

MEETING NEEDS: A STAFF DEVELOPMENT RESOURCE FOR REDESIGNING SOCIOLOGY COURSES ACCORDING TO AN OUTCOMES-BASED MODEL

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Abstract

This paper describes the development of “Changing Outcomes - Exploring Needs Based Course Design in Universities” a Web/CD hybrid application incorporating an expert system for analysis and redesigning of courses. This interactive staff development tool will assist academics in reconceptualising courses according to an outcomes-based model. The development of this application through educational design, interface design and expert system design is described, together with the results of formative evaluation of the product and an analysis of project management data gathered throughout the project.

Keywords

Expert system, Web/CD hybrid, outcomes-based course design, formative evaluation, project management

Introduction

This paper discusses the development of a Web/CD hybrid application which acts as an interactive staff development resource for reconceptualising the development of professional sociology courses according to an outcomes-based model. The project arose from a CUTSD1 grant awarded to Bell and Patterson to develop a new approach to teaching sociology units in professional degrees. The product describes the journey of discovery undergone by Bell and Patterson, but, more importantly, contains an expert system whereby practising academics can analyse and redesign their own courses based on the outcomes required of their students.

Development of the program, through educational design, interface design and production is described in this paper. Continuous formative evaluation led the design through a long and thorough gestation process. The design of the expert system was particularly problematic, requiring a thorough analysis of the range of outcomes and assessment possible in professional sociology, and the development of criteria to encapsulate this variety.

After the beta version of the program was completed, it was trialed with a range of users to determine its usability and suitability as a staff development tool for professional sociology teachers, and its potential for use in other discipline areas. The

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results indicated that the project was found to be very interesting by its target audience, but several changes are required to make it easier to use, and to increase its applicability to other disciplines.

A project management methodology was employed, which enabled the collection of comprehensive timesheet data. This has been analysed to assist in further developments.

Context

A traditional approach to teaching introductory sociology is to present a body of theory and, after a reasonable competency has been achieved, proceed to a critical approach with these theoretical models. The information is complex, often abstract, and is criticised by students as "interesting but irrelevant" to their future work as teachers. This approach reinforces a false dichotomy between theory and practice, because it uses a linear, content-based model, which assumes that theoretical competency is "acquired" at a certain point, and then "critique" is performed once this acquisition has occurred.

The CUTSD grant awarded to Bell and Patterson funded the development and implementation of two undergraduate foundation units, at Murdoch and James Cook Universities, respectively, which integrated the theoretical material of previous units with grounded, research-based assignment work (Bell and Patterson, 1998). The units were designed explicitly from the outcomes desired by students, staff, the discipline and the profession. Once outcomes were identified, assessment tasks were designed which would lead to the attainment of the outcomes in a scaffolded and developmental fashion. The assessment tasks led naturally to the types of teaching and learning activities to be undertaken by the students, which in turn determined the nature and sequencing of the content to be covered in the unit.

The innovative approach taken contrasts markedly to the traditional approach to university teaching, which usually begins with the identification of the topics (content) to be studied, and ends with assessment of how well the student has learnt the content – potentially ignoring what the student really *needs* to learn.

One part of the CUTSD grant was the dissemination of information about the outcomes-based approach to unit design to other tertiary teachers of sociology. Initially this was proposed to be in the form of a video. However, it was realised that many aspects of the outcomes-based approach are applicable to a range of other tertiary disciplines, and a more interactive approach may be more appropriate, and more easily adapted for use in other areas of university teaching.

Accordingly, an interactive multimedia program was developed by the Teaching and Learning Centre at Murdoch University.

Development details

Project Management methodology

The project was developed using a project management methodology based on that described in (Phillips, 1997). In this model, interactive multimedia development proceeds by a cycle of design, develop, evaluate, as shown in Figure 1.

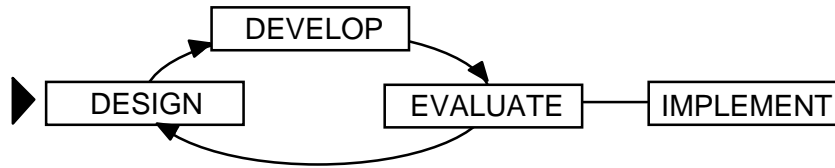


Figure 1: Project management cycle.

The design part of the process was also carried out in a cyclical fashion, designing, developing and evaluating in ever more detail until the project was completely defined and documented. Previous experience (Phillips, 1997, Phillips et al., 1997) had shown the benefit of a thorough design process in minimising production time and reducing the occurrence of errors.

The intention in this case was to complete the design phase before starting production, but this was not achieved because of a fixed deadline and the complexity of the content material. Nevertheless, the majority of the design was finished before production started.

The parts of the development process are described in more detail in the following sections.

Educational design

The rationale for producing a computer program rather than a video was that the product should be more than simply an information source. It needed to be interactive, so that people could use it as a tool to assist them in developing their own units.

Analysis of the needs of the clients identified three desired outcomes for the program:

- to tell the story of the journey of discovery taken by Bell and Patterson in developing their innovation;
- to provide a tool for tertiary teachers to review their current approaches and to assist them in redesigning these – this would be provided through an expert system;
- to present case studies of the processes undertaken by Bell and Patterson in developing new approaches to unit design based on outcomes, and to describe the changes made to their units.

Educational design led to the development of two layers of information; with the first outcome being organised under the label *Journey*, and the second and third outcomes being organised under the label *Expert System*.

The journey

In-depth information about the experiences of Bell and Patterson was elicited by conducting a semi-structured interview with an experienced facilitator. The recorded interview was transcribed, and used with other background material to develop a storyline. The intention was that the storyline would be enhanced at various points by video and audio vignettes. It was also intended that there be linkages at appropriate points between the story and the expert system.

The structuring of the storyline posed interesting problems in terms of multimedia educational design. Because the requirement was for a story, it needed to be basically linear in structure, unlike in most multimedia designs, where the requirement is for multiple paths through the content. However, there was a substantial amount of material, and if this had all been presented linearly, it would have been too long to maintain interest. Ultimately, a shorter linear sequence, with four entry points was chosen:

Introduction, Thinking Outcomes, Processes and Changing Cultures. The rest of the content was structured as short side branches of one or two screens. The conceptual structure of the Journey is shown in Fig. 2.

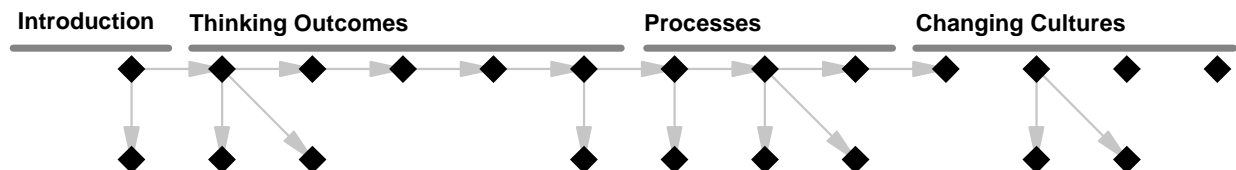


Figure 2: Conceptual structure of the Journey part of the program

The expert system

We were able to identify five separate parts to the process involved in redesigning a unit:

- the context in which the unit is taught;
- the profile of the student body;
- the outcomes which the student should attain;
- the assessment items which can lead to the outcomes;
- evaluation of and reflection on the success of the process.

The fundamental premise of Bell and Patterson's approach is to identify course outcomes, and then determine the most appropriate method of assessment to meet these outcomes. Bell and Patterson had made these judgements implicitly, by discussing them with colleagues. The challenge of this project was to make their reasoning explicit, and in a way in which a computer program could respond to all meaningful inputs.

After much effort, we were able to conceptualise four different qualities of assessment (see Table 1). The four qualities of assessment are expressed as "tensions". They should be viewed as continua, because it is assumed that they are not in binary opposition, but that each has its own strengths and limitations. Each of these tensions relates to four different ways of thinking through learning processes.

Table 1: The four learning tensions.

Quality	Tension	Description
Assessment Direction	Experiential vs Theoretical	Assessment Direction refers to the Experiential-Theoretical tension. In experiential learning modes, the learning begins from the context of the learner and then moves towards the appropriate learning theory, content or paradigm. In theoretical approaches, the learning begins within the context of the theory, content or paradigm that is accessed by the learner.
Assessment Choice	Negotiated vs Directive	Assessment Choice refers to the tension between negotiated and directive assessment; within this tension learning changes in relation to the amount of control students have over their assessment experiences.
Assessment Group	Collaborative vs Individual	Assessment Group refers to the number of students involved in assessment activities; these may be individual or collaborative.
Reworking Assessment	Reflective vs Non-reflective	Reworking Assessment refers to whether assessment items are revisited by students and are then formally reworked or readdressed or not.

A comprehensive list of types of assessment was developed, based on work by Nightingale et al., (1996). These assessment types were categorised according to the four tensions to demonstrate that the tensions were valid analytical tools.

We had already identified that there were five parts to the process of designing a unit: context, student profile, outcomes, assessment and evaluation. The same process could be applied to the two units as currently taught by Bell and Patterson at Murdoch University and James Cook University, respectively, as well as to the units as they existed prior to the adoption of an outcomes-based approach. This analysis led to a conceptual structure (Fig. 3) which allows connection (vertically) between each part of the process of designing a unit. It also allows connection (horizontally) to other instances of the same part of the process, so that the user's own work can be compared to the case study information. The conceptual structure led naturally to a two-dimensional navigation scheme which allowed users to access the major parts of the program with two mouse clicks.

Another aspect of Bell and Patterson's approach is that redesigning a unit is a developmental activity. They found that the process involved teaching the unit, reflecting on it, and redesigning it, incrementally, over three or more teaching periods, until eventually the unit was outcomes-based. The program we designed had to duplicate this behaviour.

In the design of the expert system, a significant amount of content material was developed as feedback to various actions performed by the user. Other material was implicit to the structure of the expert system, and this material was made available to the user as a *Background* layer, which supported the *Journey* and *Expert System* layers.

Interface design and implementation details

The educational design indicated that the product needed to be able to efficiently display short video segments on screen, while at the same time recording users'

responses in a database for later feedback. The first of these requirements pointed towards a CD-ROM solution, while the second indicated a web-based solution.

The final system was designed as a web/CD hybrid, based on HTML. The static elements, primarily the Journey and Background layers, are stored on the CD, together with the 62 QuickTime digital video clips. The expert system is served over the web by CGI scripts, written in PHP3 and communicating with a MySQL database running under Solaris. User IDs are recorded so that users can retrieve their data from the database in a subsequent session.

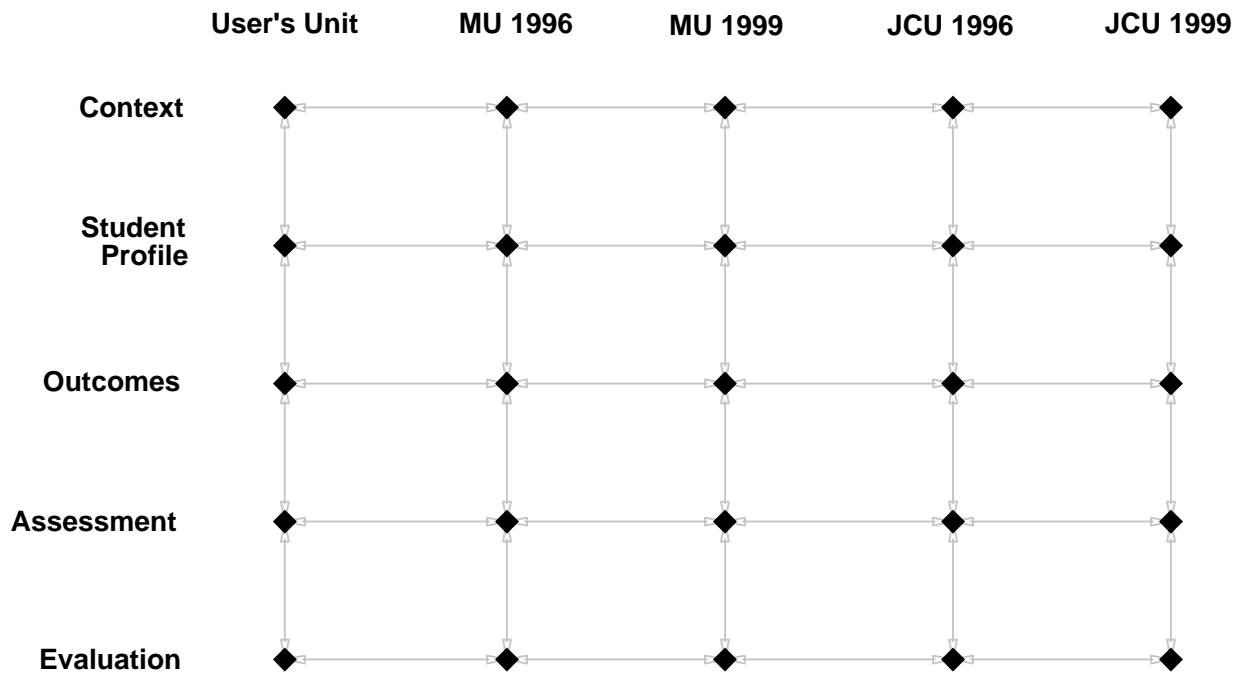


Figure 3: Conceptual structure of the Expert System part of the program. The HTML-based interface uses a three-frame layout:

- a top frame containing major navigation elements;
- a left frame to add graphic balance and provide a placeholder for video;
- a right frame containing the content.

The navigation frame, shown in Figure 4, was written in Macromedia Director. It provided direct access to the 34 major pieces of content in the program. Communication between static and dynamic HTML pages and the Director-based navigation frame was achieved through Javascript. The program contains 102 HTML/PHP3 files that display information to the user, and 11 downloadable Word documents.



Figure 4: Navigation interface

Design of the expert system

The expert system requires the user to complete questions on a series of online forms. The results of the forms are stored in a database. Many of the answers to the questions are simply stored by the program for later review by the user. However, some questions return answers which are used by the expert system to provide specific feedback to the user. This occurs mainly in the assessment and evaluation sections.

In the assessment section, the user is prompted to choose the types of formal assessment which they use in their unit. The program responds by asking for more details about the assessment types chosen, and uses this information to analyse the assessment types in terms of the four pairs of assessment tensions (Table 1). Analysis is given of the assessment mix as a whole (Fig. 5.); of the weighting of each of the assessment qualities; and of the qualities of each assessment item.

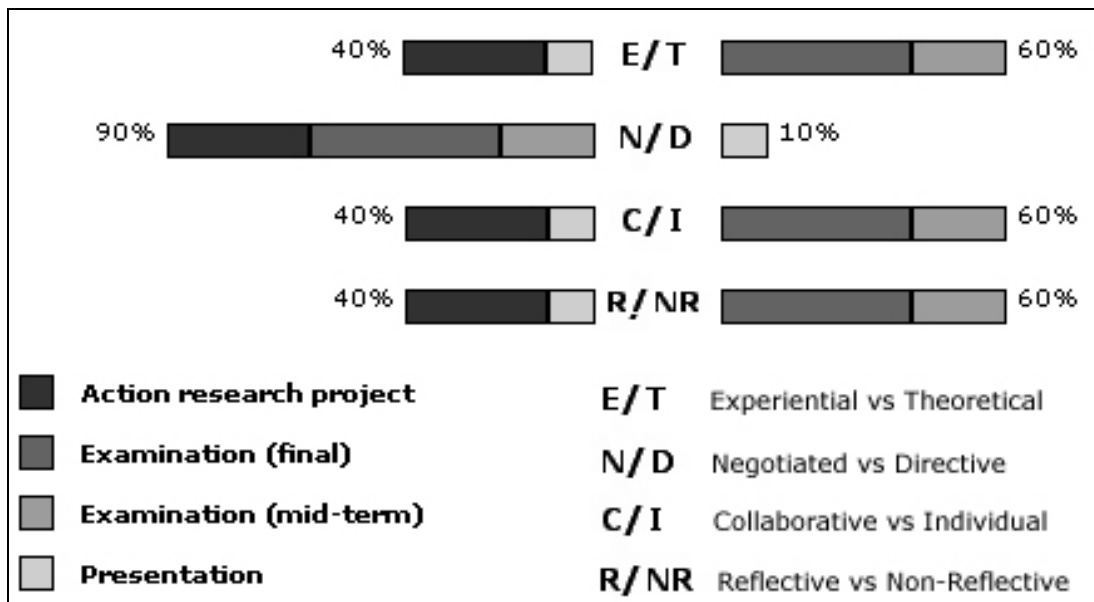


Figure 5: Visual representation of overall analysis of assessment types in terms of assessment qualities.

The user can reflect on this information, in terms of the way they approach teaching, and in terms of the outcomes they have identified for their students.

The evaluation section of the expert system summarises the data from all previous sections and prompts the user to reflect on their unit design with a series of questions. Any section can be revisited and the data modified. When the user is satisfied with their unit structure, they can choose to create a template unit outline. This draws data from the context section (number and duration of lectures, tutorials, etc.), and assessment items from the assessment section to create a template unit outline which can be saved to disk.

The expert system is intended to be used in a developmental fashion. Since all results are stored in a database, users can return later and start another session, based on any previous work they have done. Users can also use Bell and Patterson's work as the starting point for their own development.

Formative evaluation

Throughout the development of the program, formative evaluation was an integral part of the design methodology. In the early stages of the program development, evaluation involved peer review and analysis of each aspect of the design by educational designers, content experts and other members of the design team. This process was repeated a number of times prior to production, as each section of the program was progressively refined in terms of its structure and functionality and its integration into the whole.

Once the program was largely functional and suitable for testing, it was evaluated by people external to the design team.

Methodology

The formative evaluation of the beta version of the program, undertaken in July 1999, was modelled on the multi-method, multi-perspective approach to evaluating multimedia products, described by Kennedy (1999). The methodology applied to evaluate this program included observation of users interacting with the program, followed by completion of a questionnaire and an open-ended, unstructured interview. The seven participants involved in the evaluation were specifically chosen to include experts in the disciplines of sociology, education, multimedia and programming/software design. All were potential users of the final product and offered a variety of perspectives in their feedback. None of the participants was involved in the design and development phases of the program.

During the observation phase of the evaluation, the evaluator observed users of the program, encouraging the user to 'think aloud' as they worked through the program. Details of the features being used and the path taken through the program were noted, together with any difficulties encountered with the interface, content or overall functionality of the program.

The evaluation questionnaire was designed to address various aspects of the program, which were broadly classified into: Instructional and Conceptual Design, Interface and Graphic Design, and User Attitudes and Affect (Kennedy, 1999). The questionnaire was developed partially from the perspective of Reeves' interface dimensions (Reeves and Harmon, 1994). Specific criteria evaluated included: ease of use, navigation, mapping, cognitive load, knowledge space compatibility, information organisation and presentation, language/terminology used, screen design, aesthetics, media integration, user attitudes, overall functionality and suitability for its intended purpose and audience.

The interview aspect of the evaluation gave the evaluator the opportunity to ask the user to explain why particular choices were made in navigating through the program, get further comments on difficulties encountered and to identify other interface and content problems not addressed by the questionnaire.

Findings

At the time the program was evaluated some features of the program were not functional. Furthermore, in anticipation of changes to the interface, only minimal help information had been prepared. The external evaluators were presented with a one page summary of the program, and largely left to ‘fend for themselves’ in working with it.

There was general agreement that the program was potentially a powerful educational tool, if certain improvements were made. The areas of improvement identified by the evaluators involved the user interface, and some aspects of the content.

The frequency of responses to the survey are summarised in Table 2. There was a mixture of responses to most questions, but the most negative responses related to navigation and orientation within the program. Observation and interview also indicated that users had difficulty in knowing how to move around in the program.

One reason advanced for difficulty with the navigation was that the names used for the different parts were not meaningful to the user. Another user did not recognise the purpose of the navigation bar. However, while there were obvious navigational difficulties, observation showed that users were able to learn to navigate within the program after an initial period. This is backed up by the comment: “It took me a while to work it out, but once I did it was easy to use.”

The seven evaluators took a range of paths through the material. Two users started with the Background; two with the Journey; one with the Expert System and two with the Sitemap. Interestingly, some of these users felt that the first choice they would like to make was not in the most logical location. However, given the range of approaches to navigation taken, there is no best choice to make.

Table 2: Summary of survey results. The Table shows the frequency of each response on a Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Question	Response:	FREQUENCY OF RESPONSE				
		1	2	3	4	5
1. I found the Changing Outcomes website easy to use.			1	4	1	
2. The website gave me a good overview of the organisation of the content within the Changing Outcomes program.			1	2	3	
3. It was easy to navigate within the website.			2	3	1	
4. I always knew which part of the website I was working in.		2	1	2		1
5. I could tell that I covered all of the content presented in the website.		1	2	2	1	
6. It was difficult to cope with learning how to use the website and to interact with the Changing Outcomes content at the same time.			4	1	1	
7. The language used was part of my vocabulary.		1	1	2	2	
8. This website will assist me in further developing a unit which I teach.		1		3	1	1
9. The analysis of assessment items was useful.				3	1	1
10. The feedback I received through the program allowed me to compare the assessment mix with the outcomes I set.			1	1		1
11. The website screens were useful and well-balanced.			1	3	2	
12. I liked the colour scheme of the website.		1			3	2
13. The fonts used throughout the website were easy to read and attractive.				1	3	2
14. The navigation bar buttons were clearly labelled and easy to understand.		1	2	3		
15. The website contained too much text.		1	2	1	2	
16. The use of animation, video, sound and other media was relevant to the website content.			1	2	1	2
17. Less text and more interactive media (animation, video, sound etc) would be more useful.			1	3		2
18. The use of media helped me to understand the program.			1	2	1	2
19. I enjoyed using the site.			2	2	1	1

20. The material in the website was useful to me.		2		2	1
21. This website met my expectations as a university teacher.		2	1	1	1

Some of the non-Sociology evaluators had difficulty with the language in which the content was expressed. It was felt to be too ‘humanities-based’. A related comment was that the program is "*geared to a group of experts - it's not for me.*"

Some of the Sociologists and educationalists took issue with the four assessment tensions that were regarded as dichotomous in the Expert System, but which were not in their experience.

On a more positive note, one Sociologist was impressed with the ‘diagnostic’ utility of the package, and felt that it was "*impressive to generate a coherent analytical statement*".

Another Sociologist praised the program:

I was fascinated. ...When I was filling in the questionnaire I found that, apart from minor teething glitches, I think the website was very easy to use. ... I thought it was good the way you could move around, so that if I wanted to go back to the background and see the theory behind it I could. I could have spent another hour or two working on it.

Project metrics

An intrinsic part of the project management process was the recording of accurate timesheet records, both to measure progress against the budget and also to record data for use in quoting future projects. A two-tier recording system was used, with seven major categories. Each of the major categories has a set of sub-categories, to enable fine-grained analysis of tasks performed.

After the initial analysis of the project, a budget was developed based on the time estimated to be spent on each sub-category. In estimating the budget, it was assumed that there would be approximately 50 screens of content, with users interacting with the program for an average of one hour. The initial budget estimate was that 500 hours of effort would be required to develop the 50 screens of content.

In practice, significantly more time was spent in developing the project. A total of 1393 hours was recorded on timesheets, excluding time spent by the content experts. There are a number of reasons for this.

- The project ended up being larger than predicted – 102 web pages, some of which were relatively long, compared to the initial estimate of 50.
- Following formative observations of users, it is estimated that interested people could interact with the program for approximately three hours.
- Time pressures on key staff and a looming deadline meant that no time was left to reduce and redesign the content.
- The expert system and associated database became more complex than initially anticipated.

Figure 6 displays an analysis of hours spent in categories. The major discrepancies are in project management and web authoring. Project management became an extremely important factor in delivering a beta copy of the project in time for the prescribed deadline. Twenty five percent of the total project effort was spent in project management. In the final stages of development, approximately 600 files and documents were in circulation among a team numbering over 10. Effort invested earlier in the project lifecycle in defining document management and version control processes proved invaluable during the final, hectic stages of development, and resulted in very little wasted time. The web authoring category was higher because of the extra volume of content, and because of an under-estimate at budget time.

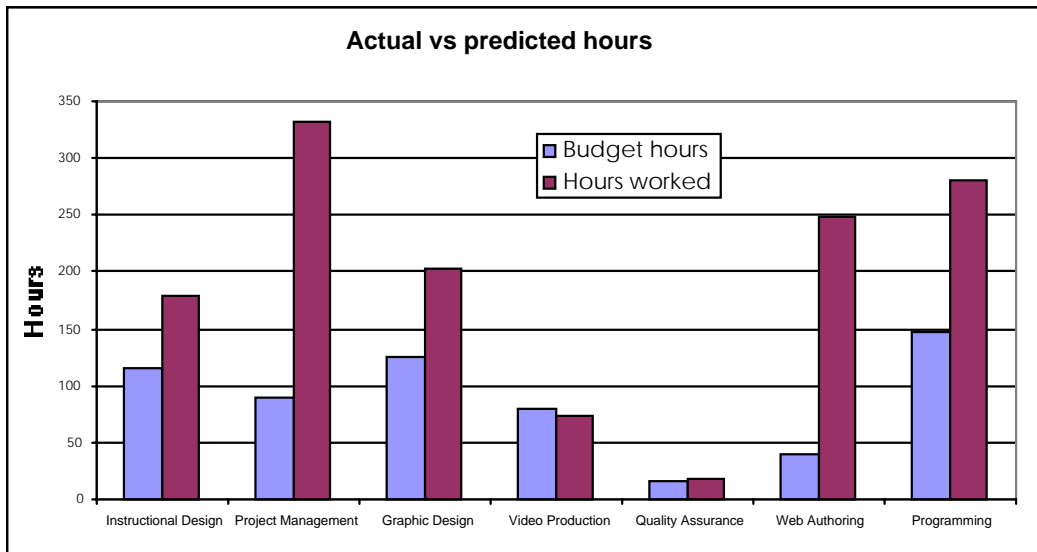


Figure 6: Comparison of actual vs predicted hours per timesheet category in the development of this project.

Conclusion

This paper has described the development and formative evaluation of a web-based program designed to serve as an easily-accessible, self-directed professional development tool for academics involved in the design and teaching of sociology units in professional degrees.

It is intended that the program be used as a developmental tool by university lecturers. That is, they can analyse their unit, reflect on it, redesign the unit and teach it. Then, before the next semester, they can come back to the program, reflect and redesign again, incrementally, until eventually their course is outcomes-based over a period of 3 years or semesters.

The results of the evaluation indicate that the program will be able to meet these goals, once some improvements are made to the user interface, and contextual/help information is developed.

Acknowledgments

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