usefulness of tutor's feedback' but the more general 'useful feedback has been provided' declined. There was however an improvement in the perception of 'helpfulness of support staff'. See appendix A for the full list of questions and analysis of responses.

The responses to the questionnaires open question 'What did you like about the six-week experience?' were categorised to reveal common underlying themes. The three most highly represented themes were: 'practical experience' (34% of all respondents making a positive comment, 0% negative), 'working in a group' (23% positive, 1% negative), and 'teaching methodology' (18% positive, 1% negative).

Similarly, the three most highly represented themes from responses to the question 'How could we improve it?' were: 'more break time' (11% supporting), 'increase exercise by one week to allow catch up' (9%), and 'more assessment information' (5%). Students were also asked if they would like to see more of this type of activity, to which 74% replied 'yes', 22% 'no', and 4% 'no response'.

The student focus group concentrated on three areas; information and communication, structure, and teaching and learning. Key points related to a need for clear assessment guidelines and feedback, more interaction with teaching staff, better workload balancing, more free time, appropriate time allocations for different activities, facility to cater for students with different prior experiences and backgrounds, recognition of a preferred teaching/delivery style and enthusiasm for competitive/team work elements. While the three strongest themes emerging from the staff discussion related to the need for better workload balancing, the positive effect of competitive elements in engaging students, and difficulties with attendance patterns.

The impact on retention and consequent progression, compared to the previous year, is illustrated by the module and course completion statistics summarised in table 4.

Table 4: Course and Module Completion Comparison (% of cohort)

	2007/8 (n=69)		2008/9 (n=100)	
	July Programme Board	September (Re-sit) Exam Board	July Programme Board	September (Re-sit) Exam Board
Core Module - Focus of six-week ALL activity	78	82	96	96
Students gaining 120 credits (maximum)	35	65	43	64
Students gaining 100 credits (eligible to progress)	55	72	63	76

The results for the core module, substantially completed after the first six weeks, produced an early measure of academic progress that, with a pass rate of 96% (78% in 2007/8 initially and 82% post re-sits), supports a positive response to the issue of '**insufficient academic progress**'. (Yorke and Longden, 2008)

On completion of stage 1, university regulations allow students achieving 100 credits (5 modules) from 120 studied to progress to stage 2 (the failed module being retaken alongside stage 2). The initial examination board showed that 63% of students achieved a minimum of 100 credits and qualified for progression (55% in 2007/8) and 43% of students gained the full 120 credits (35% in 2007/8). Following the re-sits exam board, 76% of students achieved a minimum of 100 credits and qualified for progression (72% in 2007/8) and 64% of students gained the full 120 credits (65% in 2007/8).

The figures indicate clear improvement in the proportion of students passing at the initial exam board but, with a lower proportion of students making good in the re-sits, only marginal improvement overall.

There were no course transfers at any point within the academic year. Consequently, the six-week experience could not demonstrate it provided the realisation of '**wrong field of study**' followed by a successful course transfer.

Analysis

Within the broad scope of opinions expressed in student questionnaires, student and staff focus groups and the positive nature of the assessment results, there was strong support for the activity-led approach and its programming. Analysing student engagement according to Chapman (2003): students broadly indicated improved satisfaction with areas of teaching and learning (affective engagement) and were observed by staff to have high levels of attendance, although reduced in the later stages, and high levels of work completion (behavioural engagement). Addressing reasons for non-completion, based on Yorke and Chapman, (2008): there was improvement in the issues of 'suitability of learning style', student engagement' and 'insufficient academic progress', but no evidence to support improvement in 'programme did not meet expectation', 'contact with academic staff' and 'wrong field of study'.

Issues emerging from the student focus groups suggest a need to improve the balance and organisation of work, clearer assessment information and more direction given to less able students. There was support for the learning style and enthusiasm for competitive elements. The staff focus group concurred with a need to balance workloads and the positive effect of competitive elements but also recognised a drop off in attendance in the later stages of the programme.

For the core module, chosen as the focus for the ALL six-week activity, pass rates improved by 18 % at the first exam board, reducing to 14% at the re-sit board.

The students reverted to a more 'traditional' timetable to complete the remainder of the year and subsequently at the June exam board the number of students gaining full credits increased by 8% (to 43%), whilst those gaining 100 credits (qualifying them for progression) also increased by 8% (to 63%). Following the September re-sits, the proportion of students qualifying for progression was 4% higher (at 76%) although those achieving full credit was only 1% higher (at 64%). This indicates an improvement in students qualifying for progression, which is most pronounced at the initial exam board but less so following the re-sits. With more students passing 'first-time' there appears to have been less scope for additional success in re-assessment.

A number of issues arose that will inform development of the programme. These generally related to organisation and structure. Compared to conventional module delivery, the ALL approach was complex and resource intensive. Most of the 16 staff involved in the delivery contributed to the development and preparation of their tasks independently of the other tasks. Students recognised inconsistencies in the task complexity, workload, assessment expectation, feedback and appropriateness of facilities provided. Other research (BC College & Institute Student Outcomes, 2003) also indicates that satisfaction with curriculum content, organisation, and relevance is a critical dimension of students overall satisfaction and helps to explain some of the above findings especially the comments relating to the need for good task (curriculum) organisation.

It is recommended that future presentations of ALL six-week programmes would benefit from development in a number of areas, namely:

- equalisation of workload expectation between exercises
- reduction in workload in some exercises
- reduction in timetabled hours
- clearer guidance in task briefs
- clearer assessment requirements
- improved feedback
- smaller groups
- accommodation appropriate to the exercise
- increase use of competitive tasks

These improvements may be addressed firstly by enhancing the alignment between learning outcomes, teaching delivery and assessment (Biggs, 1999) and secondly by investigating further the learning space and resource requirements for ALL.

Conclusions and recommendations

The survey indicated an increase in the level of student satisfaction indicating a preference for an activity led style of learning, but also some areas for further investigation and development. Overall, it provided a strong endorsement for the approach.

Students' suggestions for improvement focused on structural, organisational and operational issues, but with no change to the style of teaching. The focus group discussions also supported this finding with many suggestions for operational change but no real criticism of the activity led approach. Staff identified improved enthusiasm for study, but also recognised that in later stages some students struggled to maintain the 'heavy' timetabling and workload demands.

Examination statistics demonstrate significant improvement in the pass rate for the core module on which the ALL programme was based and also improved results in the other mandatory modules subsequently delivered in a more 'traditional' lecture based manner. Concern over potential difficulty in progressing from the six-week ALL activity timetable to the 'traditional' timetable appeared unfounded. Improvement in progression was more pronounced at the first examination board. This suggests improved earlier engagement but consequently an academically weaker re-sit group and less scope for making good in re-assessment.

Key recommendations relate, firstly, to aligning learning outcomes, teaching delivery and assessment more effectively to address student feedback and staff observation and, secondly, to examine learning space and resource requirements alongside workload and resource balancing..

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Appendix A

Student Satisfaction Survey results and comparison to 2006/7 survey

