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## Learning through investigative games and internet on-line activities

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### Abstract:

*Internet is an important phenomenon in our society and already become one of the mostly used media around the world. In human history this is the first media, which is broadly used in so little time. Obviously, it plays an important role also in the life of our children. They use it for communication with each other (chat, email), they use it for finding new information to school, and they search the web or even create their own websites. The investigative games on internet are competitions, through which the pupils can develop large variety of skills in information literacy and problem solving competencies. The aim of the project was to improve student's skills in cooperation and collaboration, also skills of analyzing information and taking the responsibility for their own decision and skills in problem solving in real context.*

## 1 New competencies of society in general

Many recent research articles are dealing with the growing challenges for teachers. These are the challenges of the new millennium, before all teaching and learning by the information and communication technologies. In 1998 the World Educational Report (see UNESCO [1]) is describing the radical changes, which have to arise in the traditional learning and educating:

*“New possibilities are emerging which already show a powerful impact on meeting basic learning needs, and it is clear that the educational potential of these new possibilities has barely been tapped. These new possibilities exist largely as a result of two converging forces, both recent by-products of the general development process. First, the quantity of information available in the world – much of it relevant to survival and basic well-being – is exponentially greater than that available only a few years ago, and the rate of its growth is accelerating. A synergistic effect occurs when important information is coupled with a second modern advance – the new capacity to communicate among the people of the world. The opportunity exists to harness this force and use it positively, consciously, and with design, in order to contribute to meeting defined learning needs.”* (Source: World Conference on Education for All. Meeting Basic Learning Needs, Jomtien, Thailand)

There may be difficult debates about what education is. Is it just the transfer of certain knowledge? Is it more linked to the development of human beings? It is obvious, that in the modern society the transmitting of the knowledge from teachers to pupils calls for new methods. The teachers have to keep up with the times, they have to be able to work with ICT and they have to be prepared for the changes in the society. We can compare the education in the modern society to an economic activity. We can describe the knowledge as the raw material and the Education as the activity itself.

## **2 Internet: a tool for achieving new goals**

Internet is a new phenomenon in our society and already become one of the mostly used media around the world. In human history this is the first media, which is broadly used in so little time. If we consider the birth of internet to be in the middle 70's last century, nearly after 30 years it is widely used all over the world. Obviously, it plays an important role also in the life of our children. They use it for communication with each other (chat, email), they use it for finding new information to school. They search the web or even create their own websites. But, many researchers in the field of didactics (see [3],[4]) think, that potential of the internet for developing and refining the cognitive process and the mentioned competencies is much higher than we can imagine nowadays.

In an optimal situation the pupils are commonly using internet during the lessons and also at their homework. Searching and processing the findings; sending emails; involving in various online activities; creating web documents. All these should be done on daily basis in our schools. But, before this will happen, we have to think about the way, how to teach internet and how to develop the new competencies on the internet. One of the crucial questions is how to teach students to differentiate between the important and less important information on the internet. On the World Wide Web they can find various data, but not all of them they really need or they will really use. And not all of the information is correct; they have to be aware of it. To differentiate between these things is a really hard task and it is even harder for teacher to find any attractive ways to teach these new competencies. Luckily on the net there are variety of online activities, which could help in achieving these new goals and competencies. Project Sherlock-Holmes is one of them.

## **3 Project Sherlock-Holmes**

The investigative activities are competitions, through which the pupils can develop variety of skill in information literacy and problem solving competencies. The aim of the project was to improve student's skills in cooperation and collaboration, also skills of analyzing information and taking the responsibility for their own decision and skills in problem solving in real context. We are convinced that these activities have positive influence on learning to work with ICT and developing student's information literacy. The activities also give an attractive format to learning.

### ***3.1 History of Sherlock-Holmes investigative games***

Some years ago, when the internet was starting to be widely known and used, a new kind of activities was regularly organized by David Cassey from E-engage Development (not-for-profit company working internationally with schools). The activities were called "Net-detectives". Children had to create groups, register to the activity and on a special day they had to help the police to solve some crimes. They were communicating with the policemen through e-mails. Every 5-10 minutes they received new information about the suspicious persons and then they had to give their comments to police – what to do next, where to go, which person put in prison etc. These whole activities were mostly e-mail based and there wasn't too much searching of new information and learning new things. Based on these activities we decided to create our own activities in Slovak language for students from the whole country. We designed the investigations as a group competition; participating children had to work in teams. The pupils' age was from 12 to 18. The task was usually something like following: on a special day, let's say on 6th December 2006, there was a new activity. We created the activity's website and publish all the necessary information for the pupils in advance. Small groups of students (4-6 in each group) registered for the activity. The

registered teams on the day of the activity got the first e-mail about the fictional crime somewhere in Slovakia (or somewhere else in the world). This crime was the object of investigation through internet. After the first e-mail they received further information every 5-10 minutes by e-mail. These messages contained various additional information and they had to deal with them. Not all of this information was relevant and important; the participants had to decide which were necessary and which not.

### **3.2 Description of the investigation**

The sent messages were not only simple text messages. The e-mails contained new information in various formats, like pictures, sound records, maps, databases etc. Not everything was important to find the criminal; they had to differentiate among all the received messages. This was the point, where they learnt how to decide what is important and what is not. Beside this, many information they had to transform to appropriate shape and form. For example, they received a pictures' negative from a party, where the crime happened. For some teams, it was only an irrelevant negative with no information on it, because they will not be able to read it. But for some other teams, it will be much more. They will create the picture from its negative using graphic editor and finally finding the suspicious person on it how he is leaving the party. From this moment, their investigation will have a completely different dimension and they will be one step ahead all the other teams. Similar situations could happen, when they received a sound record e.g. telephone call between two suspicious persons. There was nothing special on the conversation, but after deep analyzing of the record they could notice some sound in the back-ground (like bells etc.). From this sound a clever detective was able to decide, where the suspicious person was at the moment of the call. This could be crucial for the investigation. There are many examples like these two where the participants need to analyze data not only superficially but deeply and thank to this deep analyzing they could be able to solve the problems.

There is also one important dimension which is not very common in schools. This is the group work. During the whole investigation participants had to work in small teams, coping with other views and perspectives from the rest of the team. Team work is mainly prohibited in our schools and the teachers try to develop individual skills. But after leaving the school, pupils will probably work in teams and it is very important to experience the team work also during the school years. If the team will cooperated and collaborated successfully, they had better chance to solve the problem and the crime. Nobody alone could be able to do it. But together they had a chance to divide the problems into smaller parts and solve partial problems first. In the teams they had different roles like team leader, internet surfer, e-mail writer, database analyzer etc.

### **3.3 Types of activities**

There were 4 different kinds of activities throughout the whole year:

1. Solving various tasks without the help of organizing team in a time limit of 2 hours. It was basically a competition between the teams – who will be the quickest and most successful. Organizing team was in this case just a technical support – if they encountered any problems with receiving e-mails etc. In this type the common problem was that the detectives tried to solve the task very quickly without a deep analyzing of the task. So it happened that many of them sent unfinished tasks.

2. On the website of the activity they had a huge amount of task and they could decide which tasks they will really solve. This kind of activity didn't last for 2 hours, but it was much longer; about 3 or 4 days. At the beginning they decided which tasks they are going to solve, divided them between themselves and on the next 3-4 days everybody was working on their

own task. Before the end of the activity they again met each other, discussed the solutions and sent them to the organizing team.

3. A special program was created for investigation. They had to download it and work with this program only. The program contained various tasks and didn't let them see the next task until they didn't finish the previous one. It was investigation about some crime, but in a completely different way. And obviously they had to learn at first how to use the program. After finishing the last task, they had to send back the program to the organizers, so we could check their solutions.

4. The activity was an online investigation in real time and with a team of police headquarters. This type of activity was the most often used type in the whole project. The task was always different. It could be the following: on the day of the activity, which was announced long enough ago to register to the activity, they received a brief description of a fictive crime. The information was communicated to them by e-mail, but there was also a website containing all the necessary information about the investigation. After the first e-mail they got further information every 5-10 minutes again by e-mail. The messages from the police headquarters were not only simple text messages. The e-mails contained information in various formats, like pictures, sound records, maps, databases etc. Beside this, many information they had to transform to appropriate shape and form. For example, they received a pictures' negative so they had to turn it into real photo, or they had to change in the picture the RGB of the background etc.

### **3.4 Data collection**

During the period from May 2006 to December 2006 there were 8 on-line activities. Average number of the participating groups of students was 30; in every group about 5 children. We collected data from the participants by recording their investigation on the video tape and also in every activity the participants had to fill some forms about their previous experiences with ICT and internet. After finishing the whole project we visited the most successful teams and made an interview with the whole group. Because of the shortage of time from the project final activity, we are at the stage of analyzing all the collected data. This period should last until the end of June 2007.

### **3.5 Preliminary results**

The responses from the students and teachers are very positive. We have got many e-mails from the participants that they had never experience such kind of activity and team work. The teachers especially appreciate the collaboration between the students which was in a very high level. They worked together like a real team with the team leader and distributed the tasks among themselves. It was interesting to see how they wanted to solve every question and they were eager to know more about ICT and how to use it in order to find the results. Students appreciate the use of ICT. They had to use everyday programs in a way they never used it before. There were many reactions like: "I never knew that I can use this program for such a great thing!" Obviously they learned from each other quite a lot. The whole team got the question at the same time and after a couple of minutes somebody from the team managed to solve it. When he/she got the solution, and then showed the solution also to the others. In this way they learned from each other how to do things by using the ICT.

## **4 Detectives and their initial skills**

In every activity the detectives had to fill a questionnaire about their initial skills and experiences. Also they had to write little about their team and their position inside the team.

They had to fill their personal information (name, age, team, position in the team etc). The questionnaire also contained some questions about their skills, whether they used internet before, what kind of programs did they used before, what for did they used the internet etc.

**4.1 Questionnaires from one of the activities**

In the following I would like to show some results from the questionnaire in the activity “Disappeared precious jewel”. Number of the registered teams was 45 and altogether we evaluated 108 questionnaires. I will show only the questions dealing with the internet and using of various ICT tools.

Question: **Which of these activities have you ever used (at least once) in your life?**  
(the number means the amount of the answers out of 108)

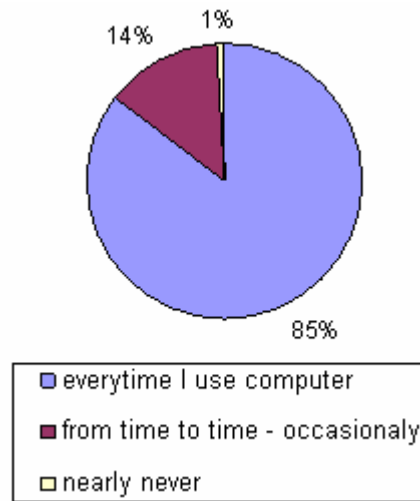
Questions dealing with internet		Questions dealing with something else	
Searching for new information on the net	108	Printing documents on a printer	94
Sending e-mails	106	Using MP3 player	88
Registered on various websites	98	Using Pen Drive	85
Using some kind of chat on the net	95	Using Scanner	73
Making a phone call through the net	59	Install additional PC components (printer etc.)	69
Using the program ICQ (or similar)	55	Install a completely new computer	48

What kind of program children used the most?

The most used programs among the participants were office programs for text editing, creating tables or presentations. Quite popular are programs for playing videos, sounds and sending messages. Less popular are specialized programs for a special kind of activity: sound editing, animation editing or video editing. Use of computers and internet is shown at the following graphs:



How often do you use computer?



How often do you use internet?

**5 Example of an investigative game: Disappeared precious jewel**

In this activity the crime was situated to Venice. Our police headquarters has visited a young lady (from somewhere abroad). Nobody could understand her single word. The first task of

the detectives was to find out from which country is she from. In case of a correct answer the headquarters was able to hire an interpreter, so we could understand her language.

Nearly in every activity they had to solve problems like how to get from place A to place B by different objects (car, bus, train etc.). In this case it was a plane. We wanted to have a task which is not quite easy to be solved, but still could be solved in not very long time. We decided to have the nationality of the young lady being Finnish. The language is not common in Slovakia, so it wasn't an easy task. But after a short search on the internet (the words, what we had from the young lady) they could find out the country. Then they had to find suitable connection through plane from Helsinki to Venice. There are several webpages, which offer flight connection from different places to Venice. We suppose that the children have never done something like ordering tickets for travelling with airplane.

Nearly all of the teams did find out the nationality correctly for the first time. There were 3 teams, which gave wrong answer: Italian, French and Spanish nationality of the young lady. In this case the headquarters wrote back to the detectives, that we have an interpreter in that language, but the young lady still doesn't seem to understand anything. Try some other languages. After several tries we sent them message that she has on her t-shirt Helsinki. After this everybody was able to find out the language.

Some of the teams did find much more information then we asked for. They didn't find out only the nationality of the lady but also found translation of the sentences what she was saying at the headquarters.

This task we considered to be a well defined problem with only one possible correct answer (see [10]). We didn't provide any kind of help in how to solve the task. We could help with additional information, but we did not give any suggestions, that they should use this website or something else. Everybody had their own ways of finding the answer.

After finding the nationality of the young lady, the detectives learn more about her and about the whole story. From this moment the investigation was divided into several aims:

1. the most important thing was to investigate the thievery of the lady's jewel, identification of the the criminal in one of the planes, following his moving on the map of Venice and finally his arresting.
2. To the less important line belonged the story of detective Marc, who at the beginning of the story became personal bodyguard of the young lady. Detectives helped him to find something usefull to do in Venice for them. They helped Marc to find a nice gift for the lady and also to hire a boat in Venice.

In order to find a suitable gift for the lady, they had to find some information about her home country. They had to search for traditions in her country and tried to find something suitable for her in Venice – so she could feel like at home.

## 6 Advantages of investigative games

- **Cooperation and collaboration** – as it was mentioned before, this is the dimension which is not very commonly used in our schools. By all tests, written exams or by answering questions in front of the class, the teacher will never allow students to communicate together or to collaborate during the tests. We try to educate the students as individuals, never to work in

team. This is obviously very good in some ways, but we don't have to forget, that after school students will be employed in various companies. They surely will belong to a team or some of them will even be team leaders. Unfortunately our school does not prepare them for this task.

This is the point where the investigative activities appear on the scene. During the investigation they have to work together, they have a team leader and they have no choice, they have to collaborate. The team consist of 4-6 members where all of them have their own task. If one of them will not work properly, the overall outcome of the whole team will be worst.

- **Analyzing information and responsibility for own decision** – working with information is very common in every school on every learning subject. During history lessons they learn about various historical events, they analyze information. During physics or chemistry they are engaged in various experiments and tests. Again, they analyze information. But, in all these cases, every time there is somebody, who can they ask when they are in trouble. There is always a wizard or magician, who knows nearly everything and has the answer to all questions. We usually call this magician simply teacher. During the investigations at online activities, there is no wizard, no magician who can they ask. Obviously there is a teacher, but he does not know the result and has no answers. They can only count on themselves. Only they alone will decide which information is important and which not. They take the whole responsibility for their own decisions.

- **Internet, ICT and information literacy** – during the whole activity the participants will use the internet as the main communication tool. They have to write e-mails, answer questions, search the web for relevant information. Beside this, they will have to use programs they never used before. For example, for the analyzing the sound records they will have to download a program by which they will be able to read more information then others. Or other example: they will get code breaking program and will have to use this program during investigation. So, we are testing them how can they cope with new situation, on which level is their information literacy and whether they can use ICT programs they never used before. And obviously whether they can use the internet for communication and for finding new information.

- **Attractive ways of learning** – usually children do not like to learn in traditional way. They like to play; they like to construct their own knowledge of things; they like compete with each other, even better if the competition is between children from the whole country. This is the situation at investigative online activities. The activity is prepared for every school in Slovakia. The pupils know it and they try to have as good results as possible to be the best. At the same time, they learn about new things, they have big motivation to find new information about Slovakia and about other places.

- **Problem solving in real context** – the result of pupils from Slovakia in PISA 2003 in problem solving (see [5]) was below the European average. In the test they had to proof, that they are able to solve problems from real life, not only mathematical equations. They were tested, whether they could understand the problem by determining relevant conditions. This requires analytical, quantitative, analogical and combinative justifications, which are the core principles of problem solving competencies. This is exactly what happens during investigative activities. They have a real problem, they have to analyze it at first, try to find partial solutions and then proof their assumptions.



## 7 Conclusions

We are convinced, at the department of informatics education at Comenius University, that using internet is at present neglected in our educational system. We are convinced that internet can be used in highly productive and constructive way in the cognitive process. We also think that on the internet there could be developed environments which (in a large measure) develop students' information literacy. We think that these environments have really positive influence on pupils and elaborate important skill like problem solving competencies and internet competencies.

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