

# TOWARDS A FRAMEWORK FOR EDUCATIONAL SIMULATION IN MANAGEMENT SCIENCE AND ECONOMICS

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## ABSTRACT

Educational simulation is concerned with the use of all suitable forms of simulation, including simulation games, in education. Focusing on management science and economics, we analyze a choice of simulation models for identifying opportunities how to turn them into educational simulations. As a result of our analysis, we propose a framework for classifying and building different types of educational simulations. We argue that in the social sciences, it is natural to use multi-agent simulation, such that simulation games can be considered as participatory simulations in the sense of (Wagner 2013).

## 1 INTRODUCTION

Educational simulation, in the form of management games, has a long history in management and social science education, and a large number of such games has been developed and is being used in university education and in professional training. With the increasing use of computers in recent decades, most of them have been developed in computerized form.

## 2 COMPETENCE DIDACTICS

The purpose of an educational simulation is to teach various types of competencies that help the learner to become a competent actor in her (professional) domain for successfully dealing with situations that are typical for the domain.

Following (Debler 2015), we distinguish between theoretical, practical and personal types of domain competencies. Theoretical domain competencies subsume a) (explicit) **declarative knowledge**, including concepts, general facts and law-like regularities, b) (explicit) **method knowledge**: knowing how to solve a problem (using which steps), as well as c) **discourse knowledge** about how others use and judge theoretical domain knowledge.

Practical domain competencies subsume a) **implicit know-how** consisting of intuitive mental and motoric operations (cannot be verbalized), and b) (explicit) **script knowledge** for dealing with situations of a certain type based on the episodic memory and classification of experienced situations.

## 3 ANALYSIS OF SIMULATION MODELS

For our analysis, we have chosen five simulation models for identifying opportunities how to turn them into educational simulations. We briefly discuss each of them in the following subsections.

### 3.1 Service Queues

Service queues are an important element of many business systems, and queuing theory is an important operation research theory. Simple service queue simulation models allow to teach basic elements of queuing theory and service-based business processes using statistics output and visualization.

### **3.2 Inventory Management**

Inventory management is an important business function in manufacturing and goods trading companies. Simple inventory management simulation models allow to teach the effects of inventory management policies using statistics output and visualization.

### **3.3 The Lemonade Stand Game**

In this simulation model, a complete manufacturing company with all basic business functions (demand forecasting, production planning, inventory management, pricing, and marketing) is simulated. The multi-agent model can be turned into a simulation game (with an animation user interface) such that in addition to declarative knowledge also method knowledge can be taught.

### **3.4 A Minimal Economy with Regional Labor Markets**

Consists of a regional labor market with firms and workers. Firms are assigned different sectors and have sector-specific skill requirements. The model deals with the complex issue of aggregated phenomena in the regional labor market, characterized by an environment where individual agents (firms and workers), their decisions at the micro-level and the policies defined at a macro level interact in a systemic way.

### **3.5 Lengnick's Minimal Economy**

Represents a stylized model of a basic economy comprising only households and firms as the main agent types forming a system without growth where the number of households and firms are exogenously fixed.

## **4 ELEMENTS OF A FRAMEWORK FOR EDUCATIONAL SIMULATION**

### **4.1 Teaching Statistics with Simulations**

We show how simulations help students to better understand statistical concepts and methods.

### **4.2 Teaching Domain Competencies with Ordinary Simulations**

Ordinary simulations, with statistics output and visualization, can be used for teaching declarative knowledge and method knowledge. These simulations may be enriched with various learning contents such as concept definitions, examples, method explanations, quiz questions and learning scripts.

### **4.3 Exploratory Simulation**

In exploratory simulation, as defined by Wagner (2013), users may explore a system by means of interventions. It allows learning the dynamics of a system by interacting with a simulation model of it.

### **4.4 Simulation Games**

Games have been found to be effective in motivating students to learn. Using the approach of participatory simulation proposed in (Wagner 2013), we show how to turn ordinary simulation models into educational simulation games.

## **REFERENCES**

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