Internet simulations for teaching, learning and research: An investigation of e-commerce interactions and practice in the Virtual Economy

K. Horton\textsuperscript{a,*}, E. Davenport\textsuperscript{a}, H. Hall\textsuperscript{a} and H. Rosenbaum\textsuperscript{b}
\textsuperscript{a}School of Computing, Napier University, Edinburgh, UK
\textsuperscript{b}Indiana University, Bloomington, USA

Received 30 January 2002
Revised 22 November 2002

In this paper we report upon the Virtual Economy (VE), an Internet simulation which operated for the first time in Spring 2000 involving students at Indiana University, USA and at Napier University, Edinburgh, UK. During 2001, the VE was extended to include participants from other institutions. The main thrust of the project was to encourage active learning on the part of students in relation to the operation of stores in the VE, the consumer experience, and the interaction and practices that emerged. A further element of the project was research based, where we were interested to understand innovation in practice as it related to e-commerce. Questionnaires and diaries were used as research methods, in addition to observation and discussion undertaken by members of staff in classroom situations. While our findings from this first operation of the VE are necessarily tentative, we discuss a number of issues that will be of interest to others considering the use of Internet simulations for teaching and learning. In addition, further issues have emerged which we posit may be of significance to our wider understanding of the experience of e-consumers, and the innovative practices in which they engage. We conclude by considering some implications of this experience for library and information science educators.

1. Introduction

In this paper we describe the innovative use of information and communication technologies (ICTs) for teaching and learning between students at Napier University, Edinburgh and at Indiana University, Bloomington. This represents the first operation of the Virtual Economy (VE), and hence this paper reports preliminary findings which will be subject to further examination as further simulations are run. The VE forms an element within a module in electronic commerce (e-commerce) in the School of Library and Information Science (SLIS) at Indiana University, Bloomington. The approach used in this class involves the design and development of an inquiry-based learning environment for teaching e-commerce. The VE has been incorporated into a module entitled Information Challenges offered by the School of Computing at Napier University, Edinburgh. The structure and format of this module encourages

\textsuperscript{*}Corresponding author: E-mail: k.horton@napier.ac.uk.

0167-8329/02/$8.00 © 2002 – IOS Press. All rights reserved
A deep-learning approach whereby students are encouraged to be active and critical learners, with staff facilitating their learning within an academic structure. Both modules utilising the VE reflect an action centred approach to learning. The students operated as two distinct groups within the VE: the Indiana students (postgraduates) operated as the storekeepers, while the Napier students (postgraduates and final year undergraduates) operated as the consumers. Both groups were set guidelines and challenges to encourage ‘learning through doing’ within the context of the VE, in addition to more traditional modes of instruction – such as lectures, and discussion based seminars.

In addition to the learning focus of the VE, there has been a research element to it. The simulation has offered the potential to examine both the two separate groups in terms of their respective foci, namely as either storekeepers or as consumers. Before and after evaluative methods have been used, as well as reflective diaries, observation, assignment, and assessment of technical data such as transaction logs. The nature of interaction across and between groups has offered a further area of research interest, with one element of this being the potential to assess innovative practice as it emerges, and to monitor outcomes.

Innovation is an important constituent within the domain of e-commerce [1]. By innovation we are referring to the ways in which people, working individually and collectively, invent, resist, and transform ideas into novel, implemented realities [2]. While thinking about the potential for innovation, we have been concerned to think about how we might identify such practices, and how we might learn from them. Typically we have found that innovation processes have been represented in a linear fashion [3]. Van de Ven [2] argues that Rogers’ [3] model requires modification to capture the non-sequential nature of such activity as well as the contextual dependency of action. With this in mind we have sought to try and record as much information as possible surrounding occurrences of innovation activities in addition to the process elements within any area of activity (ibid.). In the remainder of this paper we describe the operation of the VE, and summarise findings related to the running of such learning simulations. We follow this by reflecting upon the first phase of operation of the VE, focusing upon emerging research and operational issues that form a basis for continued enquiry in the future phases of the VE. In particular, we will be interested in processes of innovation in e-commerce that have emerged from the consumer side of the project. Finally, we conclude by considering some implications of the use of problem-based learning (PBL) and web-based simulations for library and information science educators.

2. The virtual economy

The VE has been developed so that students have a challenging, novel, technology-focused, and learner-centred educational experience and learn by “doing” e-commerce instead of just listening to someone talk about how to do e-commerce.
The teaching materials are designed around a working, robust, and web-based VE that provides a powerful learning environment; it can become an integral component of many different graduate and undergraduate modules that focus on e-commerce, and related topics such as marketing, advertising, and commercial web site design. The VE is an environment that can be used to experiment with non-traditional ways of teaching e-commerce. It can also be used as a testbed for conducting research on e-commerce. The VE is a distributed digital marketplace that simulates a competitive environment for buying and selling information products. Teaching in a VE involves the development, testing, implementation, and use of a secure web-based environment where students experience e-commerce from the ground up. Learning in the VE involves confronting and resolving a series of problems related to starting up and managing a business. Over the course of a semester, students start up, design, and operate Internet businesses (e-businesses) which compete with each other in the VE marketspace. Another group (or other groups) of students operate as consumers in the VE, using digital money to purchase information products and services. In the first version of the VE, the consumers were the students at Napier University, Edinburgh.

Developing the Indiana module around the VE involved pedagogical, service, research, and technical components. The first element was pedagogical. The module was redesigned around the concept of problem-based learning (PBL). This required the development of new curricular materials (readings, tutorials, and interactive assignments) and an instructional strategy to support the e-business start-up cycle. Rosenbaum has been teaching e-commerce since 1996 at Indiana and this was the first such module in the Indiana University system. There is a potential for the module to be developed for distributed education and for the creation of curricular materials that will allow remote populations, such as students in other universities, students in schools and people in corporate environments, to participate in the VE. The second component – service – involved sharing information about the course, its underlying technology and communications infrastructure, pedagogical strategies, and student experiences, with other interested academics. It is from this that the link with Napier University emerged, with Davenport being a Visiting professor at Indiana. The third component – research – involved evaluating the VE as a learning tool and investigating research questions about e-commerce. The fourth component was technical and consisted of the development and expansion of the VE and the computing and communications infrastructure that supported it. The VE was developed using Cold Fusion and Oracle (described below) and has now been subjected to the first round of live use. The intention was to build upon the experience gained to scale up the simulation. This work will result in clean, modular, heavily commented application that can be easily modified and reused. A more detailed description of these components now follows.
3. Problem-based learning

Both the Indiana e-commerce module and the Napier information challenges module promote innovation in teaching and learning surrounding the use of ICTs. The pedagogical approach used in the VE is based on PBL [4,5] and the development of a situated learning environment [6–9]. In starting up, designing, and managing an e-business, students face a classic ill-structured problem that engages their knowledge, skills, and attitudes over the semester. They are working in small, self-directed teams and are investigating issues involved in the creation of web-based businesses. Although there is a syllabus for the course that provides topical readings, students are responsible for determining what they need to learn in order to develop and manage their Internet businesses. As a consequence, students are drawing upon a range of disciplines to resolve the problems they face. These are some of the essential elements on PBL [10]. The various activities build upon one another as students experience e-commerce in “Internet time”.

Because consumers visited the VE and purchased products for eight weeks in the operation of the VE reported here, there were real-world benchmarks against which students’ work could be evaluated (sales, repeat customers, traffic reports, and customer feedback). This forced students to apply what they had learned to the problems as they evolved over time. Shoppers were not shy about letting store owners know what was working and what was not. This created “authentic learning” where “students publicly exhibit their learning, and there are often real life standards of quality” [11, p. 391]. This was an improvement over similar attempts to create e-commerce simulations [12] because both the consumers and the storekeepers were complete strangers to one another. Indeed, the fact that the two groups were from different cultures (despite the often mistaken assumption by the students of shared language) and were operating in traditional time zones separated by several hours added to the uniqueness of the simulation.

The overall experience, including the group work and independent investigations of e-commerce issues was intended to lead to desirable learning outcomes as students “achieve higher levels of comprehension, develop more learning and knowledge-forming skills and more social skills” [13]. What was interesting about this experience was that students had regular and immediate feedback about their work reflected in daily and weekly sales figures and customer feedback. This was as close to the experience of running a small e-business as students could have in a University setting without having to go into debt or run the risk of bankruptcy. ICTs (in the form of the VE) were being used here to redesign the educational experience to give students a palpable sense of a world that many want to join.

The use of the VE had an impact beyond the traditional classroom because of the nature of the problem students were solving. The storekeepers experienced digital entrepreneurship as they carried out many of the activities involved in starting up an e-business. The consumers experienced the highs (and lows) of these entrepreneurial
activities, and responded in ways that eventually led to the relative success or failure of the ventures. These activities would not be seen as part of the traditional classroom: for example, the students wrote and presented business plans; developed and implemented ad and marketing campaigns; designed, tested, and operated web-based storefronts; and developed methods to handle delivery, order fulfilment, and customer service [14]. Many of these activities happened in “Internet time” and were governed by the flow of business, not a prescribed sequence of modules set out in a syllabus. The Indiana students worked in small groups, while the Napier students worked individually, in asynchronous, self-paced and situated learning environments using collaborative workspaces and multiple communication channels to develop the e-businesses. This is a use of ICT which “can provide tools that replace, augment, or extend the ability to identify, collect, organise, integrate, and generate knowledge . . . chang[ing] in kind the nature of the teaching-learning enterprise” [15, p. 13].

As the Napier students learned about e-commerce, they spent virtual money in the VE, shopping for information products to help them with their main assignment. In later versions of the VE, it has been proposed that teams from Napier will operate storefronts and Indiana students will shop. Another interesting variation would be to build teams with members from different institutions in other countries so students could develop stores whilst working in virtual teams.

4. The consumer experience in the virtual economy

The first participants in the VE were divided into two groups: store teams and consumers. In this paper we concentrate upon the latter. The consumers comprised seventy-five postgraduate and final year undergraduate students at Napier University. The consumers notionally operated as individuals, and were required to shop for information products to assist them with the individual module assignment. Each student was given a virtual account in the VE bank containing $2,000. Each of the students was given a different assignment question to address from within general topic areas, which structured the academic bases for consumer enquiry. These topic areas included: the role of trust; advertising; digital payment; security. Data was gathered in pre-shopping and post-shopping questionnaires, in student diaries, and in presentations given by pairs of students to peers and staff at the end of the shopping period. Each member of the class agreed to participate in the research exercise, and completed a consent form.

The consumers then set out to explore the VE, and to shop. Staff operated solely as passive observers, rather than as active directors of student activity during their computer-lab based interactions with the VE. That said, many students entered the VE outside of formal class contact time. Each store within the VE had content pages (product descriptions, help pages, etc) and used a template page containing a product catalogue, transaction procedures, and an order form (all written in Cold Fusion). As stores and shoppers interacted the store teams redesigned sections of
their stores in response to feedback. The content the consumers sought generally comprised annotated bibliographies and collections of print and/or digital resources, reviews of web sites, newsletters, subscription services, paper editing, and consulting activities. One enterprising group attempted to carry out a business model based on entertainment; they were trying to generate a revenue stream through the sale of ‘dares’ to be performed by one store team member. This led to a situation that is worthy of further comment.

One of the consumers ‘dared’ a member of the Indiana store team to show his penis in a video feed presented through the store, with the forthcoming event being publicised in the store. So far as the Indiana students were concerned, this ‘dare’ did not represent a problem. However, from the Napier side, accessing this would have represented a breach of University code of conduct for use of the Internet. A request was made from the staff at Napier to staff at Indiana for this ‘dare’ not to take place, giving the potential breach of the code of conduct as the reason, and the ‘dare’ was subsequently cancelled. That said, the fact that such an activity could be seen as in any way problematic bemused the Indiana students (and staff), and has apparently become something akin to folklore around the campus in Indiana. Two issues are evident in the context of this discussion. Firstly, that the storekeepers unwittingly confronted an institutional norm that they did not foresee but which may conceivably have led to the suspension of the VE activities. While such behaviour was socially acceptable in the USA, the storekeepers had not considered the possibility of cultural differences that may affect their interaction with consumers. Secondly, that staff can assume nothing in operating such ICT based simulations, and it is to the operation of the VE that we now turn.

5. Operational component

An important part of the VE was to set up customer service and loyalty programs with clear policies to protect customer privacy, handle grievances and complaints, and provide technical support. The students also explored trust-building, using mailing lists, webboards, sales, and discount offerings to build a customer base. The consumers turned out to be demanding shoppers and store teams had to develop strategies to handle customer complaints, requests for refunds and other customer service problems. They also developed loyalty programs, offering, for example, discounts for repeat business. Several issues emerged from these areas of operation. Firstly, the consumers became frustrated when orders were not fulfilled immediately. It took some time for them to come to appreciate that the storekeepers were operating in a time zone several hours behind them. In the initial stages this led to a succession of e-mailed complaints to both the store operators and to Rosenbaum in his position as overall VE administrator. Secondly, instead of just buying products, the consumers began asking for more information about products prior to purchase. This often entailed a series of e-mail correspondence which placed an additional customer
service requirement on storekeepers. As for the consumers, they swiftly came to appreciate how easy it was to complain about the store offerings via e-mail. As a consequence of a series of complaints about either limited ranges or depth of information on offer, several of the stores engaged in major refurbishment of their product offerings within the first few weeks. This was an example of swift action being required in response to customer feedback; the stores had to adapt quickly or lose business.

The way in which money was handled constituted a third area of interest. Consumer students each received a virtual $2,000 which was to be spent as they saw fit. Students could see their account at any time, and this gave a record of purchases as well as a balance. What became interesting was the way in which students managed their money. Most consumers became very reluctant to spend their money without having evidence that the purchase was of value to them. This meant that instead of engaging in straightforward transactions for a given price, many students began processes of negotiation with a view to gleaning as much information as possible prior to purchase, or in order to get a better deal. Furthermore, many students entered into protracted disputes with store owners and VE administrators about both purchases and account balances, often because they had “accidentally” made a purchase (or purchases) without realising it. Several students began to pool their money, saving some “just in case”, while others formed buying groups based around topic areas. We return to these particular examples in due course when we discuss communities of practice. However, it is worth reflecting upon the degree to which students often commented that they came to perceive the VE money as their own – a situation which suggests that other dimensions of the simulation worked.

We offer the following example by way of illumination of this last point. Towards the end of the first operation of the VE, several students considered themselves to have been “conned” by what may be termed a creative pricing strategy in one store. Throughout the operation of the VE one store, Sick Little Monkey, had been offering a particular line of products at a set price – $45 – which had not varied. In the last week of operation, the storeowners changed the price of these products to $450, but decreased the font size of the advertised price considerably – to the extent that it was barely discernible. Several students bought these products with what they thought were a few tens of dollars from their remaining pot of money, only to find themselves being “bankrupted”! The effect of this was to cause several of the consumers to complain, and to continue complaining after the VE simulation had ended in an effort to get the money reinstated – unsuccessfully. This illustrates the degree to which the simulation engaged the students, here, concerning the use of a virtual pot of money. It is worth noting that consumers were neither penalised nor rewarded for either spending or keeping money at the end of the VE simulation. On a different note, it does illustrate the degree to which consumers need to be aware of the potential for creative (unscrupulous?) pricing practices given the swift nature of online payment systems.
A final operational issue with the VE surrounded students’ attitudes to store design. One of the stores, Stout.com, was consistently praised by consumers, both in class time, in diaries and in questionnaires. Upon further analysis, it was found that one of the key aspects that drew consumers to the site was the use of a metaphor – in this instance alluding to beer. While the site had a certain degree of amusement value for the students, this was not commented upon after the first couple of weeks. What the consumers said that they liked about the site was a consistency of design and clarity in product offering, both of which were closely tied to the ‘Stout’ metaphor. For example, all products were offered in pints, in quarts, or in yards, with a consistent and clearly publicised pricing strategy. This came to be regarded by consumers as “a quality brand”. The quality of service in responding to customer queries, and delivering products to consumers were regarded as being without equal amongst the VE stores. While these are all characteristics that have been found to be synonymous with successful e-commerce sites [16], the rapidity with which consumers came to trust Stout.com as being “a quality brand” was interesting, and represents an area that will be explored further in the context of the VE.

6. Technical component

The VE used HTML, Cold Fusion, and Oracle. It used no pre-existing code and was a proprietary design that had been written to be transparent to the participants. No programming knowledge was required for students to set up storefronts or to shop in the VE. The programming was modular, portable and ran on a UNIX platform. Cold Fusion has the ability to encrypt the code for the primary functions (product catalogues, shopping cart, and digital bank), so the VE was relatively secure. This architecture enables the VE to continue to be used easily by e-commerce (and related) modules, initially throughout the Indiana system, but potentially on other campuses. The VE had four main components. The first was the VE portal, the entryway to the marketplace. Consumers registered, received passwords and digital bank accounts, and then browsed the storefronts. Advertising banners on the portal page allowed shoppers to click through to the stores. When they had finished in a store, consumers were supposed to return to the portal and explore other stores. One aspect of note was the degree to which several consumers attempted find ‘unauthorised’ points of access to the materials being sold. One group of consumers claimed in their diaries to have found a ‘back door’ into the stores which enabled them the get free access to materials. They then shared these materials amongst themselves, not informing their peers of this opportunity. Even where consumers had plenty of money to spend, this did not prevent them seeking to probe the sites – effectively for fun. This may be an area to consider for future operations of the VE, perhaps considering a sanction that could be applied with a view to dissuading such activity.

The second component was the storefront. The basic template for each store was a web page with a custom Cold Fusion tag <cf_store> that contained a product
catalogue, a shopping cart, and a checkout procedure. The catalogue was configured to allow the storeowners to use a web-based form to enter two levels of product and service information. The first description contained a sentence or two describing the product and its price, and an image.

The description and image were added to a product catalogue page where all of the store's products were listed. From this listing, there were links that led to the second level of product information, a more detailed product description on its own page; this page displayed an image and pricing information. After filling their shopping carts, shoppers could check out and invoke the checkout procedure by clicking on the “buy” button. The checkout page displayed the products in the shopping cart, quantity totals, individual prices, and the total price. Consumers could check out, change quantities, remove items from the cart, or opt out of the entire transaction. Several consumers found this latter option easily overlooked in the early stages of operation, and led to quite a number of unwanted purchases. Store teams began with the same basic template and had to endeavour to distinguish themselves through design, product and service offerings.

The third component was a digital bank. When consumers entered the VE for the first time, they were given a bank account. Each store had an account in the bank. Consumers received a standard amount of digital cash; stores received amounts of money on the basis of the successful presentation of their business plans. When a consumer made a purchase, the amount of the purchase was deducted from his or her account and added to the appropriate store's account. Store teams could use their money to purchase advertising space on the portal and to subcontract design and build services. The bank was relatively secure – shoppers and storeowners could check their balances but did not have access to each other's accounts.

The fourth component was the digital product warehouse. Each store had a password-protected storage area on a server where the information products could be uploaded. Each store also had an e-mail account and a webboard that can be used in any way the store team saw fit. As the operation of the VE progressed, consumers began to receive unsolicited e-mails with special offers and general information about new product offerings. On the whole, consumers said that they found such e-mails irritating, normally deleting them without reading once they had become attuned to their receipt. By and large, the technical side of the VE worked very well, largely thanks to the considerable efforts put into its development prior to store start-up. The operation did however require hundreds of hours to be spent setting up the VE, and administrating its operation. This is an overhead not often appreciated in thinking about Internet based simulations. We now move onto discuss the research component of the VE simulation.

7. Research component

The VE has also been a testbed for research. There are questions about e-commerce that can be investigated in this environment. For example, as we have mentioned
already above, one critically important issue for successful e-commerce is the building and maintenance of trust between e-businesses and consumers. The following are examples of research questions that are a part of the ongoing longitudinal investigation which we have been undertaking:

- How is trust constituted and defined by consumers and retailers in business to consumer e-commerce?
- How can e-commerce firms develop and maintain trusting relations with consumers?

Different methods of trust building have been used in different stores selling the same basic products data gathering has, and will continue to focus upon the relative success of these methods. We have already discussed some aspects which are salient to issues of trust, and we intend to develop these in the future after further operations of the VE.

Another area of research that has been of interest concerns innovative practice in relation to both consumers and storeowners. The initial operation of the VE has now concluded, and we have seen some emerging practices which will form the basis for further investigations surrounding innovation. The first of these areas concerns communities of practice, by which we mean “a flexible group of professionals, informally bound by common interests, who interact through interdependent tasks guided by a common purpose thereby embodying a store of common knowledge” [17, p. 166]. Taking a sociotechnical perspective, communities of practice can be considered in terms of the following characteristics: situated learning, situated action, distributed cognition and social infrastructure [18].

As instructors we wished to know what students would do and what they would learn about e-commerce under the conditions we have described above, and whether spontaneous communities of practice would emerge. In the VE simulation, although a technological infrastructure was set up that had the potential to serve as a ‘social infrastructure’, students were not specifically inducted to use it in this way. Though several pairs of students collaborated in shopping across vendors, and in dividing the labour that they perceived was required to prepare for their individual assignments, only one group formed an embryonic community of practice. This was largely as a result of the efforts of one individual who acted as a classic broker – demonstrating how collaborative activity might work (‘situated learning’) and making sure that innovative bargaining strategies (‘situated action’) were shared across the group. This individual established a weblist via a Hotmail account for the group (‘distributed cognition’) which was made available to others working on related topic areas. Whether this innovative practice contributed to new knowledge is open to question. The only measures used were indirect: the course assignments produced by members of this community of practice were more informative that those of their colleagues, and the diaries of the group were more enthusiastic about the VE experience. Communities of practice is an area for further research, and in particular we will be interested to consider issues of direction versus emergence in respect of such communities.
The second area concerns patterns, in particular, the application of Alexanderian patterns as means of identifying and learning about innovation from instances of VE practice. While innovative practice is important in understanding the adoption of Internet shopping [19], identifying and reflecting upon instances of such practice is not easy. The concept of patterns furnishes us with a framework through which we can evaluate creative practices in e-commerce at the micro-level. We saw some emergent consumer-based innovative behaviour in the first run of the VE, surrounding buying groups for example. In seeking to better understand innovative practice, the use of patterns encourages groups to confront the paradoxes and ambiguities of interaction in order to engage in double loop learning [20]. The application of patterns enables reflection upon both the causes and consequences of practices by those involved, an opportunity for learning that is central to successful innovation [2].

The concept of the pattern was introduced by the architect and philosopher Christopher Alexander [21,22]. He recognised that certain attributes in building and urban design frequently occurred throughout history and across cultures. In other words, he identified successful solutions to recurring problems in context and found a way of communicating these by standardising the format into what he called a pattern. He also recognised that each solution resolves the competing forces that the architect faces (for instance light, comfort, aesthetics, etc.), to a greater or lesser degree. This meant that the solution transformed the initial context in some way and generally had advantages and disadvantages. By being explicit about the nature of the resulting context, the solutions were not necessarily prescriptive and became reflective instead, forcing the pattern user to think for themselves rather than blindly following a procedure. Furthermore, a pattern language is formed when patterns are collected together and cross-references are provided between those that provide mutual support. This connectivity creates synergy between the patterns and so enhances the resulting course of action that the reflective pattern user takes. For example, we are interested in the conditions that need to be in place for innovation to occur. While our initial thoughts are centred upon the role of small groups in localised settings, we note that e-commerce allows rapid diffusion of innovation. Patterns could be used as a means of clarifying both the nature and sequence of processes at work. The first running of the VE did not provide us with sufficient data to extract and reflect upon patterns. However, during future operation of the VE we could review data from this and subsequent operations with a view to using the concept of patterns to draw out lessons regarding innovative practice.

A further research intention has been to investigate the usefulness of the VE as a learning tool in an educational setting. We sought to collect data about learning outcomes through surveys, a self-report evaluation instrument, and unobtrusive measures [12]. Surveys were used to gather data before and after the simulation. However, one problem that became apparent arose from staff making the research aspect of the course explicit to students. Students reacted negatively to this, expressing their unhappiness at being used as “guinea pigs”. Many of the students argued that because their final degree classification depended upon the marks that
they received, they perceived a research dimension to the VE as equating to ‘untried/untested/unsound’. This was unfortunate, and may have led to the number of ‘spoiled’ questionnaires which were submitted in the post-VE survey. Further thought is now being given to the ways in which a research component of the VE is articulated to the students involved, and it may be an issue of interest to others thinking of operating Internet simulations which have a research dimension. The informal feedback received indicated that the ‘action learning’ approach taken in this class was fully endorsed by students, and has led to intense student engagement with the web mall, despite their reservations surrounding the notion of research.

8. Conclusion

The indications from the first operation of the VE were that it has provided a unique and challenging learning experience for both the Indiana University storeowners and the Napier University consumers. Students developed some innovative strategies for addressing the issues that accompany both starting up an Internet business and acting as an econsumer. The VE provides a problem oriented, student-centred learning environment where students experience e-commerce in real time. Several issues emerged from the first operation of the VE that provide a basis for further research exploring the innovative practices assumed to accompany consumer activity [19]. In particular, communities of practice, and patterns provide us with two areas for continued research in future operations of the VE. The challenge is to continue the development of the VE, and to bring in other groups to operate as consumers and as store developers. At the time of writing, a further operation of the VE is planned, involving collaboration amongst students from several countries, including Australia, Denmark, Germany, UK and USA. This will provide an interesting opportunity for participants to confront a variety of cultural and language issues, which will inevitably provide further learning opportunities for all concerned. We hope to report upon these further developments in due course.

The success of this simulation has implications for pedagogy of interest for Library and Information Science (LIS) educators because of the nature of the simulation and its basis in PBL. Although there is not yet much research literature on the use of PBL in LIS education, discussions of PBL implementations are beginning to appear in the library literature. For example, Smith [23] argues that electronic information literacy can best be taught using PBL, an argument that is echoed by Schroeder and Zarinni [24] and Macklin [25]. Baker [26] describes the successful implementation of PBL in a basic reference course and Ekhaml [27] explains how PBL augmented a distance-learning course. Miller [28] discusses how the implementation of PBL changes library practice. Given the long history of PBL in medical education, it is not surprising to see that medical librarians have been writing about its use in medical school curricula and its impacts on their work [29,30].
If our experience with the virtual economy can be generalised, there are clear benefits for LIS educators interested in investigating and adopting an alternative pedagogical strategy based on PBL and simulations. At a high level of generality, this strategy can be used to improve students’ critical thinking skills. According to Astleitner [31, p. 75]:

Although there is no research within this field testing the effects of computer simulations on all critical thinking skills in a theoretically founded and comprehensive way, there are some indications that learning within computer simulations is closely related to information exploration and evaluation skills which are also relevant for critical thinking.

Using a combination of a student-centred approach and a web-based simulation also creates a possibility that students will be able “to transfer the knowledge they have learned from simulated context to real life situations in many fields through complex abstract models of reality” [32, p. 1693]. An immersive digital simulation as a context for investigations and resolving a series of linked and complex problems allows students to form distributed communities of practice and “access other peers, experts, and sources of information regardless of their geographical location” [33, p. 98]. In addition, since the problem is modelled on a situation that is typical of professional practice, students can begin to think like practitioners, increasing the chances that the knowledge they are gaining is transferable. Responses from our students support this notion and other research confirms this benefit; describing the results of an industrial simulation, Ratte and Caron [34, p. 144] state that:

The project was a great success due to the interaction of a set of factors. First, the open nature of the input favored the sharing of expertise and strengthened the feeling that everyone can contribute, which led to a better learning experience. In a sense, it allowed students to model the behaviors of practitioners, but in a controlled environment. Finally, the project was also an enriching experience for the professor. It can thus be seen as another example of the benefit of problem-solving and collaborative learning approaches.

In describing the results of their business simulation in an Information Systems class, Toki and Snell-Siddle [35, p. 392] claim that:

From the student feedback received it appears that a significant proportion of students found the simulation helped bring the business theory to life. It has been confirmed in the business arena that playing games is effective in training and preparing employees to thrive in a competitive environment and committing to new processes.

Studies on the educational value of business simulations are both wide-ranging and extensive, although often overlooked (Campbell et al., 1970; Loveluck, 1983). Various summary reviews of business simulations have been categorised into strategic management courses (Faria, 1987), learning environment features (Wolfe, 1990), particular simulations (Wolfe, 1985) and assorted teaching claims (Hsu, 1990). Many of these simulation findings for the teaching of business rest
on anecdotal material. Bearing in mind this limitation, the literature reveals how this method fared against traditional methods such as case studies for delivering course material. Studies show superior results for business simulation based groups versus case groups in either course grades, performance on concepts examinations, or goal setting exercises.

We will let Wolz et al. [36] have the final word:

A philosophical question that must be addressed is the relationship between pedagogy and technology. Ideally, new developments in pedagogy should drive the development of new technology, which in turn spawns new pedagogy. Similarly, a technology may inspire a new way of teaching, which in turn leads to new technologies. The resulting spiral effect will, in principle, produce both better technology and better pedagogy. In practice this is sometimes true.

Acknowledgements

This article develops a paper prepared for the 3rd International Conference (IeC2000): Innovation Through Electronic Commerce held in Manchester, November 14th–16th 2000. It draws on work by Rosenbaum and Davenport [37] which discussed the concept of the VE at inception.

References


