

# **Edutainment or Entertainment**

## **Education Possibilities of Didactic Games in Science Education**

*Jiří Němec and Josef Trna, Czech Republic*

### **1. Edutainment as a topical social phenomenon**

#### **1.1 Introduction**

Edutainment is a distinctive form of entertainment that enables the participants to be educated (e.g. get new information from various fields of our life) or even brought up (their postures, values and behavioural patterns could be influenced). The education in these cases takes place and the participants hardly notice the process itself. There are many new means used in the process – experiential pedagogy, medial pedagogy, IT virtual reality, etc.

As it might be obvious from the term itself, the word is a compound of two distinctive words: education and entertainment. At first sight, the two hardly compatible terms form a new field of educational reality, in which the teacher does not perform the key role - to be the educator - but also the whole set of psychological and methodological means that are linked to the new information and communicative technologies and other heavily spread mass media. Let us have a look at the possibilities and the challenges that the edutainment provides us in the field of didactic games and simple experiments based on the experiments of the natural sciences, using simple experiments.

#### **1.2 History of the entertaining education**

The idea of entertaining education is not that new in the history of education science. Let us remember some philosophers and teachers and we will immediately visualize the concepts and their creators that supported the idea of joy, entertainment, illustrative methods and etc., just to make the process of learning for the children pleasant. It was obvious in the era of Renaissance and Enlightenment that the attitude for the pupils is changed; it is the play and other educational methods that are being focused on at the time. They aim to activate the individuality and make the process of education more human compared to the Middle Ages philosophy of education. (Němec, 2002).

First of all, Czech educator J. A. Komenský (1592 – 1670) who is often associated with the term "school as play" belongs to the pool of significant thinkers. Komenský made a play part of his pedagogical system and allocated some time in the delivering of the topics when teaching, he managed to structure the play according to the age and set up the rules how to use them. He refers to the play in his whole work and in fact he understands the play in two meanings: Play as a theatre performance that focuses, for example, on dramatization of a historical event or other educational material and play as a didactic "joyful" method that should help to educate body or mind. And it is the "joy of play" that underlined and emphasized now and as we can experience, it is becoming one of the motifs that brings us to amusements centres, educational institutions museums and in fact the involvement in the plays themselves.

### **1.3 Bordering lines of the education, entertainment and a game, edutainment as an educational concepts**

To set up the precise borders of what is the entertaining education and what is the education using the features of entertainment (edutainment) is difficult; mainly because the play itself contains the features of entertainment and education. Edutainment is very broad in the sense of the word and could be characterised by many structure activities. The basic principles are common for both the categories; they provide users with the entertainment and education. The edutainment activities are less strict in their structures and are not directly linked with the rules and ideas of the particular game. Before the game the participants have to get acquainted with the rules, its sense and also the casts of the characters participating in the game. The edutainment activities are entered directly, being motivated only by the wish to enjoy and try and only in the process itself, the participants think about the process and realize what they have just experienced and thus, unconsciously, are being educated. The following list of characteristics (Němec, 2004) focuses on the precise definition of pedagogical definition of play and at the same time it shows the fields of intersection with entertaining education.

#### **ENTERTAINMENT**

Amusements and joy are the main motifs for people to go and enjoy the activities. Longish and sometimes boring lessons could be replaced by plays and primarily do not have to be just entertaining but could focus on the exercising the new knowledge in a merry and easy way.

#### **GAME/PLAY**

Game/play could be characterized as a free activity of a group or an individual person (child or adult) limited by a certain time period. The topic of the game/play play sources in the interests of the group and the meaning is to be found directly in the game/play or is outside the play (for example motif or target). The game/play is the medium to obtain specific needs or meet different targets. The game/play is different from the everyday life by its distinctive rules and also by the inside plays features, such as competing or the role identification. The game/play brings the satisfaction of the needs, enjoyment, entertainment and also some knowledge and experience for the players.

#### **EXPERIENTING**

Game/play is classified (together with edutainment) as one part of the experiential pedagogy. If the participant is ready to accept the rules, then it is him or her who starts to be the creator “new themes” and there are many activities that are experienced directly without any in between link. Experience (based on own and unique experiencing) create the solid base for a possible change of the personality or possible fixation of new knowledge or skill.

#### **MEANING OF LIFE**

During the pre school age, sometimes even at younger school age, the game/play is the unique natural activity that is necessary for the personality development in full harmony. This is the activity that is mostly enjoy by children and creates the basic pillars of the sense of life. Professional literature states many causal cases of deprived children who could not experience the play at their childhood.

#### **SOCIAL ROLE**

If we enter the world of play or interactive entertainment, we usually accept the role which is described by a set of rules. The process is similar to the theatre character described in a script or even life role, which is described by the social and moral rules. And likewise the same Hamlets in the theatre performance using the same lines express different ideas and provide topical messages based on the context of the period, could players experience the role individually and uniquely.

## **SIMULATION**

Each place is in its nature simulative as it always pretends or imitate. The base of the simulation (especially in so called simulative games) is to create a pattern that represents the real life (problem) and is able to react to the players' and organizers' behaviour. Players in the "play area" could encounter situations that are quite unique in a real life. The base of the unique matter lies in a certain danger that is brought by the situations or potentially could bring.

## **COGNITION AND SELF COGNITION**

Plays and activities based on the entertaining education enable the teachers to learn more about their pupils and in a different way than from the classroom or any other usual habitat. Also they provide the feedback for the participant about his or her own behaviour (see simulation).

### **1.4 Edutainment in the mirror of the world today**

The present phenomena of today is the increasing correlation between the level of education and the expectation for the quality of entertainment which is meaningful and still is not considered as a waste of time. A lot of amusements centres and big leisure centres (for example in USA, they are known for their long tradition) list in the attraction also the activities that should educate the visitors. The traditional museums and also public institutions, which might sometimes imply to be boring and dull to visit, incorporate into their curator's visions features of enjoyments and play.

Edutainment features are to be found also in many different fields of a man's activities, not primarily at schools or educational institutions. We can find some in so called brand lands – company parks that are developed by the big companies and international concerns. Probably the most well known park of the kind is Legoland. The original idea of a garden that would serve as a place to exhibit the toys produced of lego was changed into a great entertaining and educational park, that was open already in 1932. Compared to the American Disneyland it does not provide only entertainment but in fact, it represents wide and popular construction kit project that is popular with kids and teens and for certainly the kits are also of educative meaning as well.

### **1.5 Edutainment in educational institutions**

The education reality is becoming also interesting from the point of view of pay back economy and marketing possibilities and therefore it is offering more and more examples of media publishers and toy manufactures. At the moment the principles of edutainment are developed on the following fields.

#### **Museums and children museums**

As already mentioned above, all the institutions are getting into the laboratories of knowledge where it is not only allowed to touch the objects, if possible, but also give things a try and try to understand complex physical and natural processes. Distinctive type of museums in the range are so called children museums (Jůva, 2004, 195) that could be characterized by creating the space for children learning that sources from the play and adventure, from experience and discoveries, they are social and they have the features of entertainment. The support for the heuristic teaching is already stated interaction of the exhibits.

#### **Leisure time and ecological education centres, zoos**

At the same time as the museum undergo the changes, there are also other institutions that are no longer focused on children as the only target group but they widen the offer also for the adults and are ready to prepare for the demanded target group (families socially handicapped groups of children, etc.). Entertaining and educative programmes in zoos use for example the direct contact with animals in the runs and wherever this is possible; children can feed the goats or ride the ponies. Ecological centres organize a lot of courses based on the constructivist principles. Children themselves make their bread to get acquainted with the process starting from the mill to the baking were able to imagine all the accompanying activities.

### **Information and communication technologies (ICT)**

ICT belong to the most spread phenomena in the field of edutainment. The development of new technologies and their vast (and therefore cheap) production brought a new phenomena; entertainment at your home PC or any other equipment (play station, video games. etc.). And in the whole section of the industry there is a new branch that concentrates directly into the usage of computer games at the education – so called Game Based Learning – GBP. Recently, we had been experiencing mostly the development of multimedia products (encyclopaedias, dictionaries, games) distributed using the CD ROM and DVD media (e.g. off line versions). But now we have been confronted (in the context of the high capacity networks) with development of similar internet based applications. That resulted in the creation of well collaborated and complex games. Players share the virtual space of the Internet and they can compete and still cooperate when gaining the territories or fighting the same enemy and all that could be done without leaving the room. Multimedia play and also encyclopaedias and all other didactic means use all the latest technical and also psychological aspects in the communication with the user. The example to illustrate the latest development follows:

*Interaction:* virtual system is controlled by the user and according to the programmed or individually decided algorithm the user gets the answer – feedback. Player gets the information all the time “about his or her behaviour” in the system and he or she can change the strategy of decision making.

*Multimedia:* all the content is delivered via more forms, if possible (texts, spoken words, music, pictures, film) and during the process as many cognitive processes of the person as possible is involved.

*Individual and social:* all the systems are subordinated to the individual rate of the user, they react as he or she likes. On one side they isolate the user in the interactively limited space (user, system, me and PC and so on), on the other hand they enable to create new social relationships that are not based on the interaction of face to face type, but on sharing the common virtual space via a communication media (Internet, mobile phones and so on.) using the new communication application (chat, e-mail, e-discussions and conferences etc.).

*Simulation and approaching the reality:* Programmes based on the simulation, simulating the real situation or a certain process are very popular mainly thanks to various simulators (aircraft control, driving cars etc.). But there are also some more complex game systems such as weather forecasting, prediction of a social behaviour of a group of people (for example games with a social topics, games simulating stock exchange, city management – quite well spread game SimCity etc.). Participants in fact change the initial variable values (variables) that are processed according to a settled algorithm (complex lists are provided by the software) and according to the output values it is decided about further steps.

### **Mass media**

Even before the rapid development of film and TV there were some features of edutainment discovered in fairy tales and fables and storytelling that mirror the experience of the mankind and are distributed by the word of mouth. They are especially fables and fairy tales that

provide moral messages that might make the base for the character development of the kids in certain cultural context of the society. Hand in hand with the development of the TV broadcasting in the second half of the 20<sup>th</sup> century and with the development of the cable TV the society experiences the spread of the entertaining educative series for children, youth and adults. We can list some educational series of the BBC or documentaries from the Discovery Channel, Animal Planet or Spectrum TVs. Edutainment is also linked with the wide spread TV series (soap operas). That kind of series is based on simple story line and human and family relationships are developed then. In many case these could be characterised by oversimplified didactics focused on certain target group (maternity leave women, students, etc.). Using the so called emotional realism the series gain regular public that identify themselves with the characters in the series during the broadcasting. The phenomena could be positively used at the education and influencing the values of people – for example in the case of planning the families, contraception pills usage, obesity prevention or drug usage. Edutainment as part of the broadcasting could be the vital element in the education of millions of people in the developing countries, such as HIV prevention. Some USA universities deal with similar projects together with Centre for Disease Control.

## **2. Edutainment as an innovative science teaching technique**

### **2.1 Edutainment in the education**

The importance of edutainment activities is largely accepted by teachers who have already been projecting its aspects in the process of education. Even though they have the possibilities to visit different exhibitions, see different companies and etc. to provide the students with the picture of the real world, they still could realize various entertaining activities directly when teaching. In the paragraphs bellow, we publish several hints how to use didactic game in the science teaching.

### **2.2 Edutainment in the science teaching**

There are a lot of distinctive teachers when teaching science at different levels of the educational system. But now and then, it is the idea of “scientific approach” that makes the teachers to emphasize the “encyclopaedia” point of view and very abstract teaching. The science teachers are in fact since the very beginning of their subject studies are set up to be afraid to use the teaching methods and techniques that might doubt the "serious" points of view in the natural sciences research in the form of principal laws. That results in the fact that the teachers underestimate the phase of motivation, they do not unify the teaching with the practical aspects of everyday life, they might refuse to use humour in the teaching and etc. Often they defend the point that teaching sciences is mainly serious mental and cognitive activity and the emotional point of view should not be present when teaching. Students might thus be distracted and de-motivated and block their future studies of the natural sciences.

Natural sciences subject didactics teachers are very well aware of the decrease of the popularity and negative attitude of pupils and therefore they search for new methods, forms and means that might change the tendency. One of the possibilities seems to be the usage of the didactic games and plays as described in the principles of the edutainment.

### 3. Didactic games and simple experiments in science education

#### 3.1 Didactic science game

##### **Edutainment, didactic games and experiments at school**

The position of didactic games at education is quite distinctive. They are often used as a review tool for practising knowledge and skills; sometimes they are used to motivate the pupils. But examples of didactics games explaining the basic physical phenomena are still quite rare. The whole process of acquiring the new knowledge and skills using these didactic games will be dealt with in details below.

##### **Introduction to the problem situation – change of the pupil’s role**

The teacher presents the pupils with a problem situation. The problem situation could be defined as a certain situations which could be characterized by the acquaintance of the entering condition but with no idea about the final level. (What will happen if ...?) At this moment we usually gain the attention of the pupil who will change his or her role from “pupil – listener” into a “pupil – creator”.

##### **Expectations**

At the level the pupil is asked to make a guess based on his knowledge and gained experience how the experiment will finish. The experiment is created in a way that the result is different from the expectations of the pupils. All the games based on simple experiments with uncertain result that do not fit within the expectations of the pupils destroy the misconception and motivate pupils to learn more and bring next questions. (How is that possible?) The search for the correct answer moves the pupil to higher level of understandings.

##### **Interaction and feedback (action & reaction)**

Uncertain result games are accompanied by interaction based on the chronological sequence of single steps. The experimenting pupil makes a step as instructed by the teacher (for example put the coin into a bottle full of water (action) and immediately he or she gets the feedback (reaction): the surface increases but so far the water does not spill out. This knowledge will bring the pupil to the next step: putting next coins into the vessel. The pupil modifies the expectations and builds up new knowledge, for example on the nature of fluids.

##### **Motivation**

The motivation of the pupil is changed from the external (“You should learn something interesting from physics.”) into internal (“I want to know how that will come out.”). The whole process is accompanied by the emotions of the pupil – **education by experiencing** (by tension, uncertainty). The didactic game as a part of edutainment activities should never be primarily considered by pupil as a process of education. Psycho-didactic problem is how to link the game with the education, taking into account the fact that the education is expected by the pupils. It is necessary to have the pupils involved spontaneously, almost instinctively. The theory of motivation deals with the aspects. According to the classification of the needs provided by Maslow, the didactic game could induce some of the needs. They are:

- (a) Sensual and muscle activities (unpremeditated needs)
- (b) Recognition and prestige in the team
- (c) Self realization in the game and enjoyment
- (d) Cognition

Didactic game is in the education presented in the form of impulse (internal motive) or incentive (external motive) and induces the needs listed above by mixing them (Trna, Trnová, 2006a). There are several types of didactic games differentiated from that particular point of view:

- (1) Play with a toy

- (2) Competitive game
- (3) Problem game
- (4) Project game

There are no strict borders between these games. A lot of competitive games include also the features of a problem game.

### 3.2 Simple experiment and didactic science game

The science education is well suited for the application of didactic games that are based on simple experiments. And those didactic games will be discussed later.

Simple experiment is an experiment which has several features. These are: (Trna, Trnová, 2006b):

- **Transparency** of an exposition of the principle of the natural phenomenon with the suppression of the side effects that might occur at the experiment.
- **Quality** of the experiment when all useless measurement does not occupy the attention needed for the principle of the natural phenomenon.
- **Easy to do** – when the experiment could be experienced almost by all senses and is realized by the pupils, regardless if at class or when doing homework.
- **Problems** – all the cognitive needs are encouraged and the follow up activity in the search for solution are both involved. Extreme extent of those needs is always raised by paradox experiments and tricks.
- **Price** – the low price is also important when talking about the usage of limited financial resources.
- Development of the pupil's **skills** and development of his or her **creativity**.

The usage of simple aids that are the pupils familiar with from their everyday life is also very important from the pedagogical, psychological and constructivism point of view. We have been using the pupils' preconception. An important part of the simple experiment is also the possibility to make simulations when, if the parameters are changed, one can tell the principle of the natural phenomenon and also find the relations among the quantities describing the phenomenon. Simple experiments with simple teaching aids could be used for most of the natural sciences didactic games.

### 3.3 Examples of didactic science games

#### **Play with toy**

The toy in the role of a simple teaching aid stimulates the need to have sense and muscle activities, to say the least, the play is then unconsciousness to its maximal limit. So the relaxation function of the play is really remarkable. There are many toys manufactured commercially all round the world. The toy is an object which displays a feature that is remarkably emphasized - elasticity, colour, distinctive behaviour, etc.

#### ***Spring ball:***

*The spring ball is a very elastic rubber ball that, after hitting the floor, jumps really high. The phenomenon to understand is the elasticity and the rule of the energy conservation.*

#### ***Balance:***

*The objects with a lower centre of mass do not capsize. It is recommended to use the commercial toys, oval covers or polystyrene eggs. The phenomenon to understand is the balance of the objects.*

***Walking hedgehog:***

*Wooden hedgehog (or any other animal) with a functional leg moves down on the inclined plane. The phenomenon to understand is the gravitation.*

***Glockenspiel:***

*A wooden tree has got spiral wooden leaves that are shivered by a ball that is dropped on those leaves. The phenomenon to understand is the source of sound, the strike tone and gravitation.*

**Competitive game**

When organizing the competitive game, we mainly stimulate the social need to win in the competition of the others. Simple experiment is placed within the framework of the competitive game in the form of a central object. The competition itself focuses on the most effective demonstration of the experiment.

***Soap bubbles:***

*Pupils or representatives of the teams try to do their best to make the biggest bubble using the straw and the soap fluid. The game is easy to alternate by asking pupils to have the bubble of certain diameter floating as long as possible. The phenomenon to understand is the surface tension when making the bubbles.*

***Liquid surface:***

*Pupils or representatives of the teams try to put objects (coins, stones, balls) into a container filled with water. The task is to use as many objects as possible without spilling the water. The phenomenon to understand is the surface tension in the fluids.*

**Problem game**

When organizing the problem game, the point is to stimulate the need to solve problems. Simple experiment is once again the central object that contains the problem itself. The game can take the form of a puzzle, trick explanation, paradox, etc.

***Ball in a glass:***

*A small ball is placed into a conical glass. The task is to get the ball out and not to touch the ball and also not to overturn the glass. The solution is to make the ball rotate and the spiral movement will drive the ball out of the glass. The phenomenon to understand is the centrifugal force.*

***Strong paper:***

*Put a strip of paper over the neck of the empty glass. The strip of paper is supposed to hold the coin from falling into the glass. The paper will not make it. The problem task is possible to be solved by folding the paper in a concertina style and only then it can hold several coins. The phenomenon to understand is the solidity and flexibility of objects.*

**Project game**

The highest level of the problem task is a project. The project game should stimulate several needs; for example, how to solve the problems or find one's position in the team. From the point of view of the time, it is easier to create shorter perspective project games.

***Ships:***

*The products of the game are the ships made by the pupils of paper, skewers, strings, plastic films, polystyrene and etc. The vessels are later presented in the class parade and are demonstrated in the tank with water. That is about two hour project game. The phenomenon to understand is the Archimedes Principle and the principle of floating and the balance.*

***Molecules:***

*Pupils create incidental shapes out of the balls and linking sticks that are supposed to represent molecules. It is also possible to use the school construction kit of molecules. The results are presented at a class exhibition where the pupils try with the help of teachers to identify the compounds and guess the possibility of real existence of the molecule. That is about two hour project game and it is recommended to set up the rules for the number of balls-atoms and etc. The phenomenon to understand is the chemical bond and their principles.*

**Summary**

Edutainment or entertaining education is a new field of education reality. The evaluation of edutainment projects must be based on qualified monitoring of the ratio between the educational and entertaining activities related to the target group. Not all the products of the entertaining industry available on the market contain enough educational features. Often the entertaining part prevails which is – based on the marketing point of view - more attractive. A lot of meaningless computer games that are based only on the number of soldiers shot is to be presented as a proof of the tendency as well as the wide spread infotainment in the mass media based on tabloid and sensationalist news broadcasting.

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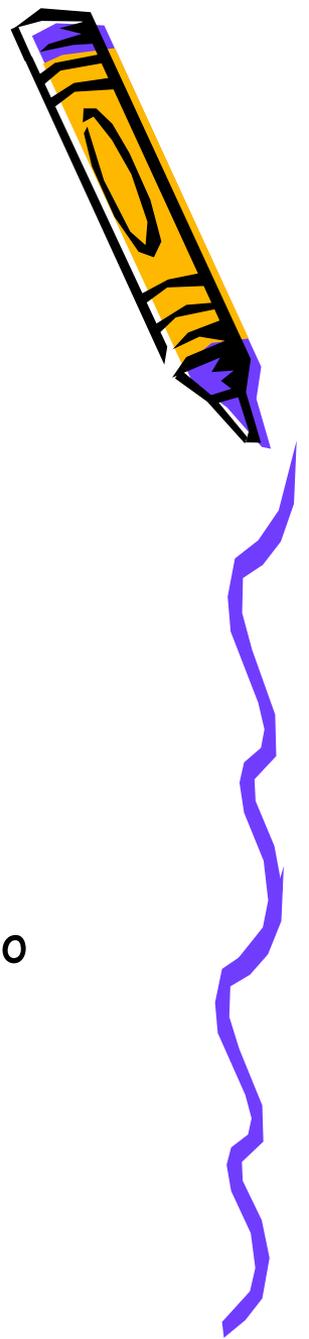
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**Key words:**

Brand lands, education, edutainment, Game Based Learning - GBL, play, mass media, infotainment, information technologies, interaction, media, multimedia, attitudes, programming, experience, simulation, education, leisure time education, teaching, entertainment, experiential pedagogy, feedback, simple experiment, didactic game.

# Edutainment or Entertainment



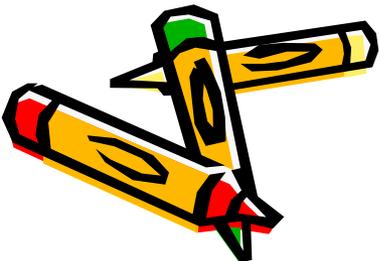
## Education Possibilities of Didactic Games in Science Education

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# EDUTAINMENT

What does the word mean?

- the word is a compound of two distinctive words
- EDUCATION and
- ENTERTAINMENT
- At first sight, the two hardly compatible terms form a new field of educational reality



# Definition of Edutainment

- Edutainment is a distinctive form of entertainment that enables the participants to be educated
- e.g. get new information from various fields of our life
- or even brought up
- their attitude, values and behavioural patterns could be influenced. Education in these cases takes place without the participant noticing the process itself. There are many new means used in the process - experiential pedagogy, medial pedagogy, IT virtual reality etc.



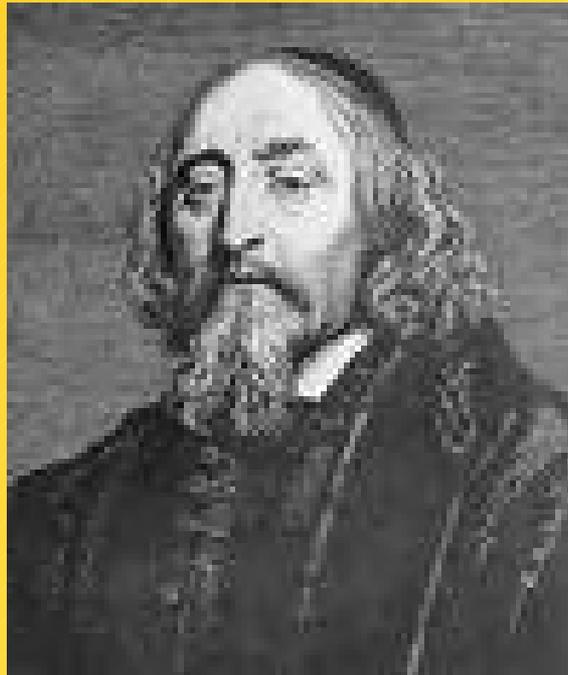
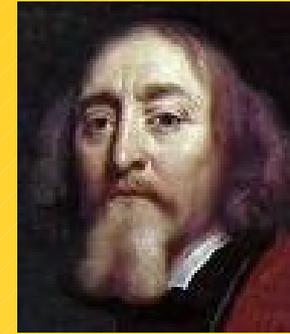
# History of the Entertaining Education

- The idea of entertaining education is not that new in the history of education science.
- the concepts and their creators supported the
- idea of joy,
- entertainment,
- play
- illustrative methods and etc.,
- just to make the process of learning for the children pleasant



# SCHOOL as PLAY

- J. A. Komenský (1592 - 1670)
- First of all Czech educator who is often associated with the term "school as play" belongs to the pool of significant thinkers



# SCHOOL as PLAY

- J. A. Komenský (1592 - 1670)
- refers to the play in his whole work and in fact he understands the play in two meanings:
  - 1) play as a theatre performance that focuses, for example, on dramatization of a historical event or other educational material
  - 2) and play as a didactic "joyful" method that should help to educate body or mind - "joy of play"



# Edutainment as an Educational Concepts

- characteristics focus on the precise definition of pedagogical definition of play and at the same time it shows the fields of intersection with entertaining education
- **ENTERTAINMENT** - amusements and joy are the main motifs why people go for the activities. Boring lessons could be replaced by plays



# PLAY

- Free activity of a group or an individual person (child or adult) limited by a certain time period. The topic of the play sources in the interests of the group and the meaning is to be found directly in the play or is outside the play (for example incentive or target). The play brings the satisfaction of the needs, enjoyment, entertainment and also some knowledge and experience for the players.



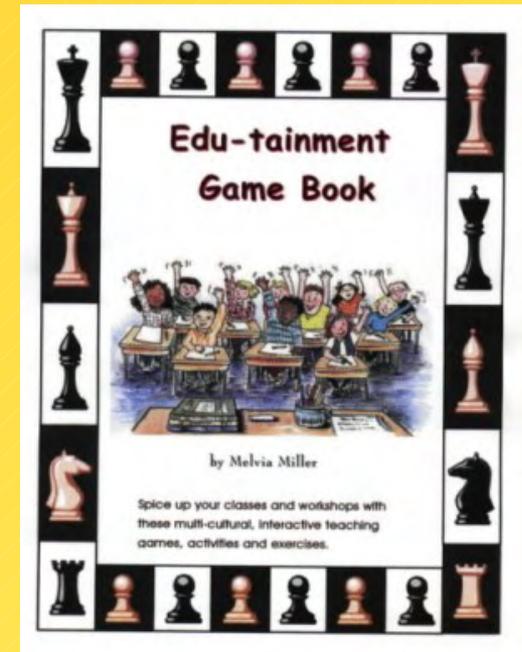
# EXPERIENTING

- Play is classified (together with edutainment) as one part of the experiential pedagogy
- Experience, based on own and unique experiencing create the solid base for a possible change of the personality



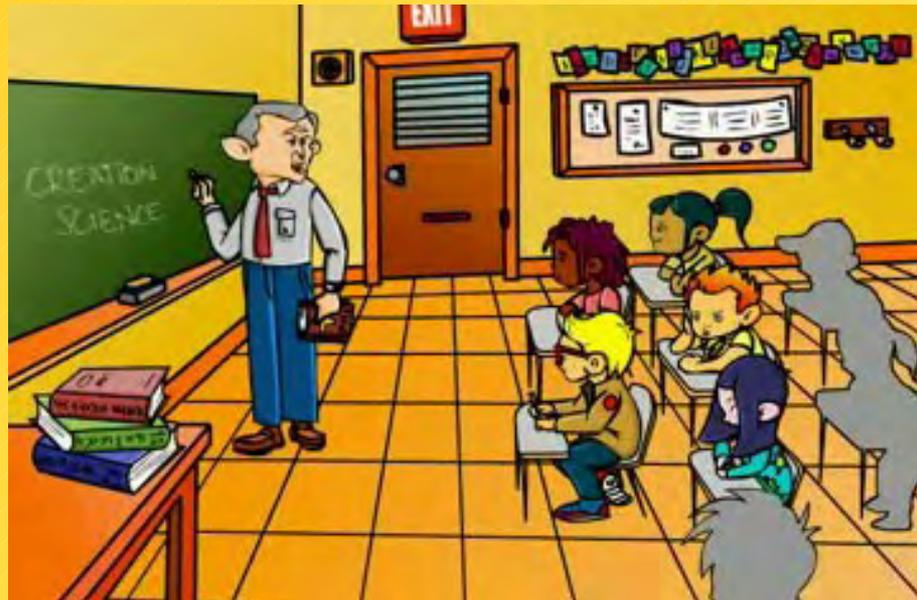
# MEANING OF LIFE

- During the pre school age, sometimes even at younger school age, the play is the unique natural activity that is necessary for the personality development in full harmony



# SOCIAL ROLE

- If we enter the world of play or interactive entertainment, we usually accept the role which is described by defined sets of rules



# SIMULATION

- Each place is in its nature simulative as it always pretends or imitate. The base of the simulation (especially in so called simulative games) is to create a pattern that represents the real life



# COGNITION AND SELF COGNITION

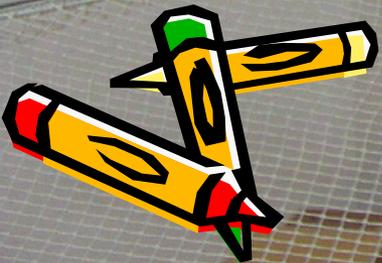
Plays enable the teachers to learn more about their pupils and in a different way than from the classroom or any other usual habitat.



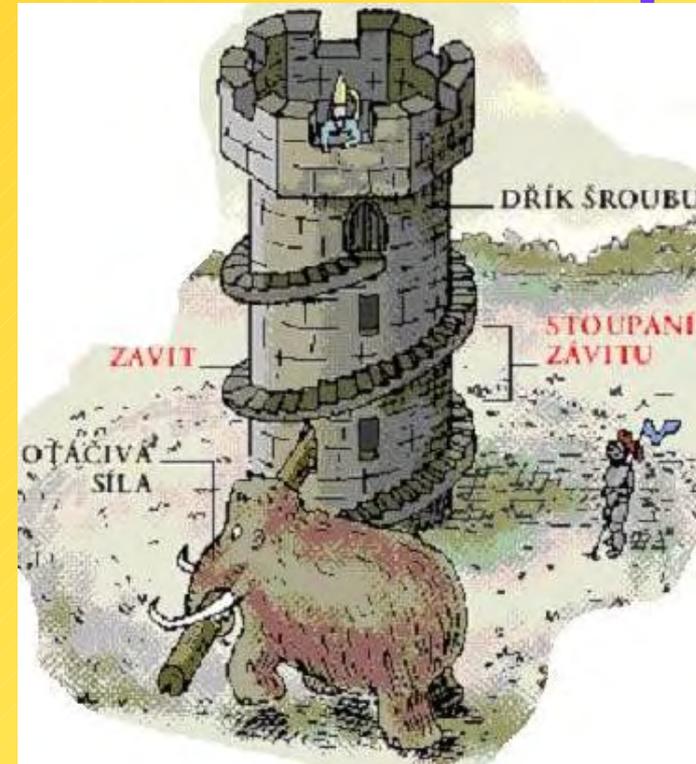
# Edutainment



in the mirror  
of the world  
today



- Edutainment in educational institutions
- Museums and children museums
- Leisure time and ecological education centres, zoos
- Information and communication technologies
- Mass media
- School - didactic games and experiments at school



# Didactic science games

- Didactic science game is edutainment.
- Didactic science game is motivational impulse and/or incentive.
- Induced needs (in combination):
  - sensual and motoric activity
  - credit and prestige in society
  - self fulfilment in game and entertainment
  - cognition
- Kinds of didactic science games (no exact limits):
  - **Game with a toy**
  - **Competitive game**
  - **Problem game**
  - **Project game**



# Hands-on experiments and didactic science game

Hands-on experiment and his characteristics:

- Transparency
- Quality
- Undemanding technical realization
- Problem
- Inexpensivity
- Development of students' experimental skills and creativity.

Hands-on experiments with everyday objects can be used in didactic games.



# Play with a toy

- The toy is an object with the accented characteristic - elasticity, colour, special behaviour etc.
- The toy in the form of hands-on experiment induces the need of sensual and motoric activity.
- Relaxation role of the didactic game with a toy is high-level.
- A lot of toys are commercially produced.



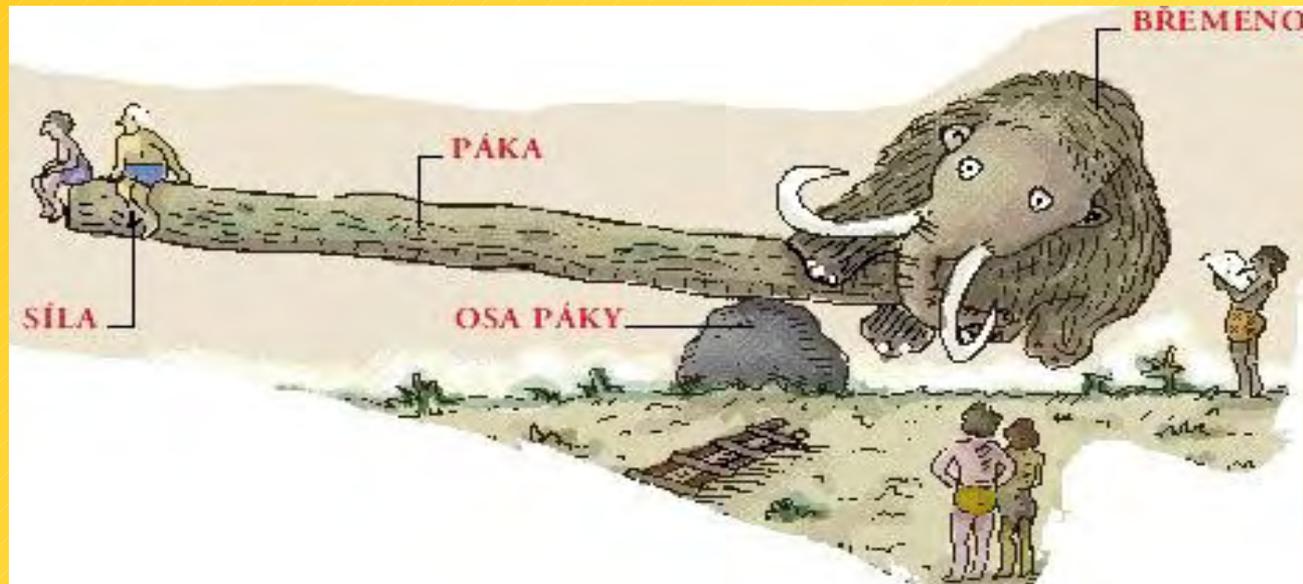
# Competitive game

- The competition is aimed on high-level realisation of experiment.
- The competitive game induces the social need of credit and prestige in society (to win).
- Hands-on experiment is insert into competitive game as the central object the game runs on.



# Problem play

- The problem has the form of brain-teaser, explanation of trick and/or paradox etc.
- Problem play induces cognitive need to solve a problem.
- Hands-on experiment is the central object with the problem.



# Project play

- The project is the complex problem with outcomes and team-work.
- Project play induces cognitive need to solve a problem and to assert oneself in a team.
- Short-time projects is needed to create by the time limit.
- A hands-on experiment and/or aids are outcomes of the project.



Thanks a lot for your attention

