

# Academic globalization and interdisciplinary – How we can use eye tracking in education?

Terezia KVASNICOVA GALOVICOVA and Iveta KREMENOVA,  
University of Zilina, Zilina, Slovakia

## ABSTRACT

Eye tracking has become a key method to test the usability of websites. This article describes how we can use eye tracking technology in other academic discipline - in education. Eye tracking can be used also in many other disciplines ranging from psychology, neuroscience, transport to sports and nonhuman research. This paper represents the newest device model of eye tracker and possibility of using eye tracking technology in education.

**Keywords:** Eye-tracking, academic discipline, education.

## 1. INTRODUCTION

We have to ask the question: What should we change to improve the educational process? Everyone has a different opinion. But than was raising new question: Should we change teachers? Do teachers understand students and student needs? Are teachers motivated? Should we change teaching methods and techniques or curriculum - content? Are students really active on lesson and motivated to study? What are they doing during lesson?

If we can understand the individual subconscious of learning process, we can improve education process, change known methods. Then we can make learning process easier and more effective.

To better understand what keeps the attention of students during a lesson, then we are able to change the way how teach and maximize the time when students stay interested. So the question is: How we can understand this?

We present a case study example, where the research team used eye tracking technology to follow the student attention. Eye tracking is a new method. In this article we show how it can be used in education and help answer our question.

## 2. EYE TRACKING

Sight is the physical sense, allowing vision of light, color, shape and orientation of bodies in space. For human is a sight most important sense, because thanks to him we perceive the environment to 80% of information [1]. Perception is a natural analytic - synthetic activity of the central nervous system in organizing, structuring the different feelings into meaningful units. The perception of reality is subjective cognition [2].

Eye tracking is the process of tracking eye movement. It allows us to monitor what the person looks on. By observing what are seen, we can find the sources of information which perceives. Tracking eye movement is used in psychology, marketing, and industrial engineering in particular to better understand human behavior, optimize equipment and safety improvements.

Monitor vision is possible with a device called an eye tracker. Eye tracker is a device that uses image projection and optical sensors to collect data on the positions of eyes, vision direction or eye movements with very high accuracy. Most eye trackers are based on the fundamental principle of monitoring corneal reflection.

Eye tracker was originally designed as a device that from a point (monitor, etc.) - recorded the sight of human. However, if the person changed the direction of view outside the sensing field views, the connection is interrupted. These types of eye trackers can be called static (Figure 1). With a new technology come also new types of eye trackers that allow collection of data freely moving people. It is a dynamic eye tracker: camera built-in glasses.

Figure 1: Static eye tracker (SMI)



Source: [www.netperfect.sk](http://www.netperfect.sk)

This eliminates the need testers to focus on the computer screen, or wear other recording equipment. The research team is able to observe a wider range of situations. Glasses give scientists the ability to capture and objective insights into human behavior in any real environment. They show exactly what the man looks on in real time during the run free as for example in a store or restaurant in the real world. Glasses also recorded a view to the sides, using the static species was not possible, thus guaranteeing natural behavior and increased the objectivity and validity of measurement data. The latest products include small eye-camera on the size of a chocolate bar, which can be connected to any device via the USB port. The device can be operated only by gaze. Eye camera focuses view taken by two infrared lamps, which in turn enable the management of eye movement (Figure 2).

Figure 2: Tobii PC Eye Go – eye camera on size of chocolate bar



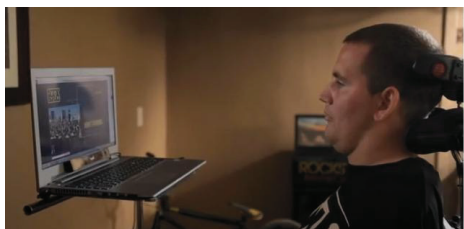
Source: [www.tobii.com](http://www.tobii.com)

### 3. THE USE OF EYE TRACKING IN EDUCATION

A base in education research is to help students learn. In this case study example, research team used eye tracking technology to follow the student attention. This study investigates the gaze patterns of undergraduate college students attending a lecture-based physical science class to better understand the relationships between gaze and focus patterns and student attention during class. We used also eye tracking by test PowerPoint presentation. We tested which kind of text on PowerPoint slides in different structuring of text and different alignment is better readable.

Eye tracking as a new technology brings ability to use a computer and interact on the Web for people, who are paralyzed, locked in (can only move their eyes) or any other kind of disability (Figure 3). It returns partial independence for them and the opportunity to communicate as a human right.

Figure 3: Handicapped boy in interaction with computer



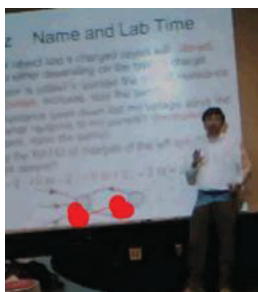
Source: www.tobii.com

### 4. CASE STUDY

There are several studies in education using eye tracking: at James Madison University in Virginia and the University of Connecticut, USA in 2005 and 2007, further to North Carolina State University, USA, 2007, Kennesaw State University, USA in 2011, the Open University of the Netherlands, in the Netherlands in 2012 the Open University, UK in 2013 and National Taiwan Normal University, Taiwan in 2014, at Central Queensland university and The University of the Sunshine Coast in Australia.

The research team from Kennesaw State University, USA used eye tracking technology to follow the student attention to better understand the relationships between gaze and focus patterns and student attention during class [3]. Study was attended by students during natural science lecture. The sample consists of a total of 8 people (all females aged 20). Professor use Power Point presentations and gives students the opportunity to print your presentation in advance, or they can download the presentation in electronic form. Testers were students who wore eye glasses. Places which devoted student attention at some point are shown in color in figure 4.

Figure 4: Screenshot Output data of eye glasses



Source: Rosengrant (2011)

This case study examines the following research questions:

- what the students during lectures focus on,
- what distracts student,
- what keeps students' attention to the lecture.

During each minute interval, the research team recorded what the tester watched as her dis-attention, or conversely, increased attention and whether it was the role of active or not. Research is determined that the student-tester is active in teaching, when looking at the board, speaker or images in any format, or in the event that talks with its neighbors on the subject. If tester looked at classmates, mobile phone or walls, it was inactivity in the classroom.

One of the most interesting findings in this study, regardless of any other factors that students spend very little time focusing on the professor. Students read Power Point images during the lecture, or looking at your notes. However, when the professor drew something on the board inserted into lecturing humor, or by analogy talking about something that was not on the slides, students tended to follow him. Each new image attracted the attention of students, or at least redirect view on the board. When the student looked at the picture on the board first place to focus the eyes were heading, then a picture or diagram (if there was), and then focused on the text on the slide. Students generally read all of the text on the slide before they changed the point of view of interest. The new images, or completely new information displayed on the slide were not the only thing attracting attention to the student. A number of factors affect the students' attention during the study. The first is whether students have printed notes available before the lecture. If so, it seemed that pay less attention to what is comprised lectures and lose attention to be active on the subject faster than those students who had to write everything (looking around the room, playing with a mobile phone or look for other students). However, these students tended to look at the professor more compared with students who made notes on paper and rarely looked at the professor while he discussed the information in images.

The research team questioned the assertion that the attention of students in lectures takes the first ten minutes and confirmed that it is not linear and is affected by various factors. Students are losing attention at certain intervals or were outsiders often, but never more than 5 minutes. The results support the claim that place in the classroom where the student sits, can affect its performance. Research has shown that students in the front and center of the classroom tend to be more attentive than students sitting on the edge of the classroom because the students in the back of the room there are more visible interference.

It is important to be careful in interpreting the data that tells us only that what the student looks, can not say what the subject of his thoughts.

If students spend very little time focusing on the professor and more read during the lecture Power Point images, or looking at notes (printed slides), we have to turn our attention to PowerPoint presentation and its use.

First presentations contained a large amount of text. It was conceived as a tool to mediation lot of information in a short time. Thanks many advantages fully replace the blackboard and chalk, as well as foil. We consider as the main advantages of PowerPoint:

- easy use of images, videos, graphs, etc.,
- more information in less time,
- better structure of topic,

- easy and quick adjustment data,
- possibility of archived, spreading online, print,
- can be used as study material.

Teachers use Power Point presentations and give students the opportunity to print presentation in advance, or they can download the presentation in electronic form. Students used it as study material – it saves time (they do not write all what teacher say) and money (it is cheaper to print presentation than buy a book). As the main disadvantage was that we lost eye contact between teacher and students, because many speakers read the text.

Time brought new trend: less text, more „talk“, what act more professionally. Reynolds [4] says: „The best slides may have no text at all“. Sommerville [5] advises: „Avoid paragraphs, quotations and even complete sentences. Limit your slides to five lines of text and use words and phrases to make your points“. One of tips for making effective PowerPoint presentation by National Conference of State legislatures is: „Do not read from your slides. The content of your slides is for the audience, not for the presenter“.

We can see opposing views here: Became presentation thus only the backbone of presenter as outline of presentation, or it intended the audience?

The eyes, the reader does not move smoothly, as it might seem, but in substantially the lines bounce. And the judder is called fixation. Most untrained readers but fixed every word line so generally read up to seven stops, when returning back to their even more. To better and faster reading should we try to reduce the number of fixations per line and extend the visual range? Effective included in one fixation more words. When you just learn this, reduce the number of stops and quickly read the line. And the eyes can be so exhausting. This can be achieved by extending the field of view. Number of fixation can be reduced by almost half [6].

## 5. CONCLUSION

In the article we introduce eye tracking technology and its use in the interaction man – machine in education science and practice. The use of eye tracking is still emerging and new opportunities in education. The aim is to remove distortions, to increase the attention of students and enable improvement of education. In the case study was used eye camera to determine what the students watching during the lecture on, which distracts the student and the student maintain attention to the lecture. It is important to reiterate that the results of the study are presented as a place where students watched during the lecture. Student attention is most concentrated of PowerPoint slides or its printed version.

Eye tracking technology can be used in education and in terms of our example research and teaching pilots to Air Transport Department, as well as rail and road transport safety testing in transport, pedestrian visibility, and response in conditions of poor visibility, to reduce reaction time when driving and so on. The research in education can help improve the quality of education in this area and to increase transport safety as well.

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