2006

Introducing Flexibility into an IS Curriculum

Martin Atchison
Monash University, martin.atchison@sims.monash.edu.au

Christabel Gonsalvez
Monash University, chris.gonsalvez@sims.monash.edu.au

Introducing Flexibility into an IS Curriculum

Martin Atchison, Christabel Gonsalvez

School of Information Management and Systems
Monash University, Melbourne, Australia
martin.atchison@sims.monash.edu.au, chris.gonsalvez@sims.monash.edu.au

Abstract

This paper deals with the problem of enabling and encouraging diversity and the development of specialist skills in undergraduate teaching. It describes an innovation in which a flexible curriculum component was added to the course structures of two IS-related programmes at a large Australian university. The paper concludes that the approach which it describes can help to accommodate diversity in student interests and aptitudes, and prepare students for a range of possible professional career paths, while also providing them with the greater depth of specialist knowledge which makes them more immediately useful members of the work force.

Keywords

IS Education, IS Curriculum, Studio, Studio-based teaching, Curriculum, Flexible curriculum

INTRODUCTION

This paper deals with the problem of enabling and encouraging diversity and the development of specialist skills in undergraduate teaching. It describes an innovation in which a flexible curriculum component was added to the course structures of two Information Systems (IS) related programmes at a large Australian university. The innovation has now been in place for several years, and the paper summarises experiences to date and the lessons learned from them.

The paper opens with a review of the factors contributing to the need for flexibility in IS curricula, and the perceived inadequacies of current curriculum structures to meet them. Section 3 explains the rationale for the approach to introducing a flexible component into course curriculum. It briefly describes the degree programmes into which it was introduced and the way in which it was implemented. The main outcomes from the implementation are summarised in Section 4, and Section 5 reviews the key issues which have emerged to guide future related work in this area.

BACKGROUND

The Problem, Our Educational Philsophy And Purpose

It is a truism to say that IS is a very diverse field. Components of an IS curriculum draw on influences from the physical sciences, the humanities and the social sciences. The discipline attracts students with varied aptitudes and interests, and its graduates embark on career paths which encompass a wide range of sub-disciplinary and cross-disciplinary specialist skills. Furthermore, the rate of change in the discipline and its related disciplines is so rapid that professionals working in IS must be very adaptable and must be able to develop new specialist skills to meet the changing needs of the work place.

The literature on IS curriculum reflects the breadth of the discipline (see for example, Arnott et al 1996, ACM 1999). There are a number of fundamental topics which appear consistently in model IS curricula, but beyond these there is a very wide range of additional topics which compete for inclusion, and whose place in the curriculum is dependent on the focus of the course.

It is not the purpose of this paper to explore the philosophical, educational and vocational issues around what should be included as mandatory components within an IS curriculum. However we believe that the range of views as to what could or should be included in an IS degree reflects the need for a curriculum to be flexible and open to the inclusion of material covering a wide range of topics. A good IS curriculum should be able to reflect the diversity of the discipline and should cater for the variety of aptitudes and interests of its students, and the variability of their desired career outcomes. It should make students aware of the wide ranges of career choices available to them, alert them to the need for them to chart their own career paths, and encourage them to be willing to explore new areas and to develop specialist skills.

There are many indications in the IS education research literature that these objectives are not being met to the extent which we would like (see, for example, Lee et al 1996, Doke & Williams 1999). At ACIS 2000, industry

representatives on an IS curriculum forum commented on the lack of specialist knowledge amongst IS graduates, and on the inability of many graduates to be able to articulate a clear sense of what skills they could offer a prospective employer, and what sorts of roles they saw themselves taking up in their careers as information professionals (ACIS 2000).

A key problem in changing this situation is the limits which the bureaucratic structure of a university imposes on the amount of flexibility which can be built into a university course. As a mass education provider, the university tends to encourage a standardisation of courses and subject content which cannot readily adapt to change. The committee approval processes which most universities require as a means of quality control necessitates long delays in bringing about significant changes to subjects. We are not trying to suggest that standardisation of course content and thorough approvals mechanisms are necessarily a bad thing, but for all the good they may bring in terms of quality control, they also act to inhibit the incorporation of flexibility into course and subject curricula.

In our experience, the two main methods which have been used in the past to give students greater diversity of curriculum and greater scope to develop specialised skills have been the use of elective subjects and the use of project-based subjects.

Providing elective subjects as part of a course structure enables students to diversify and develop specialised skills and knowledge in particular areas. However our experiences of offering elective subjects for this purpose has highlighted a number of shortcomings:

- the establishment and resourcing of elective subjects creates a significant teaching load which can only be justified if the subject attracts sufficient students;
- once established, the elective subjects themselves suffer from the problem that their structure and content are relatively fixed and inflexible, and cannot readily be adapted to different student needs;
- finally, and most importantly, the fact that electives are not core elements of the course means that students tend to treat them in isolation from one another and from the core components of the course. It is difficult for students to integrate their knowledge and understanding from the electives into the core.

Project-based subjects are another approach which has been used to enable greater flexibility for students to focus on areas which interest them. Project-based subjects enable students to learn the skills of system development in depth, usually by applying them to the practical development of a system. As well as learning to apply some of the core IS development skills in practice, the students get an opportunity to take on roles within the project team which they enjoy or which suit their career aspirations. However, although the project-based subject gives some scope for flexibility, in our experience it too has shortcomings:

- the nature of the projects limits the type of work which the student groups can do;
- the constraints of each project limit the range of roles which are available for each student group;
- the composition of the project team limits the freedom of students to take on the role of their choice.

Thus, although the use of both electives and project-based subjects can offer significant benefits, both fall well short of meeting the need for curriculum components which allow true freedom of choice within the confines of meeting course objectives.

With these problems and needs in mind, we set out to try to establish an approach for making a course curriculum more flexible. We aimed to provide students with elements in a course structure which better suited their aptitudes, interests and career aspirations, while still ensuring that they have a strong set of basic skills to meet fundamental professional requirements.

A Possible Remedy And Its Implementation

The approach devised was introduced as part of several new studio-based subjects in undergraduate teaching. The introduction of more flexibility into the curriculum was one of a number of features of the studio-based subjects which differentiated them from traditional university class teaching. Studio teaching has long been a key element of teaching in the creative arts, and its implementation is gaining recognition in IT teaching (see, for example, Docherty et al 2001). The rationale behind the studio-based approach, and details of its implementation in our degree programs can be found in Arnott & Atchison (1997) and Gonsalvez & Atchison (2000).

The basic curriculum elements of the studio subjects operate in the same way as 'normal' subjects; students are given a set of standard seminars and/or lectures with an accompanying standard set of mandatory core tasks. However, beyond that basic material, students are given the freedom to choose their own tasks to perform in the areas of the discipline which most interest them. These tasks may focus on any topic deemed relevant to the curriculum; they may be done individually or as part of a group project; they may be done as one major project or as a number of small tasks. The split in work load between the mandatory and student-selected specialist

components varies according to the year level, with the amount of mandatory work generally decreasing from first to third year. In some cases students have been given permission even to use parts of the specialist tasks as substitutes for the mandatory core tasks because of the degree of overlap, and the suitability of the nature of the specialist task in assessing mastery of the core tasks.

In regard to the teaching staff's role in the students' specialisations, formal class teaching is minimal. The teacher's role is more akin to that of a supervisor of a research project, assisting in mapping out an appropriate body of work, discussing the relevance to core material, highlighting the links to mandatory themes and supplying technical expertise when necessary. As the students' levels of maturity and competence increase through the course, the nature of the teacher's role changes. As one of our colleagues memorably put it in an address to first year students: "At the beginning of this year I am your coach, but by the time you get to third year, I want to just be the cheer leader standing on the side line urging you on".

Throughout the year students are required to display and make class presentations of their work, discussing what they are doing and how it fits within the disciplinary framework of the course. A key aim is to ensure that even though students may be pursuing different individual interest areas, they can all see how their specialist work and the specialist work of their peers fits within the overall framework of professional practice in the discipline.

At year's end each student presents a portfolio of their work demonstrating their knowledge and skills and explaining how the work they have done has prepared them for professional practice. This work is examined by a panel of assessors with expertise in the range of topics covered by the students' work.

To date, studio subjects with flexible curriculum components have been used as a major component of two undergraduate degree programmes, and on a slightly more limited scale in a third. The authors have had significant involvement in the implementation in the first two of these, and it is our experiences in these degrees that form the basis of the remainder of this paper. Details of the degrees and the degrees and the way in which the flexible curriculum component was implemented are as follows:

- Bachelor of Multimedia (BMM): This was a completely new degree which was envisaged from the time of its inception as having a very strong multi-disciplinary focus. The degree was set up as a shared programme to be run jointly by the Information Management and Systems Department from the Faculty of Information Technology and the Design Department from the Faculty of Art and Design.

  The need for the flexible content and assessment component was seen as being particularly important in the BMM. The aptitudes, interests and career aims of students attracted to a multimedia degree vary to a much greater extent than in most degree courses (Gonzalez et al, 2000). Once they graduate they will work as members of multimedia development teams which require an extremely broad range of specialist skills among their team members (see, for example, England & Finney 1996). Therefore, it was seen as essential that the degree cater for the widest possible range of specialist skills within a basic framework of generalist knowledge.

- Bachelor of Information Management and Systems (BIMS): This was also a new degree in name and structure, but it differed from the BMM in that it had two antecedent degrees, the Bachelor of Information Management (BIM) and the Bachelor of Information Systems (BIS), which shaped its structure and content. The focus of the BIM had been primarily on information management tasks relating to records management, archives and librarianship. The BIS had been a more traditional IS degree oriented towards system development process and analytical and design techniques. The new BIMS degree aimed to bring these two streams together into a combined degree.

  Although the disciplines and sub-disciplines involved in the BIMS are much more closely related than those contributing to the BMM, there are still distinct differences in the aptitudes and interests which students bring to the course, and in the career outcomes to which graduates might aspire. Again the aim was to continue to allow students to pursue specialist interests within the broad degree framework.

Implementation of the flexible curriculum component within the studio subjects is now in its fourth year in the BMM and in its second year in the BIMS. Although the details of the implementation have varied between the degrees, the basic concept remains the same. In each case, the studio component of the course comprises a full-year studio subject which constitutes 25% of the workload in each year of the degree. All other core subjects in the degrees run as 'normal' subjects with fixed curricula and standard assessment tasks for all students.

OUTCOMES

Evaluation of the outcomes to date has been done by means of formal surveys of students, informal feedback and by assessing the quality of work which has been produced. As is often the case with teaching innovation, there are many difficulties involved in making a precise assessment of the outcomes of this new teaching approach. In particular, in this case, rigorous evaluation has been hampered by a number of factors:

- the flexible curriculum component has been introduced at the same time as a number of other changes to curriculum and teaching methods, which makes it difficult to isolate the effects of the flexible curriculum component alone;
- there have been significant variations in the details of the way in which the approach has been implemented in different years, across different year levels and across the two degrees;
- a complete assessment of the success of the program requires a cohort of students to undertake the entire degree program using the new approach; so far only one cohort of BMM students have done so, while the implementation for the BIMS has been in place for only one year.
- the fact that both the degrees in which the approach was implemented were new degrees means that there are no 'control' groups of past students with whom comparisons of student results could be compared.

Consequently, the observed outcomes (both positive and negative) have to be treated with caution. However the following points have emerged.

Student response

As an educational idealist one might hope that all students would respond to being given greater freedom of choice with enthusiasm and an increased sense of responsibility over their own destiny. To some extent this has happened, but, as is usually the case, the reality has been slightly less than the ideal, with responses ranging from extremes of reluctance and caution to extremes of enthusiasm.

At the positive end of the scale almost all students have indicated that they have enjoyed having some say over the direction of their education. They have felt that their ability to choose areas of study that they believed suited their career interests would make them more marketable when they graduated. It has also improved their confidence that they are better prepared to deal with life in the workforce where they will need to be able to work independently and pick up new skills with little or no direction. They were better able to appreciate what they were good at and how best they could contribute to a project team in a professional environment.

Invariably students have chosen areas of study which they liked or excelled in, which generally led to further improvement in their performance in these areas. Over a period of time this has led to many students coming to be regarded as the class 'experts' in their chosen area of interest, and being called on for advice and assistance by their colleagues. Students have found it very satisfying to be regarded in this way. Not only have they enjoyed sharing their knowledge, but they have often acted as mentors for other students who were afraid to venture into that area. In some cases this has even reached the point of them offering semi-formal 'tutorials' to help other students. In general it has helped create a better shared learning environment for all the students. This success has generally helped to improve their education outlook, and has frequently led to improvement in their course outcomes.

On the negative side, some students have found it very disconcerting to have to make choices about what they are going to study. (This phenomenon had also been evident in the past when students have been required to choose elective subjects). This form of response usually seems to be based around:

- habit - the students are accustomed to an educational environment in which they are told what they must do;
- ignorance - the students' understanding of the discipline is still too limited for them to be able to make an informed choice. (This is particularly a problem for students in the early years of the BIMS who are very unclear about aspects of IS and IM);
- uncertainty - students can't decide what they are really interested in - either because they are not interested in anything or they are equally interested in a range of things;
- fear - students are concerned that they may make the 'wrong' choice and in so doing damage their career prospects.

Problems have also arisen in some cases where students have becoming excessively enthusiastic at the freedom of choice which they have been offered. These problems include:

- taking the freedom they have been given as licence to do whatever they like, regardless of its lack of relevance to the aim and purpose of the degree;
- taking on tasks which are too difficult, as a consequence either of over-estimating their own abilities or underestimating the complexities involved;
- over-indulging in their area of specialisation, and neglecting other core areas of study because they were enjoying their specialist work so much that they could not be bothered with anything else.

Various management strategies have had to be developed and implemented to deal with these problems. In some cases the problems were anticipated and plans were in place in advance to deal with them, but in other cases, this

was not so, and remedies had to be found 'on the run'. It should be stressed that although these problems have been different to the 'standard' problems which are experienced in running normal subjects, they have not posed significantly greater difficulties for teaching staff to manage. The main problem for staff has been to learn what to expect and to have strategies in place in advance. Once this was done, the problems have been dealt with satisfactorily each year.

Staff response

Like students, the academic staff involved with the subject have responded with attitudes which have ranged from tentativeness and reluctance through to great enthusiasm.

Some staff have felt uncomfortable about the idea of taking on a subject which has aspects whose basic philosophy and teaching approach are different to what they are accustomed (this has also been heightened by their uncertainty over some of the other innovative aspects of the studio subjects). Staff who are used to a fixed subject content and pre-planned classes have felt uneasy about the freedom given to students to choose their own direction, and the resultant sense of a lack of control over students. The potential benefits of the approach seemed vague and nebulous to them when compared to the certainties of standard classroom teaching.

The nature of the teaching work involved was also unfamiliar to many staff. As mentioned earlier, the amount of front-of-the-class teaching is considerably reduced and the role of the teacher is more akin to that of a mentor. This imposes a different set of requirements to normal lecturing duties. Staff need to be able to deal with a greater amount of one-to-one interaction with students, and be more creative and flexible in their management of each student's work. An unexpected outcome was the concern expressed by some staff when students in the later years of their course began to achieve extremely high levels of competence in their (the student's) chosen area of specialisation. Unlike our colleague quoted in the previous section, these staff found it somewhat threatening to be dealing with students who had begun to match their knowledge of some aspects of the discipline.

The additional work load involved in managing the flexible curriculum component also caused problems. Initially teaching staff loads for studio subjects were allocated on the same basis as for normal subjects. Staff quickly became aware that the teaching effort to manage a subject with significant levels of flexible content was much greater than normal, and many accordingly reacted against it. Steps have now been taken to increase levels of teaching support to the subjects and adjust teaching staff loads to reflect the actual work load.

Unexpectedly, some of the strong supporters of the concept among the teaching staff also created problems. In some cases their enthusiasm to encourage student self-expression and experimentation led them to adopt an 'anything goes' attitude in which virtually all references to course structures, subject structures and quality controls were abandoned. Experience has proved that the need to retain structures and control measures is as strong as ever.

It would be an exaggeration to say that all staff have overcome their doubts and are now committed and enthusiastic supporters of the concept. However it is certainly true that many of the initial doubts expressed have diminished, and the evidence of the good effects on student results has persuaded many of its value. The main task which still remains is that of establishing and passing on to all staff the principles of good teaching practice which we are learning as we go.

Student Work

To date the effect on student work has been seen largely in the BMM students who have been using the flexible curriculum component in their course for several years. Overall the effects have been seen to be very positive, with many students producing work of an extremely high standard in their selected areas of interest. Given that their choice of specialisation is usually something in which they are skilled or interested, it is to be expected that their work on their specialisation would be of higher standard than that done for their other work. However even allowing for this, the overall quality of work produced has been exceptionally good, and has shown a level of creativity and initiative not usually seen in student work.

The clearest objective evidence of the quality of student work outcomes has come in the form of industry response to the work of the BMM students. Throughout their course the students were encouraged to use industry clients as a source of work tasks for inclusion in their portfolios. The standard of work produced was so high that in several cases the students' work was used by their client as part of commercial products. This ultimately led to a group of about twenty students being hired by the Sydney Organising Committee for the Olympic Games to work with IBM on aspects of the Sydney Olympic games web site. The success of the students in this work culminated in the establishment by the university of a commercial venture, staffed largely by undergraduate students working under the direction of an experienced project manager. The students work at normal commercial rates of pay, and have attracted a strong group of commercial clients.

It must be stressed that these results have not just been achieved by a handful of exceptional students. A significant cross-section of students have been involved in the commercial ventures, while outstanding work has also been produced by other students who have not been involved on the commercial side. At the end of the final year of their course the students ran an exhibition displaying products and portfolios created by all students. The exhibition was well-attended by industry representatives who were impressed at the range of talents which were displayed and the depth of talent shown in specialist areas.

It is not possible to quantify the extent to which the flexible work environment contributed to these outcomes, and to what extent they were due to other factors. However, it is very clear that the flexible component has engendered good student attitudes towards self-direction and motivation. Students have demonstrated excellent self-awareness of their skills and weaknesses, and have shown a good understanding of how they could best contribute in a professional work place.

ISSUES

Our experience to date has indicated that the introduction of the flexible curriculum component in the studio subjects has been generally successful. However, it has highlighted a number of key issues which we believe need to be addressed and carefully managed to ensure success. Following are some of the main issues with which we have had to contend, and the strategies which have been employed to deal with them.

- Creating an appropriate environment: Encouraging real student involvement and commitment to the concept of a flexible curriculum component is a key element in making it work. As discussed in Section 4, many students appear to expect that they do not have a role to play in setting the curriculum for their education. Therefore many of them find it disconcerting, or even frightening, to be placed in an environment where they have to make decisions of this kind.

  Our experiences indicate that students need time to become accustomed to this environment. This means that the use of flexible curriculum components should be introduced as early as possible in the course, and should be established at all year levels. Ideally, there should be a steady increase in the level of freedom of choice, and a steady decrease in the amount of direction and guidance given to students as they progress through the course (further aspects of this issue are discussed in the next point).

  Presentations and formal exhibitions of student-initiated work can also be a major influence in increasing student acceptance and commitment to the needs of the flexible curriculum environment. Seeing and sharing the work of their peers encourages students and helps stimulate their thinking about what they might like to do. A subject web site can be very useful in achieving this objective, by playing the role of a gallery where students can display their work and see what their colleagues are doing.

- Setting the level of freedom: As a corollary to the previous point, controls must be placed on the students' freedom of choice to ensure that the tasks remain manageable from both a staff and student point of view. Students must be given some guidance as to the range of tasks which are appropriate for the course and their abilities, and which can be managed by the teaching staff.

  In early years it may be appropriate to nominate a range of acceptable topics. However, as students become more competent and confident it may be possible to broaden the range of topics and allow for deviations to suit individual student preferences. It may also be necessary to reduce the level of choice for more pragmatic reasons associated with resource availability as discussed in the following point.

- Teaching support and teaching work loads: A flexible curriculum takes away some of the economies of scale which teaching staff have in subjects with traditional fixed curricula and assessment. In a normal subject, teaching staff need to be familiar with only one set of teaching materials; student problems and support needs tend to follow similar patterns; and the uniformity of assessment tasks allows for greater speed and efficiency of effort in marking. Inclusion of a flexible curriculum component requires a wider range of disciplinary skills on the part of teaching staff. In addition, student task management requires intensive monitoring of student progress and more individual student support. Hence, the staff load associated with a subject with a flexible component is significantly greater than for normal subjects.

  The structure and level of control placed over the flexible curriculum component must be tailored to the availability of suitably qualified teaching staff. If resources are limited, the proportion of flexible material can be reduced or the range of topics can be limited. As discussed in the previous two points, the degree of flexibility permitted to students can be adjusted within and across year levels.

  It is worth noting that a partial solution to some aspects of this problem may also lie with the attitudes that the flexible curriculum teaching environment creates. As discussed in Section 4, many of our

students have displayed a willingness to act as mentors to their peers and take some of the pressure off the teaching staff. To some extent the entire class can become a valuable teaching resource to itself.

- Equity: The use of a flexible curriculum can raise problems with actual and perceived differences between the quantity and quality of student work. Unlike a fixed curriculum which ensures that the workload and assessment tasks are standard for all students, the flexible curriculum means that work submitted by students may vary significantly in type and complexity. This can make it difficult to assess the relative workload and the relative merits of student performance.

  Careful monitoring of student work is needed throughout, with the most critical times being when students choose their tasks, and at the end of the year when they are assessed. However regular feedback and evaluation of progress is also needed throughout the subject to monitor progress. Assessment can pose particular problems because the range of specialist work taken on by students may extend beyond the range of expertise of a single academic staff member. In this case it may be necessary to use a panel of examiners with a suitable range of skills.

- Maintaining quality control: The need for introducing and maintaining mechanisms for quality control is implicit in all the points raised above, but is so important that it is worth stating explicitly. Having a flexible curriculum component removes some of the layers of bureaucracy which can inhibit innovation, but it may also remove the safeguards over quality assurance which these bureaucratic structures try to maintain. Quality management issues must be uppermost in the minds of the teaching staff involved in running a subject with flexible curriculum options.

  The need for careful planning, structuring and monitoring is even more important with flexible curriculum components than for normal subjects. It may sound slightly paradoxical, but the 'looser' and more flexible the desired outcome, the 'tighter' and more carefully managed must be the control structures.

CONCLUSIONS

The overall success of the flexible curriculum innovation in the studio subjects, particularly in the BMM, has encouraged us to believe that it offers significant benefits for undergraduate students. We believe that the approach can make a major improvement to educational outcomes from the point of view both of the university and future graduate employers. It can help to accommodate diversity in the interests and aptitudes of students, and prepare them for a range of possible professional career paths, while also providing them with the greater depth of specialist knowledge which makes them more immediately useful members of the work force.

However as a new and untried teaching method, its implementation also raises new, and at times difficult, issues for curriculum planners and teaching staff. Setting an appropriate curriculum framework, establishing control structures, managing the resourcing of the programme and monitoring and managing quality all pose problems unlike those found in traditional teaching. Our experiences to date indicate that these problems can be resolved and that benefits which flow from doing so make it well worth the effort.

REFERENCES

ACM (1999) *MSIS 2000: Model Curriculum and Guidelines for Graduate Degree Programs in Information Systems*, Association for Computing Machinery

Arnott, D. Dampney, K. and Scollary, A. (eds) (1996) *The Australian Debate on Information Systems Curriculum*,

ACIS (2000) Panel: Curriculum Matters in Information Systems, *Proceedings of 11th Australasian Conference on Information Systems*, Brisbane (November)

Arnott, D. and Atchison, M. (1997) Professional Engagement and Information Systems Education: Background, Critique and Directions for the Future, *Proceedings of ISECON '97*, Orlando, (October)

Docherty, M. Sutton, P. Brereton, M. and Kaplan, S (2001) An Innovative Design and Studio-based CS Degree, *SIGCSE Bulletin*, Vol 33, No 1

Doke E.R. and Williams S.R. (1999) Knowledge and Skill Requirements for Information Systems Professionals, *Journal of Information Systems Education*, Vol 10, No 1

England, E. and Finney, A. (1996) *Managing Multimedia*, Addison-Wesley

Gonzalez, R. Cranitch, G. and Jo, J. (2000) Academic Directions of Multimedia Education, *Communications of the ACM*, Vol 43, No 1

Gonsalvez, C and Atchison, M. (2000) Implementing Studios for Experiential Learning, *Proceedings of Australasian Computing Education Conference*, Melbourne, (November)

Lee C, Kettinger, W and Kuilboer J (1996) Market Segmentation of IS Academic Programs, in Journal of Information Systems Education, Vol 8, No 2

COPYRIGHT