The development, design and delivery of a retail simulation

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Abstract
theRetailGame.com is a web-based package of e-learning materials designed to support students on retailing courses. It uses the focal point of a ‘store opening’ to draw attention to key operational variables. The web-based package allows students to explore the impacts of variable combinations in a risk-free environment. This paper outlines the rationale for developing this new package; explains the design principles underlying its construction; and describes the delivery and assessment mechanisms in which it has been embedded. The case history of the project is reviewed, and actor-network theory is used to characterise the alignment of requisite time and expertise as a feat of engineering, facilitated by top-down support but dependent upon the creative manoeuvrings of the bottom-up enthusiast.

Introduction
Exhortations to work smarter are a mantra with which UK academics are becoming increasingly familiar, and information and communication technology (ICT) is presented regularly as a key enabler (Dearing, 1997; Laurillard, 2001a, 2001b; Darby, 2002). The philosophy (Noble, 1998a, 1998b, 1998c; White 1999), blend (Roscoe, 2002a) and potential (Curran, 2002) of ICT-based learning has received considerable attention; however, this article sets out to address Burge et al’s (2000) criticism of the lack of frank, intra-personal reflection on the practicalities of developing web-based systems to support learning.

The paper follows the development of a web-based business simulation in a ‘new’ university business school, and uses elements of actor-network theory to expand on Hall and White’s (2002) tentative view that successful e-learning initiatives combine top-down, bottom up and middle out dynamics.
“Bottom-up” enthusiasm
From 1995 to 2001 a paper-based store planning exercise had been used to support first year retail management undergraduates. Students were typically 18–19 year olds with some retail experience, often gained on the shop floor. The exercise was conducted over a period of eight weeks. Individual reflection on lessons learned from the exercise, informed by intra- and inter-group comparison of outcomes, contributed to the summative assessment.

The exercise used the scenario of opening a new store to highlight key operational variables and their dependencies. Based on a tutor’s first-hand experience of planning such events and refined year-on-year through contact with industry, the exercise required students to make decisions about selecting stock lines, organising staff cover, arranging store layout, choosing stockloss prevention methods etc. These decisions would be informed by calculations and projections of future performance that the student carried out. Students’ decisions were submitted to the tutor in a group report. The quantitative data on turnover, profit and so on were checked by the tutor who inputted values into a spreadsheet template. A perceived weakness of the process was that students’ initial decisions could impact upon subsequent decision options, and hence a poor initial choice could adversely affect their results. However, students did provide positive comments about the realism of the learning experience. The search for alternatives to the paper-based exercise only served to demonstrate a lack of suitable alternatives. Kirkup and Moirano’s (1997) store planning exercise, for instance, also required the manual calculation of decision consequences, which is time consuming for tutors and inevitably delays feedback to students. The commercially available game Entrepreneur (Smith and Golden, 2000) was considered as an alternative but was rejected as it requires users to submit their calculations for central processing by tutors, prior to moving to the next stage of the store planning process.

The course tutor was under increasing (self-imposed) pressure either to abandon this well-received exercise or find an alternative, more efficient way of delivering it. The retail tutor therefore began looking at the possibilities of web-based ICT.

Assessing suitability for web-based delivery
Most commentators agree that ICT has the potential to assist learning, but effective deployment requires an holistic appreciation of the learning process and the factors that enable and constrain it (Freeman and Capper, 1999; Roscoe, 2002b). Many counsel against simply substituting ICT materials for face-to-face contact (Noble, 1998a, 1998b, 1998c); face-to-face and computer-mediated communication channels have different characteristics that translate into different strengths and weaknesses for supporting learners. The challenge is often framed in terms of finding the right blend of face-to-face and computer-mediated contact to deliver intended learning outcomes for a particular community (O’Donoghue et al, 2001; Chickering and Ehrmann, 1996; Chickering and Gamson, 1989). In other words, a sound strategy for deploying ICT would play to documented strengths for a particular pedagogy, and would not neglect the value of face-to-face communication possibilities.
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The paper-based store opening planning exercise can be regarded in many ways as problem-based learning. Juwah (1992) and Weller (2002) are amongst those who highlight the potential of ICT in this regard, particularly for providing immediate, formative feedback on user input. The value of “discovery learning” arising from the safe experimentation and immediate feedback enabled by ICT games and simulations has not been lost on authors such as Senge (1990). However, Siemar and Angelides (1997) warn of the dangers of trial and error clicking. They advocate explaining and controlling the steps of play, allowing activity monitoring with targeted assistance, and some form of post-game report and critique. These requirements for meta-level feedback on progress must be delivered alongside the more immediate feedback signals that denote the computer’s response to learner inputs. Ideally, the ICT interface should help the learner to construct a mental model of the problem space they are exploring, so that emerging appreciations of input-output patterns can be assimilated, leading to new understanding.

In summary, it was apparent that web-based ICT offered an attractive channel for supporting the learning outcomes that had previously been delivered through the paper-based store opening exercise. However, effective development required careful (and complementary) attention to learning process and learning technology. It would not be sufficient simply to switch paper for web delivery. Adjustments to face-to-face communication and assessment would be required. ICT design would need to be informed by an acute sense of audience, so that a clean and simple interface could be produced through which learners could appreciate and feel comfortable to explore the underlying rules of opening a store. In other words, the project required web-based ICT skills and an investment of time and domain expertise to transform this element of the retail course. The retail tutor’s intellectual and emotional ownership of the paper exercise and his interest in innovation placed him in classic “bottom-up” enthusiast territory. The next section deals with the “top-down” support that enabled his desire to invest time to be matched with the ability to do so.

“Top-down Support”

In January 2001, Manchester Metropolitan University formally established a Learning and Teaching Unit (LTU) to provide a focus for learning and teaching excellence and innovation. With a specific remit to share best practice and stimulate development of more flexible and scalable modes of delivery, the LTU sought ways to match top-down support with bottom-up enthusiasm.

In summer 2000, the embryonic LTU was allocated funding to support up to ten Learning and Teaching (L&T) Fellowships, for which anyone with an innovative L&T project could apply. The aim of the one-year scheme was to catalyse local initiatives by “back-filling” teaching time to provide staff with space to innovate. (Funding to replace teaching hours in this case cost approximately £5000). Some evaluation and dissemination costs could be covered, but the budget could not be used to fund computer hardware purchases or out-sourced, professional development of ICT materials. It will become clear that this L&T Fellowship scheme played a crucial role in launching the
web-based retail game project, but it was a necessary rather than sufficient factor for project completion.

The retail game project
The retail tutor made a successful bid for an L&T Fellowship to develop the web-based store opening game, and for the 2001/2002 academic year his timetable commitments were halved. Initial project activities focused on gaining familiarity with the university’s standard e-learning environment and developing an appreciation of similar games and simulations through conferences, trade fairs, web site visits and personal communications.

It soon became clear that the game format of the project placed it outside the scope of the university’s standard e-learning platform (Web-CT), which was oriented towards hypermedia materials, on-line chat facilities and multiple-choice assessment. Spreadsheet technology offered a possible solution to modelling the complex relations between store variables, but the retail tutor was keen to avoid a solution that depended on proprietary software. To maximise flexibility and availability a web-browser solution was preferred, but abandoning the standard e-learning environment would force the retail tutor to extend his ICT repertoire to include web programming. Self-study texts, on-line introductory materials, and sheer determination ensured that progress up steep learning curves was forthcoming but the slow pace was frustrating.

When it became apparent that this approach would not deliver the required web-based game within the L&T Fellowship time-frame, the retail tutor decided to offer the proposed web-based game to students scheduled to enrol in the next quarter on a European Social Fund (ESF) Healthy High Street 2 Project. These students could take an optional introduction to retail management issues and resources were available to fund development of e-learning materials to support them, which could then be used more widely. Actor-network theorists would describe this manoeuvre as a consummate piece of “heterogeneous engineering” (Law, 1991, 1992). The opportunistic alignment of existing accomplishments and new commitments created a win-win situation for the ESF and retail game projects as resources became available to bring in web development expertise from elsewhere within the university. This accelerated development of the retail game project and facilitated a “middle-out” exchange of web-based e-learning experience with an e-commerce colleague, whose talents and interest in the area had become obvious in an earlier chance meeting.

Game design
After the e-commerce colleague joined the project on a paid consultancy basis, game development followed a “rapid prototyping” approach (Maude and Willis, 1991; Stapleton, 2002), in which sample screen layouts provided a focus for discussions between the two tutors. Initial layouts were adapted from the reports that students used to document their decisions on. It soon became clear that the web version could be more
interactive and dynamic; it could do more than automate the paper version. Instruc-
tional flow could be based upon learning outcomes rather than simply following the traditional system.

Pages were re-designed to reinforce distinct clusters of intended learning outcomes. Questions from the e-commerce tutor prompted the retail tutor to identify the need for a strategy page, a space utilisation page, a staffing page, and a stock shrinkage page. These four pages then became ‘homes’ for sets of controls for adjusting relevant store variables.

Following Siemar and Angelides’ (1997) comments about the importance of letting students know how far through the intended learning outcomes they had progressed, a decision was taken to add a progress bar to each page. The web page was divided into two frames to ensure that the main game area could scroll without losing the progress bar. This work on overall flow and structure was informed by parallel development of the underlying data; rules for decision consequences; and game controls.

To ensure that the retail tutor could maintain the site easily, pages were designed so that complex, interactive content could be drawn from a well-structured database. Separating core data from complex delivery mechanisms allowed on-going maintenance to be achieved without knowledge of web-programming. For instance, stock prices could be altered or staff wages changed without touching the web pages. The database-driven approach ensured that students would pick up the new data the next time they accessed the system.

Detailed screen design focused on game controls and feedback cues. Standard web form objects such as pull-down menus and buttons were used to enable user input (and also constrain it to manageable levels of variety). Read-only text boxes were used for feedback cues, such as available staff budget. JavaScript routines were written so that the consequences of one game control had immediate influence on reported values and other controls on the same web page. The use of JavaScript introduced testing overheads, as behaviour was sometimes inconsistent across web browser versions, but the desire to reinforce learning outcomes outweighed these drawbacks.

The observable behaviour of controls on and between pages was determined by under-
lying game rules. The e-commerce tutor’s lack of familiarity with the subtleties of retail management forced the retail tutor to articulate tacit knowledge so that it could be codified with sufficient precision to produce the desired on-screen behaviour. This element of the project was particularly rewarding as each tutor’s specialist knowledge inspired contributions from the other. Useful information highlighted through this interdisciplinary dialogue was added to a suite of web pages that introduced the intended learning outcomes; described the store opening scenario; offered hints on approaching some of the challenges; and provided students with links to sites that would be useful to them as they worked through the game. The resulting structure of the game can be seen in Figure 1.
The basic flow of the game is from left to right, working towards a final report that summarizes the decisions taken and shows the kind of profit that would result from those decisions. However, at any point a student can go back and vary an earlier decision if s/he does not feel able to work with its consequences. This iterative dimension was not possible with the paper version of the game due to time constraints and processing overheads.

Interactive discovery is facilitated further by the choice of JavaScript for the main pages in the game. As all the processing takes place in the web browser, there is no round trip over the internet to get the next or previous page. Students can thus explore the decision space and see the consequences for store operation quickly and easily.

Before leaving a page, students are encouraged to document the rationale for their decisions using free-format text (see Figure 2). These comments appear alongside the decisions in the final report (Figure 3), which adds incentive for completion as students are made aware that the entire report will eventually be seen by the assessor.

**Pilot implementation**

Initial testing of the game was completed by June 2002, with the support of retail and marketing colleagues whose comments helped refine user instructions.

A system of personalised user ids and passwords was introduced to open future avenues for commercial exploitation and enable detailed analysis of site usage. In November 2002, an initial pilot of the site took place with a group of 38 first year undergraduate retail management students. These students were introduced to the game in a lecture and given details of how to access it. They were informed that each student must submit a printed report from the game for assessment after a week without classes. Student use of the game can be seen in Figure 4. The retail tutor explained that he would be available for email, phone or face-to-face support, if required.

All 38 students completed the assignment, and 36 of them provided feedback on their experience through questionnaires. Extracts from preliminary analysis of these can be seen in Table 1.
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The RetailGame was relevant to my studies 4.56
The RetailGame was useful 4.25
The RetailGame was interesting 4.25
I found the RetailGame challenging 4.14
My knowledge of retail operations has improved by using the RetailGame 4.11
It was easy to navigate through the RetailGame site 3.97
The help pages were useful 3.89
I liked the option of trying out different combinations of products, service levels and staff allocations 3.86
I think the RetailGame was realistic 3.83
The instructions on what was required were clear 3.75
**Proposal for FashCo’s new Chimer Store**

<table>
<thead>
<tr>
<th>Floorspace (sq ft)</th>
<th>3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turnover</td>
<td>754250</td>
</tr>
<tr>
<td>Profit</td>
<td>307515</td>
</tr>
<tr>
<td>Staff Costs</td>
<td>66669</td>
</tr>
<tr>
<td>Fixed Costs</td>
<td>162250</td>
</tr>
<tr>
<td>Net Operating Profit</td>
<td>149595</td>
</tr>
<tr>
<td>Profit/Turnover Ratio</td>
<td>20%</td>
</tr>
<tr>
<td>Turnover $/sq ft</td>
<td>25</td>
</tr>
</tbody>
</table>

**Stock Strategy**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Style</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ladies</td>
<td>Casual</td>
<td>High</td>
</tr>
<tr>
<td>Ladies</td>
<td>Casual</td>
<td>Low</td>
</tr>
<tr>
<td>Mens</td>
<td>Casual</td>
<td>Low</td>
</tr>
</tbody>
</table>

**Rationale/Explanation**

I chose these stock and staff strategies because there is a tendency towards casual dressing. The staffing reflects the low cost positioning of the company.

**Space Allocation**

<table>
<thead>
<tr>
<th>Ref</th>
<th>Product</th>
<th>Gender</th>
<th>Style</th>
<th>Range</th>
<th>Price($)</th>
<th>Margin</th>
<th>Min sq ft</th>
<th>Max sq ft</th>
<th>T/O sq ft</th>
<th>Floor space</th>
<th>Turnover</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jackets</td>
<td>Ladies</td>
<td>Casual</td>
<td>High</td>
<td>30</td>
<td>49%</td>
<td>250</td>
<td>260</td>
<td>260</td>
<td>260 (10)</td>
<td>56000</td>
<td>26950</td>
</tr>
<tr>
<td>2</td>
<td>Jeans</td>
<td>Ladies</td>
<td>Casual</td>
<td>High</td>
<td>15</td>
<td>52%</td>
<td>260</td>
<td>280</td>
<td>260</td>
<td>260 (9)</td>
<td>65000</td>
<td>29350</td>
</tr>
<tr>
<td>3</td>
<td>Skirts/housers</td>
<td>Ladies</td>
<td>Casual</td>
<td>High</td>
<td>16</td>
<td>53%</td>
<td>260</td>
<td>260</td>
<td>260</td>
<td>260 (8)</td>
<td>52000</td>
<td>27950</td>
</tr>
<tr>
<td>4</td>
<td>Blouses</td>
<td>Ladies</td>
<td>Casual</td>
<td>High</td>
<td>10</td>
<td>65%</td>
<td>300</td>
<td>320</td>
<td>225</td>
<td>225 (9)</td>
<td>67900</td>
<td>31725</td>
</tr>
</tbody>
</table>

**Figure 3:** Final report page with rationale/explanation from strategy page carried forward

**Figure 4:** Student use of the web site
Two of the most frequently cited improvements made by the students were the option to save their attempts, and print out all the instructions and background data in a single document.

Summary and discussion
In addressing Burge et al’s (2000) criticism of the lack of frank, intra-personal reflection, this paper makes two key contributions. The first arises from describing the design of the web-based game, and its subsequent embedding in delivery and assessment. The second arises from using actor-network theory to present the project as a thread of sometimes deliberate, sometimes fortunate, and often precarious, achievements.

Design and delivery
This project set out to exploit the iterative discovery possibilities afforded by ICT game technology. Web technology was chosen over a spreadsheet solution in order to maximise the potential audience for the retail game. Web pages were designed as windows through which the underlying rules of retail operation could be glimpsed through the observable behaviour of on-screen controls. Rather than simply automating the self-completion forms of the paper forerunner, web pages were designed to exploit opportunities for immediate, interactive feedback around intended learning outcomes. In the best traditions of “rapid application development”, on-screen layout and behaviour provided an effective focus for dialogue and knowledge exchange between the retail specialist and the ICT specialist. Underlying rules and data were stored in a database from which the web pages were generated. This enabled the retail specialist to make changes without becoming embroiled in complex computer code.

Four practical lessons can be drawn from features of the technical design the team would definitely repeat:

- Conceptualise game design in terms of rules, data and on-screen controls
- Organise interaction around intended learning outcomes
- Use sample web pages to focus dialogue about desired layout and behaviour
- Separate changing content (data and rules) from page presentation code to facilitate maintenance

Attempts to embed the game in delivery and assessment for retail units are on-going, but initial evaluation would suggest that the following lessons can be drawn:

- Demonstrate desired ICT interaction in a traditional face-to-face delivery setting
- Clarify the role of ICT outputs in assessment

Project management
The account of the game’s development offered in this paper is not just another “top-down support meets bottom-up enthusiasm” story. In this case, alignment of the two was necessary but not sufficient for project completion. The retail tutor had to align this project with another to marshal requisite resources. The existence of the e-commerce tutor’s interest and expertise only became apparent through chance; and
the alignment of projects that secured his enrolment involved a highly creative and
opportunistic manoeuvre. Even then, project completion was precarious, resting on the
ability of two individuals to harness the interplay of their diverse specialisms.

This frank account presents e-learning development as a struggle to discover, harness
and align suitable resources, despite the best intentions of those trying to stimulate and
support such development. It is not written to decry the efforts of the central L&T Unit,
which clearly played a crucial, catalytic role in this case; but rather to urge would-be
enthusiasts to see themselves as “heterogeneous engineers”, continually looking to
enrol useful resources (people and equipment) to their cause, and working tirelessly to
address the natural tendency of things to go off in different directions (Law, 1991,

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