INTERACTIVE EDUCATIONAL TOOL
FOR DIGITAL PRINTING SYSTEM

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Abstract

New education tools are increasingly present. The development of technology enables the improvement of learning techniques. Given that the main goal of successful education is a trained student, which can operate independently, it is necessary to give the student more efficient and faster way to acquire needed knowledge for practical work. In graphic arts industry, students need to be familiar with a large number of printing machines, devices and software. In these and similar educational programs, interactive learning technologies can be applied to demonstrate various procedures and operation on particular machines, its circuits and functions. This work aimed to create an interactive presentation of the digital *electrographic* printing machine for educational purposes. The paper explains the production of 3D model and animations using one software and making an interactive presentation in second. The development of interactive presentation implies access to the real-world machine, its analysis and access to the technical documentation on the basis of which modelling and animation are carried out.

Keywords: *educational tool, digital printing, interactive software*

Introduction

The reasons for the introduction of new learning techniques are many. The benefits of e-learning when it comes to influencing participants are:

- Enabling users to participate in the teaching process;
- Flexibility regarding time and location;
- Reducing costs and time for educational institutions;
- Encouraging the determination of an independent pace and learning methods, creating learning that is directed towards a student;
- Providing unlimited access to learning material;
- Allowing adding materials that are kept more efficiently.

The new concept of education involves linking theoretical knowledge and practical skills. In this way, students can control, design, test and materials according to their needs. The combination of traditional approaches to

education and online learning leads to the development of a concept called *blended learnin*g. The concept of *blended learning* is a combination of traditional educational methods with activities and resources available through the e-learning system (Despotović et al. 2008).

Multimedia is a potentially powerful learning technology, a system that can improve the learning process. The practical goal of this researching is to develop the most effective principles of multimedia presentation design.

Instructive methods, lesson design

Instructive methods are ways to present a lesson, e.g. spoken or written text in combination with animation. The method does not alter the content of the lesson; the material is the same regardless of the way it is presented (Mayer, 2009).

What makes a well-designed multimedia lesson presented with a computer is as follows:

1. The presentation should consist of pictures and words (e.g. narration and animation, not just narrations). Therefore it should be multimedia.
2. Appropriate parts of animation and narration should be presented simultaneously.
3. It is necessary to present only key information for explaining the cause and effect, without unnecessary additional words, sounds or images.
4. It is best to present the words in the form of a narrative simultaneously with the picture presentation. The presentation should be directed to both channels of the cognitive system at the same time.
5. The lesson should not be too long.

This work aimed to create an interactive presentation of the digital printing machine. Before the modelling of the machine, a large number of photographs were collected. They served as a reference during the modelling process.

Visualization

Several types of visualisation are used today. They are videos and images, 2D animations and 3D animations. 3D animation provides the highest degree of photorealism and is therefore used in the development of this education tool. Nowadays, 3D animation is the most common type of visualisation. The 3D software requires powerful computer configurations just to run them, and even more powerful to get the desired photorealistic rendering. Production of the 3D educational tool takes a lot of labour, money and time, and therefore tool has to be well designed to be cost-effective.

Software analysis

Two programs were mostly used in the application development: Autodesk 3D Studio Max, for 3D modelling and animation, and Adobe Flash for creating the interface and shaping an interactive presentation.

3D Studio Max is one of the most used software on the market. It is suitable for creating solid models, machines and modelling of architecture. Other similar software on the market could be used for these purposes, for example, CATIA, AutoCAD, Blender, Houdini and others.

Adobe Flash is a platform for creating multimedia content and software. It can be used to create vector animation and graphics, software and interfaces, games and the like. In developing of this educational tool, Flash was used to create the interface and to ensure the interaction of the software/user

Once the necessary information is collected, and the suitable software selected, begins the process of creating 3D animations and assembling all the elements into one flash presentation.

Modelling

During the modelling process, the polygonal modelling method was used predominantly with a certain percentage of modelling using geometric primitives. For modelling most of the device parts, Editable Poly options were used using operations like translation, rotation, scaling, adding geometry and extrusion. TurboSmooth and Shell modifiers were also used to obtain the desired smoothness and thickness of machine parts. Modelling using geometric primitives was applied to smaller and less visible parts.
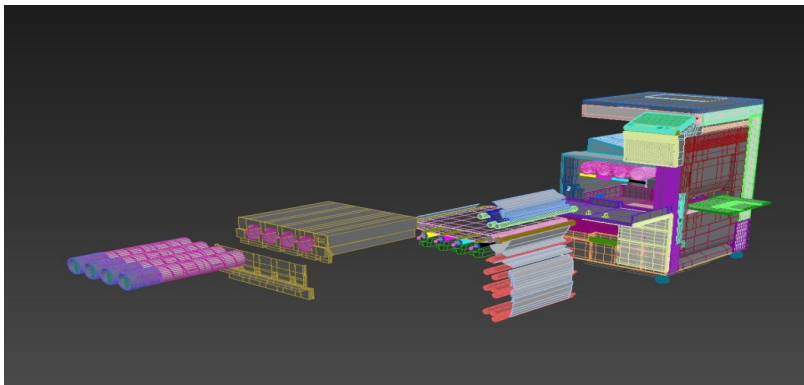

Figure 1. The appearance of the printing machine with visible polygons

Animation

The animation of the devices was done with the *Keyframes*. Objects were moved only by translating and rotating, or restrictions with paths. Animation of the material was also used. Changing paper appearance as it travels through the machine is done by material animation. One reason is the mere fact that this paper is printed during the process so that its material must, therefore, be changed as it travels through the machine.

Figure 2. All parts of the machine are moveable and visible

The travel of paper through the machine had to be animated as well so that the paper changes its shape depending on its path. The path (in the form of a line) had to be placed through the machine. The paper was then connected to that path and moved through the machine. This connection gave the impression that the rollers deform the paper while moving it through the machine from position to position. The Keyframe animation is also used here, but this time the object is enabled to move only by the path specified by the PathDeform option.
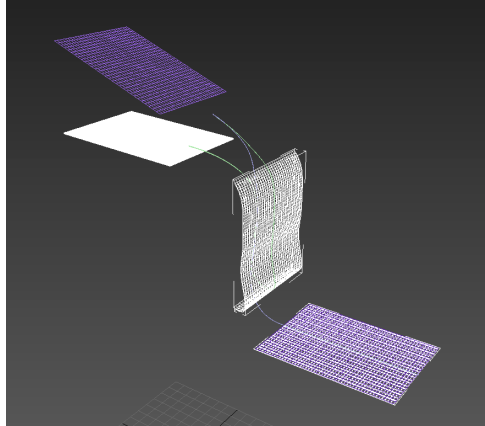
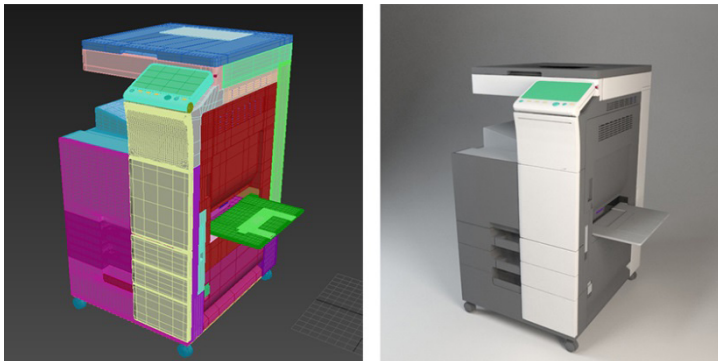*Figure 3. Paper and its path through the machine*

Figure 4. The appearance of the machine without materials (left) and with materials (right)

Since the virtual machine is in an infinitely space, the light reflected from the model can only continue his path to this infinite space; it does not return to the camera. This has greatly influenced the shortening of animation time. Because of this, it was not necessary to further adjust the rendering features. Instead, the basic settings were used.

Interactive presentation

The presentation consists of several parts and navigation is done by clicking the button on the right side of the interface. The main parts are 360º, process preview, machine preview and application of ink and each one of them displays certain properties of the machine.

Figure 5. The interface of Flash presentation

A button named "360º" allows the user to view the machine from all angles. The process overview shows how rollers transfer paper to the print unit, application of ink, turning paper for duplex print and eventually to eject the paper from the machine. Here the animation is stopped and offers the user to click on the parts of the machine that (s)he is interested in. The Machine preview section shows all the parts that are otherwise accessible to the user and which he could see in real life. Here also, the user can click on parts of the machine to get more information. The last part of the presentation is called Application of ink. This section shows the process by which the ink is applied to the transfer tape and then applied to paper using press roller.

Interface buttons were programmed through Flash's ActionScript programming language. For each segment of the presentation, a special flash file and flash movie are created and connected to a unique flash file.

Conclusion

The main goal of this paper was to create an interactive presentation through which students can study about the given digital printing machine. Predictions related to multimedia and online learning are high. It can be said that the field of multimedia, interactive and online learning is currently a very popular and interesting research area for scientists, researchers and experts.When the most influential factors for the good design of interactive computer lessons are investigated sufficiently (Kühl et al. 2011) (finding the best „recipe" for creating them) it will enable many school programs to introduce more practices for students at various levels of education.

Acknowledgement

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