

## Book Review

# Eye-Tracking Technology Applications in Educational Research

Reviewed by Wen-Li Chyr, Department of New Media and Communication Administration, Ming Chuan University, Taipei, Taiwan

Reviewed by Pei-Di Shen, Institute of General Education, Ming Chuan University, Taipei, Taiwan

Reviewed by Lynne Cheng Hsu, Institute of General Education, Ming Chuan University, Taipei, Taiwan

Reviewed by Chia-Wen Tsai, Department of Information Management, Ming Chuan University, Taipei, Taiwan

Development in eye-tracking technology has been going on for decades and has become an established research tool in various areas (Ashraf et al., 2018; Leggette et al., 2018). With applications in fields such as education, medicine, industry and business, researchers can use this technology to gather more data on participants' behaviors and construct more precise learning patterns for further analysis. Traditional methods such as surveys or interviews may not be sufficient for researchers nowadays; therefore, this book, "Eye-Tracking Technology Applications in Educational Research," could be useful to them.

The book is divided into six sections; each is deeply associated with the others. As the introductory part, section 1 discusses methodological issues in eye tracking. To readers who are new to this field, the first chapter starts by introducing a range of studies regarding eye-tracking methodology mentioned in past literature. The authors carefully select topics that cover the shifting trends in learning theories to how eye movement methodology helps researchers to better understand the learning process. The authors in the next chapter further explore eye movements during the reading process, explain the characteristics and measures, and use different examples (word, sentence, and discourse) to illustrate how these measures could be studied or interpreted. The third chapter brings in the issue of how eye tracking and other physiological measures could help researchers to study more complex aspects in human psychology such as mindsets (stress or anxiety) or motivations. These methods could be used for those who are not good at verbal expressions, for instance small children, and through these measurements, researchers could identify and quantify effects of how mindsets influence motivation behaviors.

Section 2 contains chapter 4 and 5 that probe into eye-tracking and language comprehension. In the first half, the authors diligently brief the readers on the developments in studying eye movement behavior over the past century. Through the studies on different age groups (youth and elders), readers with different skill levels in reading, and individuals with special conditions (deaf readers), the authors vividly illustrate the significance of the eye movement methodology. Chapter 5 continues to explore the use of eye-tracking in spoken language comprehension. The authors clarify the advantages of using eye movement measures, especially in studying children, and how the findings help readers understand more about language processing, its complexities and the distinct differences between children and adults. In conclusion, when it comes to mechanisms in language comprehension, children could employ those mechanisms more effectively and efficiently than adults.

Section 3 ties the use of eye-tracking technology with multimedia learning, and spans over three chapters. The arrangement of chapters starts from discussing computer-based early literacy media to the use of eye-gaze data in multimedia learning, and the practicability in adopting eye tracking as an instructional tool. Chapter 6 lays focus on children's interaction with computer-mediated software and the use of eye-tracking technology to facilitate researchers' understanding in this field. Besides presenting the results, the authors also list the limitations of eye-trackers for future studies. In chapter 7, the author presents extensive studies from recent years regarding how eye-gaze data is used in understanding multimedia learning and different interpretations that vary between learning contexts and researchers. The authors of the last chapter summarize various studies of using eye tracking parameters, and emphasize that in order to use eye tracking as an instructional tool, it is better to be based in theories according to how people formulate knowledge in the learning process. This section points out that is room for future researchers to build related models and test hypotheses about establishing links between studying eye movements and multimedia learning.

After exploring the usage of eye tracking methodology in language comprehension and multimedia learning, section 4 turns attention to another field of learning: Mathematics. By combining action-logging, eye-tracking, and clinical-interview data from designed experiments, the authors in chapter 9 consider their results provide possible links between attentional anchors and mathematics learning. The authors in the next chapter apply cognitive theory of multimedia learning and cognitive load theory and use evidence from an eye-tracking device to explore how revised visual materials in a mathematics lesson would affect students' cognitive load, cognitive processing, and learning. Although the results from eye-tracking devices support that the revised materials have effect on students' cognitive load, the materials are insufficient to influence learning outcomes.

In chapter 11, the authors introduce graphic organizers and their various forms, review eye tracking literature in educational research, and organize the results in graphics and matrices. These examples illustrate how students study graphic organizers, explain the differences and the merits of data processing with the help of eye-tracking technology. Similar application of eye-tracking in spatial thinking research is discussed in the next chapter. The authors argue that eye-patterns could be the ideal tool for understanding participant's flexibility in cognitive strategy use, and present supporting literature to call for use of eye-tracking data for better design in spatial training, and thus correspond to the section 5 topic of visual-spatial learning.

The last section focuses on studies in special populations and sheds light to readers about how eye-tracking technology could apply in fields other than education. Chapter 13 studies literature from children with language disorders, and chapter 14 probes into cases on high risk populations with autism spectrum disorders (ASD). The former mentions new and affordable products such as eye tracking glasses that could fit in the real-life situations of children and therefore could lead to better understanding in their visual world. The latter explains the complexity in studying behaviors of children with ASD, and points out that by utilizing eye-tracking technology on young infants and toddlers of siblings with ASD, these data could serve as early identification and intervention opportunities for researchers and doctors.

This book provides both historical context and the latest applications of eye tracking technology, and introduces the implementation in different fields and on participants who could not be fully understood through traditional methods. It also raises the concerns and lists the related limitations of these that researchers face. The book is well organized with clear structure for readers with different interests, and the contents are carefully placed in correlation with section topics. It would be even more helpful to read if more studies of multimedia learning and special populations are added in the next edition, for multimedia is trending for future learning and the development in technology may further help with the education of individuals with special needs.

*Eye-Tracking Technology Applications in Educational Research*

*Editors: Christopher Was, Frank Sansosti, Bradley Morris 2016 by IGI Global 370 pp. \$164.00  
ISBN 978-1522510055*

## REFERENCES

Ashraf, H., Sodergren, M. H., Merali, N., Mylonas, G., Singh, H., & Darzi, A. (2018). Eye-tracking technology in medical education: A systematic review. *Medical Teacher*, 40(1), 62–69. doi:10.1080/0142159X.2017.1391373 PMID:29172823

Leggette, H. R., Rice, A. H., Carraway, C., Baker, M. A., & Conner, N. (2018). Applying eye-tracking research in education and communication to agricultural education and a review of literature. *Journal of Agricultural Education*, 59(2), 79–108. doi:10.5032/jae.2018.02079