Learning by Earning: The Dollar Bay Project

By
Jessica Mack, Brian M. Slator, Kellee Boulais, Viet Doan, and the students of CS345

Andrew Justin Anderson, Brian James Anderson, Wayne Scott Anderson, Jeff L Bachmeier, Michael John Baloga, Brian Michael Bata, Mathew James Bitzegaio, Nathan J Bollinger, Tanner Emil Bossert, Bradley Ray Brendel, Jeremy James Bring, Matthew Allan Calderwood, Blaine Will Campbell, Clinton Roger Carder, Brian Scott Daily, Michael Robert Devine, David James Dockter, Brett Thomas Dolliver, Matthew Jon Fee, Daniel Thomas Flannery, Daniel Nevada Fox, Matthew Wayne Gadberry, Corey Patrick Gartner, Bradley David Gehrls, Anthony Scott Geraghty, Nathan Dayle Haaland, David Paul Hanson, Jason Martin Herzog, Daneen Sue Hoff, Joseph Roger Hoffman, Neil Martin Iversen, Justin D Jordan, Renu Jyoti, Sanjay Jyoti, Travis Lee Keller, Sarah D Klockmann, Ryan Michael Kranitz, Brent Kristopher Kubat, Lisa Lynne Laturnus, Eric Francis Lefor, Korene Ann Lefor, Jesse Aaron Lien, Rebecca Jean Mairs, Joshua Dean Malnourie, Eric James Mauch, Michael Robert McCarthy, Kyle John McConnell, Steve C. McGinnity, Brandon James Mertz, Nicholas Lee Meyers, Steven J Mitchell, Thuy Thi Thu Nguyen, Anthony Alvin Olson, Anthony Wayne Pawlowski, Mark Christopher Powell, Gretchen Elise Roppe, Anthony John Rosten, Amanda Irene Russler, Russell Rytter, Timothy Lee Satrom, Steven Melvin Scherweit, Hayden Ross Schulte, Peter Marshall Schultz, John Ernest Schulz, Chad Jeremy Selle, Bryce Lynn Smeby, Cole Thomas Stanford, Justin Paul Torkelson, Kelly Jean Tuhy, Dan Watson, Derek Jay Wentz, Andrew James Westby, Nicholas Jay Zimprich,

Computer Science Department
North Dakota State University
Fargo, ND 58105

Abstract

The Dollar Bay Project is part of the North Dakota State University WWWIC (Worldwide Web Instructional Committee) Research effort. Dollar Bay is a fictitious seaside town simulated in an interactive, Web-based environment intended to teach the principles and practices of retailing. To begin the game, a player must first create a character and become a storeowner in Dollar Bay. The character is then assigned retail space and a starting budget. The player's goal is simple: make more profit than the other store owners in Dollar Bay. However, the means by which a player obtains their profit represents a formidable, yet invigorating challenge. For instance, the game has the ability to simulate seasonal affects on consumer purchasing trends. Dollar Bay players must anticipate these and other trends along with socioeconomic factors in order to adjust inventory and pricing accordingly to keep their business thriving. Depending on the success of their business decisions, players may also be inducted into the Hall of Fame. Each semester, students are assigned to cross-functional teams, much like those in today's progressive organizations, in order to facilitate improvements in various areas of Dollar Bay. The Dollar Bay Project is the anthology of ongoing collaboration of students taking Computer Science courses at NDSU.

Keywords

Problem-based Learning, Collaborative Learning, Role-based Learning, Immersive Virtual Environments for Education

Introduction

These days, college students range from pre-pubescent prodigies to golden-year grandparents. Without regard to age, students in higher education are being subjected to a more technologically driven educational experience than ever before. Combined with problem-based learning, which exercises students' analytical and problem solving capabilities, classroom technology demands that students take a proactive approach to learning.

The Dollar Bay Project implements an interactive, multi-user, Web based application to simulate a plausible retailing environment. When playing, a human learner is immersed in a Reality-Oriented Learning Experience (ROLE; Chaput et al., 1997). Each year, students taking Computer Science 345 (CSCI 345), Topics in Computer Science, participate individually and collaboratively in ROLE-based learning in order to proactively complete semester-long tasks. Students are also provided the opportunity to hone their skills in the areas of economics, strategic management, and marketing while simultaneously making enhancements to the Dollar Bay game.

Background

The Dollar Bay Project is a part of a multi-project research endeavor of the NDSU Worldwide Web Instructional Committee (WWWIC; Slator et al., 1999). WWWIC is an ad hoc group of North Dakota State University faculty dedicated to developing internet-based educational software (WWWIC, 2001). To help support their efforts, The National Science Foundation (NSF) awarded the committee a total of $1.9 million in September 2000 for a five-year period (Coomber, 2000).

What all WWWIC research projects have in common are that they all have shared and individual goals. Shared goals include the mission to teach science structure and process: the Scientific Method, scientific problem solving, diagnosis, hypothesis formation and testing, and experimental design. The individual goals teach the content focused on individual disciplines: Geoscience, Cell Biology, Computer Science, Microeconomics, etc. (Slator et al., 1999).

Educational simulations are developed and executed on a MOO, which is an acronym for MUD Object-oriented (Curtis 1997). The multi-user dimension is supported by the MUD, which is short for Multi-user Domain or Multi-user Dungeon. Technically, a MUD is a networked multi-user database and messaging system. MUDs support the object management and interplayer messaging that is required for multi-player games, and at the same time provides a programming language for writing the simulations and customizing the environments (Slator et al., 2001).

Role-based Environments

When learning in a role-based environment, the age-old adage, "When in Rome, one must do as Romans do," is helpful to remember. The premise is not to only teach students concepts, but also to teach them how to think conceptually and apply

methodologies in order to complete individual or group tasks. Role-based environments provide students with an immersive, interactive atmosphere to facilitate "learning-by-doing" which is conducive to truly learning lifelong analytical and problem-solving techniques.

Figure 1: The map view of Dollar Bay

Starting the Game

Dollar Bay is a graphical and interactive Web-based course intended to teach the principles and practices of retailing. The game is set in an imaginary collection of neighborhoods that are surrounding the "Dollar Bay". Figure 1 displays Dollar Bay in the Map view. Each player has "inherited" a store, and must strive to run a successful business. The player is given a shop space and a starting budget. Figure 2 represents the interior of a store when it is first created. From there, players will generally start by hiring employees, choosing products to sell (perhaps along a certain theme), advertising their store in the local newspaper or on the radio, and exploring the neighborhood to see what their competitors are selling.

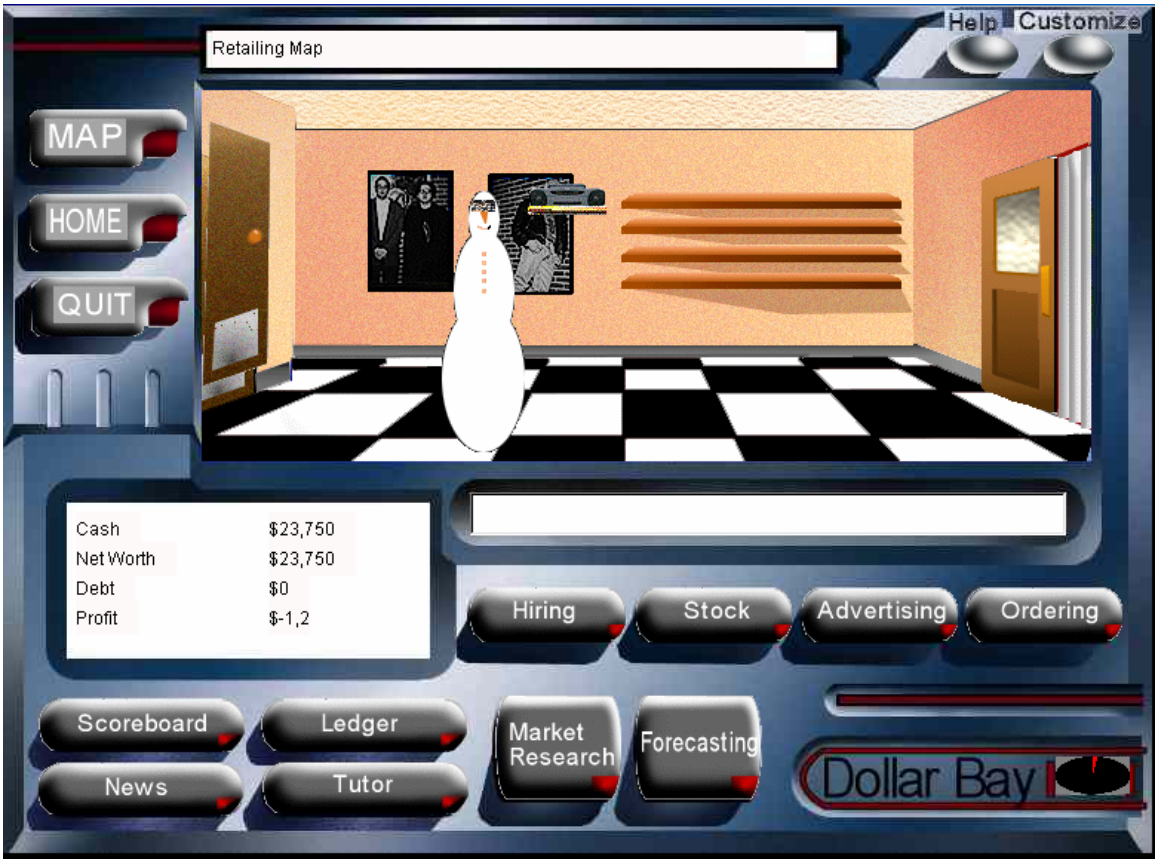

Figure 2: The basic Dollar Bay store interior at the beginning of the game.

Target Markets

The population of Dollar Bay is divided into twenty different categories. Each category indicates a different type of demographic data about the software agents, such as marital status, age, and income level. By identifying a certain section of the population to target, the player can make their business much more successful. The "Market Research" tool helps the player to do this. Exploring competitors' shops can also be an invaluable tool for success. The player should use this information to differentiate their store in some way to bring in the most business. Low prices or a wide variety of products often attract Dollar Bay customers. Another effective way to attract customers is advertising.

Advertising

When players choose to advertise their store, they must first choose a media type. As in the real world, players should keep cost in mind, as advertising can be quite expensive. The size, style, and type of the ad contributes to the overall cost. Players then pick a differentiating feature of their store to highlight in their ad. For example, if the store targets lower income groups, it would be a wise idea to advertise their low prices. The shopping agents use these ads to choose a store. The ad runs until the player can no longer afford it, or until the player graduates into the "Hall of Fame".

Managing Employees

Each player must have an employee to run his or her store. The employee manages the store as well as performing such functions as informing the user of other players currently using the game and telling the season. Figure 3 demonstrates a transaction between the employee and a customer. Only employees can make transactions with customers. Players choose a wage that they can afford and advertise for an employee. They can then choose from the list of available employees who are willing the work for the advertised wage. This employee stays with the store until the player can no longer afford their wage, or until they are fired.

Figure 3: Complete view of owner, products, and a customer transaction

The Effect of Seasons on Dollar Bay

The change of seasons in Dollar Bay brings about changes in the way the game progresses. Shopper agents will make statements that indicate the season. Product demand changes as seasonal items become more popular. One day there will be a change in the graphical user interface, such as snow or leaves on the ground. In addition to these more subtle hints, a window at the start of the game announces the season.

Dollar Bay as a Class Project

The Computer Science 345 class took over the Dollar Bay project in January 2002. The instructor, Dr. Brian Slator, functioned as the project leader. Dr. Slator instructed the

class to think of themselves as consultants working on a legacy system that needed repairs and revisions. He divided the class into teams according the interest and experience as shown on questionnaires, or "resumes", submitted by the class.

Dollar Bay was already a functioning game residing on an NDSU server when the semester began in January 2002. However, several of aspects of the game were not functioning correctly, and Dr. Slator had many suggestions for additions to the current program. NDSU students had done previous programming on the game.

The class was divided into four teams. The Java team was in charge of basic programming of the game client. The LamdaMOO team maintained the server. A graphics team worked on the graphical user interface, including the graphics that represented players, merchandise, and shoppers. The web team kept the web page up and functioning correctly. Each team was further divided into sub-teams with approximately six to eight members and two leaders per team. Other members of the class were assigned jobs as student project leaders, under Dr. Slator, and scribes, who took notes for team leaders and documented the project in general.

Tasks

The following table is a list of tasks sorted by priority with their corresponding groups, difficulty, and the estimated team members needed to complete the job. Tasks of a lower priority were not completed, but left as suggestions for a future Computer Science 345 class to consider when they take over the Dollar Bay project.

Table 1: A list of current tasks sorted by priority.

Priority*	Task	Group(s)	Difficulty	People Needed
100	Security - prevent players from access to the stock of others	Server	Medium/Hard	2-3 person(s)
99	Internet Explorer - enforce runtime, detect non-supported browsers	Java/Web	Easy	1-2 person(s)
98	Inform Players of OTHER players that are logged on	Server/Graphics/Java	Medium	3 person(s)
93	Conversation cache - transcript of speech	Graphics/Java/Server	Medium/Hard	2-4 person(s)
92	Seasonal effects - shoppers say **seasonal** things - product demand changes - visual effects (i.e. snow, clothing on shoppers, trees change) - a window pops up at login, announcing the season - newspaper opens automatically at login, giving seasonal news Newspaper - contains more interesting news, graphically **looks** like a newspaper, advertises wholesalers	Server Server Graphics/Server rver/Graphics/Java Server raphics/Sever/Java	Easy Medium/Hard Easy/Medium Easy Easy/Medium Medium/Hard	1 person(s) 1-2 person(s 6-8 person(s 1 person(s) 1 person(s) 3-6 person(s
92	Install pre-existing interfaces	Java/Graphics	Medium	3-6 person(s

92	Install new map	Server	Medium	1 person(s)
91	Catalog sales - create **invisible** warehouses	Server	Medium/Hard	1-2 person(s
90	Overnight calculation - inform players when the game is locked	Server	Easy	1 person(s)
90	Registration - similar to Vcell/Planet Oit (note: requires MySQL development) Create/Connect Login Procedures Support Site Repair/Redesign	Graphics/Server/Web Web/Java Web	Medium/Hard Medium Medium	3-6 person(s) 2 person(s) 3-4 person(s)
90	Layering/positioning - find and fix cosmetic problems	Server	Easy/Medium	1 person(s)
90	Broken casino - fix slots, fix blackjack	Server	Easy/Medium	1-2 person(s
85	Hall of fame - hide others on connect, greeting by host	Server	Easy/Medium	1 person(s)
80	Support person to person transactions	Server/Java/Graphics	Medium/Hard	10-12 person(
80	Collectibles - product definition, shopper agent demands?	All	Medium/Hard	10 person(s)
10	Roles? - wholesaling agents, retailing agents (bumpable)	Server	Medium/Hard	4-8 person(s
2	Warehouse issues - clutter vs. visibility, capacity limits availability of goods	Graphics/Server	Medium	2-4 person(s
2	Restaurant	All	Medium/Hard	10-20 person(s
2	Partnerships? - Marketing, purchasing	All	Really Hard	? person(s)
2	Auction	All	Really Hard	? person(s)
2	Relocation	All	Hard	8-12 person(s
2	Revive Quickie Advertising	Server	Medium	1-2 person(s
2	Revive Chamber of Commerce	Server	Medium	1-2 person(s

Conclusion

The Dollar Bay Project was an excellent opportunity for students to gain real-life programming and project management experience. It provides students a glimpse of what the world of information technology consulting is really like. In addition, the actual Dollar Bay game can provide an educational experience for individuals who play it. Dollar Bay is an excellent tutor in the field of business administration, teaching students about accounting, marketing, and management. Instructors at any level could use it as a learning tool in their classes. Based on our results, we predict that this type of course could easily be replicated in other universities with great success.

References

Chaput, C. and Brian M. Slator. The NDSU GAMES Project. 10 January 1997. 30 April 2002. <http:// www.cs.ndsu.nodak.edu/~slator/html/games.html>.

Coomber, Sarah. Dream Worlds, Real Learning. Fargo Forum. 14 January 2000. 30 April 2002. <http://oit.cs.ndsu.nodak.edu/~mooadmin/saved/publicity/itr-article00/forum-09142000-604.shtml>

Curtis, P. (1997). Not Just a Game: How LambdaMOO Came to Exist and What It Did to Get Back at Me. Cynthia Haynes and Jan Rune Holmevik, Editors: High Wired: On the Design, Use, and Theory of Educational MOOs. Ann Arbor: University of Michigan Press.

World Wide Web Instructional Committee (WWWIC). North Dakota State University Website. 30 April 2002. <http://wwwic.ndsu.nodak.edu/>

Slator, Brian M. and Harold "Cliff" Chaput (1996). Learning by Learning Roles: a virtual role-playing environment for tutoring. Proceedings of the Third International Conference on Intelligent Tutoring Systems (ITS'96). Montreal: Springer-Verlag, June 12-14, pp. 668-676. (Lecture Notes in Computer Science, edited by C. Frasson, G. Gauthier, A. Lesgold).

Slator, B.M., Juell, P., McClean, P., Saini-Eidukat, B., Schwert, D.P., White, A., & Hill, C. (1999). Virtual Environments for Education at NDSU. Journal of Network and Computer Applications, 22 (4), 161-174.

Slator, Brian M., Wynne, K., Burleigh, D., Kadrmas, J., Kennedy, E., Alt, J., Aus, J., Balliet, D., Balliet, D., Bergstrom, C., Blaha, R., Bopp, K., Carlson, B., Carlson, S., Collins III, G., Crary, P., Cusey, J., Deck, M., Dewald, A., Dieken, S., Elezovic, A., Ely, D., Engels, G., Ernst, M., Fimreite, K., Finke, E., Fredrickson, C., Fredrickson, N., Guerard, M., Hall, T., Hanson, M., Hartman, K., Hawkinson, W., Hessinger, K., Ho, H., Hoffert, J., Hoffert, J., Hofland, C., Hokanson, B., Holzer, M., Hoque, M., Hossain, S., Hurlburt, M., Johnson, B., Kawamura, S., Levasseur, J., Lindvall, N.,Lorentz, B., Louwagie, J., Mafua, D., Martens, R., Matthews, J., Miller, B., Moorhouse, S., Olson, D., Parisien, K., Reiser, J., Resler, C., Richardson, J.,Romberg, C., Schilke, S., Schmidt, J., Schott, D., Seira, S., Sell,R., Seymour, B., Sjoblom, L., Tarnowski, J., Ternes, S., Thompson, B., Wells, T., Wolters, M., Wong, A. Rushing Headlong Into the Past: The Blackwood Project. May 2001. 30 April 2002. Proceedings of the Fifth IASTED International Conference on Internet and Multimedia Systems and Applications (IMSA 2001). Honolulu, HI, August 13-16, pp. 318-323.<http://lions.cs.ndsu.nodak.edu/~mooadmin/papers/imsa-final.htm>

Acknowledgement

Some portion of this NDSU Worldwide Web Instructional Committee (WWWIC) research was supported by funding from the National Science Foundation under grant EIA-0086142