ASCILITE December 7-10 '97

Acumen: An Interactive Multimedia Simulation Based on Situated Learning Theory

Peter Standen & Jan Herrington

School of Management & University Learning Systems

Edith Cowan University

Abstract

This paper describes the development and evaluation of a multimedia simulation for teaching research skills to business students. Graphics, sound and video are used to create semi-realistic 'microworlds' which students explore in order to solve a relatively unstructured problem, a process quite different to learning from textbooks, lectures or videos. One advantage of microworlds is that students construct meaning by actively and selectively working through a variety of information sources, a process which mimics real-world learning and enhances higher-order learning outcomes.

We describe the theoretical principles used in designing the simulation, particularly situated learning theory which claims a number of advantages for teaching that is 'situated' in the context of real world problems. There is also evidence that the 'immersive' quality of microworlds may be more motivating than other teaching/learning modes, at least to some students. As the technology for creating media-rich simulations is still new, we discuss the issue of how realistic simulations should be.

Our multimedia package can be related to a long tradition of teaching methods in business that attempt to put theoretical principles into life-like contexts, via case studies, experiential learning, internships, or real-world projects. The advantages and disadvantages of computer microworlds over such methods are explored.

Introduction

Teachers of applied disciplines have always sought ways to make classroom learning more applicable to the world of professional practice. In business teaching for example, case studies, site visits, research projects and internships have been used to provide varying degrees of contextual 'embeddedness' to textbook principles. Now, multimedia technology allows students to interact with realistic 'microworlds', depictions of business environments created through the use of images, sounds, video and interactivity. This paper describes the experience of using this technology to embed learning of research skills in simulated business environments. Students are given a task which requires them to use textbook principles in a context where practical skills, problem solving and social skills are also required. The task is open-ended, complex and somewhat ambiguous, as real research projects often are.

The three sections of the paper discuss the theoretical rationale for teaching research skills in this way, the issue of how much and what sort(s) of realism might be used, and how we are evaluating the program.

Theory of Situated Learning

Since the late 1980s, in particular, there has been much argument in the literature that schools and universities are lacking in their ability to produce students who can think creatively, who can solve problems and who can use the knowledge they have acquired in appropriate and adaptive ways. The assumption is that students' abilities to think and reason are not being developed, and the culture of classrooms promotes superficial rather than deep learning .

Resnick contends that school learning is fundamentally different to everyday, practical learning in several distinct ways. School learning largely promotes individual endeavour and cognition, and yet activity outside school is predominantly shared. School learning concentrates on promoting 'pure thought' and abstract representations rather than the effective use of tools (such as calculators, notes, and books) as is preferred outside. Symbol manipulation, favoured in school learning, is largely rejected outside where actions are closely connected to the actual context of objects and events. Finally, school learning promotes generalised, theoretical principles and skills rather than the situation-specific capabilities used outside. These differences between formal and real-world learning are not only evident in schools. Any form of teaching or training is inadequate where trainees are removed from authentic situations and given instruction which adheres to a traditional classroom model. Universities, corporate management training, teacher training and military training programs have all suffered from too little engagement with genuine situations, and too much emphasis on theoretical perspectives .

Sternberg, Wagner and Okagaki analyse the differences between the kinds of problems learners face in academic situations and practical, real-world applications. For example, academic problems tend to be: formulated by others, well-defined, complete in the information they provide, characterised by having only one correct answer, characterised by having only one method of obtaining the correct answer, disembedded from ordinary experience, and of little or no intrinsic interest. In direct contrast to the academic approach, practical problems tend to be characterised by: the key roles of problem recognition and definition, the ill-defined nature of the problem, substantial information seeking, multiple correct solutions, multiple methods of obtaining solutions, the availability of relevant prior experience, and often highly motivating and emotionally involving contingencies . These key differences between the school-based approach and real life have been summarised by Lebow and Wager (see Table 1).

Real-life	**In-school**
1. Involves ill formulated problems and ill structured conditions.	1. Involves 'textbook' examples and well structured conditions.
2. Problems are embedded in a specific and meaningful context.	2. Problems are largely abstract and decontextualized.
3. Problems have depth, complexity and duration.	3. Problems lack depth, complexity, and duration.
4. Involves cooperative relations and shared consequences.	4. Involves competitive relations and individual assessment.
5. Problems are perceived as real and worth solving.	5. Problems typically seem artificial with low relevance for students.

According to many of these writers, traditional school and university learning is in danger of becoming isolated, irrelevant and marginalised from mainstream real-world activity and performance. The challenge is for educators to align formal learning more substantially with the way learning is achieved in real-life settings, and to base instructional materials design on more recent theories of learning which reflect this shift. One method which has the potential to achieve this is the theory of *situated cognition* or *situated learning*.

Situated learning as a model of instruction has grown out of a general theoretical shift within the educational community from 'behavioral to cognitive to constructivist' learning perspectives . In the mid-to-late nineteen eighties, teachers and researchers in education began to investigate the notion of apprenticeships and to try to distinguish those characteristics which were critical to its success. Their aim was to begin the process of developing a theoretical perspective for learning based on the apprenticeship model, the success of which cognitive science had, to date, not been able to explain. Brown, Collins and Duguid were the first to use the

ideas to produce a proposal for a model of instruction that has implications for classroom practice. In their model of situated cognition, Brown et al. argue that meaningful learning will only take place if it is embedded in the social and physical context within which it will be used. Collins defines situated learning as: 'the notion of learning knowledge and skills in contexts that reflect the way the knowledge will be useful in real life' (p. 2).

The Teaching Problem

Teaching research methodology is typically done through lectures, tutorials, and, sometimes, practice research projects. The latter allow students to integrate the text and classroom learning, and to see the interconnectedness of topics presented in weekly 'spoonfuls'. They also show students that completing research involves practical skills, requiring management of time, personnel and resources. Additionally, in a business environment social skills and an understanding of the way problems are framed by managers are required. While these contextual skills are considered valuable by student and teacher alike, research projects are messy, requiring considerable staff time in developing real-world topics that are manageable, and making sure students do not 'mess up' in a real organisation. A further problem of increasing relevance involves external courses, or offshore class-based courses, where projects are impossible to supervise.

The Solution: Acumen

Our solution is modelled on the experience of a student employed as an apprentice in a summer job. Here, we describe just one of three such experiences in the package. The student is 'employed' by *Acumen Research* to undertake a research project for a client, a large bank. In their office at *Acumen* (Figure 1) are various resources, including information on office procedures (principally on navigating in the simulation), books on research and statistics (electronic version of textbooks or guides), and a folder containing information on the project. Two general resources are available throughout the simulation, a phone which provides context sensitive help (e.g., hints on what to do next), and a notepad primarily for taking notes or storing information.

Figure 1: The office and offer of employment at *Acumen Research*

Figure 2: The client

There are no instructions on using the program, as navigation involves only clicking on objects or people. The larger problem of what

is required, is explained in a project brief which will require further elaboration by students. After familiarising themselves with the resources, students are directed to 'travel' to the client's office. There they meet the manager commissioning the research (Figure 2) and have a preliminary 'discussion' on the nature of the problem as he sees it. The discussion involves a preliminary statement by the manager, after which students can choose questions from a list in the notebook. The manager's statement and responses are video clips. Students are expected to choose questions with some thought to the situation: there is not time to answer all questions, and some in the list are largely irrelevant to the problem. They work in pairs, and are encouraged to discuss the best choice of questions, and, indeed, all other choices.

The manager also invites the student to discuss the project with one of his senior staff members (in another module, there are far too many people to talk to, and students must select the most relevant people). What they learn in such discussions is that the problem has other angles and must be reformulated to some extent. Apprentices are told beforehand that, as in the real world, there may be no one right way of construing the problem, but that certain views may be more appropriate or politically important than others.

After constructing their version of the problem, the students design a questionnaire by selecting questions from a large bank of items used in previous surveys. They then choose the sampling design from a set of alternatives. Again, the choices are not straightforward, and collaboration between students is encouraged. On finishing the research design tasks, students receive their data, which has been 'collected' by a group of telephone surveyors employed by the research agency (Figure 3).

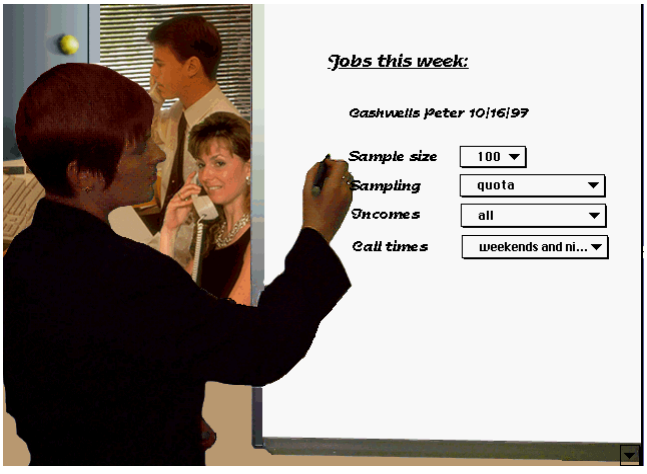

Figure 3: The telephone surveyors' office

The research issues, survey questions and data are all from an authentic project, although some of the more complex issues have been simplified. The data are a random selection from the real data, so that students in a class will have different results, even if they come up with the same set of questions.

Finally, the data are downloaded from the program and analysed in a statistics package, and a report written. The report is to be modelled on an authentic client research report found in the package (Figure 4). This report can be evaluated by the lecturer. It would also be feasible to use a learning log or diary to record students' reflections on the process of the apprenticeship.

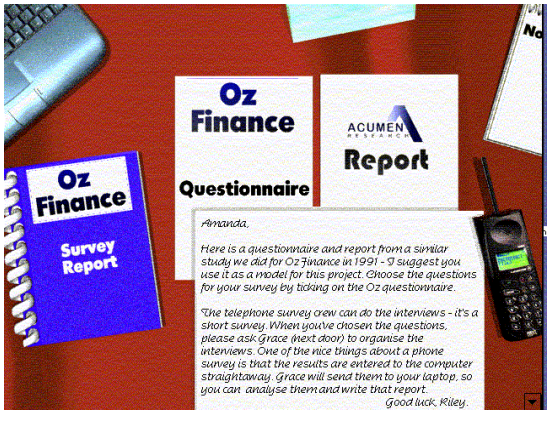

Figure 4: The student's work desk and resources

Thus the simulation provides an experience set in a world characterised by ambiguous and contradictory information, practical limits on time and budget, and social agendas. These bring a requirement for practitioners to actively construct an appropriate version of

the problem, as well as a sequence of problem-solving steps based on both the textbook principles *and* context sensitivity.

The Issue of Realism

To us as designers, and many viewers of our demonstrations, a key issue is how realistic we can and should make a microworld, particularly given the diminished budgets available in tertiary education today. For example, our videos are not fully realistic, being compressed. The opportunity to explore is constrained by the resources available to develop complex artificial worlds. The need for closed-choice interactivity with microworld inhabitants means students 'speak' by selecting from a list of possible questions, a little artificial. And the feedback will be the same if you ask the same question twice-there are limits on the naturalness of this world. Do such compromises restrict or negate the goal of learning-in-context?

Initial evaluations suggest students do not see these limitations as significant. None interviewed after using trial versions reported feeling they had been given degraded experiences. Of course, their views are based on certain preconceptions of what computer materials should look like. However, there is also a body of research evidence from a several fields that a high degree of realism is not necessarily required, and in some contexts may overload students, leading to frustration and poor performance. For example in the literature on simulating complex machinery, the suggestion is that only the minimum amount of realism necessary to simulate *function* should be provided (Hays & Singer 1989).

There is also some evidence from virtual reality designers (Laurel 1993) that people have elaborate 'projective powers', particularly in relation to social settings, but also in relation to the physical environment. There is some evidence that these are called upon in studying simulations in business teaching which are not particularly 'media rich' (Standen, 1995). These powers involve a tendency to impute personalities and build elaborate stories around a set of minimal cues. Indeed the process of 'sensemaking' in everyday life involves the pervasive construction of social realities from partial clues (Weick, 1995). Multimedia designers need to provide only enough clues to enable imagination, not technology, to create 'realism'.

These consideration suggest that realism is not a major issue for users, and our experience is that moderately priced technology can now deliver acceptable simulations of social environments, subject to some limitations. This claim would be further enhanced by evidence of transfer of learning to a real world context: we are unaware of research on this issue.

It may also be worth asking whether the purpose of a simulation should be a veridical copy of a real world experience. A view commonly found in the educational simulation and gaming (SAG) literature is that the major role for simulations is to provide an opportunity to practice higher order skills-in the words of Goodman (1985) to provide 'practice in theory'. Certainly simulations like *Acumen* can provide opportunities for a range of higher order skills, from collaboration to problem formulation and critical thinking. From this view, it matters less that the learning problem and process are *precisely* the same as the real world equivalent.

A final consideration is that there should be enough realism for students to perceive the problem as real: where this happens, there is likely to be a motivational effect beyond that derived from fictitious case studies and generalised textbook examples.

The challenge for developers of simulations such as *Acumen*, then, is to provide only enough realism to: firstly, enable students to see how textbook principles get modified in use according to the practical and social constraints of context; secondly, enable practice of relevant higher order skills; and, thirdly, motivate those who prefer to practice on real rather than artificial problems. Each of these outcomes is difficult or impossible to achieve in other forms of classroom teaching.

Evaluation

The success of an interactive multimedia program such as *Acumen*, will ultimately depend on how students respond to the learning environment, how it engages their attention and whether they perceive it to be an authentic situation within which to learn and practice their research skills.

A preliminary evaluation of the program is currently underway, using interpretive research methodology, to establish the influence of the authentic context, the authentic activity and the authentic assessment on students' beliefs about the effectiveness of their learning. Four students (two groups of two) have been observed and videotaped using the program for two consecutive weeks of class time. The four students will be interviewed individually, and all data will be transcribed and analysed with the assistance of a computer-based qualitative analysis program, such as NUD*IST and *VideoSearch* . The results of the evaluation will be reported more fully in the conference presentation.

Conclusion

This paper has explored some of the theoretical justifications for using loosely structured multimedia environments to teach applied subjects, using the *Acumen* project as an example. Situated learning theory suggests that university teaching generally fails to take into account many aspects of the *practice* of the textbook principles. We suggest that computer simulations offer an opportunity to bring elements of practice into the classroom. The limitations of technology mean that simulated environments will not be complete substitutes for the real thing, but on the other hand they can provide enough complexity, unstructuredness, embeddedness, and social context to make them worthwhile vehicles for the practice of many activities not permitted by other teaching methods.

References

Brown, J.S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-42.

Cognition and Technology Group at Vanderbilt (1993). Toward integrated curricula: Possibilities from anchored instruction. In M. Rabinowitz (Ed.), *Cognitive science foundations of instruction* (pp. 33-55). Hillsdale, NJ: Lawrence Erlbaum Associates.

Collins, A. (1988). *Cognitive apprenticeship and instructional technology* (Technical Report No. 6899). BBN Labs Inc., Cambridge, MA.

Ertmer, P.A., & Newby, T.J. (1993). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly*, 6(4), 50-72.

Goodman, F. L. (1995) Practice in theory. *Simulation and gaming,* 178-189.

Hays R. T. & Springer M. J. (1988) *Simulation fidelity in training system design.* NY: Springer-Verlag.

Jonassen, D. (1991). Objectivism versus constructivism: Do we need a new philosophical paradigm? *Educational Technology Research and Development*, 39(3), 5-14.

Knibb, K. (1997). *VideoSearch* [Computer software]. Perth: Edith Cowan University.

Laurel, B. (1993) *Computers as theatre.* Reading, Mass: Addison-Wesley.

Lebow, D. (1993). Constructivist values for instructional systems design: Five principles toward a new mindset. *Educational Technology Research and Development*, 41(3), 4-16.

Lebow, D., & Wager, W.W. (1994). Authentic activity as a model for appropriate learning activity: Implications for emerging instructional technologies. *Canadian Journal of Educational Communication*, 23(3), 231-144.

Qualitative Solutions & Research (1993). *NUD*IST* [Computer software]. Melbourne: Author.

Resnick, L. (1987). Learning in school and out. *Educational Researcher*, 16(9), 13-20.

Standen, P. (1996) Realism and imagination in educational multimedia simulations. *Proceedings of the 3rd International Interactive Multimedia Symposium,* Perth.

Sternberg, R.J., Wagner, R.K., & Okagaki, L. (1993). Practical intelligence: The nature and role of tacit knowledge in work and at school. In J.M. Puckett & H.W. Reese (Eds.), *Mechanisms of everyday cognition* (pp. 205-227). Hillsdale, NJ: Lawrence Erlbaum Associates.

von Glasersfeld, E. (1995). *Radical constructivism: A way of knowing and learning*. London: The Falmer Press.

Weick, K. (1995) *Sensemaking in organizations.* Thousand Oaks, Calif: Sage.