Methodology for using games as an educational tool

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Abstract - To motivate today’s students that have access to various learning online platforms and use computers and different mobile devices every day, as a teacher I am forced to constantly change and use a variety of teaching methods. This paper will describe the methodology for the following types of games: guessing games, conclusion games, competition games, memory games, knowledge and validating resources games, games played in pairs. These games are intended primarily for teaching computer science subjects. Activities listed in this paper can help create an active learning environment and encourage teachers to look further for the better solutions of their application.

Keywords - guessing games, conclusion games, competition games, memory games, knowledge and validating resources games, games played in pairs

I. INTRODUCTION

A game is a structured form of play, usually undertaken for enjoyment and sometimes used as an educational tool. [1]

Playing games shouldn’t be just one of the side-effects of teaching work, it should be part of the student's reality. The purpose of this article is to help teachers find a game that will best suit their group of students at a certain point in time. Some of the games are shown in several variations; I hope that this can inspire teachers to explore further ways of changing and adapting the proposed games to the specific requirements of a particular group of students. Regardless of their age, a group of students differ in their likes and dislikes of a certain activity, and the teacher's attitude towards games has an impact on students.

This paper will describe the methodology and the examples for the following types of games: guessing games, conclusion games, competition games, memory games, knowledge and validating resources games, games played in pairs. An objective for each game is described in the Table I. The game division and the ideas for the games came after reading a book intended for teaching foreign languages: “A game is a game is a game [2]”.

These games are intended primarily for teaching computer science subjects. They were designed and implemented during several years of teaching different ICT subjects in the 4-year programme: Computer engineering technician in the Electrical Engineering Vocational School Zagreb.

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<td>Guessing game</td>
<td>Guessing a concept (term) on the basis of very little or no data or information.</td>
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Games described in this article showed the best results in motivating students to achieve their learning outcomes. Examples described for each game were used during teaching different computer science subjects. The methodology for each game was used in more than one subject.

This paper is a practical result of years of inventing and testing different games and approaches to motivate students to participate more in the classroom.

A. A Good Detective

Students gather around the table that has different printed cards; there is one card more than the number of students. [2] The teacher explains the rules of the game: all characters are suspected to have participated in a cyber-attack, but only one character has committed the attack, and that character has no alibi. Also, the teacher explains the nature of this cyber-attack. For example, a cyber-attack in which a hacker accessed Google's corporate servers and gained access to a database...
containing classified information. The teacher can also leave a short description of the cyber-attack on the table so students can see it while asking questions and giving alibies.

Students have some time to memorize the cards with the characters (about two or three minutes). The teacher takes away the cards and shuffles them, then gives each student one card. Students mustn’t see the cards held by other students.

The teacher has that one, extra card for the character that has committed the cyber-attack. The teacher then places that card on the table, face down. Nobody knows what character is that because the card is placed face down. Only the teacher knows that all students are innocent and that the card placed on the table is the criminal.

Students now accuse for the crime each character that they can remember. A student who has that character needs to explain his/her alibi. Alibi is an explanation for the character’s vocation. If the student gives a valid alibi, he/she places the card back on the table placing it face up.

For example:

Student number one: I accuse the AutoCAD designer!

Student number two: (the student who has the card with a picture of the AutoCAD designer) No, the cybercrime that was committed has no connection to that field. AutoCAD designers are drafters that specialize in the use of computer-aided design software to create digital technical drawings.

The game is over when each character is mentioned, and all alibies are given. Then the card that was left on the table face down is turned over. Each student needs to give a reason why this character has committed the cyber-attack.

This game can be played in two groups. The first group is playing while the second group is monitoring their activities, then they switch roles.

To prepare for this game, the teacher needs to print the cards with the objects. The estimated time for smaller group of students (up to 14 students) is 20 to 30 minutes.

C. What Does the Word Mean?

The teacher writes one word on the board. Students need to explain what that word means. To answer, they can only ask the teacher questions that can be answered with yes or no. [3] For example, this game can be used in repeating learned concepts from various programming languages.

For an advanced level of this game, the teacher can use pieces of code, and students need to guess the function of that code segment. Also, the teacher can give a list of specific sets of commands and students need to guess what they are used for (e.g. configuring a wireless router, creating a database, etc.).

To prepare for this game, the teacher needs to prepare terms, pieces of codes, sets of commands used in the game. Materials for the game can be printed, shown as a PowerPoint presentation or written on the board. The estimated time for up to 10 terms and for a group of students (up to 14 students) is 20 to 30 minutes.

II. Conclusion Games

A. Problem Solver

The teacher gives each student his own problem to solve. In doing so, the teacher can write down guidelines on how to find the answer to the given problem, what needs to be researched and taken into consideration.

For example: “A friend of yours is a painter and wants to open a web shop so he can sell his paintings. Create a concept for that web shop.”, “You have an apartment rental agency and need to create a web page to promote it. Create a concept for that web page”, “Your sister and her friend have a small office. They want you to create an office network for them. Create a basic concept of that network”, “Build a concept for the weather station for one flower plantation”, etc.

To do the necessary research and solve the problem, students can use books, other written materials and Internet resources. Each student has 30 to 45 minutes for doing the research. Each student needs to present the solution for the specific problem to the rest of the class.

A simpler version of this game is to put one problem and guidelines on the board for all students. Students can do the research in pairs or groups. At the end, each group can present their solution to the rest of the class.

To prepare for this game, the teacher needs to print the problems and guidelines, prepare books or other written material. Each student must have access to a computer and the Internet. The estimated time for a group of students (up to 14 students) is up to 90 minutes.

B. What Category Is It?

The teacher has up to 20 cards that have pictures of different objects. The teacher puts pictures of the objects on the board. Students need to group the pictures into
categories, such as networking devices or computer hardware. There can be two or more categories.

To prepare for this activity, the teacher needs to print out pictures with objects.

The estimated time for a smaller group of students (up to 14 students) is up to 10 minutes. If this game is played with the whole class up to 25 students or more, students can be divided into groups and each group can have its own category. After they sort the objects into categories, students need to present their category to the rest of the class. The estimated time for a larger group of students (whole class divided into groups) is up to 45 minutes.

III. COMPETITION GAMES

Guessing and conclusion games can be modified to become a competition game. Competition games give students an opportunity to prove their competences under pressure, to learn to win and to lose. The main objective for implementing these types of games is strengthening the psychological stability of an individual.

A. What Is It? No Questions Asked!

The teacher prepares up to 20 different terms (or, for example, problems). The teacher explains the term or the problem to students and they need to guess the term or figure out the solution to the problem. Students aren’t allowed to ask the teacher any questions. They can discuss among themselves or use learning materials.

The student with the most correct answers wins the game.

To prepare for this game, the teacher needs to prepare terms or specific problems. Each student must have access to a computer and the Internet. The estimated time for a group of students (up to 14 students) is up to 20 minutes.

B. Programmer

The teacher gives each student the same task. To solve the task, each student needs to write a code in a specific programming language (or, for example, to fix errors in the code and make the program functional).

Students have 30 minutes to do the given task. Assignments are submitted and the teacher evaluates the best solution. After all the students have submitted their assignments, the teacher can show one of the probable solutions.

The winner is the student who finishes the assignment first, and then he/she explains the solution to the rest of the class.

To prepare for the game, the teacher needs to print the programming task and guidelines or other necessary written materials. Each student must have access to a computer and the Internet. The estimated time for a group of students (up to 14 students) is up to 45 minutes.

IV. MEMORY GAMES

A. Match Pairs Memory Game

Students need to match a term or a concept with its definition or explanation. For example, the term can be “IP address”, and an explanation would be “A unique string of numbers separated by full stops that identifies each computer using the Internet Protocol to communicate over a network”. In teaching programming, students can match parts of the code with the explanation what that part of the code does in a specific program. Also, students can match commands with an explanation for that command.

The teacher can use an online tool to create the matching pairs game, so each student can play for himself/herself. If students don’t have access to computers, the teacher can print the term or concept and its definition or explanation, divide students into pairs and let them play the match pairs memory game in pairs.

To prepare for this game, the teacher needs to prepare an online game or print out the necessary materials keeping in mind the number of students in the classroom. The estimated time for this activity is up to 15 minutes.

V. KNOWLEDGE AND VALIDATING RESOURCES GAMES

A. A Quiz

A quiz consists of various types of questions such as Multiple Choice, Yes or No, Fill in the Blank, Matching, Definitions, Open-ended, etc. It can have a time limitation implemented on the whole quiz (for example: a quiz with 10 questions can last 20 minutes) or each question can have its own time limit (for example: multiple choice-1 or 2 minutes, writing the answer-5 minutes).

Questions can be created in a way that students need to research a specific topic and validate found information to write an answer.

To prepare for this game, the teacher needs to prepare a quiz (using various online platforms such as Moodle, Edmodo, Schoology, etc.). Each student must have access to a computer and the Internet. The estimated time for a quiz activity depends on the level of difficulty. Quizzes can be used as a method for repeating learned outcomes, testing the level of achieved learning outcomes, researching a specific topic or problem, or as an introduction to the learning outcome.

The estimated time for the quiz activity depends on the number of questions asked and their difficulty.

B. A Quiz - Without an Online Platform

The teacher reads a question and students answer. Also, the teacher can give a more difficult question that requires from students to go through the written materials and evaluate researched data and then give an adequate answer.

To prepare for this type of a quiz, the teacher needs to prepare and print out questions, written materials (books, technology magazines). The estimated time depends on the number of questions and level of quiz difficulty. The
estimated time for a group of students (up to 14 students) is from 10 to 20 minutes. If the whole class is involved in this activity, students can be divided into groups and the activity can last for 45 minutes.

C. An Empty Nutshell

The teacher divides the class into teams (four or five teams, depending on the number of students in the class). Each student gets a picture or a term that only he/she can see. Then each student needs to write several sentences (a description) about that picture or topic. Each group reads the explanation for their topics and students from other groups try to guess what the answer is. [4]

This game is over after all students have presented their object, terms or topics. The point of this game is not to guess the answer. The winner is the group that has written the best descriptions in the sense that others couldn’t guess the correct term.

It is not necessary to divide students into groups; descriptions can be read in front of the whole class. All students can try to guess the answer.

To prepare for this activity, the teacher needs to print out objects, topics or terms for each student. The teacher can also prepare additional questions to help students write down the necessary descriptions. The estimated time for the whole class (up to 22 students) is up to 45 minutes.

VI. GAMES PLAYED IN PAIRS

Most of the games mentioned in this article can be modified to be played in pairs. In that case, the teacher needs to prepare a larger quantity of written materials for the students.

A. Describe and Arrange

Students are divided into pairs. Each pair gets their own set of pictures and articles. The teacher writes several categories on the blackboard. Students must read the material first and organize pictures under each article. Then, each pair of students needs to put their articles and pictures under a specific category on the blackboard explaining why they chose that category.

For example, when learning about computer hardware, the teacher can use different technology magazines (such as Bug or PC Chip in Croatia) to prepare the necessary pictures and articles. The categories in that case can be Input Devices, Processing Devices, Output Devices, Memory/Storage Devices, etc.

For students that have basic or advanced knowledge of different programming languages, they can first match a command with its description (basic level) or part of the code with its function in the program (advanced level). Then, after doing so, they organize given commands or parts of the code under the programming language category.

While each pair is sorting their materials under the category written on the blackboard, other students are listening and stating their opinion on the chosen category.

To prepare for this activity, the teacher needs to prepare the necessary written materials, pictures and articles for each pair. The estimated time for a smaller group of students (up to 14 students) is up to 45 minutes.

B. The Empty Office

Students are divided into pairs; each pair has a different assignment. The main task is to equip an open office space for a small company (for example: architect's office, programming office, etc.). Depending on the number of pairs, a different task is given to each pair. For example: the first pair needs to order the necessary equipment from the computer store, the second pair needs to recommend the number of computers and a minimum computer configuration needed, the third pair needs to recommend and order additional equipment (such as printers, scanners, plotters, projectors, etc.), the fourth pair needs to configure a network and order the required equipment from the store, the fifth pair needs to recommend all the necessary software for that company and the cost for each software (such as operating system, Office, AutoCAD, programs for editing pictures, videos and sound, etc.)

At the end, each pair presents their work to the rest of the class. Students can write down their answers and post them on the blackboard, or the game can become a project where each pair will create a poster with all the necessary steps they had to take and the pictures for the hardware ordered from the store. If students have access to a computer classroom, the game can be played in a way that they put their solutions on Google Drive (the teacher can create a folder and share it with students) and then present their work to the rest of the class as a presentation.

To prepare for this activity, the teacher needs to prepare written materials and questions that can help each pair come to the solutions for the given task. If the students have access to a computer classroom, the teacher can prepare guidelines for searching the Internet to find the required information for completing the task. The estimated time for this activity is up to 90 minutes; also this activity can become a project assignment.

VII. CONCLUSION

As a teacher I am forced to constantly change and use a variety of teaching methods to motivate today’s students. Games are one of the easiest ways to encourage them to start mastering learning outcomes more effectively. Playing games shouldn’t be just one of the side-effects of teaching work, it should be part of the student's reality. The attitude of the teacher towards games plays a major role in their implementation.

I have applied the described methodology in my personal work with students during the period of several years. As a teacher I have noticed that applying these games made my work easier. Students were more motivated and have shown better results in achieving the learning outcomes.

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REFERENCES


