

Chapter 1

Eye–Tracking as a Research Methodology in Educational Context: A Spanning Framework

Pedro Rodrigues
ISMAT, Portugal

Pedro J. Rosa
COPELABS – ULHT, Portugal & CIS-IUL, Instituto Universitário de Lisboa (ISCTE-IUL), Portugal

ABSTRACT

A large body of educational research has been keen to the processes and outcomes of learning. Usually, clinical interviews, self-report measures or behavioral assessment procedures have been the most frequently used techniques to assess cognitive activities during learning. Equally, such approaches often suffer from validity issues. The eye-tracking methodology can be used to overcome some limitations in the study of cognitive processes linked to learning and performance. Therefore, this chapter aims to show how eye movement studies can be used to link ocular metrics to learning processes (e.g. language acquisition, reading, memory). The authors cover a topic that ranges from the paradigm shift in the theories of learning, through eye movement applications and measures, to the contribution of eye tracking methodology to investigate learning processes in educational settings.

INTRODUCTION

The maintenance of the human species can be explained in terms of an adequate relation between vision, perception and action (Rosa, Esteves, & Arriaga, 2012; 2014). Vision is by far the most important sensory channel (Rosa, 2015). Even before the use of writing and more recently the event of modern technologies, the primary role of vision has been to provide the information needed to carry out everyday life tasks (Rosa, Esteves, & Arriaga, 2015). In turn, perception allows the awareness of environmental elements through physical sensation. And finally, the guidance of action allow us to actively and consciously act

DOI: 10.4018/978-1-5225-1005-5.ch001

in the execution of the activities required for our survival. (Rosa et al., 2012; Rosa, Gamito, Oliveira, & Morais, 2011). Any kind of action, from the simplest to more complex ones, requires the cooperation of several brain systems, each of which with a different role in the execution of the action. (Esteves & Rosa, in press; LeDoux, 2000). It is true for the act of finding something to drink when we are thirsty and we need to look for a cup in order to accomplish the action. To achieve all that we need to recruit our gaze control systems (Hoffman, 1998). But, is also true when someone needs something about a topic and look at a specific book that contains the answer to his/her question. The ocular scanning of the visual scene is an important selective process in visual perception (Banović, Rosa, & Gamito, 2014; Ferreira, Rita, Morais, Rosa, Gamito, Santos, Soares & Sottomayor, 2011, Rosa, Esteves & Arriaga, 2010; Rosa, Gamito, Oliveira, Morais, Pavlovic, & Smyth, 2015). Therefore, recording and analyzing eye movement data from our participants provide us an excellent on-line indication of the cognitive processes underlying visual search and reading (Rosa, 2015).

Most recently, neuroscience perspectives on human learning have drawn increasing interest among researchers in education. The neuroscientific research on visual processing has made significant gains recently, and the use of eye-tracking technology has been particularly effective in providing empirical evidence of how visual information processing, mediated by visual processing center of the brain, related to learning (e.g., Gamito & Rosa, 2014; Gastgeb, Wilkinson, Minshew, & Strauss, 2011; Jarodzka, Scheiter, Gerjets, & Van Gog, 2010).

A significant body of educational research have been devoted to the processes and outcomes of learning (e.g., Posner, Strike, Hewson, & Gertzog, 1982; Schnotz, Vosniadou, & Carretero, 1999). Conventionally, self-report measures and interview procedure based on the think-aloud protocol has been the most important and frequently used techniques to probe cognitive activities during learning (LeCompte & Preissle, 1993; Mintzes, Wandersee, & Novak, 1999). Nonetheless, these approaches often suffers from validity issues (Schwarz, 1999). For this reason, educational researchers are seeking various research methods developed in different academic domains hoping explaining the process of learning from different viewpoints (Anderson, 2007; 2014). Among various techniques, the eye tracking methodology, which has been intensively used by psychologists to study basic cognitive processes during reading and other types of information processing (Rayner, 1998, 2009), has just started to attract attention from educators in recent years. This methodology is valuable due to its capacity to recode online cognitive activities, and therefore, it is certainly a promising tool for tracking the cognitive process of learning.

This chapter aims to show a set of relevant studies that have been conducted in this research domain by explaining the intimacy between movements and learning processes.

BACKGROUND

Learning and Cognitive Development

Historically, we have come from a behaviorism that highlights observable behaviors to cognitive/constructive perspectives that strengthens the impact of cognitive processes in learning behavior. Since Piaget (1936) and Vygotsky (1978) theoretical learning models underpinning that cognitive development endures active changes in cognitive structures. Based on such early cognitive psychology viewpoint, learning is thought to bring about cognitive development (Ginsburg & Oppen, 1988; Phillips & Soltis, 2009). This landmark is further strengthened by several neurocognitive studies showing the flexibility of the human

24 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

www.igi-global.com/chapter/eye-tracking-as-a-research-methodology-in-educational-context/167528

Related Content

An Exploratory Mixed Method Study on H5P Videos and Video-Related Activities in a MOOC Environment

Stefan Thurner, Sandra Schön, Lisa Schirmbrand, Marco Tatschl, Theresa Teschl, Philipp Leitner and Martin Ebner (2022). *International Journal of Technology-Enhanced Education* (pp. 1-18).

www.irma-international.org/article/an-exploratory-mixed-method-study-on-h5p-videos-and-video-related-activities-in-a-mooc-environment/304388

How to Trim: On Fetishes and Technology

(2021). *Acquiring Learning Skills With Digital Technology* (pp. 10-39).

www.irma-international.org/chapter/how-to-trim/273756

Active Use of Digital Technologies in Mathematical Problem Solving

Duncan Symons and Robyn Pierce (2019). *Redesigning Higher Education Initiatives for Industry 4.0* (pp. 183-203).

www.irma-international.org/chapter/active-use-of-digital-technologies-in-mathematical-problem-solving/224215

An Integrated Model to Assess EFL Learners' Online Learning Behaviour

Tiantian Wu (2023). *International Journal of Technology-Enhanced Education* (pp. 1-17).

www.irma-international.org/article/an-integrated-model-to-assess-efl-learners-online-learning-behaviour/323453

Design and Implementation Principles for Dynamic Interactive Mathematics Technologies

Thomas P. Dick and Gail F. Burrill (2019). *TPACK: Breakthroughs in Research and Practice* (pp. 372-400).

www.irma-international.org/chapter/design-and-implementation-principles-for-dynamic-interactive-mathematics-technologies/220853