INDUSTRIAL TRAINING WITH SIMULATION GAMES

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Abstract

More and more projects in simulation are aimed to support decision makers through interactive models. Techniques like "simulation games" call increasingly the attention in different academic and business organisations. Nevertheless, there exists a lack of good real applications in simulation which support the process of qualification of decision makers. More than this, there is a shortage of support tools which facilitate the use of those applications as well as the reuse of previous simulation models and games.

This paper does not cover in detail any of the components of the proposed simulation support system. We motivate the need and the importance of having simulation games for professional training and decision support. Further, we describe the different stages necessary to build a simulation support system. The paper's central subjects are professional training for decision makers, a definition of the concept of "simulation games" and an overall project description.

1 INTRODUCTION

The level of complexity of the decisions which have to be faced in different economic contexts like manufacturing or marketing has been considerably increased in the last decade. The increasingly demanding challenges imposed by new developments in technology, together with the necessary improvements of a company's competitive edge by increasing productivity, improving quality and reducing cost, calls for reinforcement of the present methods of qualification and training of people involved in decisions.

The question that almost everyone brings up is: How to get those "professionals" trained in decision making? The process is long and demands considerable human investments. The need to implement tools which will allow us to improving this process, making it more accessible and shorter, is becoming more and more apparent.

Regarding the high-priority requirements for more skilled professional decision makers, less attention must be focused on developments of new simulation techniques, or on improvements at the methodological level, and more at the application level.

2 PROFESSIONAL TRAINING FOR DECISIONMAKERS

The present requirements in the training of qualified professionals demand are:

1. The development of concrete environments.

2. Concrete applications taken from reality.

3. Interactive simulation models which requires the active participation of the user.

4. Models which provide the users with the possibility to learn new concepts and to get training in the evaluation of different situations, and

5. Models which allow the setting up of a scene with business games and which show the user what may happen if he makes a specific decision.

Even though, the introduction rate of different approaches with the purpose of creating new and more innovative training programs based on simulation is increasing. It seems that the idea of building simulation support tools in order to organise and control all of those simulation games, gaining features like reusability, extendibility, robustness and completeness of information, is the most relevant approach at the moment (and perhaps the easiest one!).

Companies are developing simulation games in order to train personnel in a concrete task or to improve their participation level in the company's "business". But the development of those simulation games is sporadic and corresponds to the momentary training needs. Because of the lack of classification, documentation and control of the simulation games, they are developed in isolation from each other and the effort expended on them doesn't yield the necessary pay-off. In order to guarantee organisation of the simulation games and to take advantage of all the possibilities behind modularisation, composition and reusability, it is necessary to create a support system. Simulation games would be created step by step in the system like knowledge is in a knowledge base.

3 THE CONCEPT OF A SIMULATION GAME

Physically, a simulation game is a simulation model where changes have been made in order to achieve particular training goals and to provide a special environment to the user. Simulation games simulate real life organisations and capture essence both qualitatively and quantitatively. The game is designed in order to aid problem solving in such a way that the users will recognise the crucial issues. They will have realistic information available and simulated situations will be similar to those they encounter in the actual organisation.

Like simulation models, simulation games allow one to identify and test different alternatives without incurring the extra costs of implementations. They allow users to increase their knowledge level about the functioning of the real system as long as they can figure out the relationships between the organisation's components. Abstracting out unimportant aspects from the real system, simulation games offer an overall picture of the simulated domain.

The main role of a simulation game is perhaps as a communication medium. It will help develop a user's understanding of a situation in terms of options, key relationships, major aspects, potential consequences, problem areas and priorities. It also provides practice in important managerial skills. The simulation game must use an appropriate game frame, but at the same time be realistic to the playing user.

Participating in a game, users will feel free to try different options which most likely they will not try to implement in reality because of the involved risk. This aspect includes an important factor for the stimulation of the user's creativity. Simulation games will provide users the possibility to try their own ideas. Released from external constraints, the user becomes a better decision maker. Games provides natural conditions for training which will serve as a basis for learning. Learning by analogy is one basic approach to learning.

But, unlike simulation models, simulation games can not be used in order to workout quantitative relationships between components on the system or to provide statistical measurements of the behaviour of the parts in the model. In many aspects, simulation game research is not "academic" in nature and rarely requires repeated observations and rigorous testing. This does not undermine the game's value, but it is necessary to appreciate their proper role and limitations.

4 OVERALL PROJECT DESCRIPTION

In this section we briefly describes the different stages that we have identified for the implementation of a simulation support system. The overall plan for the project is divided into six stages. The first five stages will define the building process of the simulation games. The last and sixth stage concerns the realization and use of the final product. The building process is inherently iterative, starting with very simple simulation models with the purpose of discovering the basic, functioning and the bare bone requirements of a simulation game. The following step will be to improve the basic simulation game into a more functional prototype. The final product should be a simulation game functioning as a training tool on the education level as well as a tool for improving the level of competence of already active professionals.

4.1 Problem Definition

During the initial stage we will perform empirical studies. The goal is to find appropriate problem areas where decision makers would like to improve their performance and their competence level. Simple theories as well as relevant and practical problems with pedagogical value in the area of decision making will also be studied. The desired outcome of the initial stage is a small set of problems in decision making useful for training.

4.2 Framework Development for Simulation Models

In the second stage, the problems collected during the initial stage will be refined into simulation models. These simulation models need to take into account the organisation structure and the actual training objectives, and be rather simple in structure. They will define the basic relationships between the different entities of the system. We stress the need to develop simple simulation models regarding the technical considerations of future simulation games. The process for building simulation models is a collaborative effort between many specialists in the organisation. Developers will probably control the process, based on support and input from many domain experts and decision-makers in the organisation.

4.3 Outline of Simulation Games

A simulation game is an instance of a simulation model, specialised for the actual training needs, the organisational context, the current objective and the constraints. We have to underline that there exist no algorithm for transforming a simulation model into a simulation game. Also, one simulation model can be specialised into several different simulation games. The following factors influence the construction of one simulation game:

1. The actual training goal and purpose
2. The characteristics of the organisation, and
3. Many technical and logistic considerations around the simulation game, like game variables, feedback to participants and user interface considerations (see figure 1).

4.4 Information Collection from Simulation Games

The outline of a simulation game will now be turned into a full-featured simulation game -

Figure 1: Framework development for simulation models.

including the environment (game's context), operational structure, game logistics, and documentation. In this stage, we will define the structure and the design of the main storage components for the simulation support system: a data base (DB) for storage of simulation runs and parameters for the games, a model base (MB) to store the simulation models and games, and a knowledge base (KB) to store the information about the use of those simulation games: how to use them, in which situations, requirements, etc.

Figure 2: The components of the simulation support system.

Most important in this stage, we will make preliminary checks of the simulation games prototypes in order to get feedback about their functioning and do further refinements. The goal is to adapt the games (and models) to better suit the different training needs. It is important to mention here that the potentialities of one game are supplemented by attitudes, values, experiences and perceptions which different participants bring into the game when they play it (see figure 2).

4.5 Structure Development for Simulation

During the fifth stage, we will concentrate our efforts on the definition of the interconnection between the different bases. Included is the structure and the interaction between these three components. The following main tasks will be defined for the initial simulation support system:

1. Supporting developers producing new and more refined simulation models, and simulation games. This is performed by reusing the existing base of models and games as well as extending them.
2. To facilitate the user's choice of appropriate simulation games based on their specifications (organisational context, problems and specific training needs).

None of the techniques proposed in this simulation support system is really new. The original contribution is the combination of the techniques into a coherent system in order to support the qualification processes of different professionals and to aid the labour of developers producing refined simulation models and games.

4.6 Development of Intelligent Front Ends

Now, in the final stage, we will define and implement the user interface for the system. We have two intended classes of users:

1. Domain experts producing new simulation games or simulation models.

2. Normal users or participants in simulation games.

For the second category, we would like to have an intelligent front end, where the users should be able to specify: organisational context, problem definition and training needs. The system should be able to select an appropriate simulation games based on this information (see figure 2).

5 CONCLUSION

Simulation games designed to simulate the operation of real-life organisations provide a stimulating challenge for practitioners in computer science. They are likely to become a powerful tool in management training, organisational policy development and problem-solving. Nevertheless, simulation games should not be restricted to the area of management. Parallel efforts should be invested in areas like manufacturing, marketing, personnel management, social environment and accounting systems, etc. As long as we gain more experience using games for training purposes, simulation games will become an increasingly important tool for professional training and decision support.

Although the idea of simulation games comes from the simulation model concept, they present significant differences. The purpose of the game must be remembered. It is essentially a tool for professional training, but not a substitute for managerial decision-making.

In order to achieve more advantages from simulation games, we propose to create a simulation support system. The main tasks of this system will be:

1. Supporting developers producing new and more refined simulation games.

2. To facilitate the user's choice of appropriate simulation games, based on their specifications.

The structure of a simulation support system is very simple and the process of building it was described through 6 main stages. The first five stages defined the building process and the last one the realization and use of the final product.

Through this paper, we hope to make the point that training by simulation games, could be made more effective, and possibly less costly, if developers and users of simulation games could be supported by suitable tools.