Chapter 12
An Exploratory Study to Understand the Phenomena of Eye-Tracking Technology:
A Case of the Education Environment

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ABSTRACT

Technology has played a pivotal role in revolutionizing the formative aspects of learning and teaching in the current digital age. Due to technology, there is an expectation of having customized medicine, customized interaction, and customized formative communication instead of traditional mass reporting approaches. Formative assessment within higher education teaching and learning environments are no exception to such an approach in the 21st century digital environment. Eye-tracking technology in recent years has provided an insight to understand the human eye movements and concentration patterns, which has application in education. Eye-tracking can be used to examine the processes of individuals in their learning to establish how learning contents are delivered and perceived by all involved (e.g., teaching staff, students, and markers). This chapter proposes that critical and specific information from eye-tracking software can lead to tailored educational content to accommodate, customize, and optimize the unique learning methods for an individual student as per their learning habits. This chapter describes the available eye-tracking technologies and their application in educational processes.

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INTRODUCTION

A new era of physiological assessment has arrived. How do our eyes react to various sorts of visual stimulation? What do students look at and where, and for how long? What cognitive workload does their gaze create and how can learning designers use this understanding to optimize the educational process? The answer to such queries is within the realms of possibilities if revolutionary eye-tracking technology and its derivatives can be harnessed. Eye-tracking technology has made it possible to measure cognitive workload objectively and inobtrusively in real time (Palinko, Kun, Shyrokov, & Heeman, 2010). Eye-tracking describes the eyes position and movement recorded in an environment based on the optical monitoring of corneal reflections. While the impression of eye-tracking is quite straightforward, the technology behind it is evolving every day (Farnsworth, 2018a). Eye-Tracking has numerous potential usages, and it can make a significant contribution to formative information provided to learners in the educational process. The innovation is utilized to quantify the effect of visual stimuli and gives understanding into subjective and cognitive engagement (Wang, Yang, Liu, Cao, & Ma, 2014). It discloses what individuals see, to what extent they take notice and what they see or do not take notice of. Eye-tracking is a tool to study visual focus and social interaction in all education settings but the focus of this chapter is its application in the formative learning space and in reducing assessment bias. By researching how different features of the knowledge process shape educational results, researchers can effectively design, evaluate, and improve education practices (Pro, 2019). However, before we ponder into the effectiveness of Eye-tracking technology in the field of formative assessment, let's first understand the basic principles this technology is based upon and its evolution over the period.

WHAT IS EYE-TRACKING?

Eye-tracking is the way of defining the motion of an eye relative to the head (Doherty-Sneddon, 2008). They are the interplay of saccades and fixations movements (Hoffman & Subramaniam, 1995) as shown in Figure 1. Although there are other types of eye movements like pursuit eye movements, where eyes follow a moving target and the action is much slower than saccades. Alternatively, there are the vergence eye movements where eyes are moving inward to fixate a close object or the vestibular eye movements

Figure 1. Eye-tracking trajectories consist of fixations and saccades. When a human focuses on something of interest the eye jitters around this area
(Krueger, Koch, & Ertl, 2016)