

Biz/Ed Virtual Worlds: Models to Enrich the Learning Experience

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Abstract

The use of the Web to support learning and teaching is now widely recognised as being an integral part of the development and delivery of learning and teaching materials. However, there is still a tendency to simply use the Web as a relatively static medium, with little thought to the underlying pedagogical guiding principles. This paper describes an online resource for business and economics students, which aims to provide a rich, engaging learning environment. The underlying assumptions for the development of the site will be described and key aspects of the main facilities outlined. The paper shows how the underpinning pedagogical principles were translated into practical online interactive resources.

Keywords

Biz/Ed, Virtual worlds, Constructivism, Internet resources, Internet gateway, Economics, Business

Setting the context

Information and Communication Technologies (ICT) are playing an increasingly important role in learning and teaching. However there is still enormous potential for innovation in the use of ICT in a cost and educationally effective way that can result in a more exciting and varied learning experience for the student and enhance the overall quality of the learning and teaching process. Most Higher Education Institutions (HEIs) in the UK now have in place or are developing institutional information strategies, alongside overarching learning and teaching strategies, which

place a significant emphasis on the application and management of ICT within learning and teaching. It is clear that ICT is moving from peripheral innovation and development to underpinning and affecting all aspects of learning and teaching within institutions. Furthermore, there is an increasing emphasis on integration and embedding of ICT into mainstream practices and on enhancing collaboration between institutions and across sector boundaries. Current drivers in the UK that reflect these factors include the amalgamation of the Teaching and Learning Technology Programme (TLTP) with the Funding for the Development of Learning (FDTL), the roll out of ICT use in schools through the National Grid for Learning (NGfL) initiative and the development of the lifelong learning marker through the launch of the University for Industry (Ufi). Recent initiatives include the New Opportunities Fund (NOF), the JISC DNER developments and UK/European research funding calls. Furthermore, it is evident that students are becoming increasingly sophisticated users of technology and, in the future, will have a raised expectation of the standards and quality of teaching materials and resources.

One of the biggest obstacles to integrating ICT into mainstream learning and teaching remains the time it takes to evaluate appropriate materials and how they can be used (although the growth of subject-specific information gateways, portals and guidelines to resources will go some way towards alleviating this problem). An additional bottleneck is equipping lecturers with the necessary skills to embed ICT. Furthermore, it is evident that the 'not invented here' syndrome (HEFCE 1996; Tavistock, 1998) is no doubt still present. Evidence from research and prior experience suggests that integration of technology into learning and teaching is best supported by "enabling frameworks", which help to embed best practice by applying targeted and relevant pedagogical and technical knowledge.

In recent years there has been an exponential increase in the range of online learning environments and associated tools to support learning and research. These range from stand alone communication tools such as email, discussion boards and synchronous chat, authoring facilities and assessment tools right through to more integrated learning environments such as Learning Space, WebCT and Blackboard. Coupled with this there is now supposedly a range of tools to facilitate searching, ranging from search engines like Alta Vista and Yahoo to more subject specific information gateways and portals. Despite this there is little evidence of wide spread uptake in the use of these technologies within education (Jones, 1996; MacKenzie and Wajcman, 1985; Bijker, Hughes and Pinch,

1987). A recent report concludes 'amongst the factors that are slowing the uptake...is the lack of a coherent framework within which to evaluate both the pedagogical benefits and the organisational changes required to effectively implement it' (Britain, 1999). Evaluation research to date shows that it is difficult to encourage true virtual learning or collaboration. Discussion board use, for example, often shows a pattern of peak use directly related to teacher intervention or responses to particular hot spot topics. Collaborative group work needs to be carefully set up and orchestrated to achieve desired results and despite this may still end up as a rather stilted collaboration exercise not comparable with direct face to face equivalent group work (Jones, 1999). Integrated learning environments are still predominantly used as a shell to display Web pages and rarely get beyond basic information dissemination and administration. With respect to information seeking and handling, the volume of information available to researchers and learners is increasing exponentially, unmatched by the sophistication of the searching and handling tools (Lawrence and Lee Giles, 1999). Information overload, coupled with confusion as to where to look, is becoming increasingly problematic and despite a growth in the range of searching tool and portals, it is still not evident that the right information is being dispatched to the right users in a timely and quality assured fashion.

This paper will describe an online resource (Biz/ed) that attempts to address many of the issues outlined above. It provides a subject-based focus for learning resources and integrative models and simulations to enhance learning and provide a rich student-centred flexible environment. The paper will describe the main features of the resource and map it to underlying pedagogical frameworks, which will be outlined in the next section.

Pedagogical Frameworks

This section presents examples of pedagogical frameworks that aim to encourage the application of good practice according to a particular pedagogical approach. All develop from a particular theoretical viewpoint, which is a factor that is clearly reflected in the framework designs. Lefoe provides a review of research into design goals for Web-based constructivist learning environments (Lefoe, 1998). She begins:

‘There has been a widespread increase in the use of Web-based instruction...However, ...[there is] concern that some sites emulated ‘the worst of face-to-face courses...[where] learners constructed as passive recipients of information’

She outlines the shift from behaviourist instructional strategies to constructivism and goes on to consider development goals building on the latter.

Rich Environments for Active Learning (REALs) are instructional systems that are underpinned by constructivism (Grabinger and Dunlap, 1995).

Key characteristics of constructivism (such as active knowledge construction and evolution, indexed knowledge acquisition, collaboration and the social negotiation of meaning) provide the bedrock for the defined attributes of REALs, mapping the resulting resources directly to the underlying instructional strategies. By providing a context and framework for linking the instructional work to a particular pedagogical theory, users of REALs can map their own work and development to this approach. An example of this application is illustrated in a paper by Kitts and Hancock (1999).

Another example of a theory that builds on a particular pedagogical framework is the Cognitive Apprenticeship Model (CAM). This combines socio-constructivist theories of learning with knowledge engineering techniques from the field of Artificial Intelligence. It aims to provide a rich Multimedia Learning Environment, which brings together multimedia technology and Intelligent Tutoring Systems (Smith and Jagodzinski, 1995). The system consists of the following ten components:

1. Content – including knowledge and learning strategies
2. Modelling and explaining
3. Situated learning
4. Coaching
5. Scaffolding
6. Fading
7. Articulation
8. Reflection
9. Exploration

The authors claim that the framework provides a clear and detailed rationale for the way in which material is presented to learners, for modelling and for the interaction between these two elements. They go on to state that ‘careful attention to design can unlock the potential of multimedia as a learning tool’. This is relevant in the context of the current work, as it is an example of a model for designing systems capable of supporting novices. The work Biz/ed has done on the Virtual Economy (as described more fully in section 4.2) has followed this framework by allowing students to use the economic model iteratively to examine different possible outcomes while still interacting with the supporting educational materials.

A pedagogical framework for integrating learning technologies has been developed by Conole and Oliver (1998). It builds on Laurillard’s conversational framework (1993) and provides a structured approach to integrating learning materials into courses. The framework is designed to take the user through the thought processes of re-engineering a course. It begins with an evaluation of the existing course and analysis of strengths and weaknesses. Different media types are then assessed, and in particular the different educational interactions they support is considered. A selection process then considers limiting factors, including resource issues and local constraints, such as those identified in Section 2 as affecting the re-use of materials. The final part of the framework is a mapping of the new course. Part of this framework has been developed into a toolkit for media selection, Media Advisor, which is described in more detail in the next section. The examples quoted here are just a sample of the ways in which researchers and developers are trying to ensure that sound pedagogical principles underpinned the development of Web-based materials, with the overarching goal of producing an enhanced learning environment for students. The Biz/ed site, and its associated activities, attempts to build on this work and provide practical examples of interactive, engaging learning materials developed within a contextualised environment. Particular emphasis will be given to the Virtual Worlds section of the site.

Background to Biz/ed

Biz/ed is an economics and business gateway specifically designed for students, teachers and lecturers of business and economics across the educational spectrum (<http://www.bized.ac.uk/>). It was launched in January 1996 and has since then grown significantly. The site currently

often receives in excess of 1 million page accesses per month. The site has an international focus as well as UK specific material.

The site is designed to provide a comprehensive one-stop shop of educational resources in business and economics. The aspiration is to work towards the development of an enriched learning experience which maximises the benefits the Internet offers whilst maintaining a clear pedagogical basis. There are five main sections to the site.

1. The Internet Catalogue – this was funded initially by the Joint Information Systems Committee's electronic libraries (e-Lib) programme in the UK. The aim is to create a catalogue of high-quality Internet resources, focusing on the business and economics subject areas. There are currently over 1,700 resources catalogued and every resource is checked against a set of quality criteria to ensure its quality. All entries in the catalogue have an abstract and keywords and the catalogue is both browsable and searchable.
2. Company Facts – this section aims to add a 'real life' focus by linking directly to useful up-to-date information on key international companies. It has the answers to frequently asked questions about companies. The questions cover a range of topics from marketing to human resource management to social and ethical policy. They are provided by the companies themselves, but are vetted by educational advisors to ensure the educational value of the content.
3. Learning Materials – this section aims to provide a variety of learning materials to support students from school through to masters-level. It encompasses the economics and business subject domains and in turn covers specific accredited curriculum pathways including GNVQ, MBA and the International Baccalaureate. For each area there are a variety of resources including Internet-based worksheets, downloadable PowerPoint presentations, interactive questions, resources databases and notes.
4. Data – this section has a variety of UK and international data. It includes data from the Office for National Statistics in the UK, Extel company data, Penn World data and also a chronology of UK and international economic events.
5. Virtual Worlds – this section contains a variety of large-scale learning resources developed by Biz/ed and it is these that this paper will be mainly focusing on. Available are the Virtual Factory (launched in June 1998), the Virtual Economy (originally launched in March 1999), the Virtual Bank of England (to be launched in September 2000) and the Virtual Developing Country (to be launched in October 2000).

Virtual Worlds

The Virtual Worlds concept attempts to provide a rich, contextualised learning environment, which is both stimulating and educational. The users are encouraged to actively participate and engage with the resource, reinforcing the constructivist approach to the design outlined in the second section.

Virtual Factory

The original conceptualisation of the Virtual Worlds section began with the Virtual Factory (<http://www.bized.ac.uk/virtual/cb/>). It is becoming increasingly difficult for students to get access into firms to try to apply the theoretical principles they have learnt to real-world problems and issues. The aim behind the Virtual Factory was to give students the opportunity to get inside a factory from a distance and see how the various business functions (production, marketing, purchasing, accounting and so on) are carried out. A further aim was to help raise a variety of issues that were faced by this company in trying to maintain its competitive position in the market.

However, that alone was not felt to be sufficient. One problem with online materials is the tendency for students to take a cursory look at the resources and feel they have done enough. They tend to be less willing to read as great a volume of text on-screen as they would with more conventional resources (Nielsen, J. 1997). To encourage students to explore further, we felt it was vital to integrate the information about the company with supporting educational materials based around their curriculum. The intention was to encourage students to learn by exploring and questioning. This meant creating an integrated package that also contained worksheets and sections that raised issues and problems for them to consider. This approach ensured that the resource fitted in with the design criteria set out for Web-based constructivist learning (Lefoe, 1998) and prevented students from simply being “passive recipients of information”. Using the power of hypertext to link all the materials together and integrating the worksheets with the rest of the information delivered this outcome. The design therefore required a consistent user-interface to be used throughout the site. In this way students could explore at their own pace and take their own direction through the site. There was no need for a conventional linear approach, but they would be able to tailor their learning to their requirements. At the same time there would be worksheets and other resources available to help them focus this learning and to help give them some suggested directions. Navigation around the site is done mainly by clicking on a floor plan of the factory. This was felt to be a straightforward and intuitive user interface and subsequent evaluation has shown this to be true. Text-based links are always available and there is also a universal navigation bar (done as a ‘server-side include (SSI)’ at the head of each page. (See *Figure 1*)



Figure 1 – Virtual Factory Home page

The Virtual Factory will be upgraded and further developed in the latter half of 2000 to add a greater degree of interactivity to the site. There will be some interactive on-screen worksheets on the basic business principles and in the rest of the worksheets students will be able to type their answers and submit them. They will then receive back a sheet with their answers lined up against some suggested answers or questions they should perhaps have considered.

Virtual Economy

The intention behind creating the Virtual Economy on Biz/ed was to use the power and reach of the Web to give students the ability to experiment on a high quality and sophisticated model of the economy. The idea stemmed from work that had been done by the Institute for Fiscal Studies in the UK. They had a tax and benefit model (Tax-Ben) that showed the impact of different tax and benefit changes on a variety of different families and income groups. They made this available on the Internet in 1997. At the same time The Macroeconomic Modelling Centre at Warwick University created a 'ready-reckoner' which enabled examination of the comparative properties of a variety of well known macroeconomic models (Church, K.B. et al, 2000). This package distilled three different well-known macro models and made the results available to

people on a floppy disc based version. We felt that if we could combine a macro model with a micro model, then users would be able to try out a variety of policies and see the effects, not just on the principal economic targets but also on the individuals.

Having received a grant from the Nuffield Foundation to develop this work, we began in 1998. The IFS Tax-Ben model was integrated with an adapted version of the HM Treasury model developed by the UK government. These were combined technically and given a universal front end where users could input the policies they wanted to try. The input is done through an HTML form where users can choose to change a wide range of variables ranging from interest rates and government expenditure to income tax and the taxes on alcohol and cigarettes. Users then select the change they would like to make from a range of options and submit their policies. The model is solved (using a block of Fortran code) and the results sent back as a long HTML page including graphs and data to how exact changes. The first thing to load is a series of summary graphics for both the macro variables and the families and these show the approximate changes. Clicking on any of these takes the user to a detailed breakdown of the change.

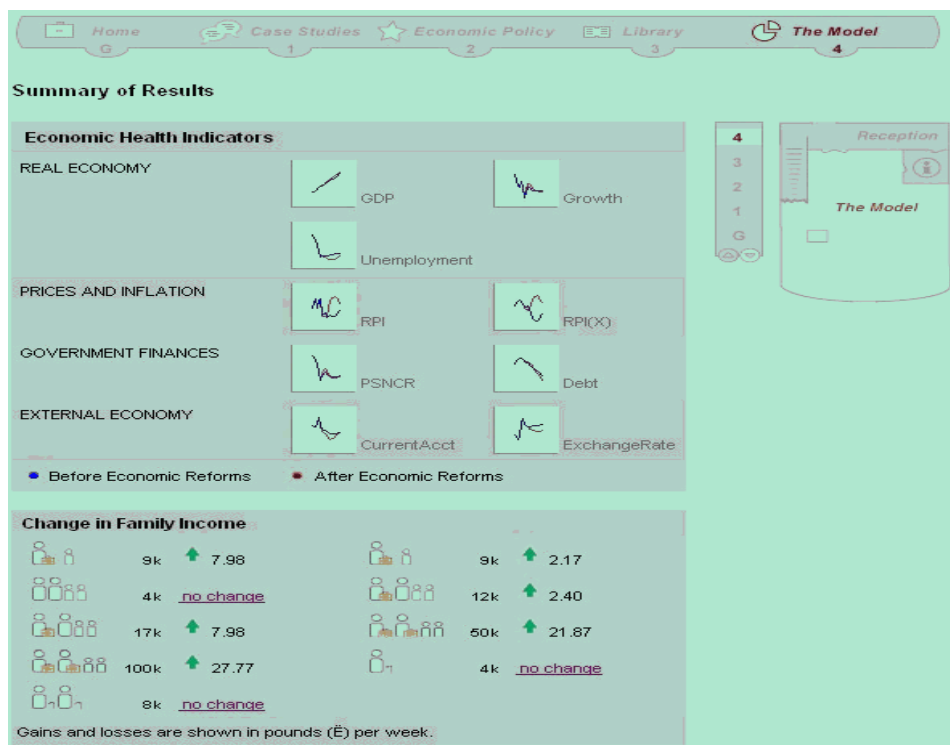


Figure 2 – Results page of the Virtual Economy

Surrounding all of this is an integrated set of materials that give full details about all variables in the model. For each economic outcome (economic growth, inflation, unemployment and public borrowing) and each economic instrument (taxation (direct and indirect), government expenditure and interest rates) there is a full explanation of the meaning of that variable, related economic theories and a set of worksheets.

The worksheets are all carefully differentiated and developmental in their approach. They are intended to help students to develop both lower order skills like knowledge and factual-recall, but also higher order skills like evaluation and synthesis. They aim to achieve this by being progressive in nature. Early questions may encourage them to reinforce their knowledge of a particular area by linking across to some of the explanations or theoretical material. Gradually the questions then move up in an 'incline of difficulty' and suggest strategies and policies that they can try on the

model. They can then try to apply the theory to the results they get and see the extent to which theory matches reality. Open-ended questioning then raises further issues and gets them to consider where the assumptions made in the course of developing theory may break down in practice. In this way they can look at the application of theory to reality through a process of experimentation, but also develop a better appreciation of the interconnected nature of much of the subject matter of economics. This vital higher order skill of synthesis is the ultimate aim of a large-scale integrated learning resource of this nature.

The development of a consistent user-interface for the whole site was vital to achieving this outcome, and much thought went into the development of this. User evaluation had shown that the symbolism of the 'clickable' factory floor in the Virtual Factory had been a very powerful navigation tool, but this was more difficult to achieve with a Virtual Economy. After all just what does symbolise an economy? We chose to use the concept of a floor plan once again, but this time we chose Number 11 Downing Street – the home of the Chancellor of the Exchequer. By having a number of floors where the materials progress from the more general introductory material through to the more complex economic theory we felt users would have a logical navigation structure throughout the site. On each floor they can click on a variety of different offices to access the available resources. One of the floors is also a library where there is a full glossary and a timeline of the development of economic theory and the economists who created it. To follow the theme of integration throughout the whole site, every glossary item is highlighted throughout the site and linked to the glossary in the library. The Virtual Economy can be found at:

<http://www.bized.ac.uk/virtual/economy/>

Current Projects: Virtual Developing Country and Virtual Bank of England

The Virtual Developing Country will follow a similar structure to the previous Virtual Worlds and will be a resource rich in data and images. The principal aim of the Virtual Developing Country is to raise the level of awareness among students of development issues. It is intended to be a resource that they can return to time and time again throughout their studies as they cover different aspects of development. The case study approach taken should also help to raise the level of awareness and understanding among students of 'theory in context' issues in development studies. Resources presented will not only outline economic data and theory but also encourage practical application through worksheets and activities.

In 1999 Biz/ed was commissioned by the Bank of England to create a Virtual Bank of England. They wanted to create a resource that would help raise awareness of the role they play in the management of the economy and the control of inflation and saw the Internet as the ideal

route for the dissemination of such a resource. As with other Virtual Worlds, the Virtual Bank of England will be rich in images and data. Users will be able to take slideshow type tours through the various areas of activity of the Bank and these will be carefully cross-referenced with other resources available elsewhere on the site. Also available will be theoretical analysis of the work done by the Bank, worksheets and full details about senior members of the Bank's staff and the work they do. The Virtual Developing Country and the Virtual Bank of England will be launched in Autumn 2000.

Underlying principles and methodology

The underpinning principles behind the development of all the Virtual Worlds are:

- Usability
- Efficiency
- Skills development
- Integration
- Interactivity

Usability

A key starting point for all the Virtual Worlds has been the issue of usability. We have always felt that learning resources of this nature should allow students to learn flexibly and at a pace that suits them. It is only then that they will be motivated to explore the site and get the optimum learning outcome. The sites have therefore always needed to be stand-alone integrated sites and not just a series of web pages. The user-interface design has always looked at the basis of navigation around the site and aimed to use some sort of symbolism that the user associates with the area they are studying. In the case of the Virtual Factory we used a floor plan of the balloon factory and in the case of the Virtual Economy – Number 11 Downing Street (the home of the Chancellor of the Exchequer). This navigation is consistently available wherever the user is in the site so that there is always a degree of continuity about their work. Evaluation has shown that users navigate in a variety of different ways and so all the Virtual Worlds have alternative methods of navigation to suit as wide a range of users as possible.

Efficiency

The Virtual Worlds have all been designed and constructed to encourage students to use and re-use the resources available. By ensuring that each resource gives broad subject coverage but still retains carefully focussed

navigation and site architecture students are encouraged to return to the site frequently. Each visit will tend to yield different experiences and information, but on each return visit familiarity with the site ensures an efficient learning outcome. Many of the users of Virtual Worlds will be schools, colleges and individual students who may not have the benefit of a high-speed Internet connection. For this reason all the Virtual Worlds have been designed to be very efficient in their download times. Much of the navigation is done with 'server side includes (SSI's)' to speed up the download of the core navigation features and the designs are carefully chosen to be as efficient as possible in terms of file sizes. All images are carefully and individually processed to optimise them for the web. In light of the fact that many institutions are still struggling to develop the quality of Internet connection they would like, we have also made all the Virtual Worlds downloadable. This enables users to download a single self-extracting zip file which expands to give them a full version of the site on either their hard drive or local area network or intranet.

Skills development

The Virtual Worlds are intended to help students to develop a variety of skills – both lower and higher-order. They are thorough in their coverage to give students all the information they need, but also try to raise questions and encourage further investigation. In this way students have an opportunity to apply the theory they have learnt to a real-world situation and develop analytical and evaluative skills. All associated worksheets are progressive in nature to try to achieve this and use a variety of different questioning techniques. Careful differentiation of the materials and worksheets enables students to progress at their own pace so that they can choose to focus on the areas where they are least certain. All resources are designed to be readily accessible to teachers or lecturers and there are always printable versions of all worksheets and other resources so that they can be used in a classroom or lecture theatre environment without adaptation.

Integration

Perhaps the key to the success of the Virtual Worlds is that they are stand-alone integrated resources. Throughout the site hypertext is used to cross-reference all information on the site. All sites have their own glossary and all terms in the glossary are highlighted in the text and linked to the glossary definition (often by a small 'book' icon). Worksheets always refer to the relevant theoretical, descriptive or numerical material to give

the student the necessary stimulus material to start thinking through the issue or problem concerned.

Interactivity

A constructivist approach to learning requires students to interact with the site. They must be encouraged to develop critical awareness of the materials they are looking at and to develop analytical and evaluative skills. This will only happen where they interact. All of the Virtual Worlds have elements of interactivity. Each of them will be constantly updated and developed to enhance the interactivity of the sites as technical developments enable this.

Evaluation

This section will describe the ongoing formative evaluation of the site that is carried out. This takes the form of statistics about site usage, case studies of how lecturers are using the materials and feedback from users.

Statistics

Statistics on the use of the site and the ways in which users are navigation through the materials is logged as routine, users are also encourage to submit feedback online. Figure 3 illustrates the exponential growth in the use of the site over the last 18 months. It is perhaps significant to note that this growth can be directly correlated to the increase of enhanced features of the site, particularly the development of the Virtual Worlds section of the site. Statistical reports are regularly generated from the Biz/ed server logs and these allow us to determine the relative usage levels of different parts of the site, right down to the level of individual pages. Some attempts are also made to determine where users are located. For example, we can determine relative usage of particular HE or FE institutions, although this is problematic, because many users connect from ISPs (Internet Service Providers) at home. The dramatic growth in usage of Biz/ed is also monitored in other ways. For example, in the last week of March 2000, 15864 distinct hosts were served, of which 8571 had not been served to in the previous 15 months. Biz/ed will shortly be attempting to track users more carefully using a cookies-based method. This will allow more detailed monitoring of how users actually use the site by providing, for example, information on the exact route taken through the site and how long was spent on each page. Each section of Biz/ed is

tracked individually and regular analysis is undertaken of the way in which users interact with the resources.

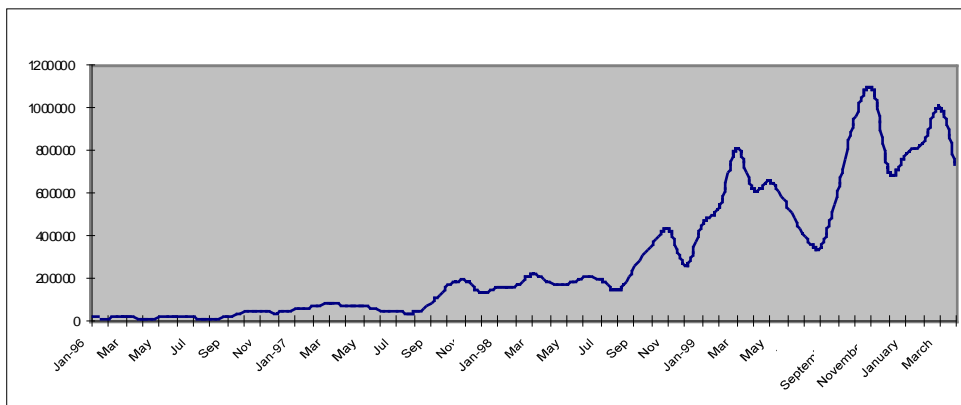


Figure 3 – Biz/ed Access Statistics January 96 - April 2000

Case Study: Using Biz/ed to support teaching and learning at the University of the West of England (UWE)

At the University of the West of England, Biz/ed has been used very successfully with all 800 first-year students in their business school. The Virtual Economy, while based around the UK economy, also has a series of fictional case studies of firms and individuals to encourage students to consider the impact of economic policy on these groups. The Virtual Economy has been incorporated into lectures and was the basis of a 2,500-word assignment on how different economic policies affect business.

Feedback

Feedback from users confirms that they react positively to the advanced features of Biz/ed particularly those in the Virtual Worlds section as the following quotes illustrate:

“Fabulous site...brilliant resources...excellent idea...very well done. This will be used time and time again. Thank you!” *Peter Thompson, lecturer, The Isle of Wight College*

“Excellent work. These pages are enjoyed by both me and my students.” *David Jones, Anglo European School*

“This is an exceptional site. I’m pleased to have blundered across it. From all appearances this will be useful for my beginning economics students. Thanks.” *Will Fowler, teacher, Novato, California*

“Thank you for providing a well structured, innovative site with exceptional content. Simply one of the best and certainly most informative sites I have come across!” Ryan Harris, student, Canterbury, Kent

What is evident from this is that users are engaging with the learning materials and find the multifaceted interactivity of the site stimulating. Equally important is the fact that the materials are within context and there is a cohesive learning environment for different activities and work packages.

Conclusions

The work described in this paper has investigated two main areas: the design and development of Web sites to support learning, A review of the underlying theories has been presented and examples of the ways in which researchers and developers are trying to apply theory to develop better, more educationally focused online learning.

A specific attempt to provide a stimulating, engaging online environment has been described. The general architecture of the Biz/ed Web site has been described and a specific aspect of the site, the Virtual Worlds section has been outlined.

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