A Methodology for the Design of Courses in Information Systems

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Abstract

A wealth of literature exists on the use of Internet technologies for Information Systems education; however, there is little research on course design methodologies that are particularly suited to Information Systems courses. This paper reviews several generic frameworks for course design and develops one that incorporates the important elements of each for use in designing Information Systems courses. The development process revealed that there was a framework within a framework, that is a higher order cyclical framework and the lower level design/redesign framework. The results of initial research on the applicability of the framework for the design/redesign of Information Systems courses suggest support for the usefulness of the approach.

Keywords: IS Education, Educational IS, Design Methodologies.

1 Introduction

Universities are facing increasing pressure to meet the educational demands of the marketplace. The types and level of degree programmes required by current student cohorts are diverse and specific to the student's own situation. Increasing the level of flexibility available to students and the use of Internet technologies are two strategies that universities have adopted in response to increasing pressure from the marketplace. In many instances, universities have combined the two strategies in such a way that Web technology is being used as a means of offering a higher level of flexibility to students. However, the use of computing technologies such as the Internet affects the teaching and learning process. Further, the eclectic mix of students makes the task of providing educational material within a flexible framework difficult and complex. Flexibility is generally understood to mean offering students some choices in the learning environment to better meet individual needs. The use of Internet technologies by universities that have embraced flexible learning has broadened the range of educational choices for students. These choices include but are not limited to choices in class times; location; assessment; completion dates; course content; the amount of communication needed; and selecting assignments relevant to the student's workplace (Collis 1998).

The shift towards a flexible learning environment from the more traditional approach presents a challenge to course planners. The main concern for planners and the focus of this research is how best to plan for the change to the teaching and learning environment and then to design a course that is supported by Internet technologies and which provides a requisite level of flexibility. This paper overviews several design frameworks and develops one that incorporates the important elements of each. The first section presents a comparison of several design frameworks in order to identify important design issues that should be undertaken when designing a course, particularly a course in Information Systems (IS) to be offered in flexible mode. The next section describes the design framework at a macro level with a more detailed discussion provided in the third section. This framework was used to design three IS courses. The final section describes a study that examines student opinions of three flexible learning courses that were designed using the proposed design framework.

2 FRAMEWORKS FOR COURSE DESIGN

The design models or frameworks presented by Print (1993), Nikolova and Collis (1998) and Gibbs (1999) were reviewed. Print (1993) presents a continuum of models depicting two extremes in the curriculum process. At one end are the linear models that are straightforward sequential approaches to viewing the curriculum process. Dynamic and interactive models, which are located at the other extreme of the continuum "*view the curriculum process as flexible, interactive and modifiable*" (Print 1993, p 63]. For example, Gibbs (1999) presents an overview of the main components in course design and describes how the components can be linked together. Nikolova and Collis (1998) also present several components of design while expounding a method for the development of flexible instructional modules (The Method). Models that reflect elements of both designs, for example the cyclical model, are located between these two extremes (Print 1993). Cyclical models are structured and sequential but reflect a state of constant change in that the curriculum process never ceases.

These frameworks share many of the same or similar stages: learner characteristics, assessment, instructional strategies/learning and teaching activities, objectives, content and resources. Only two specifically mention evaluation - an important stage in the design and development process (Rowntree 1992). While other elements are included in framework presented by Gibbs, these relate primarily to supporting the students and creating a learning community. No explicit mention of

reflection is made in any of the models although it may be implicit in Evaluation elements and in Gibbs' Coherent and Incoherent course design element. An evaluation of the frameworks revealed that both the linear and cyclical models are too structured and do not appear to provide sufficient flexibility to enable a return to a previous stage or element. The 2-stage interactive model appears to be more flexible, while the Method approach for the development of a flexible instructional module (Nikolova and Collis 1998) also has appeal. Both models provide a pedagogical structure on which to base a framework for IS course design within a flexible teaching and learning environment. A set of characteristics is identified in the 2-stage interactive model while a generic module is designed under the Method approach.

The relevant elements from the Method approach were incorporated into the 2-stage interactive model. The combination of these two models, however, did not offer all the desired elements for flexible teaching and learning environment, so these were also added into the framework. This process became problematic as too many aspects were being incorporated into a single framework. However, reflection on the process revealed that there was a framework within a framework. The framework was refined into two distinct levels: the higher order cyclical framework and the lower level design/redesign (D/R) framework. The two levels are discussed in the following sections.

3 THE DESIGN CYCLE

At the macro level, the Course Design Cycle provides an overview of course design and implementation (Figure 1). The higher-order cyclical framework was based on Kolb's cycle of experiential learning – experience, reflection, generalisation and testing (McGill and Beaty 1995:30). The "plan-reflect-change-reflect" cycle of action learning (Biggs 1999) are reflected in the course design cycle.

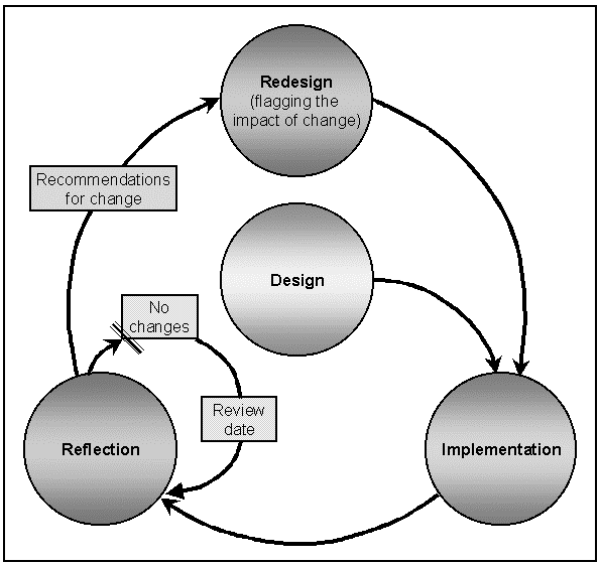

Figure 1: Course design cycle

Kolb's cyclical approach was modified to suit a flexible approach by using the elements referred to as Design, Implementation, Reflection, Redesign. The design cycle is similar to Tyler's Curriculum Cycle (Wiles 1999, 62). The Tyler 'cycle' refers to the curriculum planning cycle of analyse, design, implement and evaluate that is illustrated in Wiles (Wiles 1999, 64). The design cycle begins with the Design process. The design is then implemented and reflection on the experience undertaken. The reflection process requires thought not only on student learning and the teaching and learning strategies it also must involve learning about oneself as a teacher.

If, at this point, no changes are required, the Design cycle ends. However, it is more likely that the outcome of the reflection process would be recommendations for change. Modification of the design, that is redesign, is then performed while flagging the impact of the changes. Implementation of the redesign is undertaken, followed by reflection activities. The cycle will either finish or continue with redesign based on further recommendations for change. If there are no revisions to be undertaken in the design/redesign of the course, a time line should be established for when the review process should begin again, for example, within 12 months. By establishing a review date, course planners have a time frame in which to reflect on the existing design under the then current, possibly changed, teaching and learning environment, and determine whether any modifications should be made.

4 A Framework for Course Design/Redesign

The course design/redesign framework provides a detailed view of the Design and Redesign elements of the design cycle. The framework, as depicted in Figure 2, could conceivably apply to any course requiring design or redesign. In this paper the framework will be applied to the design of courses in the Information Systems area. The framework is divided into two parts: the course level and the module level. The components in the course design/redesign framework are overviewed in the following sections.

Print (1993) regards the development and design as being essential elements in the curriculum development process. His discussion is focused around the various forms of curriculum design, which he categorises as:

- Subject-centred - teaching pivots around a well-recognised and established body of knowledge, that is, the content;
- Learner-centred - individual development is emphasised and the design of the course ensues from the needs, interests and purposes of the student;
- Problem-centred - learner attention is fixed on problems and their resolution; and
- Core designs - a common set of skills and knowledge that all learners should possess.

The second and third models have most appeal for Information Systems courses. Learner-centred designs are not as pre-planned as problem-based designs as they usually evolve from teacher-student interactions. On the other hand, problem-centred designs focus more on the group and group activities. However, designers can have purposeful intentions with respect to student learning and still incorporate group activities that are centred on problem-based learning. Student development and learning are paramount in both designs.

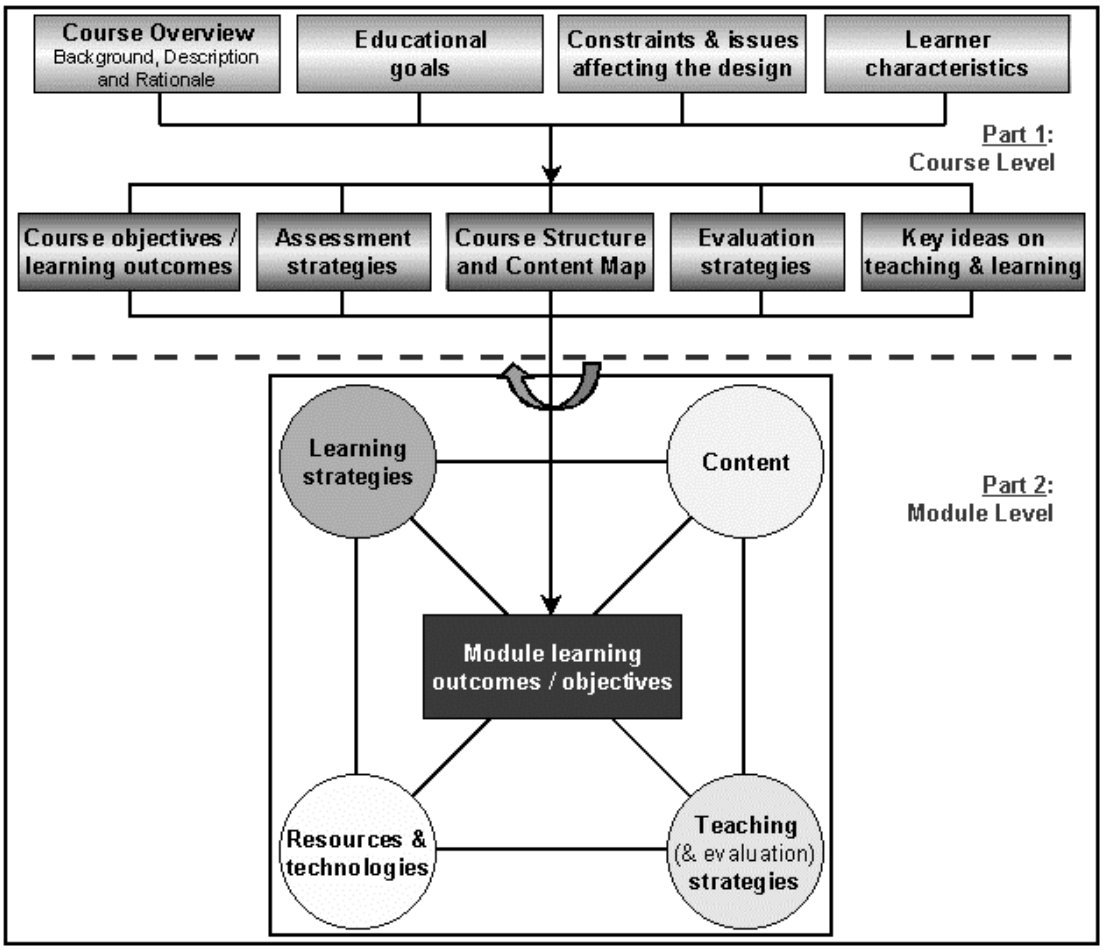

Figure 2: Course design/redesign framework

The course level itself consists of two distinct sets of activities. Some preliminary activities are required prior to the more specific course level components being undertaken. These preliminary activities ensure that the educational boundaries for the development of the course and any environmental influences are clearly articulated prior to undertaking detailed course planning. Activities include: 1) Providing an overview of the course, a short description and any relevant background information; 2) Determining the educational objectives, that is, the broad overall aims and/or goals for the course to ensure the principles of high-quality teaching and learning are explored; 3) Identifying any constraints and issues both internal and external to the educational institution, that may affect the design such, as well as the characteristics of the learning environment; and 4) Determining the characteristics of the learners (students).

Once the preliminary activities have been undertaken, the more specific course level activities are: 1) Determining the overall objectives and learning outcomes for the course; 2) Assessment strategies; 3) Course structure and content; 4) Course evaluation strategies to determine what aspects of the course, if any, require improvement or modification; and 5) Key ideas about teaching and learning, that is, the overall teaching and learning strategies. Once the key ideas for teaching and learning have been identified, all of the course level components have been explored and identified. The design process can then proceed to the Module Level.

The design activities in this stage are at the module level and are repeated for each module (section) within the course. The activities include: 1) Developing learning objectives; 2) Content; 3) Teaching strategies; 4) Learning activities; and 5) Identifying the resources and technologies that will support the teaching and learning strategies. While the learning objectives and/or outcomes are the usual starting point for design activities, there is no sequential flow between the other components. This is an interactive process where changes in one aspect can and often will cause a change in one or more of the remaining components.

5 Application to IS Courses

The D/R framework was used to redesign three courses because the University was offering new degrees and majors on a new campus. The courses were redesigned to suit a flexible learning mode; two were second year courses and the other was a third year course. The design process was the same for each of the course although the course content and assessment strategies were different. The planning team, once assembled, began the redesign process, which is described in the following sections.

5.1 Part 1: Course Level Design

The course level itself consists of two separate sets of activities. Some preliminary activities are required prior to the more specific course level components being

undertaken. The preliminary activities include providing an overview of the course; determining the educational objectives; identifying any constraints and issues that may affect the design and learner characteristics. The more specific course level activities are determining learning objectives/outcomes; assessment strategies; course structure and content; course evaluation strategies and key ideas about teaching and learning. The preliminary activities will be discussed before the specific course level activities.

5.1.1 Course Overview

An overview of the courses was formulated by including a short description and any relevant background information. This included but was not be limited to the School offering the courses, the degree program and major to which the courses belonged, how the courses related to existing courses, and what prerequisites/co-requisites were necessary. A rational for the course was also devised. Some of the information about the course was drawn from official documents concerning the course proposal. Reference was also made to prior offerings of these courses in traditional mode. Documentation of the course design began at this point.

5.1.2 Educational Goals

The next activity in the redesign process is devising the curriculum intent, that is, the broad overall aims and/or goals for the course. By grounding the design and implementation of the three courses in theory, five broad educational goals were devised to underpin the courses:

1. Provide a high-quality teaching and learning environment,
2. Provide a level of flexibility that will maximise the learning potential of the students,
3. Recognise and understand who the students are and where their experience and interests lie and provide a student-centred approach using a variety of strategies for learning in a manner that reflects the individual needs and capabilities of the student cohort.
4. Provide an online environment that not only includes course content, but also provides the students with opportunities to interact with the system to develop essential skills.
5. Maximise face-to-face interactions between students and the teacher through the use of experiential learning rather than information dissemination.

The learning outcomes and objectives for the courses and the web site were established with these educational objectives in mind.

5.1.3 Constraints and Issues affecting the Design

The constraints and issues affecting the course design including the characteristics of the learning environment must be identified. A situational analysis (Print 1993) was conducted at School level to identify factors that are internal and external to a setting, that is, a context. External factors that had an impact on curriculum design included the requirements of professional organisations and desires of employers and industry.

- *External Factors*: The societal, industry and the professional contexts were of prime importance. In redesigning the courses, consideration was given to the needs and demands of industry and the IS professional body - the Australian Computer Society (ACS). Institutional and School contexts were also taken into consideration when designing the courses. The University has guidelines on entry points, when a course is offered, duration of study, the quantity of assessment items, teaching and learning policies, flexible learning policies, expectations on quality of its offerings, etc. Under the School context, the planning team considered several factors including: the level financial and other support available to develop flexible learning resources; level of physical support that can be provided to students and to the course convenor; staff commitment to other aspects of their employment (eg research and service); the flow of courses and prerequisite structure, and so on.
- *Learning Issues*: Ramsden states that "good teaching involves finding out from students and other sources about the difficulties students experience in learning the subject matter, finding out about key outcomes that are not achieved or are only partially achieved, and considering the needs of particular groups of students" (Ramsden 1992, p 136-137]. These elements are necessary for high-quality education. Observations of and evaluations provided by previous cohorts of IS students revealed some areas of concern. Students struggle in IS courses when they fail to recognise two main issues. They often do not understand, early in the course, how what they are learning will fit into their work environment unless they have a context in which to place it. Secondly, they frequently underestimate the time involved in applying the theory to real problem situations. The effects of the first problem were reduced using a map of the content (graphical illustration) and assessment items related to real-world problems. The second was solved through assessment items that are submitted progressively throughout the semester.
- *Student Issues*: At the student level, several obstacles are evident that were addressed through the design process. These included: Level of computing skills and computer literacy; Different learning styles and needs of the students; Relevance of the content to the students' current/future workplaces; and Insufficient time to engage in learning activities. Several strategies were used to help students grasp the significance of what they were learning. Their skills were addressed by providing a clear structure and logical flow of content and learning; learning exercises pertinent to the topic and real-life; by providing the right amount of support to the students; and a web site that was easy to navigate and use. A mix of learning options was used to support different learning styles. The relevance of what the students were learning was influenced though assessment items that were current or actual business problems, teaching strategies that included seminars by industry experts, actual business cases and teaching examples. Lastly, the amount of content covered in the course was appropriate to achieve the learning objectives.

5.1.4 Learner Characteristics

The diverse nature of the student body provides a challenge to the planning team. The diversity in student ages, educational background, educational requirements, work experience and cultural backgrounds add complexity to the redesign process. Rowntree's model of learner characteristics (Rowntree 1994, p.45] was used in developing a profile of students studying the IS courses. The model has six separate elements: demographics, motivation, learning factors, course background, resource factors, and other factors.

5.1.5 Course Learning Objectives

Learning objectives/outcomes is the first of the course specific components of the D/R framework. The specific objectives/outcomes of the course were developed before any other element of design, as the assessment strategies, content, and teaching and learning activities are all dependent on the learning outcomes, that is, they are constructively aligned with the learning objectives (Biggs 1999). The objectives were stated so that the outcome could be measured. Further, they were sufficiently explicit to facilitate the design and implementation of teaching/learning activities (TLAs) and suitable assessment strategies. The objectives, therefore, underpinned the course design so the assessment strategies, course content, and teaching and learning strategies could be constructively aligned.

5.1.6 Assessment Strategies

While assessment and its various aspects have been the focus of much research, the planning team first had to determine what the purpose of the assessment was before they could select appropriate strategies. The assessment strategies were aligned with the learning objectives so the teaching team could test whether students had achieved the learning objectives. Assessment within the IS courses must address two separate types of learning. The first relates to the understanding and application of the discipline concepts, while the second relates to their knowledge of software tools and their skill in using them. Personal experience in teaching the courses has shown that students have a better grasp of the content if the assessment items are constructively aligned with the learning objectives and if they are submitted continuously throughout the semester. The types of assessment best suited to IS courses include projects, case studies and problems. These can be combined to form a single assessment item. While summative assessment was the primary focus for testing student learning, formative assessment also had a role in providing feedback to the students and to the teaching team. The project material was drawn from real world business applications and required the students to apply the theory as well as the skills they had developed during their studies. Students had the freedom to select an organisation and/or an application technology. By using a real world example for their assessment, students had to adapt the theoretical constructs to suit an actual problem environment. These activities provided another level of complexity to the learning approach used in the workshops, as well as engendering the development of the higher-order processing skills. Further, by submitting the project in two parts, students could gain feedback on their solution and incorporate the feedback into their next submission.

5.1.7 Course Structure and Content Map

The structure and overall content of the courses were constructively aligned with the learning objectives (Biggs 1999)]. Wiles (1999) described five curriculum structures that range from the highly structured to the flexible and integrated designs. The structures are 1) Simple Content Chains; 2) Spiral designs; 3) Connecting designs; 4) Conceptual approaches; and 5) Integrated designs. In these approaches materials can be organised in a modularised or free form format. Sequencing the presentation of the material can be sequential as in the first two structures, or it may be more flexible, as in the latter approaches. Within the IS discipline, the variations of simple content chains are used most often. However, while the content may be presented sequentially, the strategies used in teaching and learning need not be. Problem-based learning was used extensively and by grounding the theory in real world problems students were able to learn more and motivation increased. Concept maps were used as a tool to assist students in understanding how individual elements of the course related to others. Further, by including assessment items on the map, the relationship between the content and the assessment strategies was demonstrated.

5.1.8 Evaluation Strategies

Evaluation is important to determine what aspects of the program or course requires improvement. The most compelling argument I can make for undertaking evaluation is that change is a desired process in learning and, consequently, evaluating a course is the best way to improve on that change process. The evaluation of the IS courses were planned for at the redesign stage and conducted throughout the course. The primary purposes for course evaluations was to allow the teaching team to determine how well the students were learning and how that learning process could be improved. Both formative and summative evaluations were employed. Formative evaluation of the learning process helped to determine if the improvements were functional and useful to the students as well as determining whether the improvements are impacting on the learning process. Summative evaluation was also undertaken to determine if the improvements were as intended.

5.1.9 Key Ideas on Teaching and Learning

Key ideas on teaching and learning that is, overall teaching and learning strategies were taken into consideration. The principal issues that were addressed in the design process were: Maintaining student interest and motivation; Learning activities that encourage a deeper level of learning so students are able to make the links from their study to their workplace; Structured learning program so students could work on their own if they so desired, and see the relationship between learning outcomes, content and assessment; and Maintaining the

currency of the course content. Once the key ideas for teaching and learning were identified, all of the course level components had been explored and the design process proceeded to the next level.

5.2 Part 2: Module Level Design

The design activities in this stage are at the module level and are repeated for each module within the course. Activities include developing learning objectives, content, teaching strategies, learning activities and identifying the resources and technologies to support the teaching and learning strategies. While the learning objectives/outcomes are the usual starting point for design activities, there is no sequential flow between the other components. This is an interactive process where changes in one aspect can and often cause a change in one or more of the remaining components.

5.2.1 Module Learning Outcomes/Objectives

As with the course level objectives, the module and topic level learning outcomes were formulated first. The module-level or specific learning objectives are precise statements of educational intent that relate to modules and topics of the courses and were based on the course objectives (Biggs 1999). Learning objectives checklists were used to ensure all stated objectives were taught.

5.2.2 Module Content

The course structure and the overall content were identified earlier in the design process. At this level, the content for each module and topic were devised. A concept map was used to ensure relevant details had been identified. It is important for the planning team to remember and ensure the content is aligned not only to the learning objectives of the topic/module, but also to the course learning objectives. Each of the courses used a conceptual framework that organises the knowledge and skills needed by the students into key modules, each having several topics.

5.2.3 Teaching Strategies

The teaching and learning activities that could achieve the topic/module learning outcomes were identified. As part of the teaching strategies, the evaluation strategies were also planned. These strategies were designed so that they carried out the dual purpose of teaching and evaluation. The teaching strategies were selected to enhance student learning, that is, a deeper and more reflective form of learning was desired. The planning team determined what form of learning was required and then selected the TLAs to ensure the desired learning objectives were achieved. However, what was important to the planning and teaching team was that the TLAs were aligned the learning objectives. Teaching strategies incorporated the use of Internet technologies and face-to-face classes. A Web site was developed for each course to provide information and content to the students. A hierarchical structure was imposed over the Web site so course materials and resources could be accessed in no more than three mouse clicks thereby facilitating the ease of navigation through the site. Keynote presentations (lectures) were used, but care was taken to ensure the experience was a positive one for the students (Biggs 1999). Since students were able to download topic summaries from the Web site, the focus of the lectures was in providing appropriate examples of how the theory was applied in a business environment, rather than disseminating information. Workshops, as smaller group sessions, were structured in a flexible format, with some activities being teacher directed while others were peer-directed or self-directed. Students had access to teaching staff outside formal class times at regular set times and at other times by appointment. Access via e-mail could be gained at any time, while the electronic noticeboard was used as a means of communication, motivation and providing feedback on assessment items.

5.2.4 Learning Strategies

The student learning activities that would achieve the desired outcomes were also identified. Learning strategies were devised to enhance interactions between the teacher and students as well as among students in both face-to-face and electronic situations. As part of the learning strategies and to provide students with a sense of control and ownership, they were encouraged to form informal study groups of 4-5. Students were able to discuss course material, exercises, events and assessment items with other group members. The students were also able to discuss and analyse study materials and assessment items during workshops. The workshops were run on a regular basis and, while attendance was optional, they facilitated the interaction of students with the teaching staff in a small group context. Students were set exercises that could be completed in their own time and, if problems or questions were encountered, these were then handled most effectively during the workshop sessions. The more difficult concepts within the course were illustrated through interactive examples delivered via the Web site. The workshop exercises were designed to facilitate the learning of higher-order cognitive skills. That is, they were structured to ensure appropriate coverage of the theoretical aspects of each topic in the first instance, and then the application of the theory to case examples in the second. The relationship between the workshop exercises and the group project, along with their timing, ensured students understood the theoretical concepts and how they were applied before submitting the project.

5.2.5 Resources and Technologies

The resources to support the teaching and learning strategies together with the media on which the resources would reside were identified. A mix of print-based and technology-based resources was used. Students were given a printed version of some of the study material available on the Web site. The provision of a hard copy version ensured those students who preferred not to use the technology extensively were not disadvantaged. The study guide contained a course overview, an assessment overview, keynote presentation schedule, workshop schedule and outline, as well as the weekly workshop activities for the semester. The Web site contained:

- Course details – a course overview, learning objectives, and topic materials organised in a modular format as well as contact details for the teaching staff;
- Assessment details and relevant supporting documentation as well as notes on how each topic applied to the projects;
- Study materials including on-line topic notes, workshop exercises, group activities and suggested allocation of time,
- Review materials for each topic including self assessment quizzes that provided immediate feedback to the students, and learning objectives checklist;
- Resources including summaries of the keynote presentations in PowerPoint format, topic notes in downloadable format, links to useful web sites and a readings list with links to resources on the textbook's companion web site;
- Frequently Asked Questions facility where answers to commonly asked questions were provided;
- Forum or chat facility through which students could interact with each other, as well as the teaching staff, in order to exchange ideas, seek help, or provide help and support to other students on any problems they may have encountered during their studies; and
- Noticeboard on which the teaching team could announce events of interest, the availability of assessment material and concept tests, and provide feedback on assessment items.

Students were able to access the Web site from outside the university so they could undertake learning activities at their own convenience.

6 STUDENT PERCEPTIONS OF THE COURSES

This section explains the methodology used to explore the effectiveness of the D/R Framework. Effectiveness was considered from the student perspective. In order to elicit student opinions on the effectiveness of the teaching and learning strategy supported by the use of the Web technology, a survey instrument was developed and provided to the students. The first section contained questions on personal characteristics. The following section evaluated their experience with computing technology and flexible learning. The third section contained questions relating to the various instruments employed to measure their perceptions. The final section contained three open-ended questions. The courses that were redesigned using the D/R framework were at the second year level (2) and third year level (1). They have been labelled using course number and year offered, that is, C1Y2, C2Y2 and C1Y3 respectively.

6.1 Survey Instruments

Several survey instruments were drawn for the research literature. The first instrument was "Microcomputer Playfulness Measure" which describes "an individual's tendency to interact spontaneously, inventively and imaginatively" with a computer (Webster and Martocchio 1992, 201]. It has been demonstrated that microcomputer playfulness relates positively to learning. The instrument was selected as an alternative to learning style in an attempt to circumvent the current debate on learning styles. A second instrument – end-user computing satisfaction (Doll and Torkzadeh 1988) – was selected to describe the student's (user's) satisfaction with the teaching and learning strategy supported by Web technology. It can be argued that students are in effect end-users and as such, the instrument is an appropriate choice. Both these instruments have been tested and validated in the literature.

6.2 Subjects

Demographic details for the students enrolled in all three courses are provided in Table 1. The total enrolments for the three courses C1Y2, C2Y2 and C1Y3 were 37, 36, and 27 respectively. Students were aware that they were participating in an experiment to assess their perceptions of the effectiveness of teaching and learning approach. However, participation in the survey was entirely voluntary on their part.

Variable	Category		C1Y2	C2Y2	C1Y3
Gender	Female	=	8	9	8
	Male	=	6	12	11
Age	< 25 years	=	12	14	15
	25 years +	=	2	7	5
Country of Origin	Australia	=	10	16	15
	Other	=	4	3	4
	No response	=	0	2	0
Work experience	< 1 year	=	5	4	3
	1 -2 years	=	5	4	0
	3-5 years	=	3	5	8
	> 5 years	=	1	8	8
N	Number responses		14	21	19

Table 1: Demographic Details

6.3 Results

This section reports the results of data analyses on the students' perceptions. The second section of the questionnaire focused on the student's experience with computing and flexible learning. All questions on the course were evaluated using a 7-point Likert-type scale. The scale range, means and standard deviations of Section B questions are shown in Table 2.

While three students across the three courses rated themselves as below average in computing skills, the majority did not. However, no student considered himself or herself as a *Wizard*. Webster and Martocchio (1992) consider that users with a high level of playfulness, that is a score greater than 33, are more motivated and are better able to react to new technologies. It would appear that the majority of students can be regarded as playful and therefore, more likely to explore and use the Web site. A single question asked the student to indicate their feelings about using Web technology for learning. Again, the majority of students reacted positively to using Web technology for learning; only five students overall were hesitant about using the technology.

Questions from Section B of Questionnaire	Scale range 1	4	7	C1Y2 Mean	C1Y2 SD	C1Y2 Range	C2Y2 Mean	C2Y2 SD	C2Y2 Range	C1Y3 Mean	C1Y3 SD	C1Y3 Range
Q7. How would you rate your computing skills?	Meagre	Average	Wizard	4.4	0.9	2-6	4.6	0.8	3-6	5.0	0.6	4-6
Q8. Microcomputer Playfulness Measure	-	-	-	33.5	6.2	18-42	33.6	7.4	16-45	35.9	6.5	24-47
Q11. How would you describe your feelings about using Web technology for learning?	Hesitant	Indifferent	Excited	4.7	1.2	2-6	5.7	1.1	3-7	5.8	1.2	3-7
Q12. How would you rate the effectiveness of flexible delivery for your learning?	Not Very effective	Neutral	Very effective	3.6	1.4	1-5	5.2	1.4	2-7	5.3	1.0	3-7
Q13. Overall, how satisfied are you with flexible delivery as a means of presenting teaching and learning materials?	Very dissatisfied	Neutral	Very satisfied	3.7	1.5	1-6	5.0	1.2	2-7	5.3	1.1	3-7
Q14. I like to use computers for learning.	Not at all	- -	To a very great extent	4.5	1.2	3-7	5.6	1.1	4-7	5.6	0.9	4-7
Q15-25. End-user Computing Satisfaction Measure	Not at all	- -	To a very great extent	50.1	9.2	40-73	57.2	9.5	41-77	59.8	10.5	36-75
Q33. My level of usage of the web site was:	Infrequent	-	Frequent	5.1	1.1	3-7	5.6	1.1	3-7	5.1	1.4	3-7
Q34. My use of web site was:	Sporadic	-	Regular	5.1	1.1	2-7	5.1	1.2	2-7	5.4	1.1	3-7

Table 2: Questionnaire Results

6.3.1 Discussion on C1Y2 Results

Question 11 required the student to indicate their feelings about using web technology for learning. Only three students were somewhat hesitant (3) while another was indifferent. It is interesting to note that all three students, rated their computing skills as average or above but only two were rated as playful. Questions 15 to 25 were summed to form the end-user computing satisfaction measure - the highest possible score is 77 while the lowest is 7 (Doll and Torkzadeh, 1988). Two of these students were satisfied with using the technology for learning purposes. It was interesting to note that the student with the lowest satisfaction measure (23) rated his computing skill at 6 and was scored as playful. Further, while he was excited about using web technology (6), he did not like to use computers for learning (2). The other students all had average or above computing skills and were either indifferent or a little excited about using the technology for learning purposes. Only one was classified as playful. Six students regarded flexible delivery as being ineffective for presenting teaching and learning materials and were dissatisfied with the approach (1-3). None of these six rated themselves as having a low level of skill, while only three had a low-level playfulness, one of which was dissatisfied (Q15-Q25) along with one other student.

Two questions related to the use of the Web Site (Q33 and Q34). All but four students used the site on a frequent basis. All but one made frequent and regular use of the web site. The same student who was dissatisfied with the web technology made infrequent and sporadic use of the site. This rating is to be expected given his dissatisfaction with use the technology for learning. The remaining two students while making regular use of the site did so on an infrequent basis. One other student rated his use of the web site as sporadic but somewhat frequent.

6.3.2 Discussion on C2Y2 Results

The majority of students indicated they were excited about using web technology for learning (Q11). Only two students were indifferent (4) while one was somewhat hesitant (3). It is interesting to note that the two who were indifferent rated their computing skills at 4 and their level of playfulness was 28 and 32. The student who was somewhat hesitant rated her skills at 5 and her level of playfulness was 33. Only one of these students regarded flexible delivery as being ineffective for presenting teaching and learning materials (Q12) and he was dissatisfied with the approach (Q13). His level of skill and playfulness was 6 and 38 respectively. One student did not respond to these two questions. Two other students were neutral towards the effectiveness of the technology for their learning but were somewhat dissatisfied with the approach. One of these had a playfulness level of 16 while the other was 40. However, most regarded the technology as effective for their learning purposes and were satisfied with the approach.

All students who were not satisfied or who regarded the approach as less than effective all liked to use computers in their learning. All but four students used the site on a frequent basis. Three students rated their usage of the web site at 4 and one at 3. These same four students were also irregular users as were two other students. Only one of the four was dissatisfied with the approach and regarded the technology as being somewhat ineffective.

The scores for Q15-25 ranged from 41-77 indicating that all students were satisfied. This result supports the observations on the single satisfaction question discussed earlier. It is interesting to note that of the three students least satisfied on the single question only one had a lower satisfaction score (that is, their scores were 41, 55 and 64). The student who did not respond to the single question scored 55 on the satisfaction measure. It would seem that while the students could easily identify the

single question on satisfaction, they were not able to recognise the satisfaction measure.

6.3.3 Discussion on C1Y3 Results

Most of students indicated they were excited about using web technology for learning (Q11). Only two students were somewhat hesitant (3) while the rest of the students were excited (5-7). It is interesting to note that the two, who were somewhat hesitant, rated their computing skills at 4 and 5 and their level of playfulness was 27 and 33. Only one student regarded flexible delivery as being ineffective for presenting teaching and learning materials and he was dissatisfied with the approach. His level of skill was 5 he had a low-level playfulness (31). Two other students were neutral towards the effectiveness of the technology for their learning, but only one of the two, as well as three other students was neither satisfied nor dissatisfied with the approach. All but one of these five students was rated as being playful. However, most regarded the technology as effective for their learning purposes and were satisfied with the approach.

The scores for Questions 15 to 25 ranged from 36-77 indicating that all students were satisfied. This result supports the observations on the single satisfaction question (Q13). It is interesting to note that the single student, who was least satisfied on Question 13, had a higher satisfaction score (54). The student who was least satisfied on the satisfaction scale rated her satisfaction as 4 on Question 13. The students who were indifferent or who regarded the approach as less than effective all liked to use computers in their learning. All but three students used the site on a frequent basis. These three students rated their usage of the web site at 4 or above. Further, one other student rated his use at 3, but he was a frequent user of the site. Only one of these four students was dissatisfied with the approach and regarded the technology as being somewhat ineffective.

6.3.4 In Summary

Only six students regarded flexible delivery as being ineffective for presenting teaching and learning materials, however ten were dissatisfied with the approach. Only four students in the first course did not like to use computers for learning, whereas all other students did. All but four students were frequent and regular users of the Web sites. All but six students – two from each course - were satisfied (Q15-Q25. It is interesting to note that of the ten students least satisfied on the single question only three had a corresponding low satisfaction score. Overall there appears to be a general upward trend in the students' perceptions across all questions.

7 IN CONCLUSION

This paper has devised a framework that is suitable for designing IS courses that will be offered in a flexible learning mode. For the framework to be considered useful, its application for the design of new courses and the redesign of existing courses must be tested. To this end, the framework has been applied in redesigning three IS courses for the flexible learning mode of delivery. The student's perception of flexible delivery employing Web technologies that resulted from the application of the design/redesign framework is positive. Students appear to be satisfied with the delivery method and their interaction with it. This contention is supported by the favourable responses to the open-ended questions in the questionnaires. This evidence suggests that the use of a cohesive teaching and learning approach, which incorporates a comprehensive Web site, is an appropriate strategy for providing an effective learning environment for students studying information systems. Research is now being undertaken on the framework's application to the design of new IS courses. The course design framework developed in this paper could conceivably be of use to other teaching areas. Any area that requires students to understand basic concepts in the first instance, and then apply these concepts to real world problems and applications could employ the design/redesign framework. However, further research would be required to determine the appropriateness of the framework.

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