Using Trading Games to Interpret a Health Environment

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ABSTRACT

This paper looks the UK Health Service is developing a market between different service providers who are 'commissioned' to provide services on behalf of the patients who are actually treated, according to need. The objective is to provide an agent-based environment that allows managers, administrators, clinicians and others to explore the effects of their professional decisions both on patient experience and on the other providers. It also gives an opportunity for students to explore the issues that are important to the other professionals and to gain a better insight into what constraints they operate under and why they make the decisions that they do.

Keywords

Medical Education, Health Economics, Multi-Agent Simulation, Collaborative Learning, Social Networking, Inter-Professional Learning.

1. INTRODUCTION

The use of agent based games to assist in the teaching of various principles is now well established. Long running examples include the RoboCup [3] robot soccer tournament, RoboCup Rescue [4], and the TAC Trading Agent Game [7]. All these have a common characteristic in that they provide a platform for students (and others) to test their own agents against standard scenarios. This is a useful learning scenario for Computer Scientists and Engineers, who can test different approaches and algorithms in a competitive environment, allowing the most effective agents to 'win' the competition. These games have been used to assist in the teaching of various market-based models. Indeed, a number of competitions are now well established, that allow students to test their agents against those of other groups. This provides a dynamic environment in which algorithms and design techniques can be tested on a regular basis and the most successful identified and developed. The reason for the different competition environments is that each maintains a separate marketplace, with defined game rules. This paper looks at a rather different situation in which the UK Health Service is developing a market between different service providers who are 'commissioned' to provide services on behalf of the patients who are actually treated, according to need [5]. The objective is to provide an agent-based environment that allows managers, administrators, clinicians and others to explore the effects of their professional decisions both on patient experience and on the other providers such as commissioners, hospitals, community and primary services, and the voluntary sector.

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We are investigating a rather different situation, in which trainee and professional managers can investigate the consequences of difficult choices, and see the potential consequences of their actions. This has been attempted by for example the EIDE system, where choices can be made in the management of Electrical Supply [6]. This is a relatively static simulation where the trading parameters are specified at the start, and the system then uses these as inputs to each cycle of the simulation, which consists of a typical auction scenario.

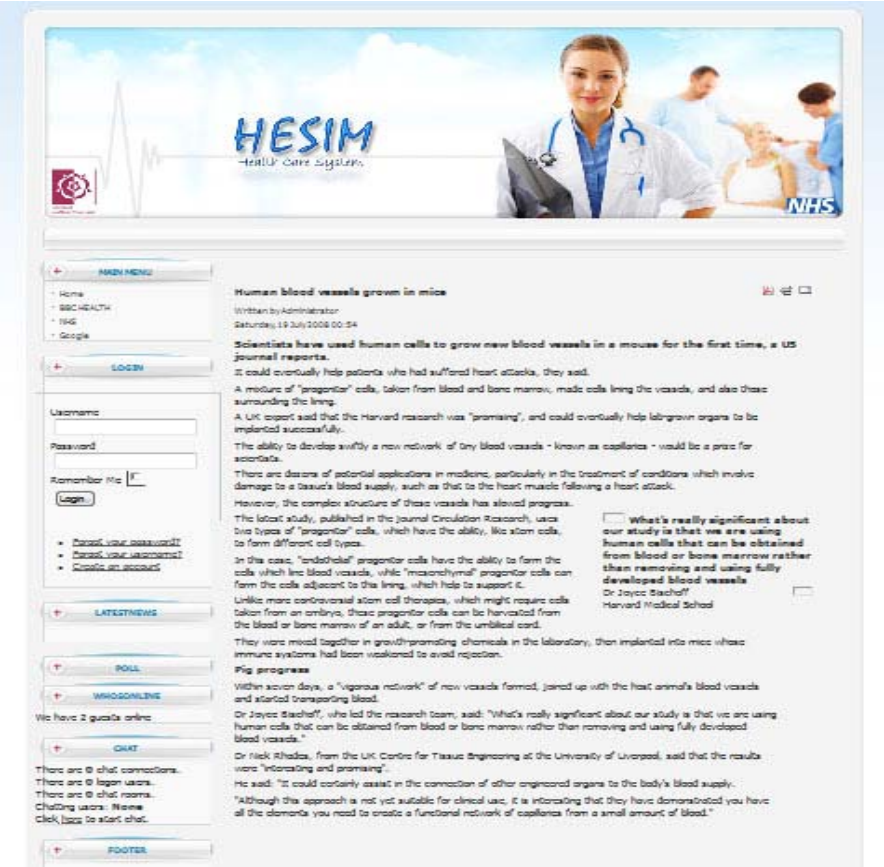

Figure 1 Login and Entry Screen

2. TEACHING OBJECTIVES

The teaching scenario that we are considering is that of healthcare administrators and professionals in the United Kingdom, where the National Health Service operates a pseudo internal market. The objective is to provide a simulation environment that will support inter-professional learning [1] and provides an environment to explore the effects of decision making over a predefined period, but speeded up to support teaching over a suitable session, such as a semester. The environment, policy changes, typical incidents, such as major accidents or large scale medical emergencies that affect the economy are all reflected in the simulation environment. The simulation cycle therefore does not have to run 'real time' and is updated at the end of each cycle.

The motivation comes from the 'Rubber Windmill' exercises run by the King's Fund [2]. Students working in groups take on a specific role in the health economy, with some specific objectives (expressed in terms of income and expenditure, waiting lists, and patient satisfaction) and resources. They pursue these objectives through interaction with other roles. The agreed results of any decisions, in terms of the system and individual parameters and then fed back to the whole system. For some decisions, such as the effect of a change on patient satisfaction, a moderator's role is required. This could either be through a panel made up of 'experts' or through the participants themselves reviewing and giving feedback about proposals. Individual roles will be able to disclose or withhold information to other roles. In engaging with the simulation, students' learning will be supported in a number of areas, for example to:

- Understand how a health economy works as a system
- Understand the policy framework for health and social care
- Explore organisational relationships in health and social care - competition or collaboration?
- Consider the operational consequences of policy decisions
- Analyse the impact of individual actions on wider non-linear systems.

A number of roles have been identified, some with broader responsibilities in a system or in an organisation and others with more operational roles in a series of settings. These are mapped onto agents in the system, which can either act as proxies for professionals in the exercise,

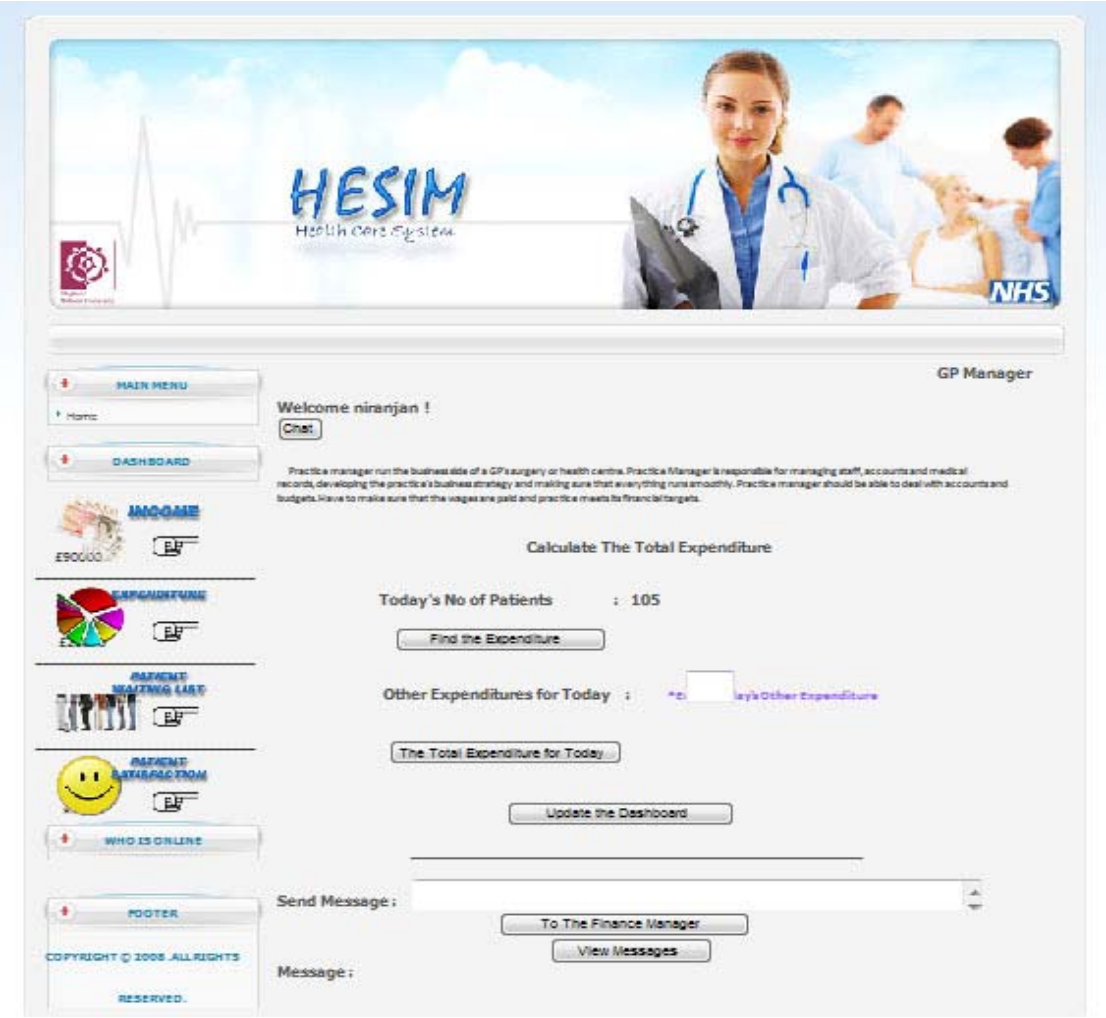

Figure 2 The Dashboard

implementing the decisions made by the human learner, or are fully autonomous. The later can be used both to monitor the behaviour of the students, and for example to give advice as to the potential consequences of particular courses of action. These may be financial, in that the students are attempting to commit money that is not available to them, legal, in that they may be putting themselves in a position that they will not be able to meet the legal obligations placed on them if, for example, they use too much money in a particular area, or political, in that a government minister makes a statement on some topical issue and it is now necessary for the individual Trusts to implement it in their area. It is also possible to simulate possible scenarios such as a large scale influenza epidemic or an accident with long term healthcare consequences and provide the support for developing learning scenarios based on circumstances that students may well face only once in their professional careers. In the current prototype tutors monitor the students' actions and send messages when they consider that these could lead to dangerous situations, such as the Trust running out of money, but it would be relatively easy to for a series of autonomous agents to monitor these scenarios and to alert both the students, by sending appropriate messages, and tutors of their concerns. This would provide much more timely and consistent feedback to the students, and allow tutors to concentrate on maximising the student learning through direct discussion.

3. THE HEALTH ECONOMY SIMULATION MODEL

The economic model is presented to the students as an economic simulation game in which groups of students consider the issues for which they are responsible, and enter their decisions. When all the decisions are available, the agent simulation runs, and results are available for the next session. This allows the groups to meet over a period, as it is often impossible for them to work

simultaneously, and for some of the activities to be managed solely by artificial agents, depending on the teaching needs of the cohort.

Users register with the system, choosing a role using the screen shown in Figure 1. They are immediately associated with a proxy agent within the scenario that defines their intended role.

They then interact with their agent through the Dashboard (Figure 2) which provides both the key indicators of the current status of the simulation, that is:

- Income,
- Expenditure,
- Patient's Waiting List,
- Patient Satisfaction

and the ability to modify parameters within their agent's control. Students are expected to review the current situation at the start of each turn, and then decide the changes they wish to make, that are consistent with their assigned role. The Dashboard therefore always gives a clear picture of the current situation. A typical set of user activities is shown in the Use Case Diagram (Figure 3). This illustrates how When trying to provide the best service in a market oriented approach each player has to understand about the income, has to balance the expenditure mean while considering the quality of the service.
From the dashboard above stated purposes are achieved.

4. FUTURE DEVELOPMENTS

The current prototype is limited in scope to a small part of the National Health Service, in that it looks particularly at the interaction between the General Practitioner Service and the Hospital Service. While this is very important, it is not the complete picture. Further scenarios need to be developed to provide a much richer learning environment.

Another area in which this approach could prove highly effective is in emergency planning. Health professionals have to plan for a wide range of scenarios which they will hopefully mostly not actually meet in their professional lives. Examples include a large scale influenza epidemic, a terrorist attack that involves the release of toxic materials, any form of mass poisoning etc. All these have a major disruptive effect on the Health Service as they require a major shift of resources over a significant period (a major accident or other incident is less likely to have a long term effect because a large number of casualties present themselves, and dealt with as fast as the available resources will allow, and the majority will merge into the normal treatment facilities). This type of simulation game gives students the opportunity to explore the issues raised in situations that are far removed from their normal working environment.

5. CONCLUSIONS

An initial prototype has been developed that provides capabilities to support a coherent subset of the roles identified, and this has been tested in a simulated teaching environment. Initial reaction has been very positive, and it is anticipated that with further development that includes a wider range of roles, the system will provide a significant tool for the development of inter-professional learning in the healthcare domain.

6. ACKNOWLEDGEMENTS

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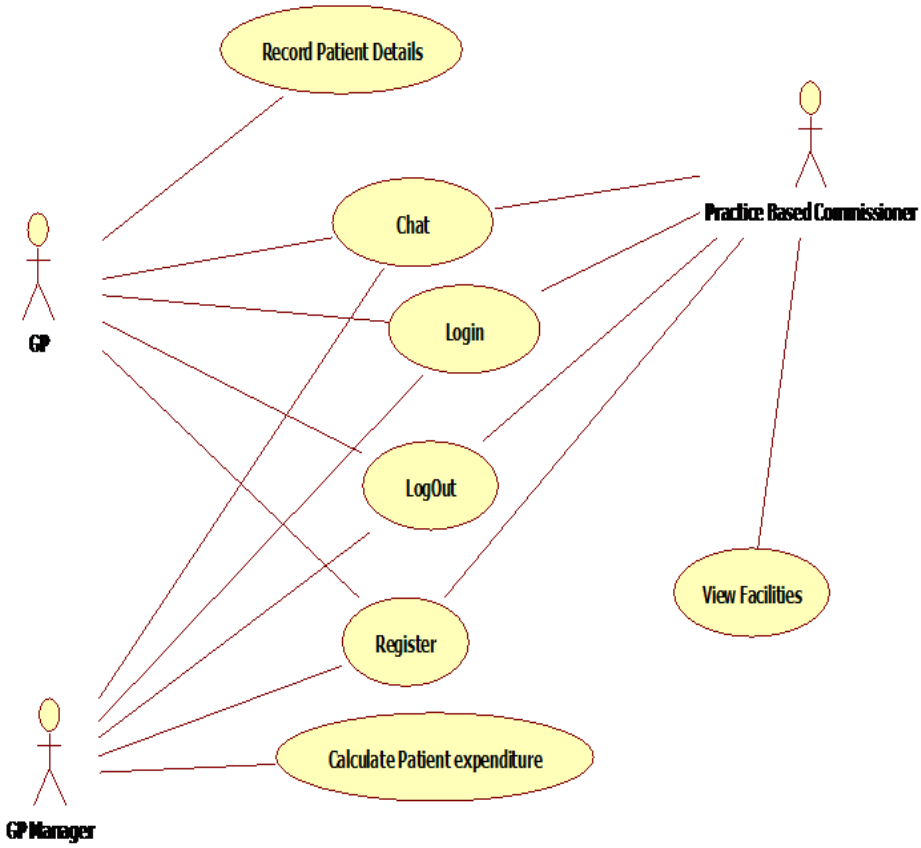

Figure 3 Use Case Diagram for the General Practitioner Scenario