DEVELOPING COMPETENCIES WITH THE GENERAL MANAGEMENT II BUSINESS SIMULATION GAME

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Abstract

The paper describes a solution to the need to find adequate ways of developing management-related competencies for students and trainees, which we consider a relevant pursuit for both literature and education practitioners knowledge. It is based on the case study method, describing the experience of the authors with the TOPSIM General Management II (GM2) business simulation game and the outcome regarding the development of competencies for participating students from two master programs from the Faculty of Engineering in Foreign Languages in Bucharest/Romania in the last 8 years, exploring the development of 21 management-related competencies. The chosen competencies and individual characteristics are: analytic thinking, strategic thinking, team work, defining goals, opportunity recognition, problem recognition, problem solving, decision making, proactive thinking, time management, communication, intuitive thinking, responsibility, argumentation, creativity, delegation, diplomacy, conflict management, flexibility, courage and self esteem. By showing the positive impact of students' GM2 participation in the development of management-related competencies from both professors and students point of view the paper adds a valuable best practice insight that can be used in universities and companies at an international level.
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Key Words: Business Simulation Games, Competence Development, Games Based Learning

1. INTRODUCTION

One of the challenges in organizing master programs is to ensure the development of certain competencies, skills and individual qualities, needed later by the graduates in a professional context. Master programs in the field of engineering and management with a special focus on technology entrepreneurship are interested especially in management-related competencies, skills and individual qualities. The development of such competencies is sometimes knowledge based and can be taught using classic forms, like a course of project management. Other competencies, skills and individual qualities like analytic thinking, strategic thinking, team work, defining goals, opportunity recognition, problem recognition, problem solving, decision making, proactive thinking, time management, communication, intuitive thinking, responsibility, argumentation, creativity, delegation, diplomacy, conflict management, flexibility, courage and self esteem cannot be developed easily if addressed by classical means, which implies that other forms of teaching and training could provide better solutions.

As an answer to this problem the paper intends to answer the research question: what could be the adequate means to enhance the above mentioned competencies? The purpose of the paper is to identify the elements of the GM2 business simulation game that can contribute to the development of the desired management-related competencies and individual qualities of the participants and assess the development impact of GM2 from the teachers and the participants' point of view for each of them. For this purpose it analyses the academic discussion about the potential and the advantages of using serious games and simulations for learning purposes and then fills the identified gaps with a case study structured in three parts:

research methodology, description of the elements of the business simulation that could contribute to the development of desired competencies and the results of the research regarding the implementation of the GM2 business simulation game and the development of the desired management-related competencies through the students participation in the business simulation. The paper ends with the conclusions about the contribution of the research results as well as its limitations and the potential for future research.

2. LITERATURE REVIEW

Authors considering the use of serious games in Italy, Spain and the Netherlands state that entrepreneurial education is often not addresses in a proper way at strategic level both by national policies and universities, especially technical universities [1].

The possibility of using serious games in order to support the development of different competencies has become a topic in the last decades of research. The idea that such games may have educational purposes is not new and is considered a definition mark for serious games by Michael and Chen [2], their increased visualization and the way they challenge student's creativity being a good potential for learning support [3]. Frunzeti brings the question of the higher adaptability of serious games compared to classical training on the list of the potential benefits[4], and Pivek emphasizes that they can deliver useful content relying on known educational material [5]. Previous research of Mustata showed that 86 % of the surveyed subjects regarded the potential of e-learning to develop business competencies and abilities as good or outstanding, while only 14 % regarded it as moderate or low [6].

Next to the development of competencies and skills, business simulation games can contribute with a positive learning impact through experience generation, conceptual understanding and affective evaluation [7]. Business simulation games are considered of great use in the areas of business strategies and business management processes [8].

A large number of authors not limited to the references above support the idea that serious games and particularly in our field business simulation games can be a potential good solution to develop the chosen competencies and individual qualities if they are well structured and designed. Previous work of Mustata proves that the experience of implementing the GM2 in classroom in the master program "Geschäfts- und Industrieverwaltung" (GIVE) and subsequently also in the master program "Business Administration and Engineering" (MBAE) both organized by the Faculty of Engineering in Foreign Languages (FILS) is potentially fruitful for developing management-related competencies and abilities [9].

The implementation of business simulation games also has potential disadvantages for some students. In a research conducted in UK the analysis of the reason why some student score poor performance indicated poor attendance as the main reason (in more than 30 % of the cases) followed by poor numerical skill (20 %) [10].

3. RESEARCH METHODOLOGY

The research presented in the paper is based on the case study method. The case study method represents a relevant scientific research instrument contributing to the development of knowledge relying basically on observation and/or survey [11]. The research describes the experience of implementing the GM2 business simulation game in two master programs in order to develop a set of 21 competencies and individual characteristics. It relies on the observations of the researcher who had also the role of a trainer with the GM2 business simulation game, correlated with the observations of a second trainer and the participants' point of view. This was a measure to avoid self bias - one of potential flaws connected with the case study method [12].

The exploratory nature of the research implies that the requirements of qualitative research have to be satisfied [13], especially the sample and data collection requirements.

The first stage of the research is an analysis of the GM2 business simulation game and its elements that can contribute to the development of the 21 desired management-related competencies, skills and individual qualities.

Subsequently the participants' point of view regarding the development of each competence and individual quality through the participation at the GM2 business simulation is collected. The instrument used is an exploratory survey. The survey research was organized in the period December 2013 – September 2016. Data were collected in February 2014 – September 2016. Data analysis took place in September 2016.

A special attention is dedicated to the sample requirements. The most important criterion is the participation of all respondents to the GM2 simulation game. The research sample consists of 88 respondents that meet this criterion 100 %. All of them graduated the GM2 business simulation game. Their occupation is much diversified including entrepreneurs, professors, managers, programmers, IT-consultants and IT Engineers and their age spans between 22 and 39 years. It is also important to note that 53 respondents (64.6 %) declared that their job involves management responsibilities. This implies that their perception is linked with the details of management reality which is also very important for the validity of the results. Taking the above mentioned aspects into account we can conclude that the sample is adequate for the research purposes and for the qualitative research.

The three important criteria we had to take into account for data collection is the use of adequate instruments, up-to-date information and unbiased data collection. The electronic survey instrument Google Forms allowed us to include several types of question in order to collect all relevant data and to reach all participants in a short time, thus being an adequate instrument. All data were collected in February 2014 – September 2016 in order to ensure that information is up-to-date. In order to obtain unbiased information, the responses were anonymous and the survey form was completed remote after the grading was finalized, so not in the presence of the professor. This way biases from professor-student interaction were eliminated.

The advantage of the Google Form is also that the data is presented to the researcher directly in electronic format, thus avoiding further errors and mistakes during data input. The limited, but easy to perform analysis provided by the Google Form for each variable could be used and where needed completed by the Analysis ToolPak from Microsoft Excel.

4. THE ELEMENTS OF THE GM2 BUSINESS SIMULATION THAT CAN STIMULATE THE DEVELOPMENT OF DESIRED COMPETENCIES AND QUALITIES

Analysing the elements of the GM2 business simulation is game the first step to reach the aim of the paper regarding the possibilities to enhance the desired management-related competencies. It shows and explains the potential of GM2 to develop these competencies, but does not guarantee or shows how this potential can be reached. The reaching of the identified potential will be discussed in subsequent parts of the paper.

The GM 2 Business Simulation Game is designed for master students and advanced bachelor students in order to develop business related competences [14]. In the master programs GIVE and MBAE the GM 2 business simulation game is present in the 3rd semester after the students had a chance to integrate the knowledge from the other courses (the 4th semester is free of courses being reserved for writing the master thesis), thus giving the students the chance to apply knowledge and skills assimilated and developed during the master program in the GM2 business simulation game.

It is played along 6-8 periods by 2-5 teams. Each team is a company in the business simulation and can contain up to 6 participants. All teams start from symmetric positions, with an identical situation. Their differentiation starts after the first game period, based on 32 business decisions of each team regarding all areas of the enterprise. The decision complexity develops to 44 decisions for each team at the final game period.

The decisions regard the most important parts of a producing company: Marketing and Sales, Research and Development/Product Development, Purchasing, Production and Personnel as well as Financing. The participants get a handbook that enables them to have general knowledge about the functioning of all these areas in order to configure their decisions.

Because the decisions are not taken by one person as an individual, being team decisions under time pressure they potentially develop the skills: team work, time management, communication, argumentation, delegation, diplomacy, conflict management, flexibility, courage and self esteem.

Some decisions present specific information and need specific skills in order to be optimized. The decisions regarding marketing and sales are: setting the price of the products on the different markets (in the beginning there is only one product on only one market), setting the budget for advertising and for corporate identity, deciding whether or not to buy a market research report and the number of products offered to a bulk buyer at a relatively low price.

For example participants are instructed in the Simulation Handbook [15] that the price-demand function has a double-bend form like presented in Fig. 1.
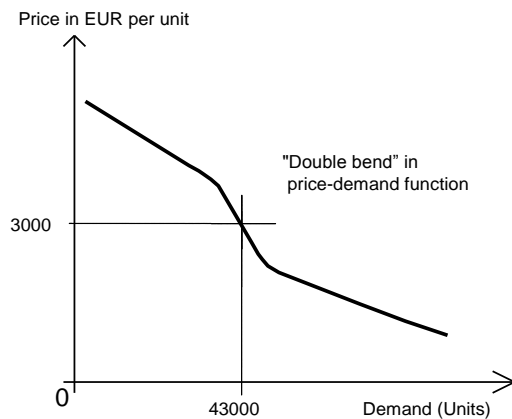

Figure 1: Double-bend price-demand function [15].

The double-bend price-demand function can be represented by an equation in the form of Eq. (1).

$$f(x) = \begin{cases} -156\,x + 500100; & x \in (0;\ 2900) \\ -47\,x + 184000; & x \in [2900;\ 3150] \\ -72\,x + 262800; & x \in (3150;\ 3650) \end{cases} \quad (1)$$

The double-bend function respects the theory about real dependency of demand and price if the other variables remain constant (ceteris paribus). The fact that the real function within the simulation is not explicitly visible to the participants also relates to business reality, where there is no clear possibility to determine the demand for the product of a company as a clear function of the price. In order to give to participant`s a better orientation about possible demand variation related to the price decision a short table with possible demand outcomes of a +5 % and a -5 % price variation is also presented in the Simulation Handbook [15] as showed in Table I.

Table I: Scheduled starting and finishing times of activities [15].

Price (EUR/Unit)	Demand (Units)
3150 (+ 5 %)	Approx. 36000
3000 (Period 0)	43000 (Period 0)
2850 (- 5 %)	> 55000

While for advertising and for the number of sales force a graphic function is visible to the participants like in Figs. 2 and 3, the influence of the investments in corporate identity on the demand is described as debatable, influencing for sure only the stock exchange price.
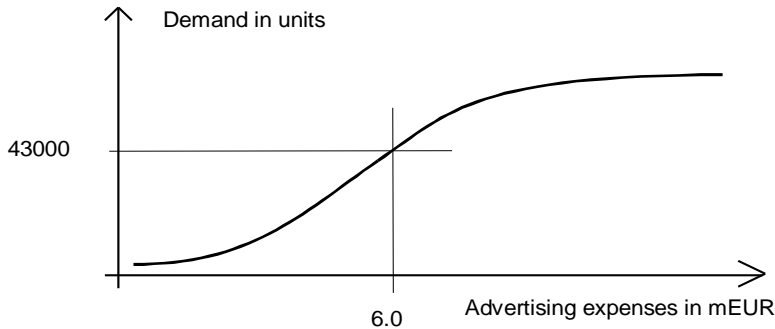

Figure 2: The advertising-demand function [15].

The advertising-demand function is a logistic function, a common "S" shape (sigmoid curve), represented by the Eq. (2):

$$f(x) = \frac{L}{1+e^{-k(x-x_0)}} \tag{2}$$

where:
   e – the natural logarithm base,
   x_0 – the x-value of the sigmoid's midpoint,
   L – the curve's maximum value, and
   k – the steepness of the curve.

The influence of advertising on demand corresponds to the Fig. 2 only under the ceteris paribus assumption that the other variables would remain constant.
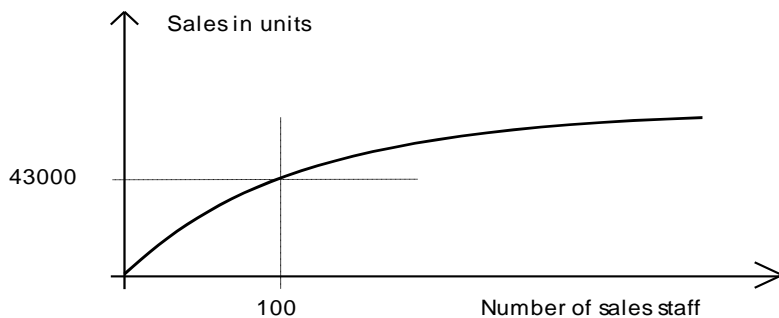

Figure 3: The sales force-demand function [15].

In Fig. 3 is described the sales force-demand function, also defined in ceteris paribus conditions, exactly like previously defined price-demand and advertising-demand functions.

The decisions of buying the report is merely a decision of paying a little sum compared to the overall budget in order to be better informed in the future.

The decision of accepting a contract with a bulk buyer for a number of products, appeals to the need of safety of the participants, while setting no low price contracts rewards courage with better profits.

Thus the setting the sales and marketing decisions in the 6-8 business simulation game periods could require and also potentially develop the skills: analytic thinking, strategic thinking, defining goals, opportunity recognition, problem recognition, problem solving, decision making, proactive thinking, intuitive thinking, responsibility, courage and self esteem.

The decisions regarding research and development/product development are: setting the staff recruitment for research and development thus influencing directly the development of the product technology, setting the budget for external consultancy in the area of ecology thus developing the product in a ecologic way and setting the budget for external consultancy in the area of value analysis thus increasing efficiency. The simulation uses a logarithmic function for decreasing the efficiency of these investments after a point, but it also contains some points of discontinuity where after reaching a certain level the efficiency jumps in a favourable way. But these details are not explained to the participants, so they can only use a trial-and-error approach to identify the benefits of these investments. Giving up an investment strategy to soon could result in failing to achieve some competitive advantages that where just in reach. Thus the potential skills required and developed for this section would be: analytic thinking, strategic thinking, defining goals, opportunity recognition, problem recognition, problem solving, decision making, proactive thinking, intuitive thinking, creativity, courage and self esteem.

The area of purchasing is simplified to one decision: setting the number of input materials in the given period, thus influencing the price per unit as well as the production potential and the storage costs. All details are very well described and determined through the Table II and the costs of inventory (0.05 mil. Eur/1000 units).

Table II: Purchase conditions [15].

Volume (Units)			EUR per unit
0	to	< 30000	650
30000	to	< 50000	550
50000	to	< 70000	450
70000 upwards			400

Because everything can be calculated, the teams can discover if they do the math that purchasing alternatively for 2 periods always lowers the costs and the potential skills required and developed for this section would be: analytic thinking, strategic thinking, defining goals, opportunity recognition, problem recognition, problem solving and decision making.

The decisions regarding production and personnel are: setting the production goal as the desired number of produced goods, and other decisions addressing either the capacity of production lines (investment and disinvestment of lines, setting the budget for maintenance and rationalization for each type of line, the investment in environmental plants) or the capacity of the workforce (number of hired/dismissed production staff, investment in process optimization and training as well as increasing/decreasing of the non-salary staff costs). The production goal should be based on a sales forecast which cannot be determined by calculations, but all production figures and capacities can be calculated with very small margins of error.

Personnel adjustments for purchasing and administration are adjusted automatically by the simulation game according to the company`s sales revenue in order to keep the complexity of the game under control. Since the participants also need to calculate the corresponding costs for they get a detailed figure for the way the game adjusts administration staff based on sales revenue as it is shown in Fig. 4.
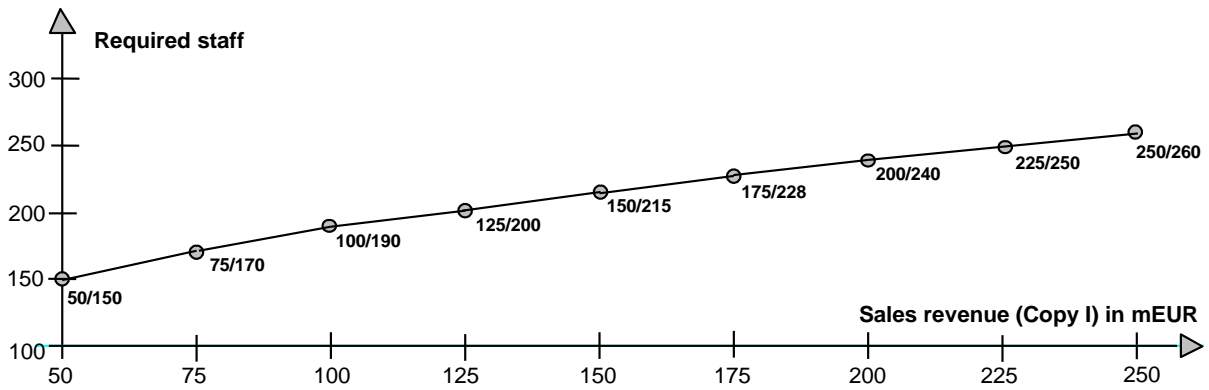
Figure 4: Cost centre: Administration: Required staff based on sales revenue [15].

The required staffs based on sales revenue function for administration is represented by the Eq. (3).

$$f(x) = 12\sqrt{x} + 70 \; ; \quad x \in [50; 225] \tag{3}$$

Similar to the description of administration staff participants are given an overview of the way the game adjusts purchasing staff based on sales revenue as it is shown in Fig. 5 in order to be able to calculate the corresponding costs.
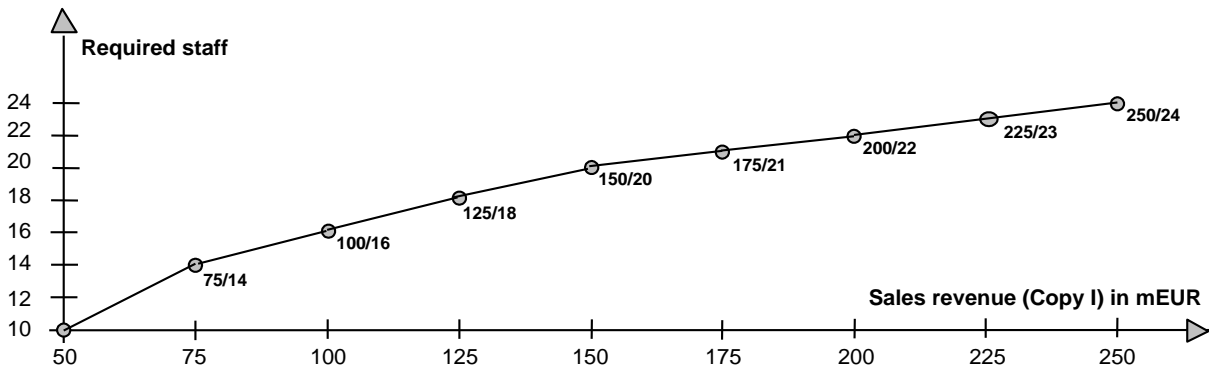

Figure 5: Cost centre: Purchasing: Required staff based on sales revenue [15].

The required staffs based on sales revenue function for purchasing is represented by the Eq. (4).

$$f(x) = \begin{cases} 0{,}16\, x + 2; & x \in [50, 75) \\ 0{,}08\, x + 8; & x \in [75, 150) \\ 0{,}04\, x + 14; & x \in [150, 250] \end{cases} \tag{4}$$

Thus the decisions regarding production and personnel require and develop skills related to exact calculations like: analytic thinking, defining goals and responsibility.

The decisions regarding financing are: setting the desired medium-term and long term loans, setting a budget for the purchase of securities and setting the percentage of profit that will be given as dividends to the investors. In the case that some teams require credits in order to cover their expenses in the current period but have not ask for some part of it, the business simulation provides for overdraft credits at higher costs (16 % compared to 7 % and 10 % [15]), thus giving a penalty to the teams who couldn`t predict their financial needs correctly. Thus the financing decisions in the 6-8 business simulation game periods could require and also potentially develop the skills: analytic thinking, problem recognition, problem solving, decision making, responsibility and self esteem.

5. RESULTS OF THE RESEARCH

The potential of the GM2 business simulation game to develop the above named competencies and skills, was analysed from the point of view of the trainer and the observers, as well as from the point of view of participants.

The conclusion of the discussions with the observers was that all teams worked hard each year to master the business simulation game and its decision. Even participants who failed and brought their company into bankruptcy showed at the end of the simulation that they learned important lessons from their participation, recognizing the aspects were their decision process failed.

The participants' point of view was collected using an online survey, where participants remained anonymous. They could asses at each competence if its development was either outstanding, substantial, moderately, just a little bit or not at all. In order to ensure a good overview and to have a high standard, we consider that competencies had a very clear positive development if at least 50 % of the participants asses its development triggered by the participation in the business simulation as either outstanding or substantial.

In Table III there are the figures resulting from the research regarding each of the 21 analysed competences.

Table III: Assessment of competence development.

Competence/Skill	No. of participants who regarded the development of the skill as Substantial/Outstanding (out of 88 respondents)	% of participants who regarded the development of the skill as Substantial/Outstanding (out of 88 respondents)
Analytic Thinking	63	72
Strategic Thinking	61	69
Decision Making	60	68
Team Work	59	67
Defining Goals	59	67
Opportunity Recognition	59	67
Problem Recognition	59	67
Problem Solving	57	65
Intuitive Thinking	55	63
Proactive Thinking	55	63
Communication	53	60
Time Management	53	60
Responsibility	51	58
Courage	46	52
Argumentation	45	51
Self Esteem	45	51
Conflict Management	44	50
Creativity	43	49
Flexibility	43	49
Diplomacy	41	47
Delegation	37	42

The data shows that after the required standard 17 out of the 21 analysed competences registered a very clear positive development: analytic thinking, strategic thinking, team work,

defining goals, opportunity recognition, problem recognition, problem solving, decision making, proactive thinking, time management, communication, intuitive thinking, responsibility, argumentation, conflict management, courage and self esteem.

Creativity and flexibility failed by 1 %, diplomacy by 3 % and delegation by 8 % to fulfil our requirements. These competences had some development, but because less than 50 % perceived this development as either outstanding or substantial they do not fall in the category of competences with a clear positive development.

While the development of creativity and flexibility is limited in the GM2 business simulation game through the fact that decisions only regard budgets and figures instead of qualitative solutions to business situations, diplomacy and delegation could rise in a team working together in a specialized way. Diplomacy might not be needed because the age of participants and the fact that they know each other and formed the teams by their own choice. Delegation might not be needed because most of the teams avoided specialization of the team members preferring to take all decisions together.

6. CONCLUSIONS

The GM2 business simulation relies on business theory about markets and enterprises offering to the participants an experience close to reality. The participation in the GM2 business simulation game proved to be a good complementary alternative to develop desired competences in the GIVE and MBAE master programs next to classical courses and seminars. Based on the observation of trainers and observers as well as confirmed by a participants` survey 17 out of 21 desired competences were perceived to have a clear positive development: analytic thinking, strategic thinking, team work, defining goals, opportunity recognition, problem recognition, problem solving, decision making, proactive thinking, time management, communication, intuitive thinking, responsibility, argumentation, conflict management, courage and self esteem.

The case study concludes that such an experience is valuable for master students as they gather close to reality experience and develop important competences without the risks of losing a fortune in the real life. The implementation of the GM2 business simulation game in the master programs GIVE and MBAE is a success in entrepreneurship education, next to other various E-Learning based methods used in Romania for this purpose [16].

This success in Romania also represents a limitation for our results. They may translate better or worse if applied in other countries with different cultures and approaches in education and management. Research based on comparing the impact of business simulations like the GM2 in different cultures and countries could be a good potential for future research.

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