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Editorial: Eye tracking for STEM education research: new perspectives

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Editorial on the Research Topic
Eye tracking for STEM education research: new perspectives

The integration of eye-tracking (ET) technology into STEM education research marks a pivotal shift toward a more nuanced educational methodologies' comprehension and improvement. The Research Topic titled "Eye-Tracking for STEM Education Research: New Perspectives," introduced a series of pioneering studies that employ ET technology to dissect and understand the complex nature of learning in the realms of science, technology, engineering, and mathematics.

The issue commences with an insightful exploration of how the combination of ET and artificial intelligence is transforming the landscape of competency assessment within engineering education. The paper "Eye-Tracking and Artificial Intelligence for Competency Assessment in Engineering Education: A Review" (Ndiaye et al.) serves as a cornerstone for this edition, highlighting the interdisciplinary fusion that characterizes the subsequent contributions. This contribution also introduces a new dimension to the forefront of research in the field. Since the launch of this Research Topic, there has been a significant advancement in technology. Artificial Intelligence (AI) is undoubtedly an aspect that the global community must integrate, a notion that holds particularly true for STEM education and its research endeavors.

Further, the issue delves into the application of ET in specific STEM disciplines. In the domain of physics education, ET's role as a pivotal feedback mechanism in teacher training is explored, alongside its utility in analyzing the cognitive processes involved in understanding vector fields (Hahn and Klein). These investigations pave the way for similar explorations within chemistry education, where studies examine the relationship between pupil dilation and cognitive load during instructional video sessions (Rodemer et al.), therefore expanding the possibilities educators will soon have at their disposal to facilitate their students' problem-solving process in real time. This line of inquiry in this Research Topic was also elaborated in chemistry, showcasing ET's critical role in dissecting the problem-solving process from another perspective (Tóthová and Rusek). Additionally, the assessment of collaborative knowledge construction (Lämsä et al.) revealed various methods by which students form conceptions of scientific phenomena in their minds.

A standout contribution within mathematics education revolves around the use of ET in statistics, specifically in how students engage with data. This research sheds light on the nuanced ways students navigate statistical information, offering a fresh perspective on data interpretation and processing (Schreiter and Vogel) which is associated with students' graph interpretation processes (Thomaneck et al.) or the way they are able to link information from multiple representation (Susac et al.) – a discipline every student faces. This study also brought further confirmation into the sometimes debated (Schindler and Lilienthal, 2019) eye-mind hypothesis (Just and Carpenter, 1980).

The issue rounds off by emphasizing the significance of visual representation in STEM learning, particularly through a study on organic chemistry (Braun et al.). This research examined how students employ ET technology to navigate the drawing of complex molecular structures, underscoring the technology's value in understanding and enhancing visual learning strategies.

This Research Topic not only highlighted the multifaceted applications of eye tracking in STEM education research but also reinforces its potential to significantly enrich our comprehension of learning dynamics and instructional methods across diverse scientific disciplines. The authors provide multiple implications for further research which promises more interesting findings in the near future.

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References

Just, M. A., and Carpenter, P. A. (1980). A theory of reading: from eye fixations to comprehension. *Psychol. Rev.* 87, 329.

Schindler, M., and Lilienthal, A. J. (2019). Domain-specific interpretation of eye tracking data: towards a refined use of the eye-mind hypothesis for the field of geometry. *Educ. Stu. Mathematics* 101, 123–139. doi: 10.1007/s10649-019-9878-z