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What do teachers attend to in curriculum materials?

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In this paper, we describe an emerging methodology using eye tracking to explore teachers' curricular attending as they interact with curriculum materials to design a lesson in order to learn what teachers pay attention to and how this attention shifts during planning. We propose affordances of this new method, remark on some of its limitations, and propose future directions.

Keywords: Curriculum research, Instructional design, Instructional materials and practices, Teacher education, Research methodology.

We are convinced that the curricular work of mathematics teaching is challenging and not well understood. Throughout many professional experiences in teaching future teachers and participating in conferences, we have observed mathematics teacher educators in the United States face challenges navigating and making sense of unfamiliar textbook materials. We have also witnessed prospective mathematics teachers (PSTs) completely overlook what we view as key aspects of curriculum materials. This raises our general research question: How can we study the process by which teachers participate with curriculum materials? Answering this question may enable us to identify potential barriers present when teachers interact with curriculum materials and to propose strategies for overcoming these barriers. Studying the teacher-curriculum interaction may also help us describe the design capacity (Brown, 2009) required of teachers as they interact with curriculum materials.

Thus, rather than conceptualize this curricular work as a simple process of selecting and using parts of curriculum materials, we instead draw from Remillard (2005) and Gueudet and Trouche (2009) to recognize a complex interaction between teachers and textbooks in which the teacher's influence (the *instrumentalization*) and the influence of the materials (the *instrumentation*) on the interaction are tangled and messy. To describe this interaction, we draw from professional noticing theory (e.g., Mason, 2002; Jacobs, Lamb, & Philipp, 2010) to recognize three interrelated phases of curricular interactions, which we conceptualize as *curricular attending* (what teachers look for and at as they look at the materials), *curricular interpreting* (what sense teachers make of what they see as they look at the materials), and *curricular responding* (what teachers decide to do with the materials based on their interpretations) (Males, Earnest, Dietiker, & Amador, 2015). This enables us to place specific focus on the challenges presented in each of these phases and foregrounds the importance of a teacher's attention to materials, something that has remained elusive in the literature.

In this paper, we describe an emerging methodology to explore teachers' curricular attending as they interact with unfamiliar curriculum materials to design a lesson in order to learn what teachers pay attention to and how this attention shifts throughout planning. We propose affordances of this new method and remark on some of its limitations. To close, we describe potential future directions.

The Context of this Research

The methodology described in this paper was developed as part of a larger study to gain insight into the curricular noticing process of PSTs. At the time of interviews, the PSTs had little experience planning lessons or using materials as a teacher. We collected data by asking PSTs to plan a hypothetical lesson while wearing Tobii Pro Glasses 2, a wearable eye tracking device. The lesson, “2.1.2 How can I measure steepness?” from the *Core Connections Algebra* (CPM Educational Program) was selected because it focuses on slope, a topic that PSTs are familiar with and will likely encounter as teachers and both, the approach to developing slope using a geometric growth pattern, and the structure of the materials varied from materials with which PSTs were most familiar.

Analytical Views of the Teacher-Curriculum Materials Interaction

One way to study the attention of a PST to materials as well as the shifting between teacher and student materials is by comparing their *Planning Timelines*. Figure 1 shows a timeline of two PST’s planning sessions, where yellow indicates attention to teacher materials, blue attention to student materials, and black no attention to the materials (e.g., focusing on the written lesson plan).

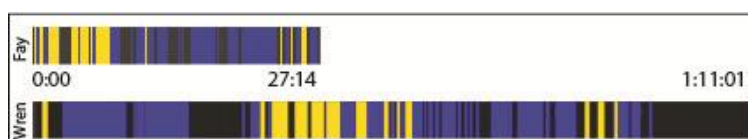


Figure 1: Planning Timeline of Fay and Wren’s Entire Planning Sessions

In these examples, we can see that the PSTs attended to student and teacher materials quite differently. First, the different lengths of the timeline indicate that Wren spent more than double the length (in minutes) planning for the lesson than Fay. Second, although both PSTs spend more time attending to student materials, as evidenced by the larger sections of blue, we see that Fay moves more quickly between the teacher and student pages, as evidenced by the smaller widths of many of the sections of her timeline. In addition, both timelines have periods of not attending which usually proceeds attention to the student materials. Since much of the non-attention to the materials occurred when PSTs were writing their plan, this may indicate that what they wrote was triggered more by the student materials. With this representation, we can study how the teacher and student materials are viewed in relation to each other throughout planning. If we wish to analyze a specific switch between materials, however, we must incorporate the use of another visual.

In contrast, a *Planning Map* shows how particular aspects of the teacher or student materials may trigger attention to other aspects of the materials. For example, Figure 2 represents 30 seconds of a PST’s planning session. The circles indicate locations of attention while the numbers within the circles indicate the order to which they were attended. This mapping reveals how certain parts of text led to a shift in attention between the teacher materials (on the left) and those of the student (on the right). Circle 2 portrays Wren’s focus on a question concerning steepness on the student page, which is followed by a shift back to the objective on the teacher page (circle 3). Although maps offer insight into how some text might influence attention to other portions, these work for only small durations of time, since lengthy time results in complex, overlapping paths.

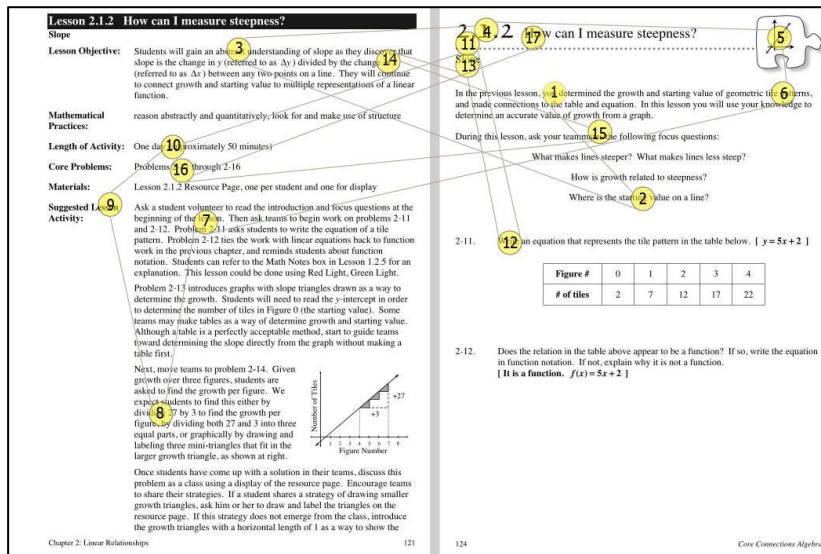


Figure 2: Planning Map of 30 Seconds of Wren's Planning Session

While *planning timelines* and *planning maps* only represent an individual teacher's attention, a *Heat Map* represents the attention of a group of teachers. In Figure 3, we depict heat maps that represent visit duration (i.e., how long PSTs attended to portions of the text) on the left and visit count (i.e., the number of times PSTs attended to portions of the text) on the right. In both maps, green indicates portions with durations or visits that were shorter/fewer than the red which represents longer durations or more visits. Taken together, heat maps can reveal what teachers find important, useful, difficult to comprehend, or requiring more attention at a later point.

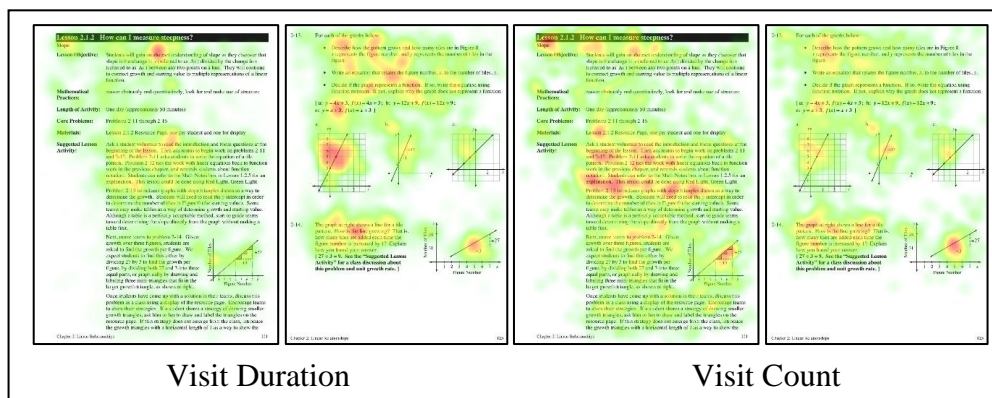


Figure 3: Aggregate View of Visit Duration and Number of Visits

Discussion

The analytical snapshots presented in this paper illustrate the methodological power of eye tracking to support researchers in describing the critical process of attending to curriculum materials and provide insight into how we might use this technology to further explore *instrumentalization* and *instrumentation* throughout an interaction (Gueudet & Trouche, 2009). We contend that the decisions that teachers make with regard to using curriculum materials rely on the interpretations that they make when interacting with their materials and that teachers can only interpret what they attend to.

As teachers use materials, they develop a sense of the design, content, and philosophy of the materials that enable new ways of interaction (Choppin, 2011; Drake & Sherin, 2009). The eye tracking technology, coupled with interviews and observations, can allow us to learn how these factors influence what teachers do and do not attend to in their materials and how curricular attending may change over a teacher's career. By including a wider range of teachers, we can tease apart how years of experience, beliefs, orientations, and vision influence the curricular attention of teachers. In addition, we view eye tracking as an exciting methodological advancement, offering insight into instrumentation. This is encouraging as there is currently little knowledge on how the structure, format, and the features of textbooks impact teacher attention. We are interested in potential patterns in how teachers attend to different textbooks features, such as those identified by Rezat (2006).

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