

The impact of the College Learning and Teaching Strategy on Undergraduate Teaching: Year One

The College of Science and Engineering has created a Learning and Teaching Strategy to allow a more systematic approach to the development of our teaching practices. The first stage of implementing the strategy has been the creation of “vanguard courses”, which are first year undergraduate classes modifying the way they teach their students, with a particular focus on encouraging students to take more responsibility for their own learning. This report gives an account of the development of the vanguard courses, and presents an evaluation of progress in the first year of the vanguard courses. All comments and feedback on the issues raised by this report are welcomed by the authors.

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Executive summary

- i) In October 2005 a Learning and Teaching Strategy was agreed by the College. It was decided to implement this strategy initially in first-year courses nominated as Vanguard Courses. The full Strategy is set out in Appendix C.
- ii) The main aim of the vanguard courses initiative is to initiate a cultural shift in students' approaches and attitudes to learning such that they become increasingly willing and able to take on greater responsibility for their own learning.
- iii) The development of the Vanguard Courses was guided by a set of Principles derived from the Learning and Teaching Strategy. These Principles are set out in Appendix B. Certain of the Principles, such as those relating to self-assessment and student group work, have been enacted more extensively. There are some promising early indications that working in accord with these Principles can enhance the quality of students' learning.
- iv) The initial evaluation of the Semester 1 Vanguard Courses suggests that the courses were perceived positively by students on a number of dimensions which would be expected to impact on their capacity to take responsibility for their own learning. It also appears that students' reasons for taking their courses, their academic self-confidence and their beliefs about how much control they have over the outcomes of their learning may be relevant to understanding differences between students on the same courses and their engagement in responsible learning.
- v) In answering the evaluation questionnaires, a majority of students on the courses indicated they had gained confidence in their ability to take responsibility for their own learning. However, in the settings where it was possible to look at change over time in questionnaire measures relating to students engaging in responsible learning there was an apparent drop over time. This can most likely be explained by two important factors: students are making a dramatic transition in their ways of learning during the first semester and thus it is not surprising that their capacity to manage and organise their learning should suffer for a time; the first questionnaire asks students to comment on their prior learning experiences whereas the second asks them to comment on how they are currently learning, it may be that students reflect more positively on prior learning experiences (for example, at school) than when reflecting on their current learning experiences (at the University).

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1. Introduction

The College took the decision in 2004 to investigate the creation of a Learning and Teaching Strategy. A Learning and Teaching Strategy Working Group was set up in October 2004 to formulate a draft strategy, which was reported in May 2005 to the College Undergraduate Studies Committee (CUGSC) and the College Strategy and Management Committee (CSMC). The Strategy was approved in October 2005 and is shown in full in Appendix C.

The underlying rationale for the development of the strategy was that the expectations of both students and employers have changed. University life may now be seen by many as preparation for working life, rather than as a way of becoming knowledgeable about one particular subject. Graduates can often expect to have numerous jobs, and potentially changes of career within their working life. The need to gain and explicitly define transferable skills is now given greater prominence and there is an increasing emphasis on adaptability.

Students in the College come from an increasingly diverse range of backgrounds; a higher proportion are international students, from non-traditional backgrounds, or are disabled. When a particular group of students is in a minority, and where staff are working under considerable pressure, a mismatch between those students' profiles of skills and what is required of them on their courses is more likely to occur. Attention therefore needs to be given to how the strengths of diverse groups of students can best be rewarded and how their particular perspectives can be addressed without placing unrealistic demands on staff time.

The impact of students' increasing technological sophistication and the expectations raised by their prior experiences of a range of online environments were also key concerns behind the strategy. It was felt that there was considerable potential to enhance the use of asynchronous online learning in ways which might better support the needs of our diverse students, and perhaps encourage new students to enrol.

The Learning and Teaching Strategy has been created to give a framework for academic policy making and to drive innovation in learning and teaching in our College. This is not a quick fix but a first step in the substantial process of adapting our perspectives on student learning and our teaching practices. The creation of the Strategy gives our College an excellent opportunity to assess what is working well and what changes might be most appropriate. It provides a framework within which systematic attention can be given to the nature of the teaching-learning environments provided for students and allows much greater potential for systematic support for and evaluation of new initiatives than would otherwise be possible.

Following the development of the strategy, three working groups investigated possible implementation plans in key areas: responsible learning, flexible learning and assessment. Each group found that progress depended on the students taking greater responsibility for their own learning. Responsible Learning was therefore made the central theme for the first stage of the implementation. This involves:

- Establishing greater student self-responsibility for learning.
- Diminishing cultures in which student participation is scrutinized.
- Providing students with guidance, understanding and support that allow them to have a self-awareness of their own progression throughout the duration of a course.
- Structuring course assignments, exercises and materials such that self-learning is actively promoted and that self-review and self-appraisal is central to the learning ethos of courses.
- Modifying the approach to assessment such that its pivotal role is to enable a sense of learning progression, not solely to provide a measurement of competence or a self-fulfilling focus for attainment.

CUGSC agreed that the best model for implementation in 2006-7 was to launch Responsible Learning in a set of “vanguard courses”, covering a wide range of disciplines across the College, followed by extension to other courses.

2. The Vanguard Courses

The principal aim of the vanguard courses initiative is to initiate a cultural shift in students' approaches and attitudes to learning. This will involve modifying the teaching-learning environments of courses together with the education of students such that they feel more prepared to take responsibility for managing their own learning. Each School was asked to nominate courses with "motivated and inspirational course teams who, with the support of their School, are keen to participate in leading this project at first-year level". All but the School of GeoSciences did so. GeoSciences were not able to contribute to the vanguard courses Initiative as the School is in the process of reorganising its teaching; it was considered premature for the School to participate.

The vanguard courses¹ for 2006-2007 were:

Course Title	Course Leader	Semester
Biological Sciences: Molecules and Cells	John Mason	2
Biological Sciences: Origin and Diversity of Life	Keith Matthews	1
Chemistry 1A	Gordon McDougall	1
Chemistry 1B	Gordon McDougall	2
Electrical Engineering 1	Markus Mueller	2
Informatics 1A	Dave Robertson	1
Applicable Mathematics 1	Noel Smyth	1
Mathematical Methods 1	Noel Smyth	1
Applicable Mathematics 2	Noel Smyth	2
Mathematical Methods 2	Noel Smyth	2
Physics 1A	Simon Bates	1
Physics 1B	Phil Clarke	2

The College has used money secured from the Principal's e-learning project fund to employ a College Learning Technologist, Daniela Gachago. Daniela will work closely with the vanguard courses staff to advise and progress innovative methods in their courses. This work will be supported by the Learning and Teaching Strategy Project Officer, Sarah McConnell, and a technology specialist who will be employed as the implementation process progresses. Additionally, Daniela will work with colleagues across the College to support innovation in e-learning. The College has also bought out 20% of the time of Velda McCune, a lecturer in the Centre for Teaching, Learning and Assessment (TLA). Velda has been working with the course teams to support the design, implementation and evaluation of changes intended to encourage responsible learning in the students. The vanguard courses are also supported by developments in the estate, particularly the refurbishment of Appleton Tower, which includes the provision of studio space for group working, and the base stations needed for the personal response system in each of the lecture theatres commonly used by College lecturing staff.

In deciding to launch the vanguard courses in 2006-7, CUGSC was conscious of the shortness of time, but felt that a basic implementation of the Strategy in 2006-7 was preferable to waiting until 2007-8, by which time momentum might have been lost.

¹ A detailed description of the vanguard courses can be found in Appendix A

2.1. The Principles to Guide the Vanguard Courses

The Learning and Teaching Strategy was used as a basis to create a set of principles to guide the development of the vanguard courses. The Principles are grouped under the themes of: assessment, modes of learning and student support. In this section, the themes are considered in turn, drawing on illustrative examples from the vanguard courses. Some of these exemplars were in existence before the courses joined the vanguard initiative, whilst others are new developments. Given the timing of the report, most of these examples are drawn from courses which ran in the first semester of 2006-2007. All of the work on these themes is taken forward bearing in mind the final vanguard principle - the Learning and Teaching Strategy should not be allowed to lead to long-term increases in costs. That is, any investment in one area should be balanced by a reduction in resources elsewhere. The full list of principles is given in Appendix B.

2.2. Assessment

Assessment is one of the key drivers of student learning and considerable attention has been given to assessment and feedback within the vanguard courses. In this section of the report we begin by highlighting aspects of assessment and feedback practices on the vanguard courses which relate to the vanguard principles. We conclude this section by drawing attention to aspects of the vanguard courses which map on to the assessment dimensions of the Learning and Teaching Strategy more generally, rather than to the vanguard principles specifically.

Principle 1. Progression and excellence: Separate elements of assessment should determine a student's fitness to progress, and their achievement of excellence. (These elements might be within the same piece of assessment.) Students should receive feedback on their performance with respect to both of these criteria.

One example of this principle is the tutorial worksheets in Engineering 1 which have been redesigned to give students more guidance as to how to approach problem solving and better feedback on how well they are progressing. The new worksheets typically begin with more accessible problems accompanied by guidance for students about how they might think about and approach the problems. These are followed by progressively more difficult problems which are labelled as to the level of achievement they represent. This approach is intended to encourage struggling students to try to engage with the problems by allowing them to start simply and giving guidance about appropriate problem solving strategies and ways of thinking. The more difficult problems should still stretch those students who are coping better with the course. This approach is intended to also allow all students to gain a clearer sense of how well they are progressing relative to their aims for the course.

Principle 2. Self Assessment: This should occur at suitable points during the course as a routine, rather than extraordinary, element of the assessment structure. Self-assessments should take place after the students have covered the material that relates to a particular learning outcome, so that they can assess their attainment of the learning outcome.

A number of the vanguard courses have been working on the provision of online self-assessment. In some of the courses this has been in place for a number of years. Two key elements of successful provision seem to be the integration of the self-assessment with the course more generally and the provision of useful feedback on students' answers. In Physics 1A, for example, formative self-assessment is taken forward using online multiple choice questions. These questions are fully integrated with online course content and feedback is provided automatically in relation to wrong answers. Lecturers demonstrate use of the online questions and make sure students know the tests are not summatively assessed. More generally, the online aspects of the course are well integrated with the course as a whole. The online materials are used during workshops and staff answer

students' questions online. Students are also required to go into the course WebCT area to access essential information, such as which aspects of their work they will be required to submit for assessment.

Principle 3. Assessment and the curriculum: Formal assessment should reinforce good study habits. Assessments should be structured to ensure that students engage with all parts of the curriculum, and cannot avoid areas with a 'question-spotting' approach.

This principle is still a matter of some debate. Whilst it makes great sense to force students to answer on all aspects of a course which they may require to understand for future years of study, in some contexts choice may be appropriate. Where a first year course covers a broad spread of topics, only some of which may be relevant to a student's future direction, then allowing choice may be appropriate and the educational literature suggests that well considered opportunities for choice can encourage deeper approaches to learning.

In Physics 1A this vanguard principle has been addressed by changing the exam format to incorporate compulsory short answers (previously Multiple Choice Questions (MCQs)) that assess fitness for progression across the entire course syllabus and longer questions that test depth of understanding. In Origin and Diversity of Life the complete range of the course is tested through an MCQ section that accounts for 40% of the exam total. In Applicable Mathematics 1 (AM1) and Mathematical Methods 1 (MM1) all of the examination questions are compulsory and they test the whole syllabus.

2.3. Other aspects of assessment relevant to the Learning and Teaching Strategy

The Learning and Teaching Strategy emphasises the importance of formative assessment which provides students with clear feedback on how their learning is progressing and how they might improve. There are many good examples within the vanguard courses of ways in which students are given useful feedback to support their development. While not part of the formal process of assessment, the use of 'clickers' in many of the vanguard courses provides excellent opportunities for students to get a sense of how well they are progressing. The 'clickers' serve the double function of providing staff with immediate feedback about how well the students as a whole are engaging with a lecture. Considerable expertise is now being built up within in the College in the use of clickers and the design of effective clicker questions.

The use of peer feedback is being explored in a number of courses, including those in Physics and Mathematics. Peer feedback if well designed can have multiple benefits. Students gain feedback on their own and get to look at other students' work, which can help them judge their own progress and get a better understanding of the nature of high quality answers. While there are demands on staff to design effective peer feedback exercises, peer feedback can in principle reduce marking loads.

In AM1/MM1 peer feedback on unassessed tutorial problems has replaced the process in previous years where there were unassessed tutorial problems combined with some assessed questions being handed in during tutorials. This has had the effect of having many more students actually completing all of the tutorial problems in advance of the session. It seems that having peer feedback and having the lecturers emphasising the importance of the tutorial problems has had a very positive effect. This parallels the wider educational research literature in the sense that giving students comments on their work without a summative grade is often seen to have beneficial effects for the quality of students' learning. This is a positive example of how students can be encouraged to take more responsibility for their own learning.

2.4. Emerging themes in Assessment

Reviewing assessment is an important aspect of the vanguard initiative. The inaugural vanguard courses have worked hard to make changes to their assessment, whether that be formative, peer or self assessment. It takes considerable effort to make changes such as redesigning tutorials to incorporate better feedback and rethink how students are led through problem solving exercises, but the feedback from students to staff has been very encouraging. The creation and use of online assessments is increasing, a number of courses now make questions available and this appears to be particularly effective when the online questions are integrated with the wider course resources such as lecture notes, discussion boards and information critical to students such as assessment criteria or scheduling.

A more contentious issue raised by one of the vanguard principles is whether assessments should be structured to ensure students engage with all aspects of the curriculum. Some course teams are not convinced that this principle is right for their courses. A compromise might be that used in one vanguard course that incorporates compulsory short answers focussed on the whole curriculum, with more in depth questions that test depth of understanding and which enable the student to choose topics they find interesting. It is not clear whether it is appropriate for assessments to cover the whole curriculum, it depends on the type of course and whether it is necessary for students to attain all the learning outcomes; this topic will need further discussion.

One across the board success has been the use of clickers. Many vanguard courses are now using these interactive tools in their lectures and find them a useful way of engaging the audience and a way of finding out what the class does and does not understand. Peer feedback is being used by a number of courses. Students appear to find it helpful to get feedback from their peers, and to see how other students are tackling questions. The area of assessment is a key area of development so far in the vanguard courses initiative; we hope that next academic year will see further innovation.

2.5. Modes of Learning

There are two distinctive principles relating to ‘modes of learning’. The first - empowerment of the students - relates to offering students greater choice in how they learn. While offering full choice in modes of learning would not be practicable or desirable for first year courses, increasing the choice available has the potential to encourage students to take greater responsibility for their own learning and to allow a better ‘fit’ between the teaching-learning environment and students from an increasingly diverse cohort.

The second principle focuses on the value of group work for students’ learning. This recognises the growing evidence that providing students with structured opportunities to work together toward shared learning goals can have significant benefits for their academic achievement. At present less work has been done relating to the first principle, whereas group work has been an important focus in a number of settings.

Principle 1. Empowerment of the students: The students should feel that they are responsible for their own learning, taking decisions about how they learn. Where alternative modes of study are available, we should in general not regard a student’s decision not to participate in one mode as a sign of lack of engagement. Nevertheless, where participation in one mode of study is required to attain a learning outcome (e.g. laboratory practical) the students should be required to participate. Detailed guidance will be provided to students to ensure it is made clear which elements it is compulsory to attend.

In Computational Logic, which is part of Informatics 1A, students have for the first time been offered the opportunity to use newly developed course content and online tests in WebCT to replace or supplement lectures and tutorials. The WebCT material was supplementary this year for reasons of compatibility with other parts of Informatics 1A. Nevertheless, about a third of students used the resource and the team are now discussing how to make it a more central part of teaching; retaining the contact with lecturers, demonstrators and tutors but anchoring the contact activity in on-line material rather than in lecture slides. The Informatics team intend to develop these resources in the coming year.

Principle 2. Interactive/group working: Students should be encouraged to work in groups, and supported in this. Students are likely to particularly require guidance in the Semester 1 of their first year.

Student group work in the vanguard courses most commonly takes place within the context of tutorials. Staff in the courses have been considering how best to take advantage of this small group work to help students understand how to think and solve problems within a particular disciplinary context.

Some of the most extensive changes to small group provision as part of the vanguard courses initiative have been taken forward in Electrical Engineering 1 in relation to the changes to the tutorial worksheets described above. A training event for tutors was held led jointly by Dr Markus Mueller and Velda McCune, with guidance from Dr Miesbeth Knottebelt from the TLA Centre. At that event staff teaching the tutorials considered in detail what might influence the quality of students' learning in tutorials and how the tutorial process could be enhanced to encourage greater and more effective interaction between students. The observations of the course team on the new format tutorials are: changing the format of the tutorials resulted in more work for tutors; the assignment hand-in rate and "achievement" seems higher than the previous year; students seem to appreciate knowing what is expected of them.

In Physics 1A the workshop classes, which were introduced in 2002, have been relocated to the new Appleton Tower studio, which has proved an extremely pleasant learning (and teaching) environment. Students frequently cite the workshops as one of the best things about the course. The range of activities in the workshops is kept deliberately broad, focusing on both physics-specific skills and more generic and transferable skills. The online discussion board in this course is also very active with students answering each others' questions. The success of the discussion board seems to be driven by the ways in which the online dimensions of the course are well integrated with the wider learning environment.

In Chemistry 1A tutorials involve small groups, of around 6 students, and tutors are paired: 1 member of staff with 1 postgraduate tutor. This format has a number of potential advantages. It gives undergraduates access to experts in the subject area and to postgraduates who are often closer to them in age and who may find it easier to understand the problems that undergraduate students have with the subject matter. The small groups mean that tutors have an excellent opportunity to surface and engage with students' understanding of key concepts and students views on how best to learn in this context. The paired tutoring also provides opportunities for apprenticeship with less experienced tutors learning from more experienced staff. More generally there is potential for peer feedback between the two tutors.

In AM1/MM1 the tutorials took place in the workshop studios with students working in groups of six supported by one tutor to three groups (in the second semester this was changed to one tutor to

two groups to help manage tutor workload). This, in combination with peer feedback, has increased the level of interaction between students about course content.

2.6. Emerging themes in Modes of Learning

Modes of Learning are an area that has provoked keen interest from the course teams. Some courses now offer alternative resources online to enable students to have more choice in how they cover the course content, and how they interact with the course team.

Group work is an area that has provided substantial advances in the methods used by course teams. Lecturers in one course have completely redesigned their tutorials to lead students through increasingly more difficult tasks. These changes have resulted in an improved hand-in rate and “achievement” on the course is higher than the previous year.

Changes to the estate have improved the learning-teaching experience for staff and students. The new interactive workspaces available in the Appleton Tower studio are being used by many courses to good effect. These positive changes in modes of learning must be built on to continue to improve the learning experience of our students.

2.7. Student Support

The principles relating to student support recognise the challenges faced by students in coming to terms with new ways of learning as they make the transition to University. They take into account that students need support and guidance to help them to become more effective learners. While the responsibility for the quality of students’ learning is always to some extent shared between staff and students, it is important that students become increasingly able to regulate their own learning and to judge their own progress over time. The first of the student support principles relates to an expectation that students will be ‘professional’ in their approach to their studies.

Principle 1. The “professional student”: As this style of learning is different from the students’ experience at secondary school, and in other university courses, they will need to be educated in this new style of learning, by a suitable induction process, and receive appropriate support during their studies. Staff will provide an encouraging environment for students as they commence vanguard courses, with the expectation that less support will be required as students start to take responsibility for their own learning. They will need to be aware of our expectations of them, and to have an understanding of learning as a process.

The essence of this first principle is the notion of gradual transfer of responsibility coupled with opportunities for students to reflect on their learning processes. The long-established system of study skills support relating to the Origin and Diversity of Life course represents a well-integrated and embedded approach to reflection on learning. Expectations of students are made clear at the start of the course and aspects of study skills are tackled within tutorials. This system is then backed up by experienced Senior Tutors who can provide additional guidance and support. The Senior Tutor role is one way in which a member of staff in the subject area can also build up expertise in relation to student learning. This offers the potential for focused and nuanced guidance to students which can be difficult to deliver without this combination of subject area and student learning expertise. The educational literature suggests that embedding support for effective learning within courses in this way is much more effective than generic study skills advice.

A different and potentially very fruitful perspective on the 'professional student' is to consider students' identification with professional roles and how this might impact on their engagement with their studies. Feeling more like a scientist or an engineer and less like a student may encourage undergraduates to take on board the value of responsible learning as such responsibility accords well with professional values. This angle is being explored in Chemistry 1A where the first lecture introduces students to the range of roles a chemist may have in the workplace and the wider industrial context of course content is often mentioned during lectures. Towards the end of the programme of laboratory classes students have the chance to investigate more open ended questions, which may give them an early opportunity to imagine themselves in the scientist role. The 'bunsen learner' study skills and advice web site set up by Chemistry students is an example of students beginning to take on collective responsibility for the quality of their learning; it would be worthwhile considering how such initiatives could be supported and encouraged in other settings.

The second principle relating to student support considers pastoral care. Again there is a balance to be struck between encouraging students to reflect on their own levels of participation whilst being sure that any serious pastoral problems will be identified and an appropriate response made.

Principle 2. Pastoral care: We need to aim for a supportive environment, but one that puts the responsibility for seeking support firmly on the students. The activities of individual students may be monitored, but this information should be fed to the students to allow them to decide themselves whether they should change their participation. They should not be contacted by Directors of Studies if they do not attend academic activities. Of course, we must remain alert for evidence of serious pastoral problems.

This principle has been enacted in both Electrical Engineering 1 and Chemistry 1A by stopping the recording of attendance at lectures although Directors of Studies will continue to follow up on problems with attendance at laboratory classes in Chemistry.

2.8. Emerging themes in Student Support

Student support is a critical factor in retaining students and ensuring they achieve their potential at our University. The changes to student support focus on providing the necessary support to enable students to become responsible learners. In many courses this means attendance is no longer monitored but support is still available to students who are struggling. Many courses include sections that show the link between the course and potential roles in the workplace; this may help students to identify what they eventually hope to aim for when they complete their course, which could be a motivating factor.

2.9. Conclusions

All of the Vanguard Principles have been enacted in at least one of the Vanguard Courses and there are a number of promising indications that the Principles are supporting developments in courses which will enhance the quality of students' learning. The Principles relating to self-assessment and interactive/group working have received the most attention, whereas it has been less common to offer students choice between alternative modes of learning. The Principle relating to assessment and the curriculum seems to be the most contentious with some debate about whether it always makes sense to offer no choice on examination questions.

3. The evaluation of semester one vanguard courses

3.1. Overview of the evaluation strategy

The overall evaluation strategy for the vanguard courses is based on questionnaires given to all of the students on a course and group interviews with a subset of students. One questionnaire is given at the beginning and one at the end of each course and the questionnaires are intended to give an overview of the students' learning processes and what might influence how they engage with their studies. A more detailed description of the questionnaires is given in Appendix D. The interviews are intended to allow richer insights into the students' experiences, allowing them to explain in their own words and at greater length what matters for their learning. The findings from the interviews will be reported at a later date.

3.2. Quantitative data: initial findings

A detailed overview of the questionnaire data collection across the vanguard courses in semester one is presented in Appendix E. Only two subject areas, mathematics and physics, were able to collect sufficient data from students to allow any cross comparison between the beginning and the end of the semester and the comparative data in physics is rather limited. The most successful strategy for collecting more complete data was where the data from both questionnaires were collected in class time and it will be important to pursue this strategy rigorously if sufficiently good data are to be collected over time to allow an effective ongoing evaluation of the vanguard courses. Despite these problems with the data set, it was nonetheless possible to perform some valuable initial analyses.

Pooling the data across the courses allowed an analysis of the relationships between the students' scores on different parts of the first questionnaire, as illustrated in Table 1. The Spearman rank correlation coefficients indicate a modest positive relationship between having more intrinsic reasons for taking the course, and being more confident academically and students' rating themselves more highly in relation to responsible learning. It seems plausible that there would be a two way relationship between responsible learning and confidence, as more confident students may be more prepared to take responsibility and taking responsibility successfully is likely to engender confidence. The correlations also suggest that believing that you can influence the outcome of learning by trying harder or adapting how you study relates to responsible learning. This makes intuitive sense as there would be no point for a student in monitoring and adapting his or her learning if success was seen as determined fully by a level of ability that could not be changed. The strength of these correlations is typical of what one would expect from data of this kind but it is perhaps best not to read too much into the exact values as these are likely to be affected by the phrasing of particular questions and the suitability of the questions for particular contexts.

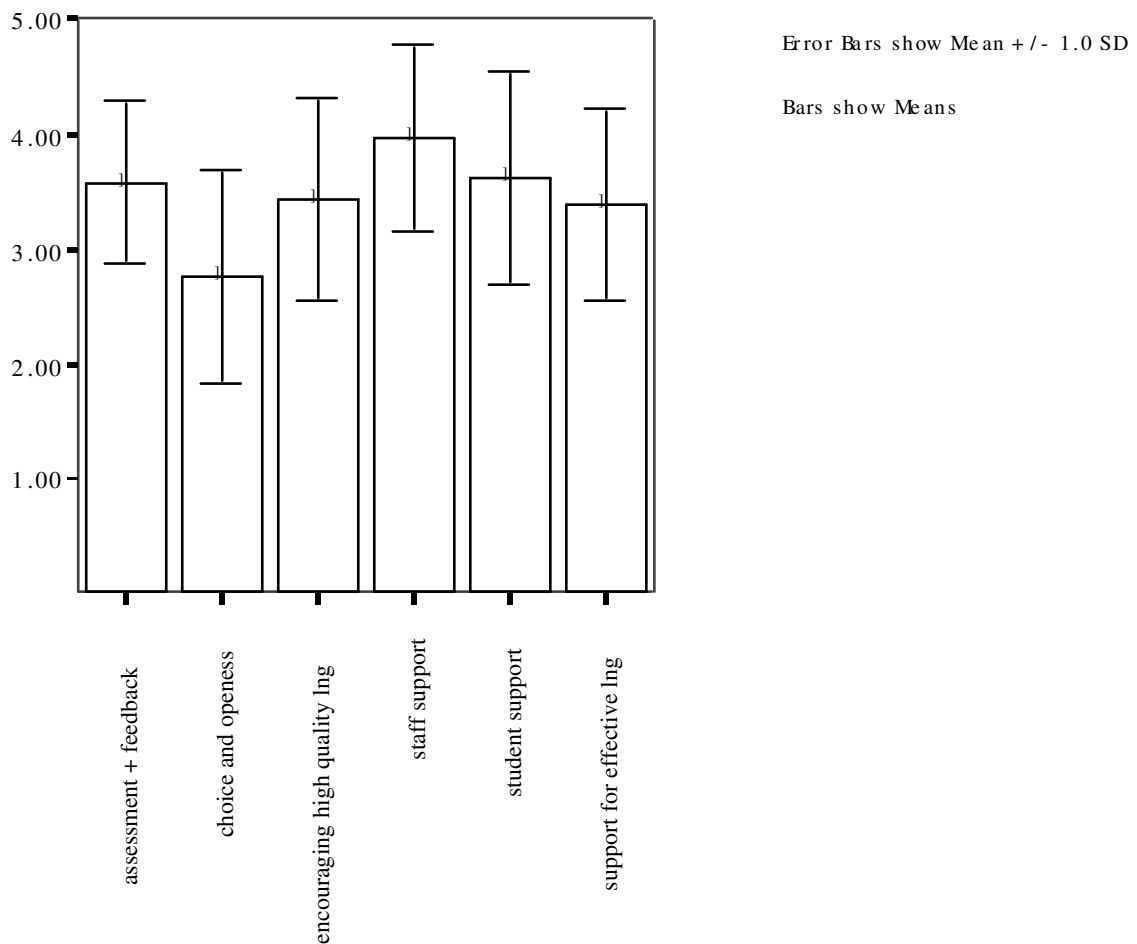
Table 1 Correlations between measures of responsible learning and other aspects of students' learning

(The scores are Spearman rank correlation coefficients All correlations are significant at $p < .01$, 2-tailed)

Measures of responsible learning	Possible influences on responsible learning		
	Intrinsic reasons for taking course	Academic self-confidence	Success relates to effort/adaptation
Monitoring studying	.30	.28	.41
Organised studying	.25	.21	.25
Effort management	.30	.30	.34

It was also possible to get some sense of the students' perceptions of the vanguard courses and how these relate to measures of responsible learning in the second questionnaire. Figure 1 shows the means and one standard deviation for the students' scores on the measures relating to their perceptions of all semester one courses with data available. This presents a positive picture of the courses, with all of the means lying above the midpoint on the scale, with the exception of choice and openness. These findings are broadly commensurate with data collected from successful first year courses as part of other research conducted by staff from the TLA Centre (see www.ed.ac.uk/etl for details). The lower scores on 'choice' are typical for first year courses, which tend to have more fixed curricula and learning activities.

Figure 1 Data relating to students' perceptions of semester one courses.
 (Means and one standard deviation on a 1 to 5 scale where higher scores indicate more positive perceptions)



The relationships between measures of responsible learning from the second questionnaire and students' perceptions of their courses were considered to give some initial indication of how these aspects of the courses might impact on students' learning. The correlations presented in Table 2 suggest that all of the dimensions of the students' perceptions of the courses are related to their engagement in responsible learning, particularly the students' perceptions of assessment and feedback practices. It is quite likely this is a two-way process, as students who are more organised about their learning may well experience their courses more positively. Once more robust longitudinal data have been collected it may be possible to shed more light on these interactions.

Table 2 Responsible learning scales against students' perceptions of their courses.
(The scores are Spearman rank correlation coefficients all correlations are significant at $p < .01$, 2-tailed)

N = 538 Measures of responsible learning	Students' perceptions of their courses					
	Assessment and feedback	Choice and openness	Encouraging high-quality learning	Staff support	Student support and group work	Supporting effective learning
Monitoring studying	.45	.16	.38	.34	.25	.33
Organised studying	.33	.13	.26	.21	.22	.33
Effort management	.37	.16	.35	.27	.22	.38

Given the emphasis on responsible learning within the vanguard courses initiative a closer analysis was made of the item: 'This course has made me more confident in my ability to take responsibility for my own learning.' The percentages of students agreeing somewhat or agreeing with this item ranged from 59% to 88% across the four courses for which there were data on this item. It does not make sense, however, to directly compare the courses given that variable response rates may well mean that only the more successful or committed students completed the questionnaires in some courses.

The data from Physics 1A and AM1/MM1 allow a comparison of the students' scores on the responsible learning scales between the beginning and the end of the semester. These findings are set out in more detail in Appendix E. The analysis indicated that the students rated themselves lower on responsible learning at the end of the semester. At first sight this is rather surprising, given that the students perceived both the physics and the mathematics courses positively. One possible explanation for this drop is that students tend to rate their learning more positively when they are asked to comment retrospectively on their prior learning experiences - as they were on the first questionnaire - as compared to when they are reflecting on their current learning.

This effect of the questionnaire design may not, however, be the full explanation. The drop in scores in Physics 1A and AM1/MM1 was larger than in data collected from another research project using similar questionnaires (www.ed.ac.uk/etl). A possible explanation for this discrepancy is that the vanguard courses considered here are first semester first year courses, unlike any of the courses sampled in our other data sets. Given that students are making a considerable transition it is not surprising that their management of their learning should suffer, even when their courses are supportive.

3.3. Conclusions

As the data set currently stands it is only possible to draw tentative conclusions about the impact of the vanguard courses. Overall, the courses seem to be well received by students in ways which would be expected to encourage responsible learning and there is some evidence that the courses do increase students' confidence in their capacity to learn independently. The analysis has also identified aspects of students' views about learning and reasons for taking their courses which provide some insight into why students on the same course might differ in their engagement in responsible learning. It is hoped that future data sets will allow comparison between: vanguard and non-vanguard courses; the same courses before and after they become vanguard courses; and the same students on different courses. At that point stronger conclusions may perhaps be drawn.

APPENDIX A: Detailed information about the Vanguard Courses

General Information	
Name of course	Origins and Diversity of Life, School of Biology
Course Organiser	Dr Keith Matthews
Semester	1
Enrolment	463
Teaching methods	5.5 hours teaching time per week.
Assessment methods	40% coursework, 60% degree examination
Exam formats (do they have optional elements)	MCQs and 6 SAQs (this comprising a choice of 2 SAQs in each of 6 subdivisions of the course)

Vanguard Course Principles

Assessment: Students are assessed by three pieces of in-course assessment: 1) write a scientific paper in accepted scientific format; 2) an extended essay; 3) submission of practical books. MCQ accounts for 40% of exam total.

Self-assessment: Lecturers have created self-test MCQs delivered in WebCT to coincide with the lectures. Eight MCQs are randomly generated from a pool of forty questions. The MCQs are made available for exam revision. This resource was well used (in a random sample of MCQs related to various lectures between 141 and 290 students completed each of them at least once).

Modes of Learning: Tutorials provide support material for lectures and assessments. Peer review and small 'chat-room' discussion groups are planned for next year.

Student Support: Well integrated and embedded approach to reflection on learning: expectations of students are made clear at the start of the course and aspects of study skills are tackled within tutorials.

Course Organisers comments

What are the **unique attributes** of the course that influences your teaching methods?

This course is the first that students encounter at University. Allowance has to be made for their diverse prior knowledge and prior teaching and learning methods. The course is also very large (usually >500 students).

Aspects of the course that made it **easier** to apply the Vanguard Course principles?

The size of the course, and requirements for electronic submission of ICA work, mean that students rapidly become familiar with communication and feedback via WebCT-type resources. The course has enthusiastic and energetic staff and student demonstrators.

Aspects of the course that made it **challenging** to apply the VC principles?

The number of students in each lecture (~250 or more) make interactive learning methods (e.g. use of clickers) quite disruptive. For this year, the notice for inclusion of ODL in the Vanguard project was very short, limiting what could be achieved.

Any particular **innovations** in your course?

Self assessment via MCQs and self-test quizzes on WebCT was well suited to a course of this size. It required minimal effort to set-up, no staff monitoring or feedback, but was well used.

General Information	
Name of course	Informatics 1: Computational Logic
Course Organiser	Dr Dave Robertson
Semester	1
Enrolment	150
Teaching methods	6 hrs teaching time per week.
Assessment methods	Written examination 75%. Assessed assignments 25%
Exam formats (do they have optional elements)	No optional elements.

Vanguard Course Principles

Assessment. Regular coursework assessment interleaving with the Functional Programming section of the course.

Self-assessment. Multiple choice questions for each major component of the course, designed to test that the learning outcomes of appropriate sections have been achieved.

Modes of Learning. Students have for the first time been offered the opportunity to use newly developed course content and online tests in WebCT to replace or supplement lectures and tutorials. Students alerted to the likelihood that it usually takes some time to understand the relatively abstract course content

Student Support. Demonstration sessions where advice associated with course components on technical issues is provided. Attendance monitored tutorials at which self-study efforts are discussed and checked.

Course Organisers comments

What are the **unique attributes** of the course that influence your teaching methods?

This is the first Informatics course (and one of the first courses at University) encountered by the students. Bottom line is that students must learn a number of mathematical techniques but to motivate these requires showing their relevance to science and technological applications.

Aspects of the course that made it **easier** to apply the Vanguard Course principles?

Before the Vanguard Courses initiative much of the course material was online but structured and presented in a traditional style.

Aspects of the course that made it **challenging** to apply the VC principles?

Vanguard approach had to be phased in first year to avoid disrupting established pattern of coursework.

Any particular **innovations** in your course?

We made a strategic decision in first year not to innovate radically because of the need to “bed down” the material with the other, interleaved section of the course.

General Information	
Name of course	Two Semester One Courses: Mathematical Methods 1 (MM1); Applicable Mathematics 1 (AM1)
Course Organiser	Dr Noel Smyth
Semester	1
Enrolment	480
Teaching methods	2.5 hrs teaching time per week for each course
Assessment methods	Each course: Coursework: 15% Degree Examination: 85%
Exam formats (do they have optional elements)	All 15 examination questions are compulsory. The questions themselves are short.

Vanguard Course Principles

Assessment: All of the examination questions are compulsory and they test the whole syllabus. Three tests or quizzes are run in the studio session marked by the tutors and returned to the students. The mark contributes 15% of the final grade. Tutors are assigned to groups of students (~20) and the tutor monitors activity and engagement of the students. This is recorded as a series of “ticks” on a chart. The expectation is that most students have the maximum number of “ticks”.

Self-assessment: Weekly assessments replaced with self-assessments peer marked in studio session.

Modes of Learning: The tutorials are in the Appleton Tower workshop studios with the students working in groups of six supported by one tutor to three groups (in the second semester this was changed to one tutor to two groups to help manage tutor workload). This, in combination with peer feedback, has increased the level of interaction between students about course content. A number of tutorial problems are assigned each week. The students then worked in the tutorial session to peer mark their colleagues’ answers (no grades are given or recorded and the marking is completed under full supervision). This worked very well and almost all students attempted the set questions. The three semester tests were run, marked and graded. The overall coursework pass rate was about 84%.

Student Support: Maths base: drop in centre in the Appleton Tower where first year students can come any time to work and/or ask questions on first year maths courses. It is manned most of the day either by staff or postgraduate students. Custom textbook with answers to problems

Course Organisers comments

What are the **unique attributes** of the course that influences your teaching methods?

The students are taking mathematics to apply to their subject areas. As such, they need to know how to apply and use mathematics without knowing detailed theory.

Aspects of the course that made it **easier** to apply the Vanguard Course principles?

The course is about learning techniques and this is done by the students doing examples until they are familiar with the material.

Aspects of the course that made it **challenging** to apply the VC principles?

Many students do not see the need to learn mathematics and are therefore disinterested and lack motivation to learn.

Are there any particular **innovations** in your course? Large reduction in volume of summative assessment, replaced by formative assessment, peer marked. Use of pro-forma quizzes.

General Information	
Name of course	Physics 1A, School of Physics
Course Organiser	Dr Simon Bates
Semester	1
Enrolment	236
Teaching methods	6 hrs teaching time per week.
Assessment methods	Weekly assignments: 33% Degree Examination: 67%
Exam formats (do they have optional elements)	Degree exam comprises short answer questions (no choice, 8/8) and long answer questions (2 from 4)

Vanguard Course Principles

Assessment: The exam now includes compulsory short answers that cover the entire syllabus; longer questions test depth of understanding.

Self-assessment: The course includes compulsory diagnostic tests used by students at entry and pre-exam. The course continues to excel in the use of clickers, reporting very positive results from students. Online MCQs are included at the end of each section of content throughout the course. Students make extensive use of the question bank. Course support team are developing a tool to allow students to query a database of students' responses to common questions; enables students to review their own performance.

Modes of Learning: Workshops run in the interactive studio in Appleton Tower. Focus on physics-specific and generic transferable skills. There has been a very positive response to the workshops from students. Peer assessment exercises have students marking each others work, with help and guidance from staff and demonstrators. Illustrates to students what makes a good answer.

Student Support: Extensive use of discussion boards for support and answers to queries
Tutor-facilitated self-study groups for students having problems with certain topics (elective).

Course Organisers comments

What are the **unique attributes** of the course that influences your teaching methods?
Long standing use of online support materials and learning technology in support of teaching.

Aspects of the course that made it **easier** to apply the Vanguard Course principles?
The course has enthusiastic and energetic staff and student demonstrators.

Aspects of the course that made it **challenging** to apply the VC principles?
None

Any particular **innovations** in your course?
"The best of both worlds"; marrying the real and the virtual learning environments together.
Strategies for interactive engagement (e.g. clickers and workshops particularly).

APPENDIX B: The Principles to Guide the Vanguard Courses

Assessment

- 1. Progression and excellence:** Separate elements of assessment should determine a student's fitness to progress, and their achievement of excellence. (These elements might be within the same piece of assessment.) Students should receive feedback on their performance with respect to both of these criteria.
- 2. Self Assessment:** This should occur at suitable points during the course as a routine, rather than extraordinary, element of the assessment structure. Self-assessments should take place after the students have covered the material that relates to a particular learning outcome, so that they can assess their attainment of the learning outcome.
- 3. Assessment and the curriculum:** Formal assessment should reinforce good study habits. Assessments should be structured to ensure that students engage with all parts of the curriculum, and cannot avoid areas with a 'question-spotting' approach.

Modes of Learning

- 1. Empowerment of the students:** The students should feel that they are responsible for their own learning, taking decisions about how they learn. Where alternative modes of study are available, we should in general not regard a student's decision not to participate in one mode as a sign of lack of engagement. Nevertheless, where participation in one mode of study is required to attain a learning outcome (e.g. laboratory practical) the students should be required to participate. Detailed guidance will be provided to students to ensure it is made clear which elements it is compulsory to attend.
- 2. Interactive/group working:** Students should be encouraged to work in groups, and supported in this. Students are likely to particularly require guidance in the Semester 1 of their first year.

Student Support

- 1. The "professional student":** As this style of learning is different from the students' experience at secondary school, and in other university courses, they will need to be educated in this new style of learning, by a suitable induction process, and receive appropriate support during their studies. Staff will provide an encouraging environment for students as they commence vanguard courses, with the expectation that less support will be required as students start to take responsibility for their own learning. They will need to be aware of our expectations of them, and to have an understanding of learning as a process.
- 2. Pastoral care:** We need to aim for a supportive environment, but one that puts the responsibility for seeking support firmly on the students. The activities of individual students may be monitored, but this information should be fed to the students to allow them to decide themselves whether they should change their participation. They should not be contacted by Directors of Studies if they do not attend academic activities. Of course, we must remain alert for evidence of serious pastoral problems.

Resources

The Learning and Teaching Strategy should not be allowed to lead to long-term increases in costs. That is, any investment in one area should be balanced by a reduction in resources elsewhere.

APPENDIX C: The Learning and Teaching Strategy

The Learning and Teaching Strategy will increase the students' sense of responsibility for their own learning, permit diversification in teaching practice, and bring forth a reduction in formal teaching and summative assessment.

The College of Science and Engineering adheres to the following principles.

- **The Scholarship of Teaching and Learning**
 - We are committed to the scholarship of teaching and learning. As academics, we will learn how to develop our teaching approaches in order to achieve better learning by our students, and to help them to develop as effective and independent learners.
- **Learning with Enquiry**
 - We are a scholarly community based on enquiry, and on generating knowledge. Students will be made familiar with the scientific method from the beginning of their studies; there will be a strong strand of learning with enquiry (learning to ask the right questions) at all levels, integrated where possible with our research activities.
- **Personal Learning**
 - Our learning environment, and the requirements and expectations that we communicate to students, will be designed to ensure that they are given, and feel, a genuine responsibility for their own learning, seeing rewards and benefits from effectively managing their activities, and negative consequences from failing to do so.
- **Collaborative Learning**
 - Collaborative learning of an informal nature will be encouraged and study-support measures will be designed with that in mind. Where possible, our degree programmes will contain significant elements of formal collaborative learning, supported by academic staff and by flexible computer-based interactions.
- **Flexibility of Learning Styles**
 - Wherever possible, learning opportunities will respond to the variety of students' circumstances, experiences and aptitudes.
- **Assessment for Learning**
 - In pre-honours years, preparedness to progress to the next level and excellence will be assessed by separate elements of summative assessment. The extent of formal summative assessment will be the minimum required for these purposes. Students will monitor their own learning by self-assessment.
 - In honours years, summative assessment will be the minimum required to assess the students' achievement. Students will monitor their own learning by self-assessment.
 - All assessment should be formative, in the sense that students receive feedback on (or can self-assess) their performance.

APPENDIX D: The Questionnaires

These evaluation tools are based on existing questionnaires from the student learning research literature, modified to suit the purposes of this project. The questionnaires draw particularly on the work of the Enhancing Teaching-Learning Environments in Undergraduate Courses (ETL) Project (www.ed.ac.uk/etl) funded by the Economic and Social Research Council. Both questionnaires incorporate items designed to measure responsible learning, to allow the possibility of detecting change over time. The first questionnaire also taps into several aspects of students-as-learners which might be expected to influence their willingness to take responsibility for their own learning.

The second questionnaire asks students to report on their perceptions of the courses, again with a focus on aspects of those courses which would be expected to impact on responsible learning. Tables 3A and B summarise the two questionnaires and includes sample items. Each item is answered on a 5 point scale from agree (5) to disagree (1). The individual items have been grouped together on the basis of a statistical and conceptual analysis of their inter-relationships.

A small number of the perceptions items were omitted from the analyses included in this report as they did not apply across all of the courses. The questions about extrinsic reasons for taking the course and beliefs about responsibility were not included in the analyses, due to problems with the strength of the correlations between questions intended to tap into the same underlying theme. These scales will require to be redeveloped for future data collection.

Purpose	Scale Name	Sample Items
Measure responsible learning	Monitoring studying	If I'm not understanding things well enough when I'm studying, I try a different approach.
	Organised studying	On the whole, I'm quite systematic and organised in my studying.
	Effort management	I generally keep working hard even when things aren't going all that well.
Measure possible influences on responsible learning	Learner responsibility beliefs	It's up to me to look for links between ideas, I don't expect staff to do all of this for me.
	Teacher responsibility beliefs	Staff should explain clearly what is important on this course and what is less important for me to know.
	Success relates to adaptation	If I find parts of this course difficult it's just because I need to adapt how I study.
	Success relates to effort	If I find it hard to understand things on this course, that's OK, I'll just try harder.
	Academic self-confidence	I expect to find the set work for this course well within my capabilities.
	Intrinsic orientation	I'm looking forward to this course because I'm really interested in the subject area.
Extrinsic orientation	I just want to pass this course, it's not that important to me to do well on it.	

Table 3A: Scales within the first questionnaire with sample items

Purpose	Scale Name	Sample Items
Measure responsible learning	Monitoring studying	If I've not understood things well enough when I'm studying, I've tried a different approach.
	Organised studying	On the whole, I've been quite systematic and organised in my studying.
	Effort management	I've generally kept working hard even when things aren't going all that well.
Measure students' perceptions of the courses	Assessment and feedback	The feedback given on my work helped me to improve my ways of learning and studying.
	Choice and openness	We were given a good deal of choice over how we went about learning.
	Encouraging high-quality learning	Having taken this course, I'm closer to being able to think like a scientist/engineer.
	Staff support	Staff tried to share their enthusiasm about the subject with us.
	Student support and group work	Talking with other students helped me to develop my understanding.
	Supporting effective learning	This course has made me more confident in my ability to take responsibility for my own learning.

Table 3B: Scales within the second questionnaire with sample items

APPENDIX E: Additional Evaluation Data

Table 4 summarises the data collection from vanguard courses in semester one. The response rates were rather variable and were problematically low in some settings. The most successful strategy for collecting more complete data was where the data from both questionnaires were collected in class time and it will be important to pursue this strategy rigorously if sufficiently good data are to be collected over time to allow an effective ongoing evaluation of the vanguard courses. Future analyses will also need to consider which students are completing the questionnaires. It may be, for example, that more successful students are more likely to be in class to respond to the data collection.

Course	N students on the course	Questionnaire 1 (N and response rate)	Questionnaire 2 (N and response rate)	Questionnaires paired (N and response rate)
Computational Logic (Informatics 1A)	152	7 (5%)	48 (32%)	2 (1%)
Applicable Mathematics 1 + Mathematical Methods 1 ²	482/492	381 (79%/77%)	341 (71%/69%)	259 (54%/53%)
Origin and Diversity of Life	454	203 ³ (45%)	64 (14%)	29 (6%)
Physics 1A	229	116 (51%)	85 (37%)	35 (15%)

Table 4: Summary of questionnaire data collection in semester one

² The data collection was combined for these two courses as most students take both courses, the tutorials are taken together and the overall teaching methods on the two courses are similar.

³ These data were collected some weeks after the start of the semester.

Figures 2A and 2B show means and 1 standard deviation on the scales relating to responsible learning for Physics 1A and AM1/MM1 respectively. The scores on the same scales at the beginning and end of the semester are shown side by side. These were the only two settings in which sufficient data were collected to allow such a comparison over time. The reasons for the drop over time in students' scores on responsible learning are discussed in the body of this report.

Figure 2A A comparison of responsible learning scores over time in AM1/MM1
 (Means and one standard deviation on a 1 to 5 scale where higher scores indicate greater responsible learning)

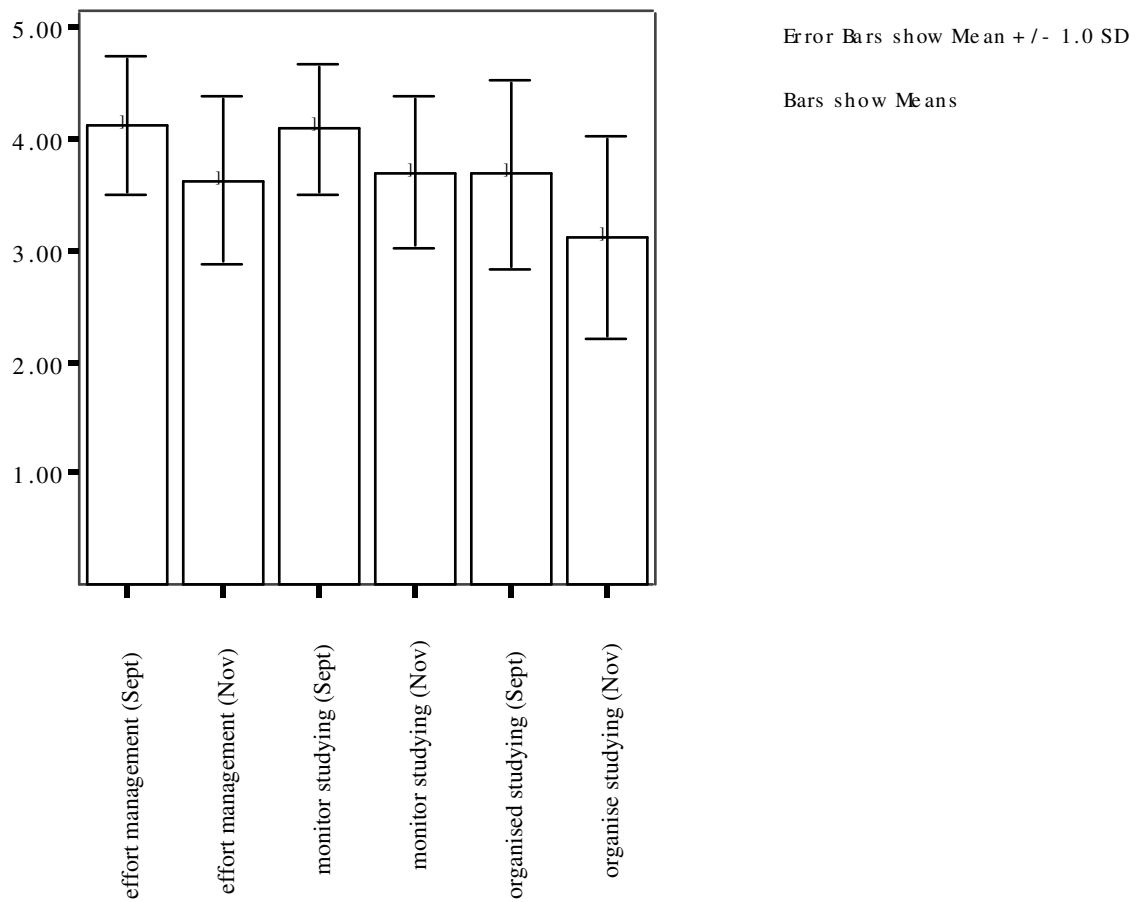


Figure 2B A comparison of responsible learning scores over time in Physics 1A
(Means and one standard deviation on a 1 to 5 scale where higher scores indicate greater responsible learning)

