Abstract: This paper describes the transformation of a multimedia program, designed to teach research skills to business students, from one based on an ‘instructivist’ model to one underpinned with a constructivist philosophy. The revised program uses the theory of situated learning as a framework for the instructional design, and introduces elements such as authentic context, an authentic activity, collaboration, and opportunities for articulation and reflection, into the learning environment.

Introduction
Over the past decade or more, there has been a substantial theoretical shift from a ‘behavioral to cognitive to constructivist’ learning perspectives amongst educators (Ertmer & Newby, 1993, p. 50; Jonassen, 1991; von Glasersfeld, 1995). Little credence is now given to learning theories that propose that learning is no more than the transmission of a body of knowledge from teacher to student. No matter how much teaching methods in the classroom have changed, the theoretical foundations of interactive multimedia programs are frequently found to be based on behavioral traditions inherited from educational technology. As Jonassen puts it: ‘The roots of behaviorism extend deeply into IST [instructional systems technology] practice’ (Jonassen, 1991, p. 6). It is possible, even today, to find many examples of multimedia learning environments which use the same instructional design as the early programmed instruction texts of the 50s.

It is one such multimedia program which we describe in this paper—a program firmly in the behaviourist mould, which attempted to take the subject of research methodology and transmit that knowledge in a linear fashion through eight modules and 26 lessons. The program was based on a pedagogical philosophy described by Reeves and others (Reeves, 1993; Duffy and Jonassen, 1991) as ‘instructivist’ where little emphasis is placed on the learner ‘who is the passive recipient of instruction’ (Reeves, 1993, p. 4). The program had been under construction for about two years, and had already swallowed up a substantial amount of funding. The Faculty was committed to the program’s completion. But we both envisaged a far better way to create a learning environment to teach research methodology. We planned to design a constructivist shell to provide a meaning to the lessons that comprised the original program.

Some educators, such as Squires (1996) have spoken of programs designed from a constructivist philosophy being used in very non-constructivist settings. Young, Nastasi and Braunhardt (1996) relate their experience of implementing ‘a constructivist design in a constructivist manner’ (p. 121). Clearly, the software itself is but one aspect of an interrelating group of influences which may determine whether learning is successful. Our plan was to incorporate a ‘non-constructivist design’ into a learning environment based upon a constructivist philosophy.
An Instructivist Learning Tool

The original program comprised a multimedia package for teaching statistics and research methods in a business degree, traditionally taught by lectures and tutorials. As in many similar courses, mastering the theory took most of the time, leaving little room to explain its application and the practicalities of using it in business. A first attempt to improve the course recognized the power of multimedia to present technical material in a self-paced format (Figure 1), using multiple choice or other closed format exercises to help students test their understanding at each stage. This approach was based on the typical transmission model of learning, made interesting with multimedia features like graphics, animations, and interactive exercises. However, unlike a lecture, students could also repeat sections of the course until the concepts were mastered.

The resulting 'electronic textbook' had some advantages over traditional lectures and tutorials, but pilot testing showed it did not really solve a major problem of the course: that the technical material was boring when studied in isolation from its application. Students lacking work experience could not make the connection, and business students are renowned for their resistance to teaching that is not apparently relevant. The attractions of self-pacing, constant feedback and animations were acknowledged, but the trial revealed no improvement in students' motivation to work through the many steps needed to understand the material. In hindsight, self-pacing and constant feedback can be seen as reducing the quality of teaching: students could not turn off when the material was difficult, nor use their considerable skills at answering tutorial questions with very partial knowledge. A solution designed to increase learner control worked on one level, but had the reverse effect on another and was actually judged worse or no better than traditional methods. The following sections describe the philosophy we adopted and how we designed a more constructivist learning environment to incorporate this original program.
Situated Learning

In designing our ‘constructivist shell’, we wanted to provide a real-life context and meaning to the learning that the students were required to do as they worked with the program. In so doing, we drew heavily on situated learning theory (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991; McLellan, 1996) which emphasises the notion that the learning process cannot be divorced from the context of the problem, and that the learner will use information and clues from the situation rather than apply formally taught problem-solving techniques. Resnick (1987) contends that school and university learning is fundamentally different to everyday, practical learning in that it provides too little engagement with genuine situations, and too much emphasis on theoretical perspectives. Above all, we wanted the learning environment to more closely resemble the way learning occurs in real life than it does in formal school and university settings.

From the literature on situated learning, it was possible to produce a list of nine critical criteria (Herrington & Oliver, 1995) that could be used to guide the design and development of the interactive multimedia which was to comprise the constructivist shell. The program needed to provide:

1. **Authentic context that reflects the way the knowledge will be used in real life**
   The program needed to be able to encompass a physical environment which reflected the way the knowledge would ultimately be used, and a large number of resources to enable sustained examination from a number of different perspectives (Brown et al., 1989; Honebein, Duffy, & Fishman, 1993). The context chosen was a large research company, with all its resources and infrastructure, where the students gain temporary employment.

2. **Authentic activities**
   The learning environment needed to provide ill-defined activities that have real-world relevance, and which present a single complex task to be completed over a sustained period of time (Bransford, Vye, Kinzer, & Risko, 1990; Brown et al., 1989). The authentic activities in the program include three research ‘jobs’ on the students’ desk when they start work, each of which require 2-4 weeks of a semester to complete.

3. **Access to expert performances and the modelling of processes**
   In order for the learning environment to provide expert performances, the program needed to provide access to expert thinking and the modelling of processes (Brown et al., 1989; Collins, Brown, & Newman, 1989; Lave & Wenger, 1991). The program provides examples of completed research projects to enable students to examine professional research reports.

4. **Multiple roles and perspectives**
   In order for students to be able to investigate the learning environment from more than a single perspective, the program needed to provide different perspectives on the topics from various points of view (Collins et al., 1989; Honebein et al., 1993; Spiro, Feltovich, Jacobson, & Coulson, 1991). In each of the research scenarios, the students need to interview a number of different employees within organisations to obtain information, and to consult a variety of other resources.

5. **Reflection**
   In order to provide opportunities for students to reflect on their learning, the program needed to provide both an authentic context and non-linear navigation to enable them to return to any element of the program (Boud, Keogh, & Walker, 1985; Collins & Brown, 1988; Kemmis, 1985). Unlike the original research methodology program, which followed a linear form, the new shell enabled students to navigate at will within the resource.

6. **Collaborative construction of knowledge**
   The learning environment needed to provide the opportunity for students to collaborate, and while this could not be incorporated within the software itself, it is recommended that students work on the program in small groups to enable them to problem-solve together (Brown et al., 1989; Collins et al., 1989; Hooper, 1992).

7. **Articulation**
   The learning environment needed to ensure that students were free to discuss the task as they use the program to enable them to learn to speak the language of the discipline and community of practice (Collins et al., 1989;
Lave & Wenger, 1991). Unlike the original program which was designed for individual students working silently on their own, the new learning environment encouraged the students to articulate their growing understanding of the research methodology with their partners.

8. Coaching and scaffolding
The learning environment needed to ensure that the teacher was available to provide required coaching and scaffolding for students as they used the program (Collins et al., 1989; Greenfield, 1984).

9. Authentic assessment
In order to provide assessment of student learning compatible with the situated learning model, the program needed to provide assessment that was seamlessly integrated with the activity (Linn, Baker, & Dunbar, 1991; Reeves & Okey, 1996; Wiggins, 1993). Students are assessed on the research report that is the purpose of their work at the research agency, rather than on the separate quizzes and tests of the original program.

A Functional Learning Tool

While this constructivist style of multimedia is not as simple to create as the instructivist electronic textbook, it has many advantages: it shows the relevance of theory to application; learning of theory is driven by the need to use it, rather than an artificially imposed pedagogical framework; and field experiences closer to professional realities than simplified student projects can be simulated. The context is modeled on the experience of a student employed as an apprentice in a summer job with Acumen Research to undertake research for a client, a large bank. In their office at Acumen (Figure 2) are various resources, including information on office procedures (principally on navigating in the simulation) and a folder containing information on the project.

![Figure 2: The office at Acumen](image-url)
The books on research and statistics are the electronic texts described earlier: students do not now have to use them except as they need to supplement learning from other sources to complete the project. Two general resources available throughout the simulation are a phone that provides context sensitive help (e.g., hints on what to do next), and a notepad primarily for taking notes or storing information. No instructions on using the program are needed as navigation involves only clicking on objects or people to perform activities as they would be done in the real situation. After familiarizing themselves with the resources, students are directed to the client’s office. There they meet the manager commissioning the research and have a preliminary ‘discussion’ on the nature of the problem as he sees it. This involves a statement by the manager, followed by the opportunity to 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 are largely irrelevant to the problem. Students work in pairs, and are encouraged to discuss their choices.

The manager subsequently invites the student to discuss the project with a senior staff. They learn in these discussions that the problem has other angles and must be reframed to meet the needs of the various organizational members. Apprentices are told beforehand that, as in the real world, there may be no one right way of constructing the problem, but that some views may be more politically important than others. These are often unexpected and interesting issues to students, and not readily available in the traditional teaching approach. After constructing their version of the problem, students design a questionnaire by selecting questions from a large bank of items used in previous surveys. Next, they choose the sampling design from a set of alternatives; tradeoffs between scientific accuracy and costs invite students to see theoretical principles in the context of real world constraints. 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. Finally, the data are downloaded, analyzed in a standard statistics package, and written up. The report can be evaluated by the lecturer, authentically, in the same way its real-world counterpart would be.

**Behavioral to Constructivist**

In designing a constructivist shell for a behavioral interactive multimedia program, we deliberately sought to adopt an approach which saw learning as an active process rather than the result of a transmission of knowledge from program to student. The tasks that were designed for the program were global, complex and sustained, rather than clearly defined tasks and subtasks, neatly broken up into lessons and modules. These tasks were placed within a full and authentic context rather than fragmented tasks and pre-determined instructional sequences. The new program required and encouraged students to explore the learning environment, rather than being captive to the presentation of a number of linear lessons. It presented a complexity which required more reflective thought than the step-by-step lessons of the original program. Students were required to select relevant data and material from a wealth of sources, rather than try to absorb a pre-determined and well-defined body of knowledge. In so doing, they were required to reflect about their path rather than progress automatically through it. The interface of the new program used an ecological approach (Pejtersen, 1993) which presented real world metaphors and objects rather than buttons as navigational devices. Students would need to associate the meaning of an object with its destination rather than click upon the ubiquitous forward and back arrows of the original program.

In its implementation, the learning environment moved from a purely individual and solitary pursuit to a collaborative one, supported by a teacher who could provide coaching and scaffolding at appropriate times. Assessment of learning became integrated, authentic and inseparable from the activities themselves, as opposed to the separate tests and quizzes designed to assess decontextualised packets of learning.

In the real world, unlike the classroom, practitioners actively construct their understanding of a problem, and design a sequence of problem-solving steps based on both the textbook principles and contextual factors. The program described here provides an understanding of how the theory behind research functions in the face of ambiguous and contradictory information, practical limits on time and budget, and social agendas. In so doing, it provides students with a learning environment no longer based on the instructivist models of the 50s, but one firmly grounded in recent theory and research.
References


Reeves, T. C. (1993). Interactive learning systems as mindtools. In P. Newhouse & J. (Eds.), Viewpoints 2 (pp. 2-11, 29). Perth: ECAWA.


