LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

Fachhochschule Vorarlberg
University of Applied Sciences

THE 38th CONFERENCE
ISAGA 2007
INTERNATIONAL SIMULATION AND GAMING ASSOCIATION

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Improving the quality of gaming simulations: Can we learn anything from evaluation?

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40 years of evaluation research in the domain of simulation and gaming (S&G):

S&G are an **effective**, yet not always the most **efficient** method for teaching and learning in a number of content areas (e.g. Faria, 2001; Wolfe, 1997; Wolfe & Crookall, 1989)

Main **stages of research** on business games (Faria, 2001):

1. Demonstrating **effectiveness** of games versus other teaching methods
2. Finding correlates of **simulation performance** (=learning performance?)
3. Identifying **knowledge and skills** learned in business games

¦ Most research activities have been directed towards answering **summative evaluation** questions

Summative evaluation (Scriven, 1972ff):

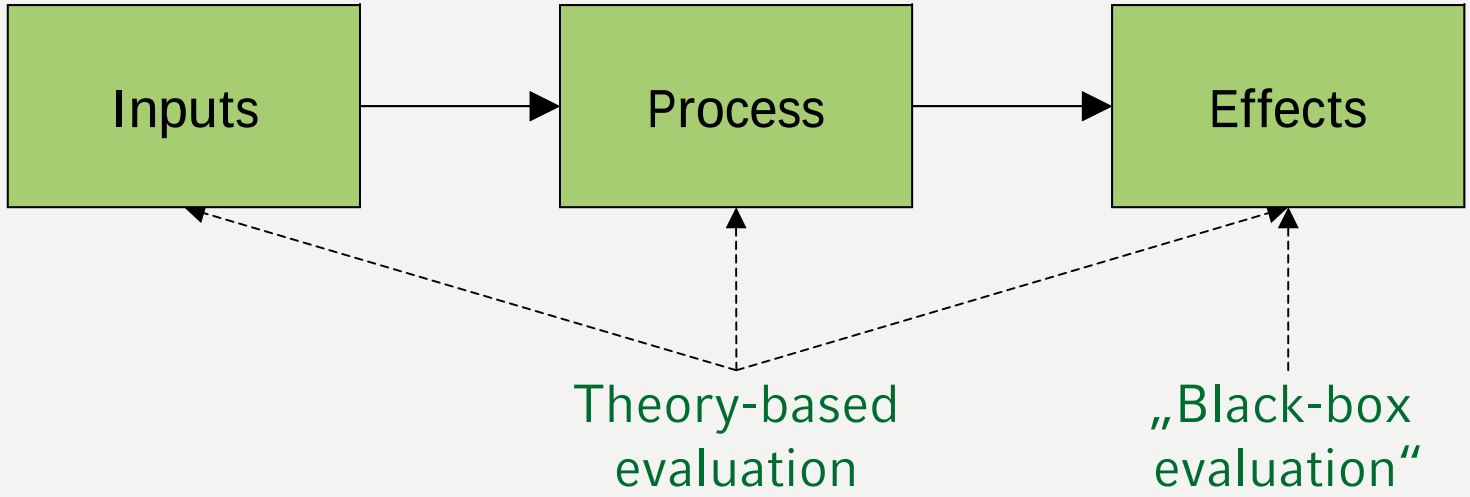
- Making **final judgments** on the merit or worth of a finished product or program
- Focus on **determining outcomes** of G&S

In many contexts it is desirable for evaluation to have a formative role, i.e. to **provide information for improvement**.

But: to know **if** a gaming simulation works does not tell us a lot about **why** it does (or does not) work.

¦ To do so, we need to pay attention to input, process and context data alike.

"[we have to spend] more effort on understanding how programs work than on the effort to find out whether or not they actually work in some specific and nongeneralizable instance" (Chen & Rossi, 1983; Chen, 1991, 2004)



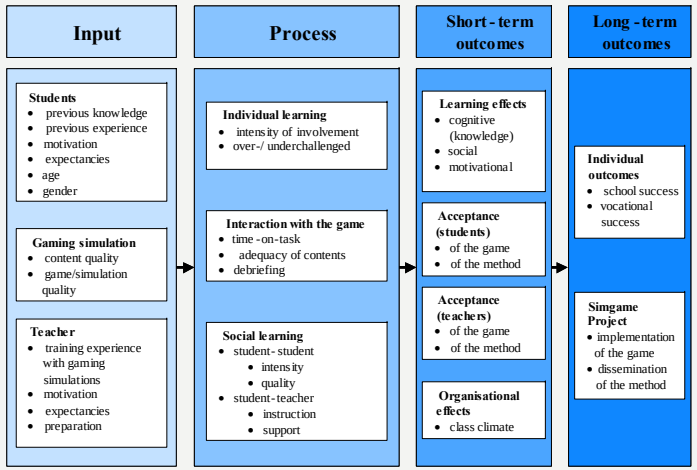
Main goal of **theory-based evaluation**: understanding failure and success (Hense, 2004; Kriz & Hense, 2006).

Logic models

- Variables that are relevant in the context of the evaluated simulation game
  - antecedent variables ("input")
  - variables related to interaction with S&G ("process")
  - variables related to S&G effects ("outcome")
- Descriptions of their mutual relationships

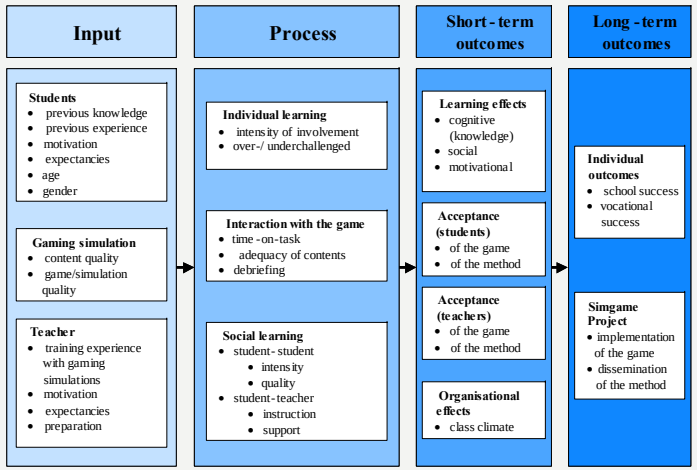
Sources in our context:

- learning & instruction research
- education
- gaming and simulation theory

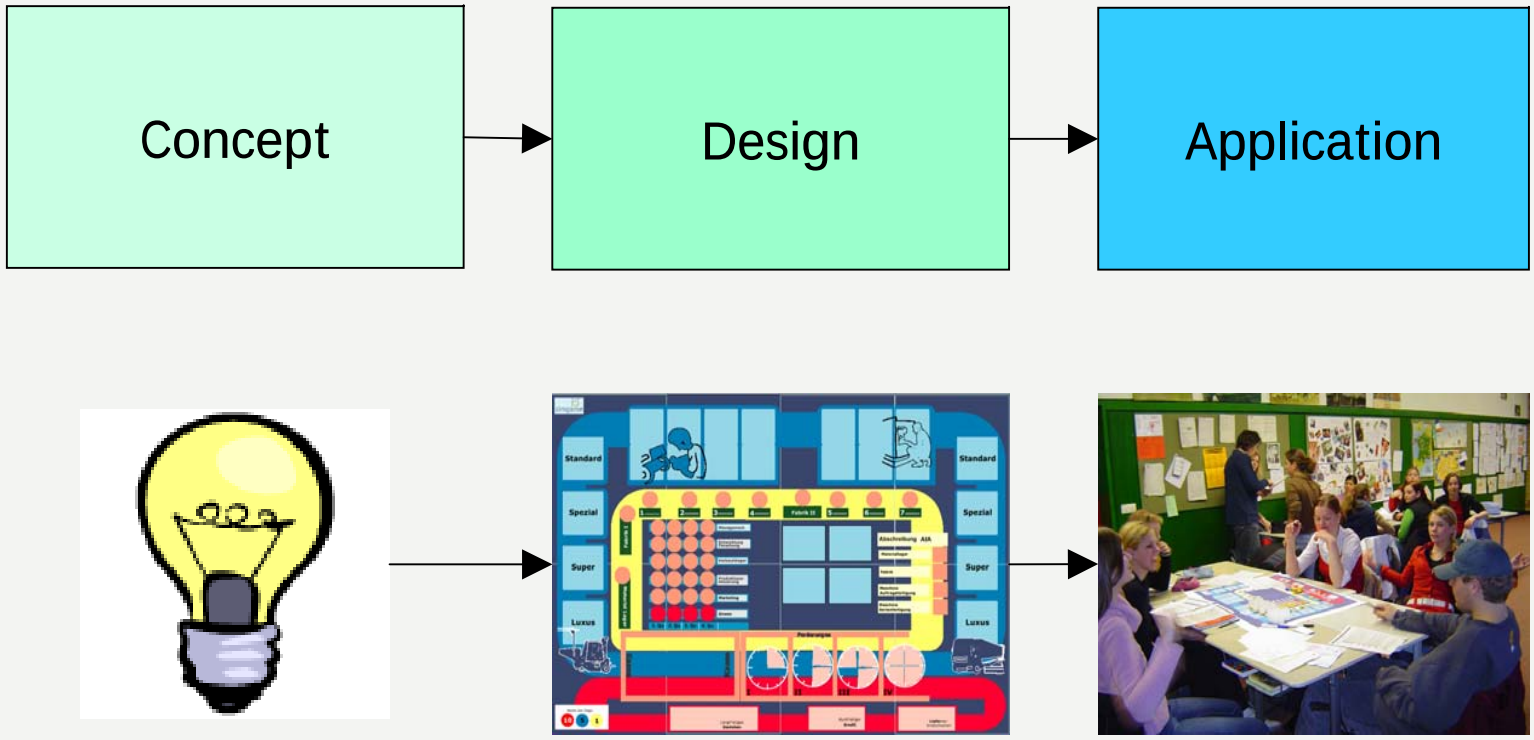


Steps of theory-based evaluation (cf. Reynolds, 1998):

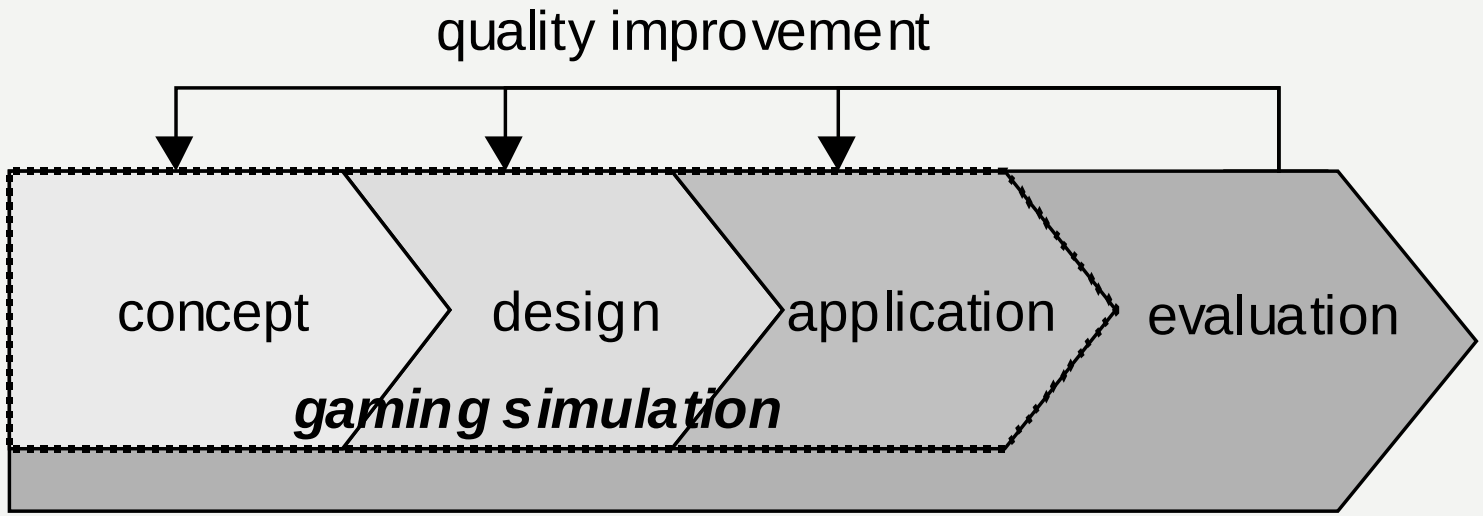
1. Develop a **logic model** of the simulation
2. Measure the **outcomes** of participation (="classical" evaluation)
3. Collect data on **input, context** and **process** factors
4. Estimate **main effects** of participation
5. Test **causal mechanisms** of the logic model → analyse which factors contributed the most, and which factors had detrimental effects
6. Identify formative uses of findings for **improvement**



What kind of improvement?



Points of leverage for improving G&S:



- Three mechanisms for quality improvement by evaluation

Improving the **application and use** of G&S within a specific context:

- Learning goals & curriculum
- Learners' preconditions
- Facilitator competencies & behaviour
- Game didactics
- Debriefing procedures
- …

Improving the **design** of G&S:

- Simulation model
- Game rules
- User interface (on- or offline)
- Game materials
- Instructions for players and facilitator
- …

Improving the **conceptual foundations** of G&S :

- Gaming & simulation theories
- Instructional theories (in the context of G&S)

Two problems:

- **Generalising** results from single evaluation studies
- **Accumulating** knowledge from different studies

Two case examples
of improvement-oriented evaluations:

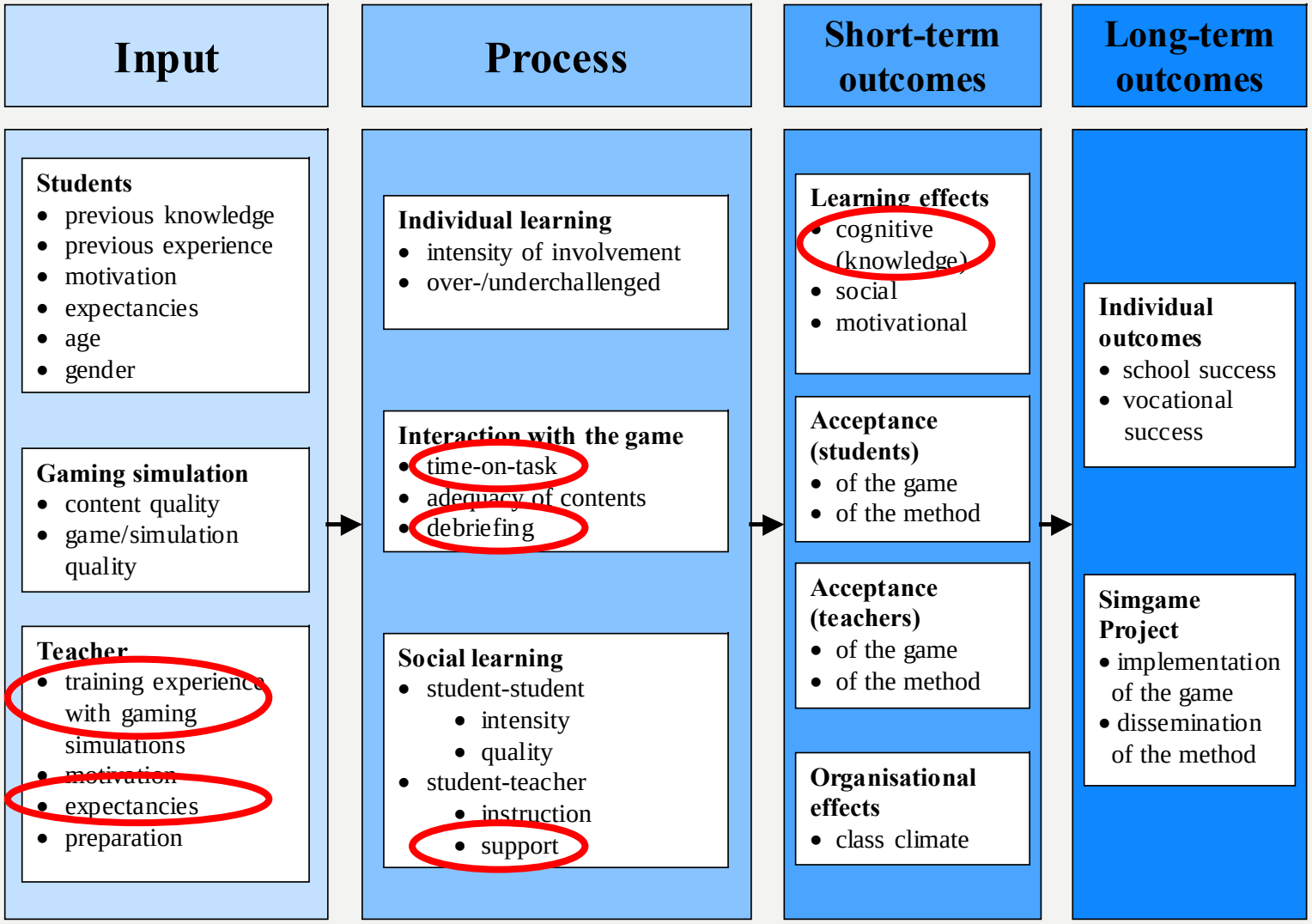
Simgame

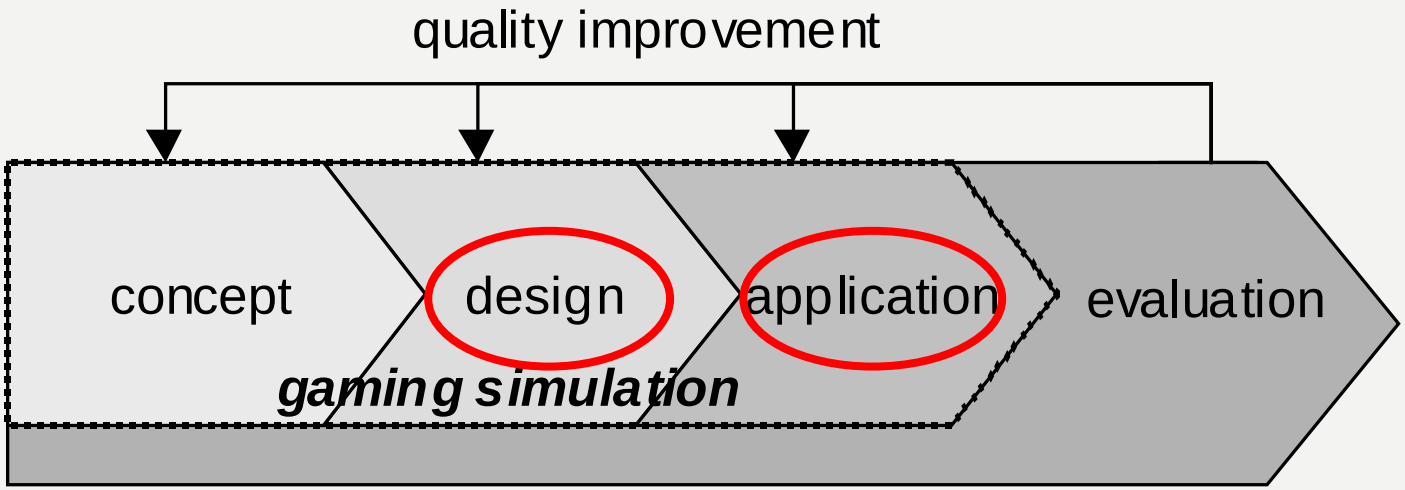
StartUp!

simgame

Leonardo da Vinci

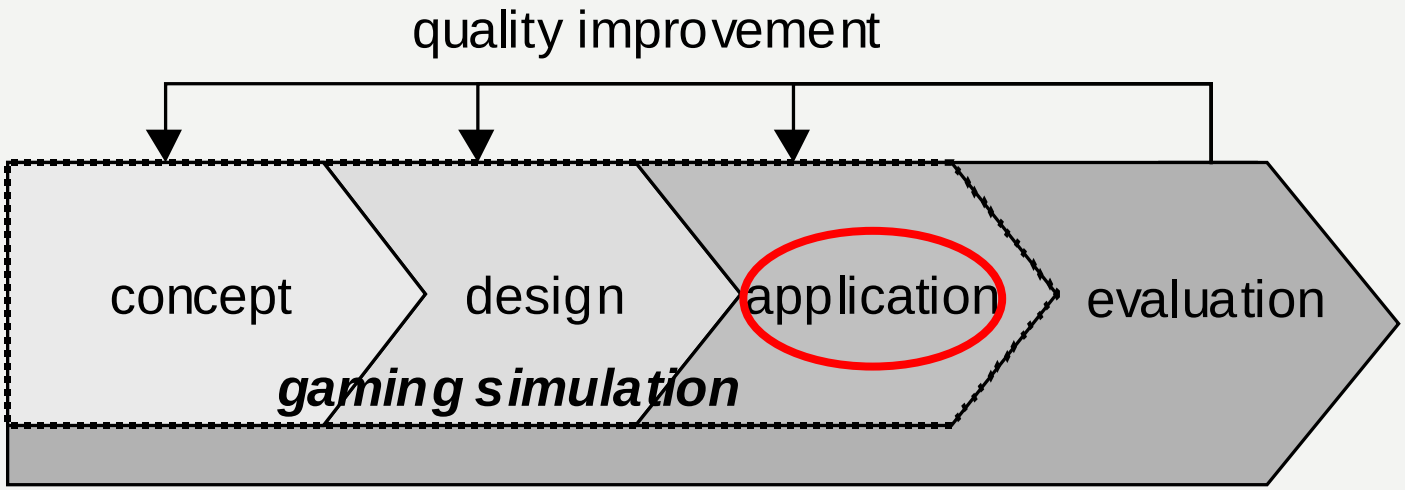
The project Simgame – "The Simulation of Economic Processes and Decision Making as a Training Module" - was a Leonardo-da-Vinci-program of the European Union and was carried out in 2003 and 2004. Simgame is also the name of a board-based business simulation game for economy lessons in secondary schools, which was developed, implemented and evaluated within the project (Hense, Kriz & Wolfe, 2007; Kriz & Hense, 2004).


Input
Process
Short-term outcomes
Long-term outcomes
Students
previous knowledge
previous experience
motivation
expectancies
age
gender
Gaming simulation
content quality
game/simulation quality
Teacher
training experience with gaming simulations
motivation
expectancies
preparation
Individual learning
intensity of involvement
over-/underchallenged
Interaction with the game
time-on-task
adequacy of contents
debriefing
Social learning
student-student
intensity
quality
student-teacher
instruction
support
Learning effects
cognitive (knowledge)
social
motivational
Acceptance (students)
of the game
of the method
Acceptance (teachers)
of the game
of the method
Organisational effects
class climate
Individual outcomes
school success
vocational success
Simgame Project
implementation of the game
dissemination of the method


quality improvement
concept
design
application
evaluation
gaming simulation

The computer supported business simulation game "Topsim StartUp!" covers all stages of a StartUp! business and is used in entrepreneurship education in German universities in the project „Grow" under the auspices of the German Federal Ministry for Education and Research and is used in the project „exist-priME-Cup" under the auspecies of the German Ministry of Economy. (Kriz & Auchter, 2006; Kriz, Auchter & Wittenzellner, 2007).

Input	→	Process	→	Outcome
Sociodemographical data • Age • Gender • Stage in Studies • Course of Studies **Disposition- & Motivation** • Intension for own Start-up • Start-up disposition in the family **Previous experience/Attitude** • simulations and „StartUp!" • teamwork **Technical- & Methodology Skills** • Knowledge of economics • Skills for business plans **Social Competence** **Entrepreneurial Competence** • Innovatory tendency • Attitude to risk • Proactive orientation **Personality dispositions** Achievment Motivation, Belief in internal control, Willingness to prevail, Emotional stability, Desire to be independent, Propensity to lead, Self-efficacy		**Individual Learning** • Over/underchallanged • Motivation und roletaking in simulation • Causal attribution **Interaction in the simulation** • Learning time / Duration of the simulation (periods) • Type of simulation (product option "Easy" or "Production" and playing option "one 3-day-block" or "several sessions during the whole term) **Social Learning** • Student-Student-Interaction (Quality & intensity of teamwork) • Student-Trainer-Interaction (Intensity & quality of support / facilitation)		**Learning** Technical & methodological competence • Knowledge of economics • Preparation of business plans • Preparation of StartUp! • StartUp! competencies Social & personal competence • Team competencies • Recognize own strengths & weaknesses Motivational • Intension to go for a Start-up **Simulation success** **Acceptance of "StartUp!" Game**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Evaluation can have a number of different **functions** in different contexts.

Within the gaming and simulation domain, a main focus of past efforts has been on its **summative role**.

This has only been natural, since summative evaluation can answer some very basic questions on the effectiveness and efficiency of gaming simulation as a learning method.

It is also important to stress evaluations' **formative role**.

Our model is a **framework** for analysing and discussing different mechanisms to improve gaming simulations.

The case examples illustrate the improvement of simulations' **design or application**.

Logic models can help to identify the key variables that need to be considered in the evaluation. They provide a frame of reference for interpreting the simulation's workings as a learning environment. They can indicate areas for improvement in the simulation's design or application.

The third component of our model addresses, though, quality improvement directed towards the **conceptual foundations** of a simulation game.

It will be an **important endeavour** for future evaluations to concentrate more on this point of leverage for the improvement of gaming simulation quality.