Gaming Simulation for Business and Management Education – A Case Example of an University Curriculum and Didactic Approach

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Abstract

This article presents methods of gaming simulation as didactic approach for an innovative university curriculum for business and management education. As an overview we show how different types of simulation games are part of the university education in the business programs. In addition we discuss in more detail one module of "systems management" as best-practice case example of the curriculum. The design of simulation game prototypes is part of the didactic approach. In the first part of the paper, we discuss in the format of a literature review building blocks of gaming simulation, principles of gaming simulation and learning, and gaming simulation's potential to improve the understanding of business and management through implementation in the curriculum. In the last part, the structure, contents, and innovative hybrid game-design approach of one specific module is shown in detail.

Keywords: systems thinking, management, business education, gaming simulation, game design

Gaming Simulation for Understanding and Management of Systems

Public policy makers, managers of companies and leaders of organizations increasingly face difficult problems and highly complex situations and dynamics. Unfortunately, abilities and strategies to deal with complex dynamic economic and social systems and societies have not improved to the required extent. Leaders and managers fail to handle the complexity of a modern world in crisis, and they are not dealing with limited resources in a sustainable and humane way. Leaders and managers need methods they can use to make complex system dynamics understandable, support problem solving and decision making, investigate the long-term and side effects of decisions, develop and explore alternative change strategies for possible better futures, and create learning organizations (Kriz & Manahl, 2016).

Gaming simulation methods have the potential to fulfill these needs and to contribute to the transformation of organizations and other real-life systems. Klabbers (1989, p. 3) pointed out 25 years ago: *"As problems and issues are becoming increasingly complex, how can we improve our individual and collective competence in steering and self-steering our societies, organizations and institutions? ... Gaming and Simulation have proved to be a powerful combination of methods and ideas in* *dealing with complex and unique issues ... Gaming Simulation provides a language for combining the social-human domain with the physical, technological and economic domains and provides a shared language for communication between the natural and social sciences."*

Richard Duke (1974) pointed out the need for gestalt and "multilogue" communication in dealing with complex systems. Duke detailed why and how gaming simulation supports the holistic understanding of complex systems and the decision-making process for policy makers in different contexts. Modern approaches of gaming still refer to these fundamental concerns and arguments (Duke & Kriz, 2014). For example Tsuchiya (2012) discusses principles for organizational transformation by using a combination of policy gaming, game design, and system dynamics modeling.

In addition to system dynamics modeling, agent-based modeling and social simulation are combined with the classical approaches of gaming simulation (Deguchi, 2004; Kaneda, 2012). These modern forms of "hybrid gaming simulation" are especially promising when used as a group model-building methodology (Fischer & Barnabé, 2009) to solve real-life problems together with different stakeholders. These approaches are also used in the university curriculum we will discuss in this article.

Methodology of Gaming Simulation

"Gaming Simulation" is the simulation of the effects of decisions made by players who assume the roles and represent the interests of real-life actors, with the latitude to act these roles out being subject to specific rules (Klabbers, 2009; Rizzi, 2014). Gaming simulation originated with war games. The Prussian army was one of the first to use it systematically and widely to plan military strategies and tactics. After the end of the Second World War, gaming simulation expanded into other fields of application. This growth started with the corporate sector and urban planning, and later branched into a variety of educational contexts at universities and schools (Klabbers, 2009).

In practice, the term "simulation games" refers to a large number of different approaches. These approaches include computer simulations, behavior-oriented role plays with or without computer-assisted simulation, hands-on board games, practice enterprises, and more recent approaches such as digital and non-digital educational games, game-based-learning, and web-based simulation games. Simulation games represent dynamic models of real situations. They help to mimic processes, networks, and structures of specific existing systems. In addition to mirroring real-life systems, simulation games incorporate players who assume specific roles of real-life actors. The prototype gaming simulation combines role-play and simulation. True simulation games include actors, rules, and resources (Klabbers, 1999, 2014). Therefore, despite their diversity and variety, all simulation games contain three fundamental elements:

Simulation Resources: A model is a description or representation of a (real) system and/or process that can help to understand how the system and/or process works. A simulation game is a model that is used to simulate an existing real system and/or process (Klabbers, 2009, p. 24). With the aid of a simulation, it is possible to replicate and investigate system processes that could or would not be carried out in real life. These processes include simulations of military maneuvers, disaster situations, or pilot training in flight simulators. Simulation games thus offer an opportunity to make the best possible use especially of limited resources and to make the long-term effects of decisions tangible and transparent. Simulation games encourage holistic, interconnected thinking and systems understanding.

Roles for Actors: Beside simulation, role-playing is an integral element of simulation games. In every real-life systems (e.g., an organization), the actions of different people or stakeholders with different interests, information, and perspectives are always interrelated. It is precisely this interaction that simulation games replicate. In the game, the players assume the roles of real-life actors. They have a certain freedom how they fill the role and interpret the situation. With modern concepts of hybrid simulation games, real human actors can also interact with simulated actors.

Game Rules: A game is an activity involving one or more players who assume roles while trying to achieve a goal. Rules determine what the players are permitted to do – including their interactivity, communication, and feedback – or define constraints on allowable actions. The rules may also impact the available resources (Klabbers 2009, p. 24). In 1935 Johan Huizinga characterized humans as "Homo ludens" and saw games as a fundamental human achievement. Unlike pure play such as a soccer match or a poker game, the simulation game serves to represent reality. Simulation games use gaming forms and artifacts to simulate real-life systems.

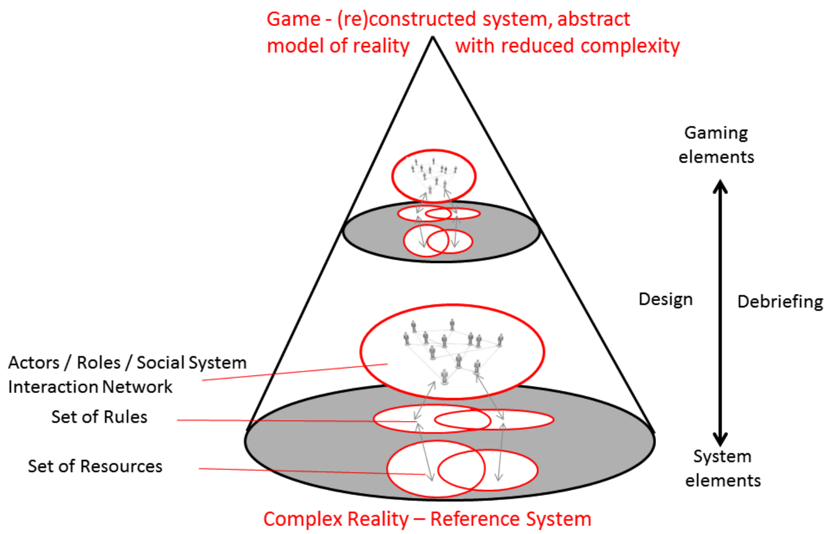

Figure 1 Building blocks of games and real systems (based on Klabbers, 2009; Duke, 1974)

Figure 1 illustrates gaming simulation's use of games to simulate system dynamics. Game artifacts are designed as an abstract qualitative and/or quantitative model of a reference system of the real world (i. e. design in the small). The play and debriefing of the game are exercises that allow participants to practice behavior and experience the effects of their decisions in order to understand and transform the simulated system and to implement transformations in the real system (design in the large) in the future. Players represent actors of the reference system and interact while playing different roles, applying rules, and utilizing resources.

Figure 2 shows the perspective of gaming as a process. A part of the existing situation of reality is selected as a reference system for the designed simulation game. The final aim is to change systems structures and processes. To carry out design in the large in the real world, a simulation game (including a specific game scenario) as a dynamic model of reality is created. In the design part of the process, a simulation model is created. This model defines the relationship between systems elements and gaming elements.

The designed game is applied through facilitation. To play the game means to use a game artifact (*form*) to simulate (*function*) systems processes. Debriefing is conducted to enhance the learning process (see below) and to apply newly gained insights, knowledge, and skills within the design in the small aimed at changing reality, i.e. design in the large. In this part of the process, known as facilitation and debriefing, a didactic model is applied. This model defines how the game is used with a specific target group and within a specific context.

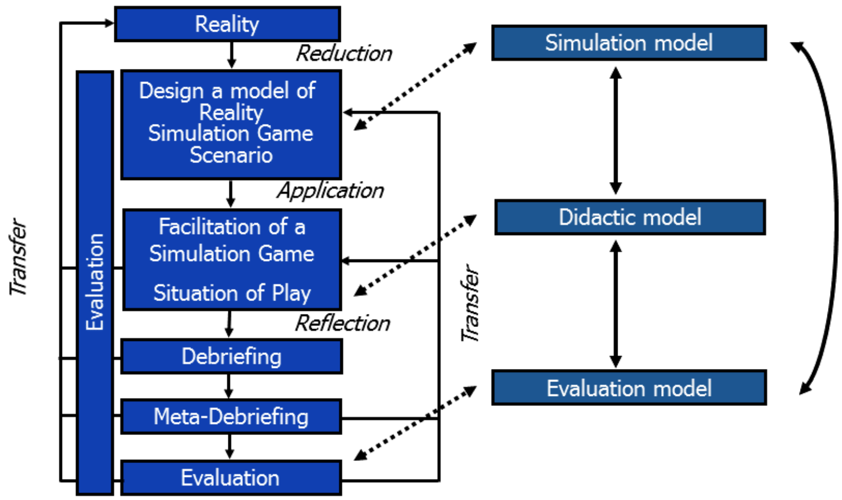

Figure 2 Process of gaming simulation

(based on Kriz 2003 and 2012)

In the secondary phase of debriefing, referred to meta-debriefing, an evaluation is required to encourage players to further reflect on the linkages between design in the small and design in the large and to measure profits of changes in reality. In this part of the process (evaluation), an evaluation model is defined. This model defines how the potential effects of the game are investigated and how and why the game works in given contexts of use (Hense & Kriz, 2008).

By inviting stakeholders and opinion leaders to participate in the design process, their contributions as agents and actors are more naturally accepted. Participating in the design, play, and debriefing allows the players to take part in the design in the small process while ultimately contributing to the next phase of the social system processes' design in the large.

Types of Gaming Simulation Applications

In literature on gaming simulation we find different types of gaming simulation applications that can be grouped into the following categories (Kriz, 2017):

I. Traditional academic research is directed at extending domain-specific knowledge by using simulation games as experimental environments and behavioral labs. The analytical science perspective uses *games and simulations as scenarios to empirically test, justify and develop theories* in specific domains. The main focus is on creating universal and context independent knowledge (e.g. Klabbers, 2009; Kriz, 2009; Kriz & Hense, 2006).

II. The science of design perspective puts an emphasis on the *usability of simulation games.* Here, games and simulations themselves are studied with the aim of supporting and evaluating their development and use in *practical contexts* (e.g. Greenblat & Duke, 1975). The main focus is on dealing with an interdisciplinary and practical approach to simulation game design (as science, art and craft) with local knowledge and unique problems or challenges. *Design-in-the-small* (Klabbers, 2006) produces gaming simulations (gaming artifacts) as interventions and interactive learning environments. Used with that goal in mind, they contribute to the *design-in the-large* process of socio-technical systems (e.g. for change management and organizational development). In practice, simulation games refer to a large number of different approaches. These include: computer simulation, behavior-oriented role plays with or without computer-assisted simulation, hands-on board games, but also more recent approaches such as digital and non-digital educational games, game-based-learning, and web-based simulation games. Also significant are those areas currently discussed with reference to buzzwords such as *serious games* and *meaningful play*. Nowadays these terms also describe the educational use of games with 3D video technology (sometimes games that were originally created for entertainment purposes).

IIa. Many applications of gaming simulation fall into the category of *education and training simulation games.* To use simulations and games as instructional and educational methods has a long tradition (e.g. Crookall, Klabbers, Coote, Saunders, Cecchini & Delle Piane, 1988; Kriz & Brandstätter, 2003; Auchter & Kriz, 2013). Here simulation games are for example used as experiential teaching and learning methods in order to foster knowledge acquisition, development of skills and competencies, understanding of complex relationships and especially facilitating simulation games to train performance of dangerous tasks in a safe learning environment. The focus of applications in this category is very often on the individual learning outcome of simulation games.

IIb. Gaming Simulation has another long history in applications that are used for concrete *simulation and game-based policy interventions* (e.g. Duke, 1974; Duke & Geurts, 2004). Simulation games support the testing and evaluation of alternative strategies and courses of action. Gaming Simulation in this tradition may lead to a better understanding and handling of interests from different stakeholders. The focal point in this category is less on individual learning, and instead, much more on collective learning and support of real decision-making within groups of actors and stakeholders.

IIc. Increasing importance can be found in the use of *gaming simulation as a core method of design of complex socio-technical systems* (e.g. Kriz, 2003). Meijer (2015) pointed out that often a concrete need of a client exists for *organizational (re)design* and/or for the innovation and improvement of a system. Simulation and gaming applications in this category may be used as a specific step in the change process, for example as an intermediate test in the (re)design of organizational rules and structures, workflow processes, performance and human factors.

Gaming Simulation and Learning

Learning experiences need to enhance learners' personal development as they gain the capacity to question the validity of acquired knowledge and develop a sensitivity toward social processes. Unlike situations of passive knowledge transfer, learners are drawn into an active, experience-based learning environment. The orientation is oriented towards the discovery of what is personally important (see Kriz, Eiselen & Manahl, 2014; Schwägele, 2014). Simulation games enable self-organized or self-directed learning, based on one's active experience to nurture competencies and skills. The key principles are:

- self-activation and learner activation (i.e., the autonomy of learners in designing their learning activities)
- learner orientation (i.e., building on the learners' previous knowledge and experience and being guided by the learners' interests, e.g., arousing curiosity)
- being close to real life (i.e., being oriented towards reality; a key idea is that thinking develops from taking practical action in realistic and authentic situations)
- holism and purpose (i.e., enabling complete action sequences, the systemic observation of connections, and the integration of cognitive, affective, and psychomotor processes while learning) (see Kriz, 2010).

To support the acquisition of skills, simulation games provide practical and relevant learning environments with realistic complexity and scope for decision-making and action. Gaming simulation is an interactive and learning environment that makes it possible to cope with authentic situations that closely mimic reality. At the same time, it is a form of social learning because it challenges and provokes team-based problem solving.

Another advantage of simulation games is the immediate feedback of action effects; the accelerated pace of simulation also creates tangible long-term effects. Simulation games are thus experimental and experience-oriented learning environments. A single simulation game allows multiple contexts of use and newly gained knowledge can be used to enter unfamiliar domains. This learning under multiple perspectives creates flexibility with domain-specific knowledge. Learning from multiple perspectives, as in gaming simulation, provides players with the intellectual tools they need to transform new knowledge into action. The major rationale for using gaming simulation is not only to define objectives and strategies for achieving learning goals but also to implement actions to achieve them. Furthermore, gaming simulation aims to diagnose, analyze, and assess responses to critical situations that occur and to make the consequences of decisions transparent (Kriz, 2003). Overall it was already shown that simulation games can effectively contribute to the development of business and management skills (c.f. Wardazko, 2013).

Gaming simulation research shows that learning is enhanced above all by additional reflection and transfer modules during and after the simulation game (Kriz & Hense, 2006; Auchter & Kriz, 2014; Kriz & Auchter, 2016). “Debriefing” has become a widely accepted term for these processes of reflection and transfer. Key debriefing processes are game analysis (What happened? What did the players feel?), game reflection (How to explain the course of the game? How to evaluate the game result?), transfer (How are game and reality related? What aspects of the game were (un)realistic?), and learning effect (What did we learn? What decisions and solutions will I actually implement in my real-life, everyday work environment?) (Kriz, 2010; Thiagarajan, 1993).

Participants enhance their systems thinking and skills for understanding and changing systems through discussion of lessons learned and problem-solving strategies during the debriefing. Debriefing offers more time for players to share multiple perspectives and to construct common mental models through social interaction (Kriz & Brandstätter, 2003). Evaluation research has shown how simulation games create a motivating learning environment. The chosen methodology should inspire players to assume a role in the game. This is important: role-taking fosters long-term interest in the educational content of the simulation game and promotes the acquisition of knowledge (see Kriz, Auchter & Wittenzellner, 2008; Hense, Kriz & Wolfe, 2009; Knogler & Lewalter, 2014).

Learning with gaming simulations can include game design. In the case of “open gaming”, the simulation model, rules, and the course of the game are not specified a priori. Instead, they are co-constructed by the participants with facilitation from seasoned simulation game designers. The participants thus become “experts” who construct systems and pedagogical models in the sense of a shared social representation of reality. This self-organizing learning environment not only shows the contextual nature of knowledge but also the connection between perspectives and changing contexts of knowledge (Klabbers, 2008; Kriz et. al., 2004).

Case Example: FHV University Curriculum of Business and Management

Gaming Simulation is one of the main methods of instruction and learning at the Vorarlberg University of Applied Sciences in Austria. Nearly 50 extensive simulation games are used within the different university programs (“extensive” means from minimum of half day up to three days duration for running a simulation game. Additionally many more “small” games and simulations are facilitated that often only take 30 minutes or one hour). The bachelor program of “management and engineering” is the front-runner with an integration of 17 extensive simulation games within the courses of the program. Several courses are not only using simulation games as didactic method. Moreover the whole course is officially defined as simulation game course within the ECTS system (European Credit Transfer System; this is the student-centered system of the European Union based on the student workload required to achieve the objectives of a program of study.). For example the bachelor program of "international business" starts in the first term with the course named "Simulation Game - Introduction to Business Management". This course uses a board-based and role-playing game to qualify for typical basic management skills and to acquire fundamental knowledge about economic processes and interrelationships in companies. In the fifth term for example all students have to select a specialization and they participate in the course "Simulation Game Elective". Here several more complex and detailed computer assisted simulation games are used that educate about special knowledge and competencies in specific areas of accounting and finance, marketing and sales, supply chain management, human resources management and organization, digital transformation and entrepreneurship and innovation.

As a detailed example we will describe a curriculum module which is part of the master's degree programs. This game-based module has 12 ECTS credit points, which ensures a minimum workload of 300 hours. The main contents and objectives of the "Systems Management through Gaming Simulation Design" module are: fostering systems-thinking (especially skills for analysis and sustainable development of complex system dynamics), fostering interdisciplinary teamwork skills (especially training of competencies for better problem solving, decision-making, communication and exchange of mental models in project teams) and learning about methods of gaming simulation.

In general, we follow an approach described by Klabbers already in the 1970s. He argued that interactive gaming simulation is an integration of a computer simulation, human-computer simulation, and gaming. Klabbers also proposed a three-stage model of simulation game development (see Klabbers, van der Hijden, Hoefnagels, Truin, 1979, pp. 118-120):

- Stage 1: Development of a simulation model (with a focus on simulation and analysis of quantitative aspects of socio-technical systems);
- Stage 2: Embedding the simulation model in an interactive (computer assisted or computer simulated) simulation (with additional focus on more qualitative individual aspects of human behavior in coping with complex systems, strategy development, and decision making);
- Stage 3: Embedding the interactive simulation in a game (with additional focus on group dynamics and communication in policy formation and organizational learning).

During stage I, students participate in different simulation games to gain basic skills in systems thinking and to learn about methods of gaming simulation (e.g. policy exercises, role play, pure games, and experiential learning activities, simulation games, and played simulations, as well as computer simulations). In this stage, teachers lecture on theory, present various techniques (e.g. tools for building models and systems analysis, brainstorming techniques, decision-making techniques, and debriefing methods), and run illustrative simulation games. Learning outcomes are that students become acquainted with the fundamental principles of systems thinking and that they can analyze systems behavior in different business and management disciplines and areas of application. Students learn how to create simple multi-relational feedback loop models of systems based on basic literature on systems-thinking and model building (e.g. Booth Sweeney & Sterman, 2000; Sherwood, 2002; Meadows, 2008). Students learn in theory and practice about important factors for cooperation in interdisciplinary teams as they have to work together in mixed discipline teams with coaching by teachers. Students learn about systems archetypes (Kim, 1994) and can analyze, predict, and display simple systems behavior and develop intervention strategies in systems. Lectures with discussions are held on different forms of systems theory (e.g. systems dynamics, chaos theory, synergetics, cybernetics) and their application to management questions.

Exercises are conducted to learn about simple modeling techniques. For example, exercises are conducted on multi-relational cause-and-effect structures (feedback loop diagrams), behavior-over-time diagrams, graphical functions diagrams, policy structure diagrams, computer models, and management flight simulators (Vennix, 1996; Sterman, 2000). The simulation games that are facilitated by the teachers are predominantly based on system dynamics models such as Ecopolicy by Frederic Vester (1994), Fish Banks and Stratagem by Dennis Meadows (1993; 1985), and Visim by Thomas Maier (2011).

In the simulation games of stage I and in the debriefing, students apply step by step different methods of systems management. For example, in the game “Stratagem” some underlying feedback-loop diagrams are part of the role description and briefing information of the players. In addition, participants have to develop further feedback loops diagrams and use them for a better systems analysis and management. In the debriefing phases, the self-developed models are critically discussed and improved.

Furthermore students learn about fundamentals of gaming simulation, serious gaming and game based learning and of gamification. Definitions and taxonomies of games and simulations are presented and the history of gaming is discussed (for an understanding of the play element in/of culture - "homo ludens"). Students become familiar with different forms of game-based learning and simulation-game-based consulting techniques. They learn how to use gaming methods for different organizational contexts from training and personnel development to change management and optimization of work flow processes in companies.

For the grading the students have to write two essay papers per person (individual work). The papers must include self-developed feedback loops diagrams. The first paper has to be based on scientific literature for a defined topic and research question. All elements and relationships of the model have to be discussed with references to research results. The second paper must discuss a case example from own work experience referring to a problem situation. The elements and relationships of the model have to be argued and some practical recommendations for the management of the described system (interventions in order to change the problem situation) based on the systems analysis (model) have to be explained.

During step II, the students work on real-life problems of real clients in small interdisciplinary project teams with coaching by their teachers. Students learn about advanced simulation methods of system dynamics and agent-based modeling. They start to build simulations and develop models with the support of different computer simulation software tools (Ballin, 2006; Vester, 1999) and use additional techniques like stakeholder-analysis, balanced scorecard, and more. They learn about the simulation of scenarios, definition of adequate decision-making strategies for management, and the change of simulated and real complex and dynamic systems, as well as related practical problems of actual systems processes and structures.

Although several researchers have proposed frameworks for the optimal design and structure of simulation games, Duke and Geurts (2004) proposed a total of 5 phases (and 21 steps). This is the approach we use in the university module. In stage II, we put the first 2 phases into practice. Students start with an initial, approximate clarification of the simulation game's objectives and target groups. During this stage of problem clarification and problem formulation, project teams are formed and can introduce different perspectives and aspects of the problem. The teams then agree with real clients on the key questions ("defining the macro problem"). System analysis and model construction are next and include the selection of appropriate content and the analysis and definition of the systems and system elements to be simulated. The team discusses factors and elements that influence the problem to be solved or that interact with the system that is to be simulated. This serves to explore the problem environment and to integrate relevant factors and relationships into the model. Another key aspect is the graphic visualization of the system elements and their interrelationships through charts, schematics, and cause-and-effect (feedback loops) diagrams. This visualization of the problem environment is also important because it shows the limitations of the simulation model. The developed systems models are transferred into computer simulation models (using different simulation software programs). Based on the outcomes of different simulations and scenario techniques, students learn to give decision-making recommendations to the client, as well as recommendations about how to change socio-technical systems.

For the grading of stage II students continue and deepen the group work. They have to carry out additional simulations and report their findings. Based on the results of their simulations they have to discuss how to improve the models and they have to discuss further recommendations and insights with referring to the client´s problem situation. They have to hand in a written simulation report and to prepare and carry out a presentation in the plenary of the participants and clients (problem owners).

During stage III, the participants remain in their teams and learn how to design simulation games. Self-created prototype games are presented, conducted, and tested. The teachers facilitate a continued meta-debriefing within the design process. Since simulation is only one aspect of a simulation game, a concrete game method has to be selected in stage III. Following the steps proposed by Duke & Geurts (2004), a blueprint is then created. The blueprint includes identifying both the actors and the concrete roles of the players. Teams must determine which actors are played and which are simulated in a different way (the game leader, for example, can play several actors or represent them via computer simulation or event cards).

Rules need to be determined to define the players' scope for action and decision-making. Teams must also decide which resources the players can use during the simulation game, either concretely or symbolically, and how this will happen. Additionally, the chronological sequence (steps of play) of the simulation game needs to be considered. The accounting system must also be decided by the teams, and should be used to record system changes and the course of the game. It is also possible to have simulation games that do not proceed via similar rounds of activity but as a sequence of continually novel scenarios, or a combination of both approaches. The scenarios themselves also need to be defined.

Features of scenarios include specific starting situations (states of system elements), defined momentum of system elements, defined events that are to happen independently of players' decisions, and defined actions that can be triggered by players (e. g., by measures determined by decisions). Ultimately, all these necessary definitions feed into the development of a system components/gaming elements matrix; a systematic overview of the game structure that illustrates how the system components and interrelations are represented as gaming elements and their relations (gaming elements include rules, roles, events, and so on).

During the next step – the concrete development or building of the simulation game – a simulation game prototype is created, tested, and modified. Once again, many different aspects play a role, from assessing the adequacy of the model's contents, to the graphic design, to the technical evaluation. In our didactic approach the design of simulation game prototypes uses a hybrid combination of role-play, tangible game pieces and boards, and computer simulation based on system dynamics and agent-based modeling. In the final analysis, it is about constantly optimizing the simulation game. Then, the finished simulation game is ready for use.

For the grading of stage III the prototype game is presented together with a written game concept report (Greenblat, 1988), game manuals, and a scientific paper (that must be based on research in the subject area of the game).

To summarize our approach follows the design sequence proposed by Duke & Geurts (2004). Compared with their model of five phases and 21 steps (pp. 269 – 348) our approach concentrates mainly on the first three phases (p. 269):

I. *Setting the stage for the project*
II. *Clarifying the problem – Define both the focus and the scope*
III. *Designing the Simulation Game – Create a blueprint for the simulation game*
IV. Developing the Simulation Game – Complete the rule of ten test runs
V. Implementation

According to phase IV, we develop the first prototype but do not follow the intense process of ten test rounds of continuous improvement. The following table 1 shows the 21 steps of Duke and Geurts (2004, p. 277) and gives some information about important differences and the main foci of our approach. Our university stage I serves to educate students in basic principles of systems thinking and system-dynamics modelling techniques. Only the process of stage II and III can be directly compared with the game design steps of Duke and Geurts.

Table 1: Comparison of Duke and Geurts game design model and the university curriculum design approach

Duke and Geurts (2004) steps of game design	Kriz and Manahl – university curriculum for systems management education with simulation game design
I-1. Administrative set-up. Organize the project.	Stage II. A real problem is chosen by every team of 4-5 students. 4-5 teams are working on different projects.
I-2. Define the macro problem.	Stage II. This step is done intensely combined with a stakeholder analysis. Result is an analysis of all relevant stakeholders and their different interests and perspectives.
I.-3 Define the goals of the project – What are the objectives?	Stage II. This step is done intensely. Result is a final definition of the macro problem and all objectives.
I.-4 Project objectives/methods employed matrix.	Not done (the goal of this step is to find out if a gaming approach is appropriate or if alternatives have to be used. For us the gaming approach is a pre-condition)
I.-5 Specification – Constrains and expectations.	Stage II. This step is done in form of a quick check with all students and clients. The main part of this step is already integrated in I-2 and I-3.
II.-6 Define the system – content, boundaries, interrelationships.	Stage II. This step is done very intensely. It is one of the main foci of our approach. In difference to Duke and Geurts we use a system-dynamics model that can be simulated. This model is developed according to Vennix (1996) group model building approach and results in a multi-relational cause-and-effect didagrams. (Duke and Geurts "only" use an approach with creating so-called schematics.)
II.-7 Displaying the system – create a lucid cognitive map.	Stage II. This step is done very intensely in an iterative process of continuous improvement. A final systems model is defined and implemented into a simulation model supported by modelling software. Simulation tests are performed and again lead to a further elaboration and improvement of the systems model. A written systems simulation report is the main part for the academic assessment.
II.-8 Negotiating the focus/scope with the client.	Stage II. This step is done in form of a quick check with all students and clients.
III.-9 System components/gaming elements matrix – a model of the model.	Stage III. This step is done very intensely in an iterative process of continuous improvement. It is one of the main foci of our approach. We use the matrix technique described in Duke and Geurts (pp. 291) and add some further definition of "gaming building blocks" from Klabbers (2008) and Greenblat (1988).
III.-10 Definition of gaming elements – describe each module	Stage III. This step is done intensely together with step 9. The simulation game model must relate to the systems model of stage II.

Duke and Geurts (2004) steps of game design	**Kriz and Manahl – university curriculum for systems management education with simulation game design**
III.-11 Repertoire of techniques – don‘t re-invent the wheel.	Stage III. This step is not done very intensely. We mainly give some recommendations in the coaching phases during stage III. Here we allow a maximum of creativity in the teams.
III.-12 Select a format for the simulation game.	Stage III. In our approach, this step is integrated in step III.-11.
III.-13 Concept report	Stage III. This step is done by the students (if necessary supported by some coaching). The written concept report is the main part for the academic assessment. The main focus is the development of a simulation game model and its usability and much less emphasis is given to the didactic model of the application. Nevertheless, also some basic ideas for the debriefing and facilitation of the game have to be described.
IV.-14 Built, test and modify a prototype exercise – put the pieces together.	Stage III. This step is done very intensely in an iterative process of continuous improvement. It is one of the main foci of our approach. Hybrid simulation game are built and tested. Students have degrees of freedom which gaming methods and media they want to use. They may use a combination of computer simulation, role play (real and simulated actors, agent based modelling), board game and other haptic elements.
IV.-15 Technical evaluation – ensure an efficient and effective tool.	Stage III. This step is only partly done. We evaluate the first prototype together with all students and clients. We are not performing the “rule of 10” test iterations.
IV.-16 Graphic design and printing, develop a professional presentation	Stage III. The graphic design is not done or only in form of a first prototype layout. A short presentation of the concept report is done and part for the academic assessment.
V.-17-V.-21 Integrate the exercise into the client‘s environment – make it fit; facilitating the simulation game – practical use by the client; dissemination – deliver the simulation game to the client (and Train the Trainer); ethical and legal concerns – protect the client and the designer; final report to the client – ensure proper closure.	These steps are not done in our university curriculum. Only the ethical concerns (step V.-20) are discussed integrated in step III-9 to IV.-14.

Conclusion

Designing a simulation game requires constructing a model of reality. Gaming simulation is a suitable method for making the interpretations and perspectives of the many different individuals contributing to the design process, including the client, visible. During the construction of a simulation model, it is possible to gain information about the social, but otherwise largely subconscious, construction of reality in a social system, which may be new for everyone involved. The simulation game is based upon a solid systems analysis and tested simulation models. The design process is practice-oriented because it deals with real-life business problems of clients and offers support for their problem solving and decision making. At the same time, the simulation game must be connected with research findings. In this way, students learn important skills for their future careers in companies, for systems management with gaming simulation, and for scientific thinking. Evaluation results of the module show that the students who have completed the program thus far were very satisfied with their learning experience.

Our positive statements are based on the first results of an evaluation research study and our own impression. Additional positive results can be derived from the university´s standard evaluation process. The mean of 20 evaluation items (N=43 students) is 1.29, standard deviation is 0.45 (on a Likert scale with 1=very good to 5= very bad). These items include statements on overall satisfaction, increase of interest for the subject matters of the course, growth of professional competence, communicative and social competence and method competence, quality of the lecturers and didactic methods etc.

The use of our approach is time-consuming and difficult to facilitate. In addition to the official workload of 12 ECTS, in our experience students invest much more additional time voluntarily. For "good" results, about 450-500 hours per student is a realistic range of investment. Although the feedback of the students is that it was worth the effort it might be difficult for the curriculum organization of many "traditional" and less flexible universities to implement such a challenging didactic approach. Furthermore, our approach requires lecturers that are qualified experts for simulation game design, coaching, approaches of systems analysis, system-dynamics-modelling and several techniques of systems management. In addition, the clients must understand that such a university curriculum needs degrees of freedom for active experimentation and even failure of the students. Student´s role is not to perform as a professional consultant. In fact, the whole curriculum is a learning laboratory together with the students, lecturers and clients.

Although it might be not possible for many university programs to use student projects with hybrid simulation game design as the main didactic approach (as we realize it in our master program) it is more easy to integrate existing games and simulations for education in business and management. The University of Applied Sciences Vorarlberg shows that the facilitation of business games and simulations with proper debriefing and with increasing complexity throughout the study program lead to successful learning outcomes. Here it is important that simulation games are connected with other traditional forms of instruction within the bachelor programs. Evaluation show a high degree of student satisfaction and development of relevant business skills.

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