Explore of the hospital management of Simulation Education learning model

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Abstract

Background: Progress in Internet and software resources have brought many changes in our daily lives. Gradually educational model has stressed the importance of simulation in both its effectiveness and solutions to many restrictions in traditional educational methods. Purpose: This study introduces a novel business-game-based learning object model (BLOM) that includes the following steps: 1.Conceptual design of simulation scenarios, 2.Model illustration, 3.Simulation model creation, 4.Internet Use, 5.Platform, and 6.Product Deployment and Testing. Methods: Based on a questionnaire study of the current needs in hospital management courses, we will take advantage of current technology to produce “Genki Hospital”, a simulation game, quickly and effectively for online education using the steps of BLOM. Conclusion: The model’s effectiveness and plausibility using heuristic and usability tests will be evaluated and apply the lessons learned into improving our model for the future also applied.

Keywords – simulation and gaming, game-based learning, simulation game, e-learning, hospital management, object modeling.

1. Introduction

Advances in information technology and the Internet in the last two decades have greatly impacted our views regarding educational methods and environments. Whereas most of the recent research has focused on establishing Internet as an adequate facilitator for learning, few proposed methodologies or models have demonstrated how Internet can improve learning by taking advantage of its inherent benefits. Essentially, we have pigeonholed Information technology as a tool instead of a platform for developing innovative educational paradigms [1]. In order to make this leap, we need to ask the question: “What can the Internet enable us to do that weren’t possible before?” Sharma and Sheth [2], in a similar effort to answer such a question in the field of marketing, noted that Internet created the opportunity for customer-centric marketing, from which new ideas and philosophies around marketing became possible.

In fact, we can adapt this idea towards online education by focusing on aspects of learning from which students will gain the most benefits (student-centric) as we consider potential systems. Simpson and Courtney [3] underline critical thinking, problem solving, clinical decision making, and creative thinking as vital qualities a student must possess; in addition, a literature survey reveals that computer simulation models, in game form, are most effective at enabling these qualities through its ability to incorporate useful education methods such as use of questions, group
interaction, role playing, analytical activities, and debriefing.

This study introduces a Business-game-based learning object model (BLOM), an innovative methodology for fast and effective development of educational online simulation games aimed at student-centric learning environments. Originally designed by Top-BOSS, Inc. intended for Business education, we want to exhibit the model’s versatility, which would not be possible without the Internet and the continued progress in technology, by incorporating it in a hospital management simulation game, hosted on Facebook, called “Genki Hospital” and assess its plausibility for future applications through a series of heuristic evaluation and user satisfaction surveys.

2. Role of simulations in education

Due to the constantly rising popularity of digital multimedia applications, Internet simulation is becoming increasingly desirable in promoting improved learning in students. The theory of situated cognition has been influential in the role simulations play in all types of education. It explains that all knowledge is deeply rooted in activities with physical, social, and cultural contexts. Traditional classroom learning packages knowledge in an abstract form while requiring students to retrieve it from condensed medium such as instructors and books thus delivering poor results. In addition, Lave and Wenger [4] argue that the unpredictable difficulties present in the real world will prove to be challenging for students to adapt and apply the knowledge gained when faced with potential obstacles. Consequently, simulation advocates the process of “learning by doing”. It is fine to make a mistake during the simulation, but it is more important for a good simulation to guide the student into understanding the “how” and the “why” that occurred. Only then, learning is achieved. Theoretically, a successful learning simulation usually exhibits the following three attributes:

(1) Providing an environment closely resemble to that in the real world.
(2) Interaction with experts who will guide you in case of obstacles.
(3) Encouraging knowledge that is concise in structure and declaration.

However, the progress in building a realistic yet effective simulation is hindered by these limitations:

Time – In an actual course, there is often not enough time to fully explore the intricacies of a simulation, and sometimes simulations take too long to complete or maximize their educational values.

Space – Conventional simulations usually take place in classrooms or conference rooms thus limiting the number of participants.

Funds – A byproduct of the previous deficits. Instructors’ time and rent both require money. The available fund dictates how long and how thorough a simulation can be performed in any course.

Naturally, we can overcome these restrictions by taking advantage of the Internet and the software resources at our disposal. Internet provides a notion of “anytime, and/or anywhere” while the declining cost of hardware and software systems makes incorporating simulations in education possible. Boehle noted that simulation has the potential to quickly become the most valuable and vital component in next generation educational software systems [5]. Recent research has also shown that simulation games have gradually been favored as an effective tool in business and
management education by providing a risk-free environment [6]. Therefore, we propose a new methodology for rapid
development of student-centric online simulation games.

3. Business-Game-Based Learning Object Model (BLOM) Overview

It has always been a big problem in non-computerized simulations that when a need for inclusion of desirable
educational concepts arises. Understandably, there are two popular courses of action:

(1) Attempt to expand the simulation by changing the structure of the simulation or appending activities in a
non-elegant fashion.

(2) An overhaul of the entire simulation is required to feature the necessary changes.

In effect, performing these two actions will result in either a dramatic increase in production time or completely
transforming the dynamics of the simulation that it does not achieve its desired educational effects. Therefore, our
model serves as a reliable platform for dealing with the complexity of developing simulation software by providing easy
and efficient integration and scalable capabilities to new ideas and techniques.

Originally designed for business game simulations, the BLOM can be separated into 6 steps in the process of
creating a simulation game system, as depicted in figure 1.

A. Conceptual design of simulation scenarios – Before any simulation game development, we want to assess its
potential for usefulness, which we can learn from marketing research through questionnaire studies. We separate our
population of hospital staff into five strata (doctors, nurses, administrators, hospital management students, and nursing
management students) and uses random proportional sampling approach. We use the chi-square analytical method in
order to understand the results. We ask the following questions in order to gain an understanding of the computer use
habits of our target audience.

(1) Habit of playing computer games.

(2) Knowledge of games related to hospital management.

(3) Opinion on integrating hospital management simulation games in an actual course.

(4) Topics included in a hospital management game.

(5) The best illustration of a hospital management game.

An analysis of our results reveals these points regarding hospital management simulations:

(1) There is an increasing ratio of people playing computer games and is open to utilizing hospital management game in
related courses.

(2) It is better to include topics regarding medical history management, resource management, financial management,
and reception.

(3) Over 60% of the subjects think that Role Playing Games (RPG) is the best way of illustrating the nuances of a
hospital management game.

Thus, we are able to design our simulation scenarios based on these gathered information using an Excel
spreadsheet.
B. Model illustration – Because the conceptual designs involve people with different technological backgrounds, we want to use our own translation method to manually map the script into concept art and code that our programmers will be able to understand and create the simulation that the students see today.

C. Simulation Model Creation – The program that we will use to parse and interpret its meanings is called “Top-BOSS Scripting Engine” (TSE). However, the parameter values, by themselves, do not represent anything meaningfully unless it understands how it interacts with the environment in game. For that, our “Top-BOSS game definition editor” (TGC) provides functionality of definition editing, runtime debugging. All of these are run on top of our backbone engine called “Top-BOSS game engine” (TGE). Users can easily interact with the simulation through appropriate graphical user interface.

D. Internet Use – What’s a simulation used in online education without taking advantage of the web services? We use two types of protocols: Simple Object Access Protocol (SOAP) and binary messages. Our platform also supports common web protocols HTTP, TCP, windows message, DLL, UDP 2.0, and MSMQ, etc to further support different systems and web requirements.

E. Platform – The simulation platform acts as the backend or server for the game. The Learning Management System keeps track of the logistics of the simulation and does any necessary calculations. It utilizes the EMBG model for completing the design and production of the learning object used by the game engines. It also keeps track of performance data for instructor and student evaluations. Its primary advantage is that it reduces development time and cost significantly while having no effect on the simulation quality. Because of the popularity increase of social media applications (i.e. Facebook) and the programming ease of utilizing their application “Application Programming Interface” (APIs), we have chosen Facebook to host our simulations in connection to our learning management system. Of course, we can always use any web application hosting platforms to achieve the similar effect, if there appears to be a better choice than Facebook in the future.

F. Product Deployment and Testing – Adequate guide during simulation execution is of vital importance to the success of an educational simulation. In our model, we provide ample help functionalities online, including a wizard, for not only the users, but the instructor and system administrators as well.

As for product testing, besides closed alpha and beta, we cannot overlook actual deployment in educational opportunities. Only through constant feedback from instructors and students alike will we gain enough insight into how to further improve our model.

4. Motivation Behind Genki Hospital and Related Work

Since the beginning of healthcare reform in Taiwan fifteen years ago, the diversity in medicine and treatment referral policies had drastically changed the medical culture. In fact, we have seen the phenomenon where the number of hospitals in the country has gradually dwindled while the number of individual services that a hospital can provide
has increased in effect expanding the patient per doctor ratio. Furthermore, medical help has never been more accessible than in its current state. Along with the advances in medical technology and the rising of public health awareness, the public mindset has shifted from being passive (seeing a doctor only when I am sick) to an active one (regular checkups and evaluation). As a side effect, the public has become more demanding and harder to satisfy in terms of medical services. Competition among hospitals also escalated since government funding of operations and research relied on having patients, and patients begin to choose which hospitals to go for their ailments in terms of professional knowledge and the level of service. For that reason, proposals for improving education quality in hospital related courses such as hospital management has gathered steam in recent years.

As mentioned in the previous section, there has been much discussion on the effectiveness of simulation in education. The increased interest has prompted many attempts at creating simulation games with educational values that are fun to play. Among the simulations current on the market, we can group them into 3 distinctive themes: purely fun, hospital management theories instruction, and actual practices of the hospital staff team.

**Purely Fun** – The representative simulations in this category are Hospital Hustle, Hospital Havoc, Hospital Tycoon, and Theme Hospital [7]. They simulate events in a hospital that require players to make decisions affecting hospital attendance and revenue. In turn, they train players in decision making and micromanagement skills. However, the developers place most of the effort into making the game fun instead of guiding the players through the process while making sure that they can reason their way into absorbing the required knowledge. Either they already have the skills to easily beat the game or they will take a long time through trial and error, which is not an efficient way to learn. As a result, their entertainment values are much greater than their educational values and are not ideal computer simulations for healthcare.

**Hospital Management Theories** – A leader in this type of healthcare simulation, Forterra System [8] features simulation of actual clinical environments where users learn about hospital management theories through experiences. It can be considered the more effective of nurse and doctor trainings that does not jeopardize patient safety while utilizing Internet to perform debriefing globally after throughout training. Because the focus of this simulation falls on providing the most effective training method, it will tend to make the user feel too much of a chore in participating in the simulation. There needs to be some sort of motivation, or fun factor, in performing the tasks required to learn concepts and theories behind hospital management.

**Hospital Staff Practices** – 3DiTeams [9] is an online multiplayer first person game developed by Duke University Medical Center to promote medical education and team training. The training has two phases, first phase is an “individual learning phase” where they learned about teamwork and communication skills and tested in a series of short video questions. The second phase consists of collaboration and team coordination phase, where 32 players can interact with each other in a virtual training environment through various missions in dealing with patients of different ailment. Finally, the team goes through a debriefing phase by discussing the pros and cons of their actions and ways to improve them. This model proves to be well-organized in providing a way for students to gain improved learning through interaction with other students and personal experience. But, it is restricting in terms of time since everyone needs to be
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online at the same time; stronger students will dominate in doing everything such that weaker students receive diminished effect.

While there is an abundance of simulation models in industry, they are lacking in one regard or another. Our model can retain the advantages while limiting the disadvantages and risks to a minimum.

A. Genki Hospital

(1) The Simulation Game

We want to extend our learning model to the design of a low cost simulation game that will enable a user to understand about hospital management concept in a new way. Genki Hospital is funded by the Taiwan National Science Council from 2009 to 2010. We will explain how we adapted each part of the modeling process into the development of Genki Hospital.

![Flow Chart for BLOM Model](image)

Figure 1. Flow Chart for BLOM Model

In Genki Hospital, we set up the scenarios for the game using an Excel table. We try to provide as much information about the game as possible after spirited exchanges with experts in the medical field detailing what type of events and roles would maximize a student’s learning potential. At first glance, includes some general information such as the name, type, and style of the game. Because of popular Facebook simulation games such as Farmville, we want to present our game with adorable animations in order to attract students’ attention and entice them into learning while playing the game.

The users are the main character, a recent nursing school graduates, working in the virtual hospital as an intern in various departments, where missions enabling them to gain knowledge managing different aspects of a hospital await. By overcoming each challenge, they get a promotion to become a part of the staff. As the story progresses, they will eventually be charged with managing the entire hospital. In our table, we list different department and its related mission that the player has to complete, and the title that she earns for completing it. For example: Manager for hospital ward – gathering patient information and present the data in either graph or a data table (transfer rate or occupancy rate...
for each month). The table as shown below will be processed for construction of simulation model in the next phase of BLOM.

(2) Simulation Modeling

Given the format of the early simulation design, the next step of our BLOM model performs design conversion into a graphical layout of the gaming model. From the central topic of hospital management, our layout shows a clear structure of the game. In the start branch, events are scheduled for the user to get started and familiar with the object of the game. Necessary parameter such as the initial department in which the user is starting are listed for use in the subsequent parts of the model.

Next, the converter discovers about the missions and the corresponding virtual environment in which the user works and represents the information with a 3 level hierarchy list. It starts with the general titles and expands them into departments. Because the jobs required are department and title specific, we need to repeat the departments for each title and save each job related parameters by themselves. Finally, we arrive at the debriefing process after the user had a chance to experience with the simulation for a pre-determined time frame (instructor-specific if the game is used in conjunction with a management course). The simulation will maintain a list of required objective and highlight the items that the user has completed. In addition, the simulation will provide both the user and the instructor with a radial performance chart. Related items include organizational skills, mental health, growth as a hospital manager, and experience gained. Finally, the user can get feedback from the simulation regarding his/her overall performances.

(3) The Game

As mentioned in the overview of the BLOM model, TSE scripting engine will be responsible for parsing and interpreting the aforementioned layout of the game in order to create the underlying decision-making state machine controlling the impact that every user action has on the final outcome. Continuing with the manager of the hospital ward career path, figure 2 shows a graphical user interface that the player will encounter during his/her time in this department.
Each different GUI image represents different stages in the gaming that is dependent on a number of factors and parameters. The TGE keeps track of all of the game’s internal parametric values and based on the results of an underlying algorithm interacts with the state machine to display the appropriate game animation to the user. Then, with the player continuing with his decision making, the game takes on different decision tree paths as shown in the figure.

For example, in the scenario of managing a hospital ward, the player has control over the logistics of the ward such as the number of patients in a room, room amenities, and cost for staying, etc. Players must make decisions based on the needs of the patient and the revenue flow of the hospital. Developers can create different scenarios in a similar manner. Hence, the game itself becomes scalable using our model in the fact that by drafting new scenarios with TSE, using gaming engines such as TGE we can develop an assortment of gaming simulations with relative ease and efficiency. The difficulty lies in incorporating concepts into our games while not losing the fun factor.

(4) Incorporation of Internet

The increasing acceptance and usage of online social media network application, namely Facebook, has piqued our interest in using it to host our simulation games. The introduction of Facebook Developers APIs has removed all doubts while encouraging additions of new functionalities to our model. The advantage of using a Facebook App (short for application) is that there is a unified framework for retrieval and storing of related data about our simulation games. In addition, the basic Internet protocols adopted by Facebook are already supported in our models. Figure 3 below shows the Facebook App of our hospital ward management scenario as a part of Genki Hospital.

![Figure 3. Facebook App of Genki Hospital](image-url)
There are two basic ways to incorporate a simulation into a Facebook App [10].

i. Facebook Markup Language (FBML) – enables developers to build an entire Facebook Application with this evolved subset of HTML along with their API.

ii. Facebook frames – a fast way to incorporate already existing apps into Facebook. (i.e. Java Applet, flash)

Depending on the way we implement our simulations, we have the flexibility into choosing the best way to host our applications. With the ever-evolving features of Facebook, performing virtual debriefing [9] in this way has never been more attractive. We feel that this is a great way of extending our model with the invention of social media networks.

B. Genki Hospital Evaluations

In the evaluation of educational simulations, there are heuristic evaluation, an objective method, and user satisfaction surveys, which is often subjective depending on individuals. Heuristic evaluation explores the effectiveness of a simulation game’s underlying educational methodologies and how well it plays the role as an enabler of student learning. Developers can use this to adjust the design of the simulation to shift the focus between education and fun accordingly. On the other hand, the usability survey gives the developers some ideas regarding if the user actually learns from playing the game or there are some parts of the game that he/she was not pleased with so that developers can confirm the model’s validity.

(1) Heuristic Evaluation

We have asked eight scholars experienced in different fields of hospital management to fill out a scoring sheet to evaluate Genki Hospital. There are five items for scoring, where each item score ranges from 0 ~ 2, with 2 being the best. A total score of 5+ shows that the simulation has good quality in terms of educational value. The items to be examined are: content, navigation and tracking of study material, instruction design, instructional media, and creativity.

The results show that in the evaluation of four different simulation scenarios, patient reception management and disease control receive a passing score from 7 out of 8 scholars, which equates to a passing rate of 87.5%, while the other departments (hospital ward management and food) receive a 100% passing rate. While this is very encouraging, they also directed us to some areas that needed improvement, e.g. providing a clearer instruction for some of the scenario controls.

(2) User Satisfaction

One of Facebook app’s functionality is the ability to let users leave messages or concerns regarding the application for efficient communication between users and administrators. We have asked an actual management college course to incorporate our simulation in their syllabus and have asked their students to leave messages regarding how satisfied they were using this tool for aided learning.

The majority of the students reached a consensus that there were not enough explanations or manuals on how to play some of the simulation scenarios. Some of the mentioned that they feel the game is too simple and boring that they do not feel like that they can learn from it. We attributed this to possibly not having enough fun factors in specific scenario that will be improved in future simulations. Our model is great at solving this problem since it provides a rapid development phase for new ideas to be implemented as simulation games. Not all feedbacks were negative, however.
Some students feel that despite the shortcomings of the game implementations, they were able to learn from experience and actually felt compelled to play the game in different ways in order to see the consequences of their actions.

5. Conclusion

We have introduced a new BLOM that, despite being intended for business simulation game implementation, can be extended to other fields of management science. Genki Hospital, a hospital management simulation game, is an example. We took advantage of BLOM’s ease of integration and fast development phase, combining with the power of the Internet, to create a game aiming to be both fun and effective in its promotion of learning through participation.

We have tested plausibility of our model with two types of evaluation methods. In heuristic evaluation, we sought experts in the field of academia for advices in terms of Genki Hospital’s potential as an effective teaching method, and the results were mostly positive. While student survey did not fare as well in our usability test, which we attributed to the likely lack of instructions and relatively simple interfaces, we believe that we are on the right track.

We have demonstrated that the underlying principles of BLOM and its possibility of becoming a mainstream model for all simulation games in the near future. However, this model merely provides a starting point for interested developers and still requires additional inputs from subject matter expert inputs (e.g. university professors, professional consultants) to improve its effectiveness and efficiency and expand its area of applications.

References