Reliability of Oculesics as an Indicator of Attention in Screen-Mediated Instructional Contexts

Addi Mavengere

Learning, Design, and Technology

University of Georgia

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Introduction

Student attention to content throughout the learning process is an important aspect of teaching. Instructors rely on students' non-verbal cues to determine students' attentiveness and understanding (Ledbury, White, and Darn (2004)). However, the advent of screen-mediated instruction has challenged the ability of the teacher to determine a student's attention without non-verbal cues. The problem is that during screen-mediated learning environments instructors cannot reliably discern students' attentional states due to the limited non-verbal communication that is conveyed from students to the instructor.

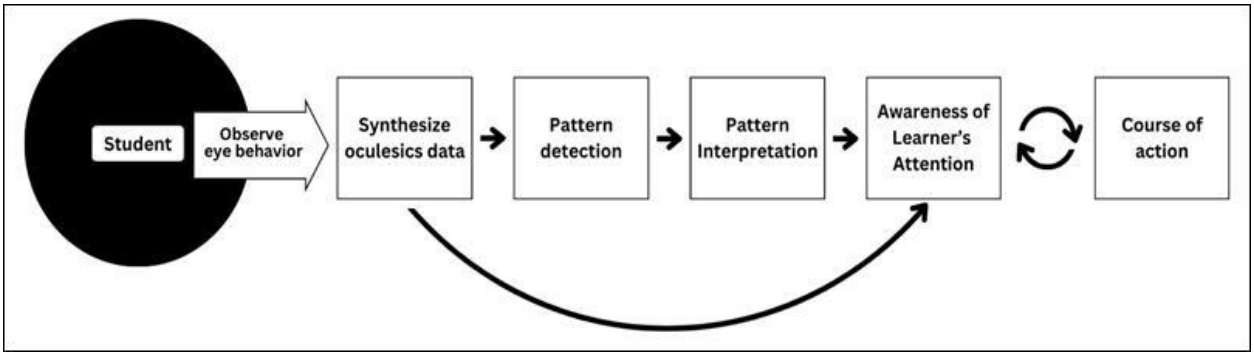
Non-verbal communication cues, such as blink patterns, pupil behavior, and saccadic eye movements, are collectively termed oculesics. Oculesics offers the potential to measure different states of attention through blink patterns (Nyström et al., 2024; Ponder & Kennedy, 1927), pupil behavior (Keene et al., 2022; Koevoet et al., 2024; Strauch et al., 2022; Zhao et al., 2019), and saccadic eye movements (Poth, 2024; Zhao et al., 2012). The purpose of this study is to determine the reliability of oculesics as an indicator of students' attention during screen-mediated instructional contexts.

Conceptual framework

The concept that frames this study is the role of oculesics in screen-mediated learning environments. Cameras fixed on the faces of research participants track eye-related non-verbal communication cues, pupil behavior, and eye movements. Eye-related behaviors associated with tasks that elicit different states of attention are analyzed to determine patterns. Observed patterns are applied to screen-mediated learning contexts to determine students' attention and inform courses of action that instructors can take to enhance instruction.

Figure 1 presents a visual representation of the elements of the conceptual framework and their relationships.

Figure 1: Oculesics in screen-mediated learning environments



Theoretical framework

This study is grounded in Cognitive Load Theory (Sweller, 1988). Attention is a finite cognitive resource that learners allocate to processing instructional material. During instruction, cognitive load and attentional focus change, causing observable physiological changes such as eye-related non-verbal communication cues, eye movements, and pupil size changes.

Significance of the study

This study aggregates knowledge about the relationships between attention and eye-related non-verbal communication, pupil behavior, and saccadic eye movements. The intention is to validate a mechanism for adapting instruction during screen-mediated learning environments based on the interpretation of students' eye behaviors (oculesics).

Research questions

1. Can distinct patterns of eye behaviors be observed consistently under task conditions that elicit different states of attention?
2. Can distinct patterns of eye behavior be used to infer different states of attention consistently?
3. Can states of attention be inferred from eye behaviors quickly enough to enable instructors to adapt instruction in real time?

Research design

1. **Context:** Data will be collected in lab-based settings.
2. **Participants:** Individuals between the ages of 18 and 24 years.
3. **Data collection tools:** Video recording and eye-parameter data sets.
4. **Data collection procedures:** ANOVA, Time-series analysis.

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