MAKE LEARNING MORE INTERESTING BY USING VIRTUAL REALITY

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Abstract

The process of learning accompany a man from a very young age. It is rather very difficult process. Many ways and techniques have been invited to facilitate the assimilation of knowledge. Traditional methods of knowledge transfer include books, lectures, instructional videos, etc. New ways of presenting and accessing knowledge have appeared at the present time. You should mention tutorials and internet courses. Due to the development of the Internet it is much easier and faster to find interesting topics. With the development of science people must learn and master more and more complicated rules and principles. Is there an easy and enjoyable way to learn? It isn’t easy but we learn more gladly when learning is interesting or presented in an interesting way. Using even simple animations you can "explain" even a very complicated rule in a few moments. Using Virtual Reality (VR) you can not only interest students, but also present and simulate various processes and phenomena. The article shows several conceptual 3D models that can be used in classes: biology, anatomy, medicine, mechanics, archaeology [12] or cybernetics. They are interesting, inertia-driven aids that faithfully reflect their real counterparts. They were developed for zSpace technology, which enables interactive immersion and 3D visualisation. Based on Virtual Reality (VR) and a natural human-computer interface, i.e. the STYLUS manipulator, students have the ability to "touch" and simulate the activities of interesting devices. The article is summed up by the results of students’ feedback to the pilot project.

Keywords: higher education, virtual reality, interactive 3D graphics, zSpace.

1 INTRODUCTION

In learning, it is very important to adapt the teaching style to the individual style of acquiring knowledge. According to Linksmann [7], each of us is endowed with a distinctive "educational superconnection", a way of processing information that makes learning more effective, easier, and more enjoyable. Using the dominant neural pathway is the simplest way to encode, store, and access messages. The individual way of utilising brain power is the link between our learning style and the activity of that side of the brain which we primarily use in the process of assimilating and storing information.

Preference in the use of cerebral hemispheres concerns how we process information that reaches us, or how we think, how we store knowledge in our brain.

Depending on the preferred sensory characteristics, we distinguish four main learning styles:

- visual,
- auditory,
- tactile,
- kinesthetic

The strategy presented in the article is based mainly on the visual learning style, but by using the innovative interface of the zSpace device, other learning styles are also activated.

2 METHODS OF LEARNING AND ACQUIRING KNOWLEDGE

There are many ways to make education more attractive, such as e-learning and MOOCs [2], computer games [8], [9], flipped classrooms, or case study method. The traditional way of learning from books or more advanced sources such as tutorials, web pages, instructional videos, as shown in Figure 1, is often used by students [6]. The disadvantage of this method is the lack of interaction with
the object about which we learn. Such interaction, in the most natural way, can be introduced by virtual reality.

It is very important that the interaction takes place using so-called natural interfaces, that is in a way which does not involve the learner's attention.

The zSpace device satisfies the above criteria well. Any other, more technologically advanced equipment that enables you to touch, rotate, move, displace, disassemble, etc. requires first getting acquainted with the device itself. Each of these advanced contraptions has its technical limitations. In the case of learning, it is very important that these limitations are kept to a minimum so that the student is concentrating on studying the issue in question rather than learning how to use the learning interface.

Figure 1 above shows the main sources of knowledge acquisition by students of computer science. A group of 17 students aged 20-28 (median 20 years) was selected.

3 TECHNOLOGIES USED

The prototypes of thematic courses (training sessions) featured in the article utilise the inertial equipment zSpace. It is equipped with a very good, efficient Stylus manipulator. This interface is characterised by very high responsiveness and relatively high precision of operation. Thanks to the built-in stylus accelerometer, it instantly maps the user's hand movement to the "virtual" 3D object he touches. Also one of the interesting new features of the zSpace interactive monitor is tracking the user's eyes. The student has three-dimensional passive glasses with markers on his head. Markers are tracked by cameras located at the top of the zSpace monitor. Every head movement automatically transforms the entire graphic scene so that the user has the opportunity to look around within the three-dimensional scene. The three-dimensional image created on the monitor is of very good quality. This is quite surprising because the zSpace 200, despite its full HD display resolution, has very average parameters (small vertical and horizontal viewing angles, average colour rendering). In conclusion, the user has the ability not only of looking around the scene with head movements, but also of full interaction: rotating, panning or zooming by using the Stylus interface. The whole gives a very natural, intuitive interaction with three-dimensional objects.
The Stylus manipulator has three freely programmable buttons, plus a triaxial accelerometer and vibration.

A very interesting and natural effect is the z-index. This is shown in Figure 3 below.

Figure 2. The zSpace 200 device.
   a) 3D glasses creating a stereoscopic image in passive technology,
   b) interactive zSpace monitor,
   c) Stylus manipulator.

Figure 3. Work using zSpace.
   a) view of the working area,  b) overview of the depth of the image.

Figure 4. Sample view: left side view "in front of glasses", right side view directly on monitor.
4 TRAINING COURSES USING VIRTUAL REALITY

As part of the master’s and engineer’s theses, as well as in the IT project team, a number of 3D objects and animations were developed, which were later used to create dedicated prototype courses. In order to propagate 3D technology and develop imagination, several general projects were created. The first is a simple project of arranging thematic 3D puzzles. The theme of the puzzle can be adjusted to the age and interest of the recipient. The puzzle is intended to familiarise the user with the operation of the stylus manipulator and generally with virtual reality. For more advanced VR users, a design has been created for arranging LEGO blocks.

4.1 A module supporting the learning of medicine, anatomy

Figure 6 below shows an example of an application for medicine. It is the human heart with its chambers. During work the student can closely see how the parts look, how they work, and most importantly he can freely choose the object of interest, which he can enlarge with the attached camera to display very detailed internal parts. It is a wonderful, unparalleled alternative to various types of illustrative films. The superiority of this method lies not only in innovation, but above all in the fact that the student chooses what he wants to see at the moment. Moreover the Stylus feedback and the built-in vibration function offer a more pronounced effect. The beating heart is literally palpable via the Stylus held in the hand. Every heartbeat causes vibrations, which consequently creates the illusion that we are actually touching the living beating heart.
In Figure 7 above, a human skeleton is examined in 3D using zSpace. The skeleton itself was created on the basis of a number of medical studies, which entails faithful reproduction, detail and high quality in the didactic process. The precision that has been made is big enough to successfully replace the drawings in medical books, offering a full image in space.

4.2 A module for learning biology

Working with exotic species of insects is certainly fascinating. However, it is not always possible to observe rare species, often on the list of endangered species. In this case, virtualisation is very desirable. Students can familiarise themselves with the faithful anatomical structure not only of a rare and valuable insect, but also with insects considered dangerous. An example lesson is shown in Figure 9.
4.3 A module for understanding the issues of mechanics and cybernetics

Certain areas of science are characterised by very expensive parts. Their incorrect connection may well destroy them. These fields of science include electronics, mechanics and cybernetics. Taking a step towards self-discovery and experimentation by students, mechanical lessons were created. Students have an opportunity to make themselves familiar with the construction of the internal combustion engine in 3D space. Students are also provided with a simple course combining and arranging biomechanical components. This allows them to get to know the problems and issues of this field of study in a very safe manner, without putting the university in danger of having expensive equipment parts damaged or destroyed.

Figure 9. An example of a cybernetic presentation of the hand and the internal combustion engine.

5 CONCLUSIONS

ZSpace can be used in engineering projects (such as machine design), architecture (e.g. visualisation and structural model analysis of buildings), in medicine (e.g. processing of images generated by magnetic resonance imaging into 3D models), in creating 3D models and animations for reconstruction, movies or games. With the Quazar3D software, one can create a variety of simulations useful in studying the user’s reactions and behaviour.

The prototype lessons shown use free versions of Unity 3D [3], [4], [5], [10] or Unreal Engine 3D. Models were executed in the free Blender program [1], [11], [13]. The level of satisfaction of students using the zSpace device in the learning process is shown in the third question in Figure 10. All respondents agreed that this is a very attractive way of learning. Students were also asked whether they would like, would dare to create software for hi-end technologies. Due to the poor knowledge of zSpace, students would prefer to program more on Oculus Rift DK2 than on zSpace. This is mainly due to low access to guides on them.

Figure 10. Percentage of positive answers to questions asked.
REFERENCES