Experience in Designing and Developing the Educational Game BlockSolver

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Prerequisites

- Each year, the amount of information in the world is constantly growing.
- Every young professional starting a new career path has to study a huge amount of information.
- The high tech sector is growing and requiring qualified resources.

This brings up a question:

How can we prepare a qualified professional and teach him/her not only what his/her predecessors studied several years ago but also the new and relevant approaches and methods that have emerged just recently and preserve the interest and engagement at the same high level during the whole study period?

A critical aspect of that question is to preserve the interest and engagement at the same high level during the whole study period.
Gamification

- The video game industry has been consistently growing since 2016 and is unlikely to slow down
- 64% of the general U.S. population are gamers
- The average male gamer is 33 years old
- The average female gamer is 37 years old

Gamification in education is a learning approach where theory is accompanied by integrated visual images and motivational aspects. The main advantage of this approach is the high student engagement.
Gaming project types

1. Game projects focused strictly on training.
   Its main goal is to convey new information to the gamer (i.e. student).

Examples:
- CodeWars (codewars.com)
- CodingGame (codingame.com)
- Lifesaver (life-saver.org.uk)
- Duolingo (duolingo.com)
- Ribbon Hero (outdated)
Gaming project types

2. Game projects oriented at entertaining the gamer with the process, which also allows him/her to learn new information.

For the most part, such projects provide tools for game interaction by means of game mechanics.

Examples:

- Shenzhen I\O (zachtronics.com/shenzhen-io/)
- While true: Learn (luden.io/wtl/)
- Factorio (factorio.com)
- PC Building Simulator (pcbuildingsim.com)
Key ideas of the BlockSolver project

- Develop a 3D graphics software that can be used for learning
- As the studied material, use LIFO (Last In First Out) and FIFO (First In First Out) manipulation methods
- Provide the user with the ability to control the character and move certain data blocks in containers. The game ends when all the blocks are in place.
- Allow the gamer to create his/her own tasks.
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**Example of a task**

<table>
<thead>
<tr>
<th>Container X, LIFO</th>
<th>C</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container Y, FIFO</td>
<td>A</td>
<td>D</td>
</tr>
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- «Blueprint» visual programming system
- Programming language C++
- Best visual implementation (among popular, free, game engines)

- Free.
- A large amount of materials for learning.
- Visual Studio Support.

- Unity3D was chosen as a platform for «BlockSolver» due to a more flexible approach as opposed to Unreal Engine 4, which allowed creating the first prototype significantly faster.

- «Drug-and-Drop» workflow.
- Programming language C#.
- Convenient and simple graphical interface.
- High speed of development.
- Excellent multi-language online documentation.
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- Unity platform that can be used for free unless it generates an annual revenue of $100,000.
- Free version of Visual Studio 2017 — Visual Studio Community
- Blender, a free 3D editor.
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BlockSolver Modules

- **Game module**: software component which implements the main game mechanics responsible for interaction of gamer (character) with the virtual environment (current level).
- **Level builder**: a module that is based on game module mechanics and which allows to develop new interaction schemes.
- **Navigation module**: provides a graphic interface, which the user uses to move between the game module levels, level builder, and other additional information presented in BlockSolver.

![Diagram of game development process]
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Implementation

- A free 3D model of a humanoid robot from official Unity Asset Store has been chosen as a user character.

- It required comparing the bones of the model skeleton to those of the standard Unity humanoid.

- Other 3D models (such as blocks and containers) used in BlockSolver were developed individually in the Blender editor.
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Implementation

- The 3D models were rendered by means of Unity platform
- All application logic implemented in C#
- JSON format is used to save data
- Each level BlockSolver is stored in a separate file and is independent of others
- The development of level builder was based on gaming mode implementation
- Navigation module development was based on description of transition logic between windows and modes of the application
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The result
- The project with source code includes almost 4,000 files. The majority of those files are generated by Unity platform.
- Some 60 files were developed individually, with more than 25 classes implemented in them, while the total number of code lines equals more than 2,500.
- The size of the solution is 80MB and includes the executable code, engine library, code interpreted by JIT and files with levels description.

BlockSolver requirements
- OS - Windows 7
- CPU - 2GHz
- RAM - 2GB
- ROM - 200MB
- Video Card – with support OpenGL or DirectX
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Demonstration
Prospects

- To make it available online via browser
- To implement the identification of students
- To allow the administrator to supervise the tasks and track the results, to control the academic schedule
- To save the number of attempts and time spent on each level.
- To calculate the average statistical data and range the results accordingly
- To make use of competition: to compile and publish ratings and increase motivation of users to develop new optimized solutions
- To invent and implement new blocks and containers
Thank you for attention!

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