



# Methodology for gamifying educational process

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## 1. Educational games

“...a man plays only where he is a man in a full sense of the word, and he is entirely a man only where he plays”

Friedrich Schiller

“Letters on aesthetic education of Man”

### 1.1. Introduction

The game has accompanied humanity since the dawn of its emergence, and everyone begins to play from an early age and continues to play throughout his life. If we add to this the possibilities that computer technology offers, it is easy to explain the rapid progress in the field of computer educational games (CEG) in recent decades.

It should be noted that the first CEGs, developed in the 1950s, were designed to train executives and were called "business games" or "management games". (At that time, computers were too expensive, so only company presidents and CEOs could play with them).

The world's first computer management game (CMG) "Imitation of decisions in senior management" was developed by the American Management Association in 1956.

In the 1960s, and especially since the early 1970s, as a result of their proven advantages and in connection with the spread of computers, management games became widespread in the training of executives (and later students) in all developed countries.

Based on the World experience gained so far, it is no exaggeration to say that the use of CMG is the most effective method for intensifying the learning process and active learning of adults (managers, professionals, or students), especially if the training itself in real conditions is impossible, dangerous, too expensive, or too slow.



Once the proliferation of games in education has started very quickly it becomes evident that the correct way to use them is to create own games, developed specifically for the particular conditions.

It is characteristic of the CMG that they are held in competitive conditions in groups of 3-5 people. Each such group is the management of a business system (workshop, enterprise, business organization, etc.). The behavior of the considered economic system is simulated with the help of a model realized in the form of a computer program. The game takes place in a series of repetitive cycles: analysis of the existing situation; elaboration of management decisions by the group; reproducing the decisions made with the help of the model; analysis of the obtained results; making new decisions, etc.

The main goal in the process of learning through management games is the active application of theoretical knowledge and the formation of practical skills for management decisions. Particular attention is paid to the preparation and justification of decisions and the principles, approaches and methods used.

During the game, learners are placed in a specific situation, which stimulates them to active independent action. Thus, in the educational work, on the one hand, elements of the research activity are introduced, and on the other hand, it is more closely connected with the practice. For the trainees, the managerial game becomes a kind of "experimental setup", the work with which requires a certain amount of knowledge and leads to the formation of certain skills.

## 1.2. Game as a psychological process

The game has a biosocial essence, it undergoes major changes in the human psyche and develops mental processes and personality formations that prepare the transition to the next periods of development.

In the game the person has the opportunity not only to get to know the world by reflecting it, but also to actively transform it, to change it. This is the joy of creativity, which is a real fact in the game. At the same time, the game activity is a kind of



combination between reality and fiction. We can bring part of the world, but not the whole world.

As a result of the development of the game action, the game role arises, which is the founder of the plot role-playing game. The game plot, on the other hand, is the area of reality that we recreate in the games. The game content is what the players devote as a main point in a given plot to the actions, relationships or moral norms that regulate these relationships. There are also so-called game rules according to which you play. Game actions perform the performance of one or another role.

We can distinguish the game from other human activities by its peculiar motivation and the combination between real and imaginary. The more important types of games are plot-role and didactic. The structural components of each type of game determine the peculiarities of the game situation.

The game also has an objective and subjective plan.

- The objective plan includes the tasks, the process, the means, and the productive result. The direction of development is as follows - the learner (player) begins to realize the results of the game process, namely knowledge, skills, habits, acquired qualities, checking evaluation and emotional relationships, etc.
- The subjective plan includes all mental formations and mechanisms through which the objective plan is realized. In other words, these are the skills of the learner (player) to achieve adequacy between game tasks and selected means, to use appropriate ways to perform game actions depending on the type of game, to show intellectual and emotional attitude to the components of the objective plan.

### 1.3. General methodological instructions

In connection with the main purpose of this material - to get acquainted with the possibilities and ways of applying management games in the learning process - the following methodological instructions are given to teachers.



Methodological and organizational activities related to the management games include determining:

## 1. Options for conducting the games

The options for conducting the games depend primarily on their content and volume. Business games, solving specific practical tasks or related to the distribution of roles, can be held within one training session. Complex games, in which the dynamics of real processes are widely represented, are held in a concentrated form without interruption or in stages over a long period of time. As a last option, we can point to their transformation into an integral part of the learning process.

## 2. Phases of the games

### 2.1. Preparation and introduction to the game

The preparation and introduction to the game takes place in a special lesson, where the teacher must provide basic information about the meaning and manner of the game, detailed motivation, and goal orientation.

### 2.2. Negotiation and acquisition of the necessary knowledge, skills, and methods

This stage is needed to create prerequisites for independent action of students. Includes recalling the necessary economic knowledge and decision-making methods during the game. It can take the form of self-preparation or a problematic situation.

### 2.3. Conducting the game

At this stage, it is important that all students actively and individually, or in teams, work in conditions as close as possible to the real ones. The teacher only guides the participants, guiding them to solve the problem and reach the necessary conclusions.

### 2.4. Final part



Includes discussion of results, theoretical and practical conclusions. All teams must present a report on the work done, making a detailed assessment of the game and its effectiveness for training.

### 3. Role and tasks of the game manager

Careful preparation is crucial for conducting business games. It is recommended at the beginning of the school year or term to prepare a schedule of business games in each discipline and a description of the knowledge and skills needed to conduct each of them. The teacher must provide independent access to the materials for the game of each student and give the opportunity for collective discussion of certain issues. The technical and organizational preparation also includes: planning of the premises; the duration; the technical means for preparing and conducting the game (instructions for the participants, self-preparation assignments, course of the lesson, calculation tools, etc.). It is also necessary to know in advance, initial data, planning data, restrictions on the game, if any; variants of solutions; evaluation criteria.

When conducting business games, you work in a team, the number of which depends on the specific content and volume of the game.

The final part is related to a detailed assessment, which considers whether the set goals have been achieved and conclusions are drawn for future work.

### 4. Tasks of the participants in the game

It comes down to three main points:

- (a) studying the game situation and solving tasks in preparation for the game;
- b) building a solution or variants of the solution of the tasks set in the game - it must take place in two aspects: first the economic task must be solved, and then a general approach must be developed to develop variants of solutions to the types of problems set in the game situation in order to be able to act in this scheme in similar situations of practice;



c) evaluation of the options and selection of the most advantageous one in view of the set tasks and planned tasks.

## 5. Criteria for evaluating the work of students

The general criteria for evaluating the work of students are:

- degree of mastery of knowledge, skills and habits;
- degree of fulfillment of the set task;
- demonstrated ingenuity by the team;
- quality of coherence of the team's actions;
- degree of team independence;
- in time, needed to achieve results.

The evaluation of the work of the team can be made in the form of:

- change of assessment according to the six-point system;
- written or oral opinion on his achievements;
- ranking, considering his place among the other teams.

## 6. General skills developed in students

They can be systematized in the following: quick orientation in a given problem situation; good communication and coherence in the actions of individual team members; accurate and clear written and oral presentation of the results obtained; selecting the appropriate place and role of each team in the overall game situation.

Depending on the specific game situation, the skills developed by playing each individual management game can be determined.



Attached to this material is a set of simple and easy to learn and use management games (often called business games). For each of them a general description of the game is made and attached:

- teacher's guide;
- instruction for the players (participants);
- working documentation.



## 2. Types of gamified methods for education

### 2.1. Overview of gamified educational methods

The essence of gamified methods is in solving problem situations that are typical for the practice of the trainees. The latter are faced with the need to look for "alternative solutions" or "the field of possible good solutions".

The training by means of gamified methods or by solving problem situations is carried out on the basis of gamified descriptions, which depending on the amount and nature of the information, from the specific tasks of the training may be different:

- the gamified description of an incident contains a small amount of information mainly in the field of human relations. It mainly develops the ability to quickly absorb information and make a concrete effective decision;
- the case includes more extensive information from different areas of human activity. This method requires more in-depth analysis and interpretation of the information, disclosure of the causal relationship and making a reasoned decision;
- the gamified description of conducting a role-play activity contains less information from different areas of life. It is addressed specifically to actors and observers. The participants analyze the situation, make and implement decisions consistently, staging, simulating appropriate actions. Observers, on the other hand, discuss and evaluate the behavior of designated performers;
- the economic situation is presented through a mathematical model and a verbal description of certain connections and relationships. In the conduct of economic games, all participants play the same role, making consistent decisions.

During the classes for solving a problem situation / case, incident, role play or other texts / it is necessary in advance / more or less time / the students to carefully get acquainted with the description in written, visual, or other form. During a lecture or other lesson, the teacher connects the didactic description with the educational content, gives guidelines for independent work. The preparation of students for



participation in the lesson requires some research of theoretical sources and references in practice.

At the beginning of the seminar the teacher is required to recall in general terms the situation and tasks of the participants. In order for the discussion to take place more fully, it is recommended to go through two stages - group discussion and plenary session. Participants are divided into smaller groups with specific responsibilities. This gives each student the opportunity to present their opinion and solution to the question. In other cases (in role-playing, staging, etc.) some of the participants are chosen to play the role of actors in the situation. Usually, a discussion arises. The leaders of the groups lead it, and at the end they summarize the speeches and formulate a collective opinion.

The solution of the situation consists in giving a clear and precise answer to the questions asked. These answers do not reflect "personal feeling or opinion", but the knowledge of the normative material, the practice, the special literature on the given topic. They contain a comprehensive and in-depth analysis of the principles, features of the concepts, signs and composition of the phenomenon. The decision of the situation must be justified by proving the inadmissibility of other decisions. It should not be reduced to repetition or comment on the facts, nor to general judgments and moralizing.

After the group discussions, the participants meet in plenary. The leaders of the group's report the collective decisions, after which they can discuss. The plenary discussion is led by the lecturer. At the end of the session, he evaluates and carefully presents his opinion, without explicitly imposing it as the only optimal solution.

The method for written solution of some problem situations / cases and others / deserves attention, which it is not possible to dwell on for now. Of special interest are also the classes with consistent submission of information / Execution of an extraordinary order and others /.

The role of the teacher in conducting gamified teaching methods is very complex and requires serious effort. He must be able to awaken the thought of the participants, to



make them analyze independently, thoroughly, and multifaceted. At the same time, it prepares to answer comprehensively and motivatedly the many questions that may arise in the course of the discussion.

The method for solving problem situations / in different variants - cases, incidents, role-plays, etc./ must be applied in close connection with the acquisition of theoretical knowledge in individual disciplines. Gamified methods are used to acquire mainly intellectual and communicative skills and habits in the presence of extensive and in-depth professional knowledge and training, as well as for testing knowledge. Otherwise, the training is emptied of scientific content. Theoretically unprepared, learners solve problem situations based on their spontaneous practical experience, sometimes too naive or too complicated.

The correct use of the method for solving problem situations contributes enormously to the activation of the trainees, especially in the improvement of their qualification. It increases the interest and creates conditions to develop a motivational basis for training. These methods help to form in the learners' various methods of mental activity, which can be successfully applied in other similar life situations.

Teaching practice shows that the creation and use of gamified descriptions and teaching methods should be seen as a constant and inalienable task of the modern teacher and researcher.

## 2.2. Discussion

The discussion is a group reflection of a given problem, in which conclusions are made in accordance with the theory and practice. In it, through an exchange, information is transferred, and the knowledge of the participants is enriched. In addition, they get used to working in a team and solving problems collectively.

Depending on the way it is conducted and the goals that are pursued, the discussion can be advisory, panel, discussion 66, etc.



1. Advisory discussion. It is a group discussion of a problem, in which those present through discussion, exchange of experience and knowledge come to a consensus and solve the problem.

2. Panel discussion. It is assigned to a group of participants / 3-5 people / or to several groups to develop a project on a given problem. After its development, it is discussed between the authors of the project and the other participants,

3. Discussion 66. The group is divided into small [7 subgroups of 5-6 people and given 6 minutes to discuss. Depending on the nature of the problem, they may be given 10-15 minutes. Here it is important to determine the time for discussion. It aims to accustom participants to organize the group and exchange views quickly and efficiently. A general discussion is then held with all participants.

An important condition for a fruitful discussion is to properly select the issue to be discussed. It must be up-to-date, interesting, and consistent with the level of expertise of the participants, and their number should not exceed 25 people. The location of the seats in the hall must be such that everyone can see the others. The duration of the discussion should not exceed 2 school hours.

The discussion goes through three main stages:

1. Communication / collection / of information.
2. Evaluation of information.
3. Summary and conclusion.

The problem raised for discussion can be divided into several smaller problems and each can be considered individually or be a basis for considering the next.

In order to conduct the discussion properly, the supervisor is required to:

1. To focus the discussion on the problem by limiting the distractions of side topics.
2. To facilitate the spontaneity of the speeches in the group and to encourage analysis and reasoning.



3. To ensure the participation of everyone, is trying to understand the motives of those who refuse to talk, to encourage them to participate and to restrict those who overdo to speak, especially if you do not say anything new, but repeating the same .
4. To understand the mental phenomena that occur in the group during the interactions among the participants and to do everything necessary to ignite the discussion.
5. Do not seek to impose your opinion indirectly.
6. At the end of the discussion to make a summary.

#### Requirements for participants

1. Be active during the discussion, not after.
2. To talk about the problem, protecting themselves from hobbies and deviations.
3. To be convinced that the successful course of the discussion depends on their participation.
4. To be heard and not interrupted.
5. Don't be embarrassed to ask questions when something is not completely clear to them.

#### 2.3. Incident

An incident is a method of training in which an unforeseen event, accident, incident or contentious issue is considered, and a decision must be made. The conflict situation is either too limited or does not exist at all, and the problem is primarily to determine the position and personal behavior of the participant in the debate in the situation. The main thing here is to create the ability to quickly navigate to additional information, revealing the causal connections hidden under the surface of the elbows and the phenomena and making the right decision.



The type of active class with the application of this method is divided into five main stages:

1. Participants shall be provided with written or oral information about the unexpected event that requires appropriate intervention or decision selection. Participants play the role of responsible leader, who must choose one or another solution. /5-10 minutes are provided for individual preparation, during which time the carefully described event must be examined to assess what additional information is still needed/.
2. Questions are asked by the participants to the leader of the discussion to clarify the facts and clarify the situation around the event. The discussion leader answers only the specific questions asked.
3. Each of the participants develops his own project to solve the problem, assessing the relevant situation.
4. It is collectively discussed and debated, comparing different opinions.
5. The event in question shall be investigated in connection with the general conditions in which it occurred, the reasons for its occurrence shall be revealed and measures for prevention of similar events in the future shall be identified.

When conducting an incident, the teacher must comply with the following requirements:

1. Monitor and direct the discussion correctly at all times
2. To be able to give additional information to the participants and to answer the questions.
3. To impose a fast pace of discussion, due to the scarce information and the relative simplicity of the data.
4. To direct the group to an in-depth analysis of the considered event and drawing certain practical conclusions.



Each of the participants plays the role of a responsible leader, who must choose one or another solution. They must be able to request additional information and determine the nature of the problem. By comparing and comparing the considered event with other similar events, they reveal the general conditions under which similar events occur and outline measures for their prevention.

#### 2.4. Case

The case is a method in which the participants are placed in a situation to consider and solve a difficult, topical, and typical case of our socialist reality, without unnecessary details and repetitions.

Describe the situation before the critical event with the necessary information about the role of objective and subjective factors. The critical event is then described, giving details of the actions of those involved in the event. Finally, the final situation is described, which often ends in a stalemate and the problem. The case can be presented to the participants in writing, in the form of a film or a tape recording.

The essence of the method is that the participants are placed in a situation close to the real one. The case under discussion contains a number of issues that prompt participants to think in depth. Through the case, participants acquire the ability to make an in-depth, critical analysis of the facts, to pinpoint the problem and make the most correct decision possible.

This method also helps to expand and deepen knowledge, to connect theory with practice and to accustom participants to creative thinking and collective problem solving. The case provides conditions for free discussion of issues and collective decision-making.

There are two main types of cases (see below), also the case may contain one main and several secondary problems and may be complex.

1. Cases in which there is a critical event, but no decision has been made.



2. Cases in which a critical event has occurred, and a decision or series of decisions has been taken that have not yielded the expected result. The correctness of the decisions taken is discussed.

The case is considered in four main stages:

1. The text is distributed, and very brief explanations are given about the purpose of the lesson and the duration. The text can be distributed immediately before the case, one day before or a few days in advance for the participants to study it in more depth.

2. The participants are divided into groups of 5-6 people to discuss the case. It is preferable that the number of groups does not exceed 5-6 and that different specialists are included in them. In order to carry out fruitful work in groups, it is appropriate to elect a chair to lead the discussion and then report on the results of the general discussion. It is advisable to appoint an observer to participate on an equal footing with the rest of the group in the discussion and at the same time to monitor the way the facilitator conducts the discussion. In this way, leaders will be trained in the art of leading meetings.

3. Gathering of all participants for a plenary discussion of the problem, where the chairmen of the group's report the opinions or decisions of the groups and are discussed in general.

4. Discussion and conclusions. It is not recommended to indicate a single solution. The aim is to draw general conclusions from the discussion of the problem, which could be applied in other similar cases.

The main requirement for the teacher is to provide a thorough study of the case by the participants. He must be able to direct them to the problem before them, to ensure their active participation in the discussion, facilitating the spontaneity of the speeches; to do everything possible to heat up the disputes and dynamically develop and conduct the discussion. He must combine his role as a facilitator with his equal participation in the discussion of the problem. The purpose of the discussion is to provoke such interaction between the participants that will ensure the most efficient results.



When discussing a case, the participants are asked specific questions, which usually arise in practice and each of the group is placed in the role of the responsible leader, who must decide. To this end, he must get acquainted with the case in detail, to study the data at his disposal, to be able to separate the main problems from the secondary ones. Each of the participants should strive to express their thoughts accurately and clearly, to listen carefully and critically to the opinions of the other participants, showing tolerance for conflicting opinions and helping to ensure the proper conduct of the discussion.

## 2.5. Situation

Researchers consider situations as an element of the art of management and of those specific forms in which they manifest themselves in teaching. One of the pedagogical classifications of situations is oriented to the nature of the material of the situations. For example, the French scientist Paul de Bruyne, speaking of this method, distinguishes four types of management patterns: situations - illustrations, situations - exercises, situations - assessments, situations - problems.

Situations-illustrations. The simplest type of management model, when with the help of the specific case from practice one or another way of solving the problem is demonstrated. Among the situations collected in the given collection, some have just such a character.

Situations - exercises. This is also a case, but described so that the student studying this case should do some exercises to memorize tables to calculate the norms according to a formula to draw up a business note, etc.

Situations-assessments. In this case, the problem is solved according to the control pattern. The listener is asked to assess a situation in the accepted way of decision, etc.

Situation-problem. The sample is presented in such a way that only the problem that needs to be solved stands out. In this case, a number of questions are raised at the



conclusion of the situation. And sometimes the problem itself is not clearly stated and a lot of work has to be done to separate it. The main thing in this case is to force the listener to analyze the state of the work.

The questions at the end of the situation should help the listener to understand the essence of the problem and then to think more about the ways to solve it. This does not mean that the right decision will always be found. But if the listener is thinking / over this or that problem, he is much more prepared than the leader who gave did not understand the problem.

Each type of situation helps to master the art of management. Through concrete material it demonstrates how this or that leader acted, forces these actions to be practically evaluated, gives a reason to think about the ways to solve the specific problem. Therefore, all kinds of situations are necessary, as each is important for mastering one of the aspects of the art of management.

Another classification of situations no longer reflects the contents of the situation, and that method will apply educator in the analysis of this situation before the group listeners. From these positions, specific situations can be learned by the following methods: the traditional situation method (Harvard type), the role method, the basketball method, the method of management games, modeling, the method of sensitivity training, etc.,

Method of traditional situations. The materials of the situation (of any of the four types) are distributed to the listeners in advance. They study them and examine them in the classes under the guidance of the pedagogue.

Method of roles. In the specific situation, the roles of the actors are distributed among the listeners and under the guidance of the pedagogue they make the appropriate decision.

Other methods have also become widespread. Some of them are described in the first part of the collection, where methodological instructions are given.



It is important to emphasize that it is about teaching by the method of specific situations. The same specific situation can be represented by any of the above types. The same situation can be studied with the help of traditional discussion, and with the help of the role method, etc. Of course, the very nature of the situation predetermines the method of occupation.

Characteristic of the method of specific situations is that the main participants in the discussion are the listeners themselves. The teacher is only the conductor of the discussion. He organizes the exchange of views between them.

As already noted, the art of management of the capitalist enterprise is characterized by the detachment of patterns (situations) from the theory of management and the replacement of theory with situations. Of course, if hundreds of situations are studied, the listener will gain certain knowledge in the field of production management. But this does not replace the need for a special study of management theory.

## 2.6. Role play

Role-playing is a method in which participants consider a factual problem situation taken from practice and life in advance by distinguishing the roles they have to play. The main advantage of this method is that it allows the participant to reassess their own behavior, to correct and improve some aspects in their leadership style. Through it, the young leader can become more self-confident, and the dogmatic one can become more flexible, more tactful, and attentive with his subordinates.

Role-playing can take many forms. The following three forms are most often used in the improvement of management staff:

1. Simplified structural staging. two participants are selected from the group, one of whom plays the role of boss and the other - of a subordinate, each of them receives a brief written of his role, which is given the basics, and the whole role is developed by the participant. Performers should be given enough time to prepare the roles. The other participants play the role of observers. It is recommended to use a tape recorder during



the role play. At the end of the lesson, the recording can be listened to by the performers to hear what mistakes they have made.

2. The students are divided into small groups of 4-5 people and each group collectively performs its assigned role.

3. The leader divides the participants into groups of 4-5 people arguing how much they are needed for the given staging. Everyone gets their role and performs it in the small group. Once the groups reach certain opinions, the leader gathers the groups and analyzes these opinions in general. It is interesting here that each group discusses the same problem, and very often they come to different opinions.

The role play is generally as follows:

1. The written material is distributed; the roles are assigned; and the observers are instructed.

2. Performance of the roles follows.

3. The roles are analyzed through a general discussion

4. Summaries and conclusions are made.

The main requirement for the facilitator is to create an atmosphere of casual, collegial and friendly relations. He should not take sides, criticize, or evaluate, and be careful not to turn the staging into a rhetorical exercise. He must guide the discussion in analyzing the game so as to achieve an effective result.

Participants acting as observers shall be instructed orally or in writing. They should not be passive spectators but take an active part in the final critical evaluation of the game.

## 2.7. Simulation game

Economic play is a method of learning in which participants are placed in a specific economic situation, representing a model of reality. The aim is to accustom the



listeners to making consistent decisions, considering the dynamic interaction between the various functions of management. The model is a mathematical description of a system or a set of different types and nature of relationships that affect the described situation. The realistic nature of the model depends primarily on its complexity, the degree of abstraction, the introduction of the concept of time, the uncertainty, the nature of the information contained, its stability and flexibility. The model must be built in such a way as to allow the influence of random factors.

Through economic games, managers develop the ability to make managerial decisions in a changing environment, the ability to organize in groups and distribute functions according to the abilities of each participant, to ensure the receipt of the necessary information and to make agreed decisions.

The following types of simulation games are used to improve the management staff :

1. Simple / monofunctional /, which are related to a specific function in a simulated enterprise.
2. Complex / multifunctional /, in which different functions are connected in one.
3. Planned, experimenting with different areas that can be undertaken to implement the general policy of the enterprise.
4. Implementation. to decide based on the observation of the obtained results.
5. Games in which computers are used and games in which they are not used.

When conducting economic games, it is very important for the participants to be acquainted in advance with the rules of the game and the principles on which the model is built.

On the day of the class the procedure is as follows :

1. Descriptive documentation is distributed, which allows participants to get acquainted with the model and understand what is required of them.



2. The participants are divided into small groups, which are organized for joint work. Small groups can elect one of them as chairman or set up specialized commissions. It is recommended that the groups be composed of different specialists.
3. The game begins and goes through several stages. Each group is given enough time to consider the situation and decide which model to apply.
4. The first decision is made. The decisions made affect the state of the system. Under normal circumstances, a period of time always elapses from the time the decision is taken to its implementation. Here the periods are separated from each other at regular intervals and decisions are made within pre-established deadlines. This is how the game differs from the real reality.
5. The results are announced by the leader of the lesson and additional information is given depending on the results obtained.
6. The end of the game is announced and summarized.

The facilitator should acquaint the participants with the rules of the game and the principles on which the model is built. He must be very well acquainted with the game and be able to answer all questions quickly, perform his calculations quickly and accurately and submit them to participants in a timely manner. The use of an electronic calculator creates the conditions for a significant reduction in computation time. In the absence of an electronic machine, the supervisor must be assisted by one or two assistants. At the end of the game, the leader conducts a general discussion in order to compare the methods used and the results obtained and to learn the necessary lessons. No group winner should be indicated.

The participants in the game must mainly study the text or the description of the organization that is given to them. They are then organized into groups to determine the dynamic impact of the various factors. They must be able to use the information at their disposal and understand the need to determine the overall strategy and tactics of the group during the game.



### 3. Features of computer management games (CMG)

#### 3.1. Computer simulation models

All CMG are based on some certain computer simulation model of a business system and its environment (“The World we live in”), replacing the economic reality. The behavior of the market environment is imitated with the help of this model, realized in the form of a computer program. From mathematical point of view the model is a system of simultaneous equations and logical conditions. The model simulates the action of random, unpredictable factors, as well as the action of various other economic and non-economic entities (competitors, counterparties, organized markets, financial institutions, government agencies, international organizations, etc.).

Management games are an ideal method of teaching. They combine entertaining and exciting emotions with the ability to actively plan and make decisions, which is an essential element of business. Teachers will become increasingly convinced of the usefulness of using them in the learning process. In management games, the real complex activities of people in business and the national economy are simplified to clarify some of the basic principles of micro- and macroeconomics. They imitate the functioning of an object of management and the main task of the participants is to decide about this object. For this it is necessary to provide information about the site and the specific situation in which the decision is made. The actions of the decision-maker should be based not on momentary considerations, but on the actual processes taking place and related to the site. For this purpose, the fundament of management games is a developed simulation models of management objects. Some of the basic concepts and principles of modeling and management are the subject of the next few lines.

In the management of economic objects (separate technological process; company; national economy) their formalized (mathematical) description is often used, called MODEL of the object for management. The model is designed to serve as a tool for easier explanation and understanding of the object or for easier manipulation with it. Mathematical models express our interests on the object through mathematical dependencies: equations, inequalities, functions, etc. They present in mathematical



form the connections and relationships between the main parameters that characterize the object in terms of its management. In the theory of mathematical modeling, each controlled object is considered as a system of interdependent elements, under the constant influence of its environment, expressed as external controllable (can be changed by the control system) and uncontrollable effects. These impacts are referred to as the INPUT of the site (input impacts). The reaction of the site to these impacts is referred to as the OUTPUT of the site that the site manager wants to bring to the desired state (e.g., to obtain certain values). does not care about their structure (considers them as a black box), observes only the inputs and outputs connected in the model through mathematical dependencies - most often one or a system of equations.

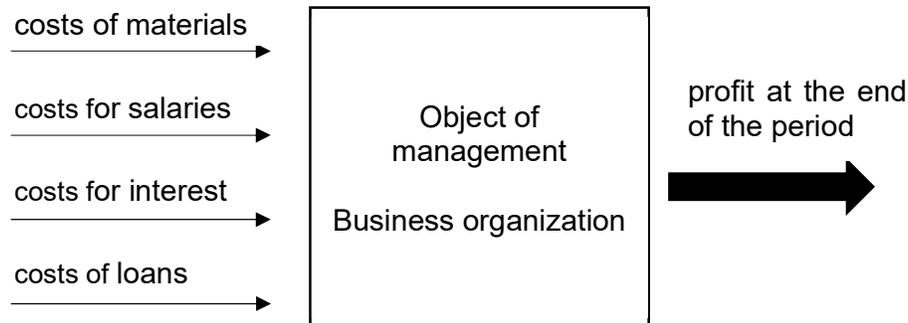
To clarify what has been said so far, an example can be given in which the object of management is a manufacturing company. The task of the site manager (e.g., the manager or his deputy) is to influence the production processes and the overall activity of the company in such a way as to obtain a certain value of the profit from the activity for a given period (i.e., to bring the site from the current in the desired state).

An important point in the management process is the definition of the inputs and outputs of the managed object, depending on the objectives of management. the desired result. In this case, the output of the site will be the profit, which changes in accordance with the changes in the input effects. And as such you can choose the cost of materials (as a total amount or by type), the cost of wages, loans (if used) and interest rates in the economy and more. Since economic systems are quite complex in their structure and interaction with the environment, it is impossible for the system manager to regulate all controllable external influences (to influence all inputs of the site), so (as shown by the example) he chooses what will be the inputs and the outputs of the modeled object in accordance with its actual structure and location in the environment and in accordance with the management objectives.

The manager can change the inputs (set different values) and observe how they affect the monitored output - profit. It should be noted that the mathematical relationship between them is known, obtained as a result of special preliminary studies and

analyzes that do not are the subject of the exhibition). Thus, after a series of attempts, he will achieve the desired result or at certain values of the input will receive a profit closest to the set and will be able to put into practice this optimal experience.

The above can be illustrated by the following diagram:



In connection with the clarification of the fundamental concepts of management theory, we will point out that each individual experience with the object, i.e., the setting of specific management influences is called the "management strategy", and the strategy with the best (closest to the desired) result - the "optimal management strategy". It (the latter) also applies in real conditions.

For experimental studies of economic systems, it is convenient to use simulation mathematical models. They formally (quantitatively) describe the connections between the inputs and outputs of the real object model and imitate as close as possible the real processes taking place in the control object.

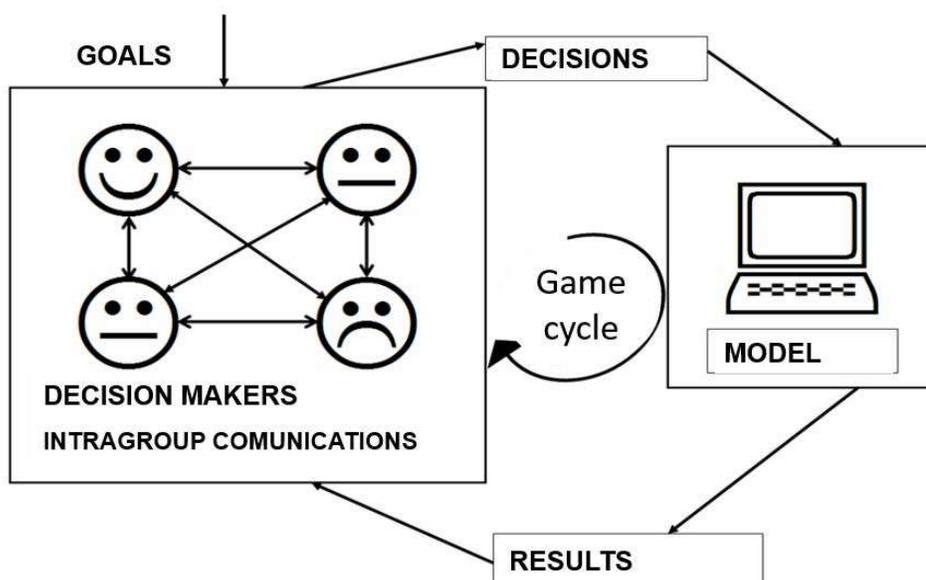
Imitation models are at the heart of management games. And the essence of the latter comes down to "playing" different strategies on the model (setting different input effects in each experiment), monitoring the reaction (outputs) of the model in each of them and determining the optimal (leading to the desired outcome) ) strategy.

There are manual and computer options. In computer control games the simulation mathematical model is embedded in a program, the manager of the object (it can be a student, pupil or amateur) has the opportunity to set their management strategies, and the program gives the result of the model outputs each time "playing" strategy. Optimization procedures can be used to determine the best solution.

### 3.2. Teamwork

The game is held in competitive conditions between several teams of students (numbering 5-7 people). Each such team assumes the role of an economic entity pursuing its goals in market conditions within a certain game scenario. Within the team, each participant takes on a specific role (for example: executive director, chief accountant, marketing director, etc.). Each team must periodically work out coordinated decisions, achieved on the basis of analysis of the economic situation and intensive intra-group communications.

The game takes place in a series of repetitive cycles: analysis of the existing situation; making decisions by the team; reproducing the decisions made with the help of the computer model; analysis of the obtained results; making new decisions, etc.



In the process of the game habits for efficient group work and elaboration of coordinated decisions are created: public collective discussion, comprehension and assessment of the game situation, expression, and defense of one's own opinion,



hearing the opinion of others and collective decision making for action. In this way the socialization and the elaboration of an active life position in the learners is supported.

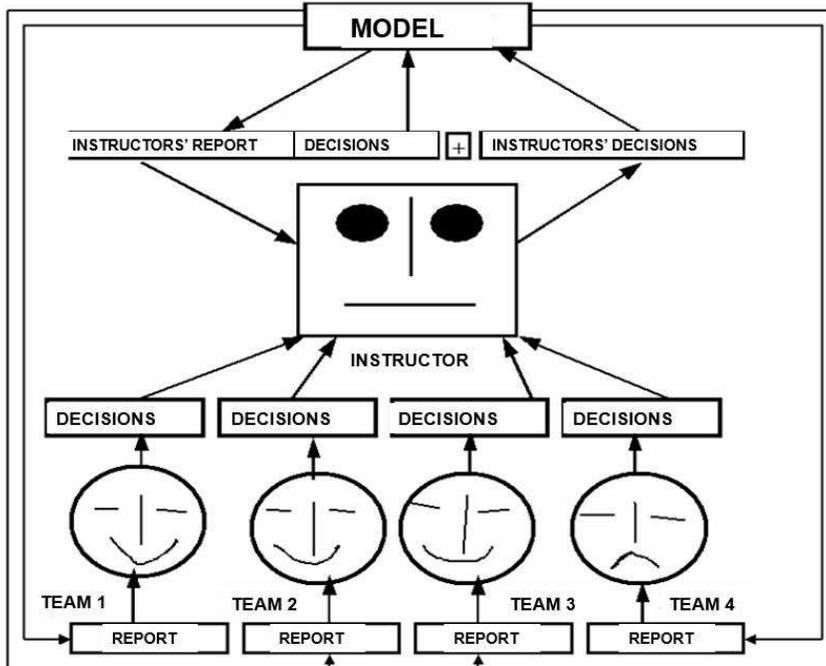
In the course of the game, conditions for autodidacticism are created, e.g., spontaneous transfer of knowledge and skills between the participants in the game, caused by their different life experiences and the unifying game goals.

### 3.3. Instructors' team

Another important teamwork within the game is the instructors' team. All teams follow certain game rules, controlled by a team of instructors.

The instructor team also simulates the action of subjects and phenomena whose computer modeling is difficult, impossible, or undesirable (consulting groups, universities, media flow, information sources, public opinion, etc.), thus creating a complex, multidirectional and contradictory information environment. .

During the game, the instructor team publishes a newspaper (the "Newspaper"), informing about the events that occurred during each game period and analyzing the changes in the simulated business environment. The newspaper exists in paper form, is published on-line on the INTERNET, and an express edition is broadcast in the form of text messages to mobile communication devices.



### 3.4. Combining various pedagogical methods

Wherever possible, the use of active teaching methods and CMS is combined with traditional pedagogical forms (demonstrations of educational films and other video materials, talks with guiding questions, discussions, preparation of written reports, discussions, presentations by students etc.).

At the end of the game (at the shareholders meeting) every team represents its strategy and achievements and defend their case. The results achieved by each team are discussed in order to compare the different decision-making strategies and to draw conclusions about the properties of the studied system. In addition, each team must present their results orally and in the course of a discussion to defend their positions.

Each team prepares a report on its activities in written and / or electronic form, suitable for collective discussion. The team is expected to prepare a high-quality business presentation using graphics, multimedia, video cuts, internet pages, etc., thus mastering the technical means for high-quality modern business presentations.



All teams are evaluated according to pre-announced, multi-criteria point system.

Very good pedagogical results are obtained by using video recordings, recording the course of the game and the reactions of the participants. In the final discussion, these "video protocols" provide rich material for analysis and conclusions.

The developed games should be grouped into families of consistently increasing complexity, but united by a common theme, common idea, or common plot. At the same time, the learners, starting with the basic modules, subsequently receive an increasing degree of freedom and their own choice in the next games, suggesting their own creative idea.

### 3.5. Integrating nature of CMG

As a rule, cognitive tasks from different sections of the study material (including from different lectures, topics, and disciplines) are integrated in one game.

Wherever possible, CCIs should be used to "bridge the gap" between what students observe in real public life and the teaching material.

During the game, learners are placed in a series of specific economic situations that stimulate them to active independent action. In this way, in the educational work, on the one hand, elements of the research activity are introduced, and on the other hand - it is more closely connected with the practice. For the learner, the game becomes a kind of "experimental installation", the work with which requires a certain amount of knowledge and leads to the formation of certain skills.

At the same time, a significant amount of theoretical material is consolidated on specific examples and through specific actions. Skills for development and decision-making aimed at certain goals and in accordance with the dynamically changing situation and the action of random factors are created. Practical habits for using simulation models and computer / communication equipment are developed.

All computer games combine the simultaneous activation of both the intellectual and emotional spheres. The games imitate fierce competitive situations and necessarily contain a competitive element.

In addition, students are introduced to the studied issues in an interesting and engaging way, activating positive emotions, and motivated to actively participate in the learning process. In this sense, the games contain a certain hedonistic element ("It's nice to play", it is "fun", "cool", etc.).



### 3.6. Computerization and internet

Due to the importance of the INTERNET in all areas of life (now and in the future), all CMG is appropriate to be "INTERNET - blended". This allows the games to run more dynamically, to actively contact the playing teams, to focus on certain moments in the development of the game, to search for appropriate information, i.e., to develop skills for doing business in the modern information environment. On the other hand, the conduct of the game itself can be supported through the INTERNET (instructing students, support materials, etc.).



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Throughout the game, learners are encouraged to use computer equipment and the INTERNET (both to gather additional information and to develop models to support their decisions).

#### 4. Best practices for implementing gamification in education

Scholastic	Gamified in-person (well established best practices)	Gamified online (additional to <i>in-person</i> )
<b>Educator attitude</b>		
<ul style="list-style-type: none"> <li>• Passive / Fixed</li> <li>• Dictator</li> </ul>	<ul style="list-style-type: none"> <li>• Influence the space</li> <li>• Win over hearts &amp; minds</li> <li>• Move around</li> <li>• Physical contact</li> <li>• Intriguing / engaging</li> <li>• Freedom of choice</li> <li>• Positive rapport</li> </ul>	<ul style="list-style-type: none"> <li>• Empty space</li> <li>• Fixed</li> </ul>
<b>Onboarding</b>		
<ul style="list-style-type: none"> <li>• -----</li> <li>• (maybe show/sell 'The Textbook')</li> </ul>	<ul style="list-style-type: none"> <li>• Purposeful effort from the first minute</li> <li>• Start with a bang</li> <li>• Present Grading Day as a goal (memories from the future)</li> <li>• Set the bar</li> <li>• Schedule, Leaderboard, Communication spaces</li> <li>• The two laws university education</li> </ul>	<ul style="list-style-type: none"> <li>• A lot more effort</li> <li>• Not necessary start with a bang</li> </ul>
<b>The lecture</b>		
<ul style="list-style-type: none"> <li>• Typically dictating</li> <li>• Or PPT re-writing</li> </ul>	<ul style="list-style-type: none"> <li>• Storytelling with multimedia elements</li> <li>• Stress on interaction with students (including physical)</li> <li>• Accessible repositories with teaching materials</li> <li>• The "Layered Cake" approach</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple channels of presentation (video/text/image... but also multiple presenters)</li> <li>• Diversity of media (Gather.Town / OpenSim / Virbella, Pixelplace, MS Teams, Forms, etc.)</li> <li>• Synchronous mode + Flipped classroom</li> <li>• Video recordings playlist available</li> <li>• Need to balance online freedoms with limitations (risk of vandals)</li> <li>• Daily quizzes to replace one big final test</li> </ul>
<b>Seminars / assignments</b>		
<ul style="list-style-type: none"> <li>• Not too many or not at all</li> <li>• Often the task is repetitive and/or repeating the lectures ('for homework')</li> <li>• Often not integrated in the educational process</li> </ul>	<ul style="list-style-type: none"> <li>• Multitudes (10-20 assignments for every student / team)</li> <li>• Main tasks and background tasks for time intensification</li> <li>• Wide choice of possibilities (both for freedom of choice, and for task individualization)</li> </ul>	<ul style="list-style-type: none"> <li>• Obligatory means of interactions among students...</li> <li>• ... but also leaving them to self-organize their own communicational protocols</li> <li>• Automated team registration</li> </ul>

Scholastic	Gamified in-person (well established best practices)	Gamified online (additional to <i>in-person</i> )
	<ul style="list-style-type: none"> <li>• Creative with research orientation</li> <li>• In teams (alternating every time) self-organized or appointed teams</li> <li>• Competition</li> <li>• Rule for self-control by team members</li> <li>• In-class assignments / games for learn-by-doing (but also for engagement and diversify the activities)</li> <li>• Strict-ish Deadlines</li> <li>• Procedure for delivery</li> </ul>	<ul style="list-style-type: none"> <li>• Stricter procedure for online submission including strict-strict deadlines</li> <li>• <u>Fully automated</u> process of solution submission and evaluation</li> <li>• Less assignments are suitable for teamwork</li> <li>• Mostly Asynchronous mode</li> </ul>
<b>Office hours</b>		
<ul style="list-style-type: none"> <li>• Only by schedule, if at all...</li> </ul>	<ul style="list-style-type: none"> <li>• Appointing wide-spread times of many contact-hours</li> <li>• Aggregating as many as possible teams on one place</li> <li>• Work with every team until they run out of questions</li> <li>• Progress related questions</li> <li>• Checkpoints throughout the semester (with bonus points)</li> <li>• Increased online presence (incl. video conference)</li> </ul>	<ul style="list-style-type: none"> <li>• Practically every day, whole day</li> <li>• Topical organization</li> <li>• Multiple channels (e.g., people)</li> </ul>
<b>Simulation games</b>		
<ul style="list-style-type: none"> <li>• -----</li> </ul>	<ul style="list-style-type: none"> <li>• Teamwork (autodidactic)</li> <li>• Computer simulation models (internalities / externalities)</li> <li>• Instructors' team (Scenario + Complex and diverse informational environment), data processing</li> <li>• Combining various pedagogical methods</li> <li>• Integrative nature (across subjects, best practices, emotional/intellectual aspects)</li> <li>• Computerization and Internet – internet blended</li> <li>• Back office is well established – workflows, roles, supporting materials, etc.</li> <li>• Managerial report</li> </ul>	<ul style="list-style-type: none"> <li>• Full web layer on top of the game</li> <li>• Appointed team forming to promote autodidacticism</li> <li>• Team registration procedure (much more complicated)</li> <li>• Per team communication channel</li> <li>• Teams self-organize their own communicational protocols</li> <li>• Open-scenario simulation model is a must</li> <li>• Data processing done by teams (better documentation + more effort on instructions)</li> <li>• Effort for diversity of informational channels</li> <li>• Back office harder to be organized</li> </ul>
<b>Examination / theoretical test</b>		

Scholastic	Gamified in-person (well established best practices)	Gamified online (additional to <i>in-person</i> )
<ul style="list-style-type: none"> <li>• Facts oriented</li> <li>• 20-25 closed questions</li> <li>• Conducting the test requires “military” operation</li> <li>• Paper (or even open question) exam</li> <li>• 2-4 variants of the test (best kept secret)</li> <li>• Approximate times</li> <li>• Delayed feedback</li> </ul>	<ul style="list-style-type: none"> <li>• Electronic (in regular computer)</li> <li>• Approximate, but dense scheduling</li> <li>• Principle oriented (mini cases)</li> <li>• Individualized</li> <li>• Open book (everyone has access to Internet and own materials)</li> <li>• KPI: power (as in physics) learned – e.g., 50 closed questions for 60 minutes</li> <li>• Strict timing</li> <li>• Immediate feedback</li> <li>• Many date options for exam</li> </ul>	<ul style="list-style-type: none"> <li>• <u>Every published question is lost</u></li> <li>• Scheme for easy / automatized question generation</li> <li>• Scheme for easy / automatized test variant compilation</li> <li>• Front-end with real-time analytics and easy replacement of the test</li> <li>• Open questions w/ 100 symbols limit (also the limit is an anti-copy/paste measure)</li> <li>• 50 questions (or even more) for 60 minutes to decrease googling time</li> <li>• Coordination is a must, but the capacity is practically limitless</li> <li>• Reduce the number of date options for exam (so less questions are lost) – scheduling of examinations</li> <li>• Special procedure for pre-registration</li> <li>• Pre-test for basic skills on testing (interface, good practices, technical risks), which serves also as a declaration of knowing the rules</li> <li>• Open audio / chat channels during the exam for questions</li> <li>• Copy / paste answers (the one remarkably similar) are disregarded</li> <li>• In essence the exam is even harder</li> </ul>
Grading		
<ul style="list-style-type: none"> <li>• Examination / test makes 80% to 100% of the grade</li> <li>• Not enough variety in aspects and criteria</li> <li>• Not enough explanation (some subjectivity)</li> </ul>	<ul style="list-style-type: none"> <li>• Positive reinforcement</li> <li>• Points system of grading</li> <li>• Small steps, immediate feedback</li> <li>• Gamification of every assignment and of the whole process</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>

Scholastic	Gamified in-person (well established best practices)	Gamified online (additional to <i>in-person</i> )
<ul style="list-style-type: none"> <li>• Absolute (as opposed to relative) grading scale, or even straight 5 scale marking w/o any stat analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Multi-criteria for every assignment</li> <li>• Competition</li> <li>• Relative grading (ECTS)</li> <li>• Switch to 5 scale in the last possible moment</li> <li>• Natural boundaries for pass grades, absolute boundary for fail/pass</li> <li>• The “normal” students are exempt from exam (but they have covered enough theoretical and also practical material)</li> <li>• On some occasions may be peer-review, and on many occasions, it is tutor-review</li> </ul>	
<b>Recap/debrief/feedback</b>		
<ul style="list-style-type: none"> <li>• No (or almost no) debrief for students</li> <li>• No feedback from students</li> </ul>	<ul style="list-style-type: none"> <li>• Qualitative and quantitative feedback at every possible step</li> <li>• General feedback at the end before Grading day</li> <li>• Grading Day Ceremony</li> <li>• Full review of the many achievements throughout the semester</li> <li>• Motivation through success in front of the peers (4<sup>th</sup> level of Maslow)</li> <li>• Special Awards (unique T-shirt &amp; Signed certificates) for the best students</li> <li>• Photo with the best students</li> </ul>	<ul style="list-style-type: none"> <li>• Digital certificates – authorized by us, and usable</li> </ul>