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Strengthening student engagement with quantitative subjects in a Business Faculty

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ABSTRACT

This paper reflects on the results of research undertaken at a large UK university relating to the teaching of quantitative subjects within a Business Faculty. It builds on a simple model of student engagement and, through the description of three case studies, describes research undertaken and developments implemented to strengthen aspects of the model, enhance student engagement and help meet the requirements of employers in terms of graduate skills. The paper also outlines some areas for future research.

Keywords: Student support; formative assessment; student engagement; curriculum development.

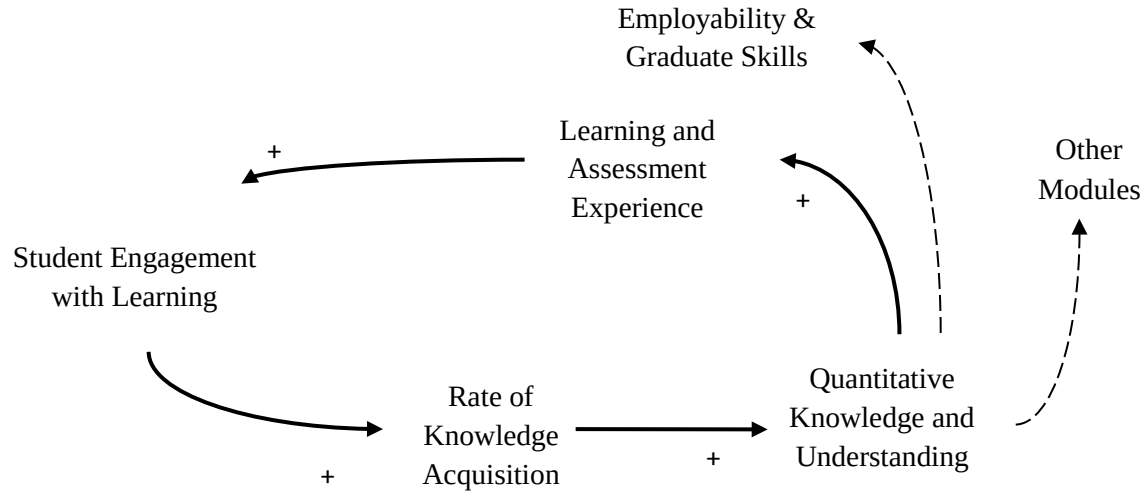
JEL Classification: M40
PsycINFO Classification: 3530
FoR Code: 1301; 1501

Background

In a recent article by Kirkham (2013) a theoretical model was developed that can be used to enhance the design and assessment of accounting practice sets at a time when there is greater diversity in the student body in higher education (HE) than ever before. In this paper we also consider a consequence of diversity within the context of the teaching of quantitative subjects - subjects which extend across nearly all departments within the Faculty of Business. The Faculty of Business has a broad mix of students which is typical of the university as a whole. Latest figures for the university show that nearly 40% of students are aged 30 or more and that 52% of students are from an ethnic minority (LSBU, 2014). Such diversity can mean that there are students who have been away from education for a considerable time, who have entry qualifications that were obtained in education systems outside the UK, or who may have had very poor (or possibly very good) experiences of mathematics education previously. As a consequence a lecturer is often faced with a class of students who, although having the required entry qualifications, have a wide range of educational experiences, prior knowledge, drive to succeed, knowledge of HE, self-confidence etc. We believe that it is the variability from one student to the next, rather than the average ability across a class, that causes pedagogic problems and requires that quantitative curricula need to be carefully designed and delivered.

Over the last few years a number of research projects have been undertaken within the Faculty of Business to explore the teaching of quantitative subjects from three interrelated perspectives: student support, formative assessment, and curriculum design. Some of this research has been completed and the outcomes implemented within Faculty of Business curricula, some is currently underway and some is planned for the future. The underlying principle for all of the research work discussed in this paper is that of establishing a positive feedback loop as described in Figure 1. In this loop the solid arrows identify the feedback loop (Warwick, 2010) and the "+" signs indicate that increasing (or decreasing) the tail concept of an arrow will lead to an increase (or decrease) in the head concept of the arrow. In this way we are able to express some simple cause and effect relationships. In its positive sense this loop becomes a virtuous circle of improvement. Of course it can also become a vicious circle of degradation in which poor experiences lead to reduced engagement which further worsens the experience and ultimately the student may fail or withdraw. In Figure 1 the dashed lines link to concepts that indicate desirable related outcomes – i.e., that core skills and knowledge in quantitative subjects link with and support other modules and enhance graduate employability.

Figure 1:
Core Feedback Process adapted from Warwick (2010)



In order to try and ensure that the loop remains of the virtuous type, the Faculty has undertaken research to ensure that key components of the core loop are supported and encouraged to increase in strength. As mentioned previously these interventions refer to student support, formative assessment, and curriculum design. To illustrate this work this paper describes three case studies – one for each intervention. The intention is to give a flavour of the teaching scholarship being undertaken within the Faculty to address some of the key issues identified in the teaching of quantitative subjects to our diverse student body. Where a case study refers to research that has already been implemented then reference is given to the relevant publications so that the reader may follow these in more detail if desired.

THE PROBLEM

Within the UK there have been for some years a number of issues related to the teaching of quantitative subjects at all ages which have collectively become known as the 'mathematics problem'. There has been much criticism from employers about the ability of graduating students to meet the challenges of an information rich society, specifically the graduates' abilities in information processing, data analysis and general mathematical skills of logical thinking and analysis. Furthermore, HE academics have also bemoaned the lack of quantitative skills shown by applicants for places with HE Business Faculties so that even though these applicants have the required entry qualifications there is still a need to run support classes in mathematics (Paton, 2012). This problem exhibits itself on courses that are heavily dependent on mathematics (such as engineering and science, finance and accountancy) and also on those courses where mathematics is a necessary supporting subject (such as business, or nursing). Thus facing difficulties with student transition from school or college into HE and from HE into the world of work course tutors have a number of issues to resolve to ensure that both transitions can be made as seamless as possible for the student. These issues include:

1. Improving mathematical self-efficacy and reducing anxiety;
2. Designing appropriate student support mechanisms;

3. Designing the taught curriculum to include the requirements of all stakeholders;
4. Designing assessment strategies that include assessment for learning as well as assessment of learning;
5. Measuring knowledge deficiencies among new students;
6. Academic staff development.

In 2004 the UK Government commissioned a report on the teaching of mathematics at all levels (Smith, 2004). In the decade since, a number of recommendations from that report relating to the teaching and assessment of mathematics have been implemented and while there has been some improvement in the numbers of students studying quantitative subjects in HE, the general perception remains that developing and maintaining an interest in mathematics among younger students and developing higher level quantitative skills is still problematic and requires support (Matthews et al., 2012). An additional problem highlighted by Smith was in making the study of quantitative subjects relevant to the lives of students and their future careers. This opens an additional set of issues relating to curriculum development: the general skills and attributes required by employers; the quantitative and soft skills set required for work in business, IT, accountancy or management; the technical skills required for specific roles within the business sector; and the skills required for continued personal development after formal education has ended.

In terms of the issues described above, we now present three case studies. These engage specifically with items 1-4 on the previous list i.e., with mathematics support and development, curriculum design and stakeholder (including employer) engagement, and formative assessment.

CASE STUDY 1 – ENHANCING MATHEMATICS SUPPORT

Although priding themselves on their diverse student intake, many UK HE institutions accept that students enter HE through a variety of educational routes, sometimes with poor prior learning experiences. Within the Faculty of Business poor retention and progression statistics across a range of modules led to the review and subsequent revision of a number of quantitative modules that were core to a range of undergraduate courses and therefore fundamental in laying firm mathematical foundations for future work but which repeatedly had poor pass rates (<60%) and student evaluations.

Until then, research work described in the literature (and the practice at many institutions) had tended to concentrate on deficits in mathematical knowledge as indicated by entry qualifications or early rigorous diagnostic testing (Pell & Croft, 2008). However even with these types of intervention pass rates on these modules remained stubbornly poor as were student engagement and attendance. Within the Faculty of Business, as elsewhere in the UK, soft attributes such as student expectations, mathematical anxiety or self-efficacy (Bandura, 1997) had not been explored as diagnostic indicators of performance nor were they seen as core to engagement and performance.

Reflecting on the disappointing results of more 'traditional' teaching approaches, the teaching team were able to develop a level 4 mathematics curriculum and pedagogy that integrated new material with mathematics support, explored student expectations, enhanced self-efficacy and reduced anxiety, resulting in real changes in the attitudes of students towards mathematics and their levels of anxiety and self-efficacy (Warwick, 2008a, 2012). This had a direct and positive impact on knowledge acquisition (see Figure 1).

The modules are team-taught with a delivery model which eschews large lecture presentations favouring smaller groups each with a dedicated tutor. Reflecting differing learning styles, material is delivered with a variety of activities (based on the Kolb cycle) so that the weekly sessions mixed new material, worked examples, practice questions and reflection with the tutor able to supply one-to-one support if required. This is supported with a richly populated VLE. All students attend timetabled mathematics support session so that support is not viewed as an 'add-on', but an integrated part of their learning experience (voluntary centrally resourced 'drop-in' sessions were found not to be successful for the weaker students). Sessions cover basic topics and students who pass one of the (optional) mathematics 'driving tests' were not required to continue attending. Experience shows though that support sessions are very successful and although many students pass their 'driving test' during the year, many choose to continue attending. Student feedback on these sessions has been extremely positive ("*I really like the way supporting sessions were run, they helped me grasp what was going on.*") and initially virtually all students showed increases in periodic assessment scores (Warwick, 2008b) and continue to do so.

To illustrate the integration of self-efficacy, the literature describes four key sources of self-efficacy evidence: subject mastery, verbal feedback, vicarious experience and physiological and affective states. The curriculum and illustrative applications help to show the relevance of the modules and engender interest in the topics (physiological and affective states) while the small group teaching and broken style help students to work collaboratively and with the tutor (enhancing vicarious experience and verbal feedback). The regular formal assessment points and the 'driving tests' assist students in evaluating their subject mastery. The assessment profile (using multiple choice quizzes, work books and longer coursework questions) reflects earlier research on student learning which confirmed the impact on student satisfaction of the timing of recommended reading and assessment deadlines as well as the decreasing marginal benefit derived by weaker students as assessments lengthen. Student feedback on assessment has been positive: "*Your overall grade is split and you do three pieces of work and hand them in. You get the feedback and then do the next three. It's just the timing and everything. It's the best on the whole course*".

Since implementation of the new curriculum and support sessions evaluation statistics across the modules show that the average pass rate increased from below 60% to 86%, and that 86% of students rated the quality of the module as 'acceptable' or better, with corresponding satisfaction figures of 86% for the quality of lectures, and 83% for the difficulty of assessment. As a crude measure of engagement, 70% said the module held their attention over the year and impact has been sustained with evaluation now regularly meeting university KPI's for progression (70%) with student feedback scores above sector norms.

In recent module evaluations, students commented that: "*I feel a lot more confident because I feel it's just so well organised and the material we did learn wasn't too hard. It was challenging but it was doable.*" and "*I wasn't that good at mathematics but since I joined the university my tutor, and the way he teaches has really encouraged me in mathematics nowadays so I feel really good and felt that I chose the right course.*"

CASE STUDY 2 – IMPROVING CURRICULUM DESIGN

One of the key issues in establishing a good curriculum design is in identifying and meeting the requirements of internal but particularly external stakeholders. These will include, of course, the employers of graduates, but also those professional bodies and associations who may offer necessary professional accreditation needed by successful

graduates. For business students these external stakeholder requirements can be of significant importance and this is particularly true in accounting and finance education. In this second case study we describe some recent research which is beginning to explore the gap between the management accounting curriculum taught in HE institutions and the work of practitioners, defined here as those working in a management accounting role in small to medium sized enterprises (SME's). These organisations form the major source of employment for accounting and finance graduates from the Faculty of Business.

Research (Howard & Warwick, 2013) shows differing opinions of management accounting between educators and practitioners when, for example, ranking the importance of management accounting topics or in ranking the importance of graduate skills. This difference impacts the delivery and content of the management accounting curriculum within HE institutions. Research conducted in management accounting education has found that what educators feel is important in educating management accountants is not the same as what practitioners think the role requires. A New Zealand study by Tan et al (2004) ranked the importance of management accounting topics and found that educators considered the three most important topics to be behavioural implications, activity based costing and performance evaluation while practitioners ranked these areas 19th, 9th and 4th respectively. Fowler (2011) repeated parts of this study looking at the changing views of practitioners and educators between 2001 and 2010 and found that there was still a vast difference between management accounting topic rankings by practitioners when compared to educators.

Thus studies identify a gap between the practitioners' and educators' opinions and clearly show a difference in opinion between what educators believe is required and what practitioners want from graduates. Where such gaps exist there is a clear weakness in the curriculum design process. The overarching purpose of any undergraduate taught curriculum must be to enable the transition of graduates into suitable employment and yet we observe that, certainly in the case of management accounting, there is a disconnect between the expectation and the reality of the curriculum. We have begun to look at the "gap" within the context of curriculum development and explored two approaches to curriculum development that could form the basis of a new model.

The Hilda Taba model (Taba,1962) is a very structured view of curriculum development. It draws on knowledge about the subject area, the students and the wider society and acknowledges that educators should have the responsibility for course development. Curriculum design is viewed as a process of induction through which the curriculum is constructed once appropriate information has been gathered although there is an implicit assumption of consensus among stakeholders.

The Hunkins Deliberation model (Ornstein & Hunkins 2013) is a more student focused process, allowing for a dynamic curriculum development process. It allows for the possibility of initial uncertainty about what is to be achieved and recognises the likelihood of subjectivity and differences of opinion among stakeholders. As a consequence of recognising multiple stakeholder perspectives the curriculum design process includes a period of deliberation that needs to be undertaken during the development phases and well before any considerations of implementation. Furthermore, the deliberation stages can take as inputs the experiential life situations of all stakeholders including those of potential students.

The above mentioned research that identified the "gap" looked at a number of stakeholders including practitioners, students and educators. The studies carried out were from an inductive view point building theoretical results that were designed to be fed back into curriculum development. The studies show that stakeholder identification

is crucial and is consistent with the Taba model and the Deliberation model. Both support curriculum development consultation and stakeholder involvement, however, the employer as a stakeholder is not specifically identified in these curriculum development models.

Reviewing further work by Gammie et al, (2002), and Fowler (2011) relating to graduate skills has identified further issues both with the definition of certain soft skills and the skills required by practitioners. Taken together with the curriculum content gap a number of issues arise that require further research and exploration.

First is the issue of defining the content of an undergraduate curriculum. Our work in exploring the literature of management accounting education has highlighted a lack of clarity in defining both the management accounting topics and graduate skills that stakeholders have been asked to specify as a necessary part of the curriculum. The implication here is that curriculum development must be an inclusive process – inclusive of all stakeholders – and there must be continuous reflection and review of the curriculum as it develops both prior to implementation and after implementation. Hence a new curriculum development model based around those of Taba or Hunkins would be a good starting point.

Second, we would contend that the drivers of curriculum development in many institutions (including our own) may be the requirements of the professional bodies and other quality assurance benchmarking statements. There is no doubt that in many business subject areas the professional exemptions that may be given as part of an undergraduate course are an attraction for potential students at a time when there is great competition for students among both the university sector and the growing number of private education providers. Of course the professional bodies and other regulatory agencies have an important voice in curriculum design but not at the expense of a more inclusive curriculum development process. Stakeholder identification is vital within the curriculum development process and should reflect a mix of employers with a mix of academic profiles, employer's background, organisation size, industry etc. Furthermore we feel this should include the experiences of past students at different stages of their professional career.

Third, educators will need to explore ways in which academic content and the graduate skills are delivered. While a good curriculum development model can give us confidence that we are 'teaching the right content' it cannot ensure that we 'teaching the content right'. This requires development of an effective learning and teaching strategy and of good classroom practice. Hand in hand with good curriculum design goes staff development. As Gammie observed (2002) "academic members of staff who are involved in the programme must be carefully selected". This is particularly true of graduate skills development in students and it may be necessary to assess the capabilities of academics within an accounting and finance department in terms of the delivery of skills rather than techniques. A final consideration here is the placement of skills development within the curriculum. Should there be a separate skills development stream as in Pang & Hung, (2012) or should the skills development be embedded within the programme?

The issues highlighted in this case study are not felt to be unique to accounting and finance. Similar problems will exist across the range of subject areas within the Faculty of Business and so developing a curriculum development model that can alleviate some of these issues is of great importance and will help to strengthen student engagement with learning in Figure 1.

CASE STUDY 3 – ENHANCING FORMATIVE ASSESSMENT OPPORTUNITIES

A number of authors have written about the importance of formative assessment as a means for engaging students with material in a practical way and enabling learning in a variety of modalities (Yorke, 2005; Brown, 2005; Diefes-Dux *et al*., 2012; Vonderwell & Boboc, 2013). Our University's 'Students First' agenda for improving student satisfaction has generated revisions to undergraduate curricula within the Faculty of Business that aim to reduce the volume of summative assessment, improve retention rates and enhance the Faculty's National Student Survey scores for assessment and feedback which remain an area of weakness. The Faculty is using formative assessment as a driver for these changes but has traditionally not used it specifically within its teaching of quantitative methods. Thus we have embarked on a review and development of formative assessment within curricula across the Faculty of Business with a view to supporting students in their academic development through the provision of feedback, in a variety of forms, on practical assignments. The aim of this work was to explore practical approaches to formative assessment that can be utilised in the teaching of quantitative subjects across the Faculty. Specifically the project constructed and implemented a model of student engagement with assessment that:

a) Reflected the developmental nature of knowledge building in quantitative subjects;
b) Encouraged self-assessment and reflection;
c) Addressed student motivation, self-efficacy and self-esteem issues as well as learning and performance;
d) Provided feedback that addressed issues of quality from a process, lecturer and learner perspective;
e) Engaged teaching staff in a learning dialogue with students.

Working with a range of academic staff and focus groups of students we were able to identify some key issues that we felt needed to be addressed and these are illustrated in the rich picture of Figure 2.

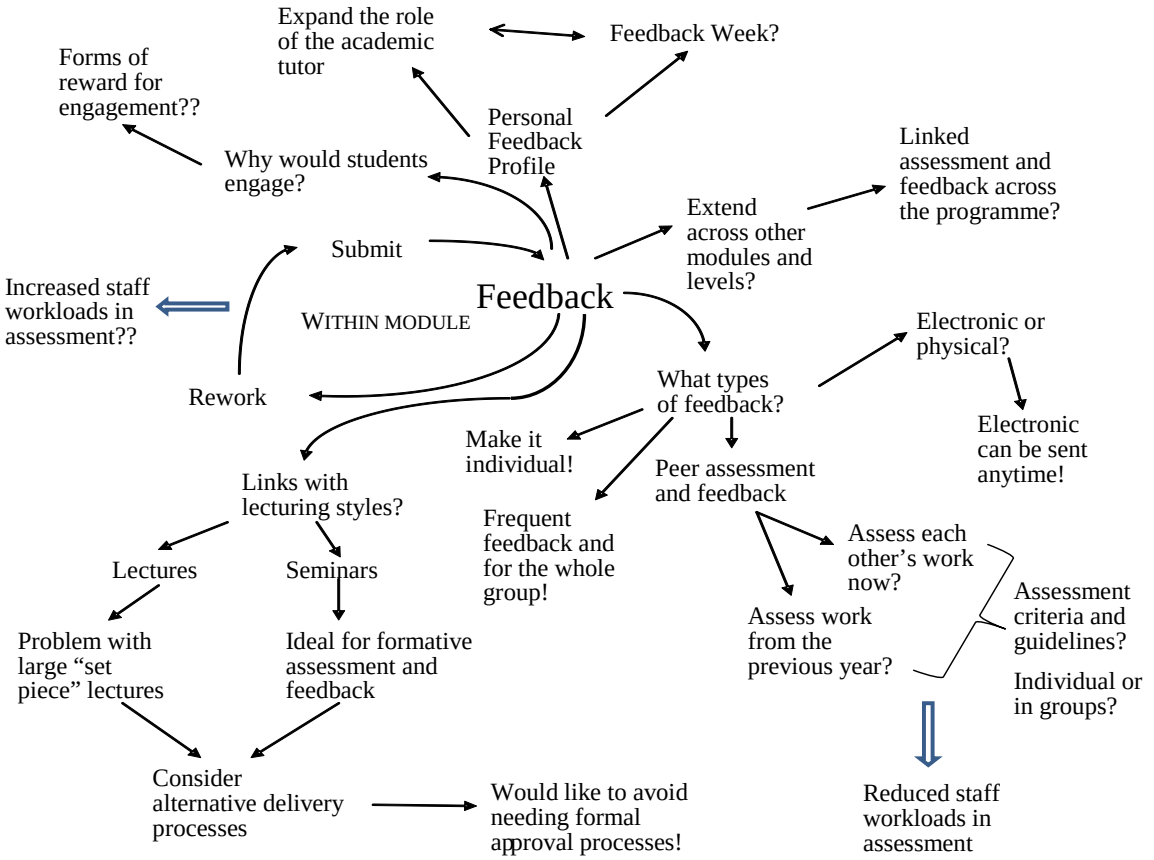
Identifying key objectives from Figure 2 and exploring the best practise available in the literature at the current time we identified seven approaches to formative assessment which could be offered to staff for application in a range of modules across the Faculty. The models that were piloted were:

1. Publishing exam solutions and publishing coursework solutions. These solutions will be published online for students to work with outside of class time.
2. Staged assessments including formative elements building to a summative assessment. Elements of coursework to be structured in such a way as to include formative stages with feedback provided to students. This will be primarily written and verbal feedback where this is an in-class activity and will use online feedback where the feedback is provided outside of class time.
3. Peer assessment. Reviewing the work of fellow students or the work of previous students. In some modules this will be undertaken by students working in groups to review submissions from students the previous year and generating written comments, in other modules this will take the form of online student assessment of the work of their peers.
4. In-class consideration of draft work. Students will have the opportunity to present draft work for consideration by the tutor who will give simple verbal feedback on the work to individual students.
5. Generalised weekly feedback made available to the whole class. A summary of the students' work in class and the common issues that arose in practical

sessions will be provided online to all students following the end of each week's class.

6. Sampled seminar work to be commented on and reviewed. Some student work will be sampled each week and the tutor will provide in-class feedback in written form (as an indicative mark) and also general verbal feedback for the whole group.
7. Feed-forward. Formative and summative commentary to be used to build on successor modules. Some modules form a clear path of learning activity such as a research methods module that leads into a dissertation module and students will use the formative feedback provided on the prior module to help structure their learning in the successor modules.

Figure 2:
Rich Picture of Key Issues of Focus in the Exploration of Formative Assessment Methods



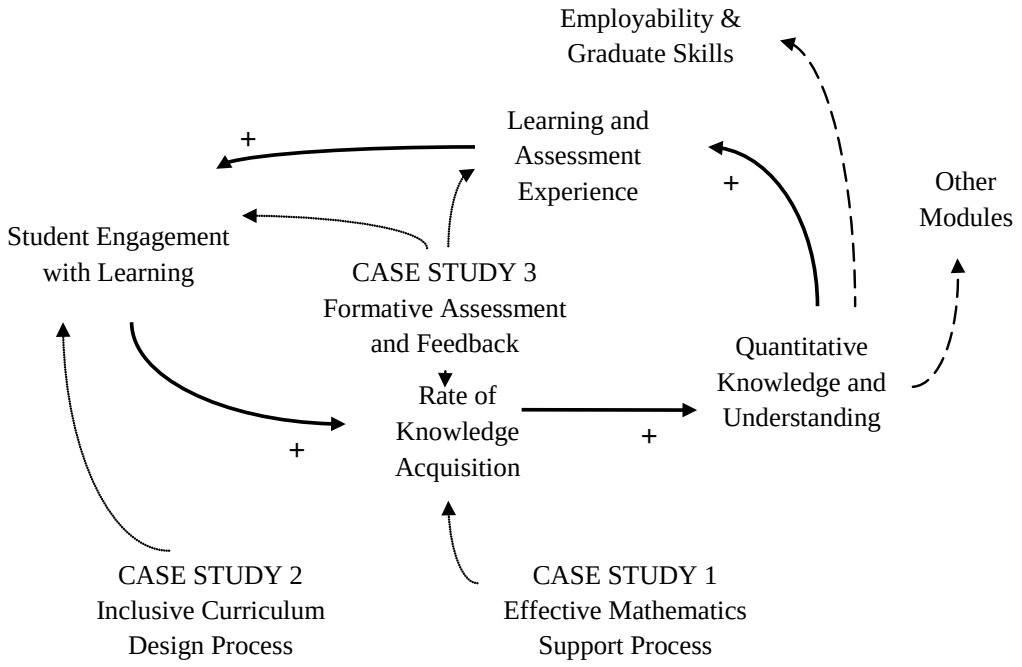
Using these seven methods of formative assessment has been most effective helping to improve the learning experience of students and the teaching experience of staff. Comments from colleagues who have piloted these methods of formative assessment include "*I love the assessment dialogue I now get with my students"* and "*I found the engagement of students a compelling argument for more formative feedback*". Students were also positive: "*Getting regular comments from the teacher helped me improve my marks.*" Formative assessment can be placed at the heart of Figure 1 as it has wide impact on the core feedback process.

CONCLUSION

In this paper we have given examples of the ways in which we are attempting to develop an approach to learning and teaching which is based around a very simple feedback model of student engagement. Although the model is simple, the student body is diverse and the variety of prior educational experiences, entry qualifications, and the personal, family and financial demands made on our students leaves them exposed to the possibility of failure through a lessening of engagement with their studies. Of course there are some demands made on the lives of students which we can do nothing about as an HE institution, but we can try to ensure that we have in place a curriculum that is fit for purpose, formative assessment methods that are both supportive and improving for the student, and academic support processes that can provide a safety net for students not just in terms of content knowledge, but also in developing perceptions of efficacy and reducing anxiety.

This paper has briefly described three case studies – areas of research which are targeted at specific key points of the engagement feedback loop. These are illustrated in Figure 3.

Figure 3
Research Support for the Student Engagement Feedback Loop



Although each case study is specific to a subject area or group of modules, the general approach of each is transferable across subject domains within the Faculty. For example, the curriculum development model under consideration in the accounting and finance area will have just as much relevance to other subject groupings within the Faculty of Business such as management or business IT as these have just the same external stakeholder requirements.

Bringing together the outputs of pedagogic research in such a way as to strengthen what we see as the core elements of student engagement has three primary

advantages. Firstly it helps to focus often scarce resources into areas with demonstrable leverage on the student experience; secondly, the impact of such practical research is often immediate with student feedback providing rapid indications on the value of the interventions and possibilities for applications across subject areas; thirdly, it identifies directions for future research with an associated knowledge base of evidence and impact. These are often key in seeking resources for further research either internally from an institution or externally.

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