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USING THE ENHANCED PROBLEM-BASED LEARNING GRID: THREE MULTIMEDIA CASE STUDIES

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Abstract

In this paper we consider the enhanced Problem Based Learning Grid, the conceptual framework for learning using the Grid and our research method. We explain the role of the Grid in describing the interaction of lecturer, tutor, student and multimedia developer in three different case studies, each of which has been chosen to demonstrate the interaction of different components within the Grid. The paper concludes with a brief discussion of the common issues raised as a result of applying the Grid to the development and implementation of online course materials.

Keywords

Problem based learning, online learning.

Introduction

Recent developments in course design at the University of North London and London Guildhall University (now known as the London Metropolitan University) have led the authors to enhance the Problem-Based Learning Grid devised by Oriogun and Georgiadou (2000), by including within the Grid the role of multimedia developer alongside the roles of lecturer, tutor and student. The enhanced Problem-Based Learning Grid is also referred to as the ePBL Grid or the Grid for the purpose of this paper - see Table 1 for the Grid. The introduction of the role of multimedia developer reflects the increasing demand for exciting, interactive learning materials that can be delivered online.

The ePBL Grid

The ePBL Grid (also referred to as the Grid in this paper) was developed as a response to the challenge of facilitating learning and knowledge acquisition, with specific reference to cognitive skills development within a multimedia development environment. The Grid adds to the significant body of literature, which argues the need for learning scaffolding when using small group learning. This version supersedes the previous one presented at the 2nd Asia Pacific Conference on Problem-Based Learning by Oriogun and Georgiadou (2000). The Grid now includes online course development in its scope by adding the role of Multimedia Developer as another learning agent within the Grid.

The aim of the Grid is to provide a structured representation of the kinds of activities undertaken by teaching and learning agents (Lecturer, Tutor, Multimedia Developer, Student - See Table 1) in order to facilitate the development of new courses that include problem-based learning as part of their pedagogical model. The Grid can be used both as a descriptive tool and as a framework for reflection. We have used the Grid in this paper as a framework for reflection in the three case studies presented in this paper.

Course Component	**Lecturer**	**Tutor**	**Multimedia Developer**	**Student**
Lectures	• *Plan* • *Schedule*			• *Attend* • *Participate*

Course Component	Lecturer	Tutor	Multimedia Developer	Student
	• *Liaise with tutors* • *Deliver*			
Online Resources	• *Liaise with developer* • *Design input* • *Provide content*	• *Facilitate* • *Support*	• *Project-manage* • *Design* • *Give pedagogical advice* • *Production of assets* • *Test prototype*	• *Interactivity*
Tutorials / Seminars / Workshops	• *Plan* • *Schedule* • *Allocate*	• *Organise* • *Facilitate* • *Monitor progress* • *Liaise with lecturer*		• *Contribute* • *Ask questions* • *Engage in problem solving* • *Report progress* • *Criticize (Peer)*
Computer Mediated Communication	• *Moderate and contribute* • *Set tasks*	• *Moderate and contribute* • *Set tasks*	• *Set up discussion groups* • *Set up chat rooms* • *Set up video conference*	• *Participate* • *Engage* • *Contribute*
Research	• *Suggest* • *Monitor* • *Evaluate*	• *Suggest* • *Help* • *Focus*		• *Plan activity* • *Research* • *Investigate* • *Document*
Individual Assignment	• *Specify* • *Monitor* • *Evaluate*	• *Direct* • *Monitor*		• *Research* • *Document* • *Present* • *Implement*
Teamwork	• *Specify task* • *Allocate groups* • *Liaise with tutors* • *Evaluate results*	• *Monitor* • *Assess Progress* • *Provide Feedback*		• *Research* • *Present results* • *Apply techniques* • *Implement software* • *Use tools* • *Participate* • *Deliver presentation* • *Peer review*
Formative Feedback	• *Liaise with developer* • *Provide content* • *Provide feedback*	• *Liaise with developer* • *Provide content* • *Provide feedback*	• *Design /develop online materials* • *Produce templates*	• *Self assessment* • *Self diagnosis* • *Peer assessment*
Summative Assessment	• *Plan* • *Write* • *Deliver*	• *Support revision*	• *Design /develop online materials* • *Technical support on security issues*	• *Prepare* • *Revise* • *Attend* • *Succeed*

Table 1: The enhanced Problem Based Learning Grid - ePBL Grid

Course Design

In the three case studies presented in this paper using the Grid as a framework for reflection, we have adopted two approaches to course design and the development of flexible learning environments. Our first approach involves the use of games as motivators. Games are activities that stimulate the mind and can encourage a more playful approach to a serious topic. The idea that people learn through play is not a new one and has been exploited in children's games for generations. As Negroponte says: "A major part of learning comes from exploration… By playing with information, especially abstract subjects, the material assumes more meaning…" (1995). Crawford's theory with respect to computer games (1982) is that "…the fundamental motivation for all game-playing is to learn," although he qualifies this by pointing out that the motivation may not be conscious. According to Grieshop (1987), playing games can increase motivation and interest in the subject matter, by focusing on the process of learning rather than

the end product. Rieber, an advocate of educational games, calls this "serious play" (2001), which for him represents a passion to learn about something.

The ability of great games to totally absorb the attention of the player is a quality that makes them very attractive to educators. Bryce and Rutter (2001) explain how the psychological experience of playing videogames, in common with various other leisure pursuits that demand concentration, comprises: "… intense involvement, clarity of goals and feedback, lack of self-consciousness, a balance between the challenge of the situation an the skills required to meet them, and a feeling of total control over the activity." Amory et al. (1998) describe how during game play, learners can be "… immersed into constructivist micro worlds … become part of the scenario, thus stimulating interest and motivation.

Our second approach is the concept of cognitive ecology (Bateson, 1972), which is inspired by socio-cultural approaches and integrates the concept of learning with the concept of cultural mediation of the learning process (Vygotsky, 1978; Salomon et al., 1991). Learning spaces are promoted as environments that provide the learner with the responsibility for their own development and allow him/her to participate and be incumbent in a new social dynamic. The cognitive dimension veers more and more towards the social dimension for circumscribing a learning process that is distributed and complex (Salomon, 1993; Chan, 1996), and whose reach relies on the appropriate arrangement of components in the immediate context of the learner. Components may include, for example, the learning task or activity, the tool-artefact activity mediator, the partners or the community in interaction with the learner (Salomon, 1993).

Research Method - Case Studies

Our research method is through the use of case studies. The three case studies presented in this paper demonstrate how individual learning agents have engaged with the challenges of designing a course or undertaking a problem-based learning activity, and have assumed responsibility for key roles outlined in the ePBL Grid. Each case study examines the interaction between specific course components and the roles and responsibilities described in the Grid, in order to evaluate the Grid by comparing it with what happened in real-life scenarios where teams of learning agents were engaged in problem-based learning activities. Each case study will consist of the context in which the initial problem was tackled, followed by the problem specification, the development process, and finally, mapping the roles within the Grid to real-life roles played out by participants, and an example of the implementation. The following are generic descriptions of the context of each case study:

(i) Multimedia students at London Guildhall University take a final year course entitled “Authoring for Networks”, which aims to develop their understanding of how to design and produce multimedia applications for the internet. The students are acting as multimedia developers themselves in order to produce a prototype piece of software. This case study describes the changing roles of the students as both learners and developers.

(ii) Professional multimedia developers at the University of North London work with lecturers to produce innovative course materials for online delivery. This case study examines the interplay between the developers and the lecturers in order to produce new resources.

(iii) The MSc Computing course at the University of North London includes a software engineering project. This case study examines the roles and responsibilities of the lecturer/tutor facilitating the course as well as the learning experiences of the students.

Case Study 1: Online Games Project

Context

This case study looks at the interaction of the course component of the Grid with the roles of students as both learners and multimedia developers. See Table 2 for the section of the Grid being considered for Case Study 1.

Course Component	Multimedia Developer	Student
Online Resources	• *Project-manage* • *Design* • *Give pedagogical advice* • *Production of assets* • *Test prototype*	• *Interactivity*
Teamwork		• *Research* • *Present results* • *Apply techniques* • *Implement software* • *Use tools* • *Participate* • *Deliver presentation* • *Peer review*
Formative Feedback	• *Design /develop online materials* • *Produce templates*	• *Self assessment* • *Self diagnosis* • *Peer assessment*

Table 2: The ePBL Grid in the context of Case Study 1

On completion of the "Authoring for networks" course at London Guildhall University, students should be able to demonstrate competence in the use of software authoring tools for the development of online projects, produce web documentation of their work and be critically aware. In order to help students gain appropriate knowledge in this area, we have devised a course that provides them with some practical and theoretical information about the gaming industry, and requires them to design and develop their own online multi-player games.

Problem Specification

The course assignment in 2002 aimed to provide students with the opportunity to combine existing skills and knowledge with new information and to encourage them to learn about how to build networked applications. (See Table 3: Specification of BSc Team Coursework Assignment).

> *For the purpose of this assignment you will work in teams to produce an online application. Your task is to plan, design, develop and implement a "Peace Game" for delivery on the web. Examples may include an interactive story, a treasure hunt, a quiz, or a puzzle.*
>
> *User data (eg. name + score) should be stored on a server so that players can revisit the site and improve their score or continue with the game.*
>
> *There should be a cooperative element to the game. eg. Players must get information or help from another player or a third party in order to continue playing.*
>
> *The game should be developed using appropriate web authoring tools. The application should be creative, imaginative and original.*

Table 3: Specification of BSc Team Coursework Assignment

The Peace Game concept was chosen to challenge the students and encourage them to think of types of games that differ from solitary shoot-em-ups.

Development Process

All the course material was delivered online, as well as in face-to-face contact between students and lecturers. The course website included web links, a regularly updated FAQ section, links to teams' homepages, links to lectures, examples and workshop resources, as well as relevant documentation from the course handbook. Students could choose from a variety of workshop sessions run by lecturers on the course, such as design issues, scripting interactivity, database development and server-side scripting.

Students assumed the roles of a team of developers, taking responsibility for project management, research, graphic design, asset production and application development as well as prototype testing. They started by researching and brainstorming.

At key points in the development life cycle, teams gave demonstrations of work-in-progress to the rest of the class. Each student had the task of giving formative and summative feedback on two other projects. An online form was implemented to facilitate this exercise, so that all the feedback was stored in a database and automatically collated for online distribution to teams three hours after the event. Both these tasks were assessed in terms of the reviewing student's ability to critically evaluate a piece of multimedia work, using criteria learned throughout their degree. The intention was that these exercises would indirectly help students to reflect on their own project work as well as that of their peers. For this project, other students on the course were also representative of typical clients for the finished application – in other words, the teams were all trying to create games that would be appealing to their colleagues. Each team member produced a website explaining their contribution to the project development lifecycle, giving rationales for design decisions that had been made and providing a critical analysis.

Implementation

The following screen shots (Figures 1 and 2) are taken from some of the games developed during the course. There were various genres represented, including quiz/trivia games, puzzles and adventures, reflex and target-practise, team games and simple strategy games.

Figure 1: Mickey & Mallory

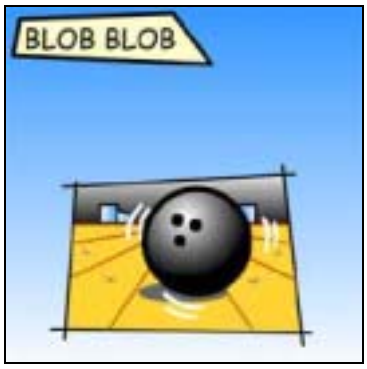

Figure 2: BlobBlob

The standard of work was generally high, with the majority of teams meeting the learning objectives of the course. On the other hand, only a small number of teams managed to meet all the requirements of the original brief, which was to design a game that included the concept of peace, involved the cooperation of two or more players and which maintained player data on a server.

Two teams chose to develop children's games with an educational slant, rather than focus on the "peace" part of the brief at all. Several groups attempted to legitimise what was essentially target practice by the changing the iconography, so that killing became changing or improving. We recognised that students were seduced by the shoot-em-up genre and the catharsis of having a legitimate enemy and then destroying it (Southern, 2002).

Case Study 2: Multimedia Development of the IncoChallenge

Context

This case study looks at the interaction of the course component of the Grid with the some of the roles and responsibilities of Multimedia Developer(s) and Course Lecturer and Tutor. It focuses on the Online Resources and the Formative Feedback sections of the Grid. It deals with a multimedia learning resource (IncoChallenge), which was developed in a partnership between course tutors and developers, and also discusses and presents the results of the final software resource. See Table 4 for the section of the Grid being considered for Case Study 2.

Course Component	Lecturer	Multimedia Developer
Online Resources	• *Liaise with developer* • *Design input* • *Provide content*	• *Project-manage* • *Design* • *Give pedagogical advice* • *Production of assets* • *Test prototype*
Formative Feedback	• *Liaise with developer* • *Provide content* • *Provide feedback*	• *Design /develop online materials* • *Produce templates*

Table 4: The ePBL Grid in the context of Case Study 2

The ePBL Grid indicates four areas where the Multimedia Developer has a key role to play in the problem-based learning process. In this case study, the Multimedia Developer was involved with developing resources for a single element of the course programme – the IncoChallenge, which was a set of interactive games and exercises for students taking a Masters course in Business Studies. The Lecturer retained control of computer-mediated communication, which consisted of students taking part in online discussions.

Problem Specification

The problem posed by the lecturer(s) was to develop a multimedia resource that:

- *Was challenging and would engage students and that wasn't boring for professional students;*
- *Would encourage learning by students with differing levels of motivation;*
- *Would be as user friendly and approachable as possible;*
- *Could be accessed by students outside of a Virtual Learning Environment, and without the need for passwords;*
- *Would facilitate initial learning and act as a revision aid prior to examination.*

Table 5: Specification for MBA Course Material

Development Process

Four key stakeholders in the project were: The Senior Lecturer in Supply Chain Management (responsible for course structure); the Course Tutor of IncoTerms the subject area and a team of two Multimedia Developers. The resource development followed the five key areas of Online Resources and the work of the Multimedia Developer as outlined on the Grid. The lecturer liaised with developers in a series of meetings, which focussed on the management of the project. In these a series of actions were set. They outlined the nature of the multimedia development process and the management of a project. These involved the planning of key stages of production, assets production and management, tasks and team roles, time management and stages of production.

The multimedia developers also offered pedagogical advice on the needs and workings of a resource. Assets necessary for the development of the software resource were mediated or undertaken by the multimedia developers. At the same time the lecturers provided the IncoTerms content for the multimedia resource. The multimedia developers undertook a 'Learning Adventure'. This involved the testing and prototyping of possible interactive IT solutions to the problem. This led to the development of a prototype solution. After the development of a resource solution there followed a reflection and refinement phase.

Implementation

The following screen shot is from the IncoChallenge project. It is an interesting interactive design that was able to give students instant feedback on answers to questions relating to supply-chain management on the MBA course.

Figure 3: INCOChallenge game

Case Study 3: A Postgraduate Software Engineering Coursework

Context

This case study looks at the interaction of the course component of the Grid with the some of the roles and responsibilities of the Lecturer (facilitators of the course), the students and the students as Multimedia Developers. The module Lecturer and the students have roles to play in all the key areas indicated by the Grid. The particular area of interest for this case study in relation to the Grid is the interplay between Lecturer, Student, and Students as Multimedia Developers in relation to the course components Lectures, Online Resources, Tutorials/Seminars/Workshops, Computer Mediated Communication and Teamwork. See Table 6 for the section of the Grid being considered for Case Study 3.

Course Component	**Lecturer**	**Multimedia Developer**	**Student**
Lectures	• *Plan* • *Schedule* • *Liaise with tutors* • *Deliver*		• *Attend* • *Participate*
Online Resources		• *Project-manage* • *Design* • *Production of assets* • *Test prototype*	• *Interactivity*
Tutorials / Seminars / Workshops	• *Plan* • *Schedule* • *Allocate*		• *Contribute* • *Ask questions* • *Engage in problem solving* • *Report progress* • *Criticize (Peer)*
Computer Mediated Communication	• *Moderate and contribute* • *Set tasks*	• *Set up discussion groups*	• *Participate* • *Engage* • *Contribute*
Teamwork	• *Specify task* • *Allocate groups* • *Liaise with tutors* • *Evaluate results*		• *Research* • *Present results* • *Apply techniques* • *Implement software* • *Use tools* • *Participate* • *Deliver presentation* • *Peer review*

Table 6: The ePBL Grid in the context of Case Study 3

The module Lecturer specified the task for the group coursework, allowing the students to choose their own grouping instead of allocating members into groups. The module Lecturer liaised with other members of staff involved in the assessment of the module on a weekly basis, as well as being part of the online conferencing for all the groups through a number of Internet Service Providers (in this particular case study, Yahoogroups.com) in order to monitor and evaluate the progress of the groups. The module convenor together with the module tutors (part-time Lecturers) monitored, assessed students' progress and provided feedback to students groups on a weekly basis on the progress of their work.

Problem Specification

Problem-Based Learning is particularly pertinent to the field of software engineering, as there can be many different approaches and successful solutions to any single project. The task assigned is indicative of one that could be expected in a real world environment and thus the group was motivated to use their collective skills to find a creative and individual solution to the various problems posed. Table 7 shows the original specification for the group coursework.

The members of the SIMT Golf League regularly compete in matches to determine their comparative ability. A match is played between two golfers; each match has a winner, a loser or is declared a tie. Each match consists of a round of 18 holes with a score kept for each hole. The outcome of a match is used to update the ranking of players in the league. The winner is declared better than the loser and any golfers previously beaten by the loser. Other comparative rankings are left unchanged. *The software should keep information about each golfer, e.g. name, club ID, address, the date of last golf match, and current match ranking, etc. Each round of golf should also be tracked. The software should allow golfers to input their own scores and allow any legal user to query any information in the system.*

Table 7: Specification of MSc Group Coursework Assignment

Development Process

At the start of the project, each group elected a Project Manager to control planning, task allocation, review processes and consistency/quality checking. The group established that the project requirement necessitated a high workload, given the size and availability of the project team. All were full-time employees attending the university one evening per week for 3.5 hours, of which at least 1 hour was compulsory lecture time. Milestones were mapped onto a timeline chart indicating key weeks and the critical path. It was also agreed that the group had a good mix of software engineering skills which could be equally utilised and because of which, at any stage, there would be at least two other skilled team members available to quality check any work produced, whether it be in project management, architecture design, methodology analysis, web design or programming. Communication was cited as a key issue for achieving project aims and the group made effective use of www.yahoogroups.com (formerly www.eGroups.com) as an online discussion presence where issues could be raised, discussion enabled and files posted and stored.

Implementation

The system was delivered on time to an estimated 90% functionality according to documented requirements. The group also purchased their own web domain name, which was re-routed to point to the host server. The online system demo can be accessed at www.wizardsolutions.co.uk (WizardSolutions, 2001). A username of: *4* and password of: *pass4* are required to be able to view all implemented modules. Figure 4 shows a screen shot of the League Administrator menu and ‘Update Club Details’ applet; Figure 5 shows the report of League members.

Figure 4: Administrator Menu

Figure 5: League Members

Conclusions

We have used the Grid in this paper as a framework for reflection in the three case studies presented. Our first case study looked at the interaction of the course component of the Grid with the roles of students as both learners and multimedia developers; the second case study looked at the interaction of the course component of the Grid with the roles and responsibilities of multimedia developer(s) and course lecturers; and the final case study looked at the course component of the Grid with some of the roles and responsibilities of the lecturer and the students in the development of online multimedia system.

The common issues raised as a result of applying the Grid include, the use of new technology, promotion of teamwork, and working with real-life problems. Our future work will be to address these common issue, by carefully monitoring and evaluating the level of our students' engagement in the learning process and our teaching strategies as educators. We argue that the Grid can be used to promote self-directed learning, it provides a structure that facilitates the logical consideration of real-life problems, and it can also be an invaluable aid to course design, by providing guidelines for the kind of tasks that might be suitable for learners to undertake.

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