A Geopositioning View of Teachers' Orchestration in Active Learning Classrooms: Following Teachers' Location Within the Classroom

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Abstract: In this study we report on a method to answer a simple yet fundamental question: How do teachers manage their space resources in active learning classrooms? Specifically, we document how a software, designed for physics education, might provide an alternative to documenting the physical position of the teacher as a function of time. This approach shows clear patterns can be produced, thereby revealing one dimension of the larger question of teacher orchestration.

A logical extension of active learning pedagogies (e.g., Chickering & Gamson, 1987) are active learning classrooms (e.g., the SCALE-UP & TEAL models). Just as the learning locus has shifted from teacher as sage on the stage to teacher facilitator supporting students' activity (King, 1993), the architecture of classrooms must also change. We define Active Learning Classrooms (ALCs) as technology-rich collaborative learning environments, which support students' learning experiences. These innovative spaces are intended to create a student-centered environment that encourages collaboration and communication among learners. Learning becomes distributed across the physical space because there is no definite "front" to the classroom: the teacher desk is often repositioned to the center of the room, if it exists at all, and rows of desks are replaced with group tables. As adapting to supporting students' needs drives the learning agenda, teachers no longer fully control what will happen in the classroom. Teachers must now manage feedback from multiple streams (visual, aural, oral, technological) and adaptively react adaptively. Such work can be characterized as *orchestration*, the real-time management of activity, along with the management of classroom resources (e.g., Dillenbourg & Jermann, 2010). As a research topic, orchestration has gaining much interest in the CSCL community (Dillenbourg, 2013). This moment-to-moment management of the constraints of the classroom ecosystem, coupled with the management of the learning, places greater demands on the teacher than traditional classrooms and traditional instruction. Physical space and layout are important orchestrational considerations (Dillenbourg & Jermann, 2010). Where the teacher is located, what the teacher can access does make a difference to the possible interactions and feedback to learners.

To date, eye trackers have provided a method to examine teacher orchestration (Prieto, Sharma & Dillenbourg, 2015). Arguably, that method comes with costs: financial, and, possible disruptiveness to the natural flow of the participants. This poster reports on an alternative, a post-hoc software, which also allows for the examination of one part of the orchestration puzzle: how the teacher moves in the learning space, as a function of time. We demonstrate the potential of the method by applying it to a case study of two classroom settings, each representing different architectural layouts that produces different movement and access patterns.

Methods

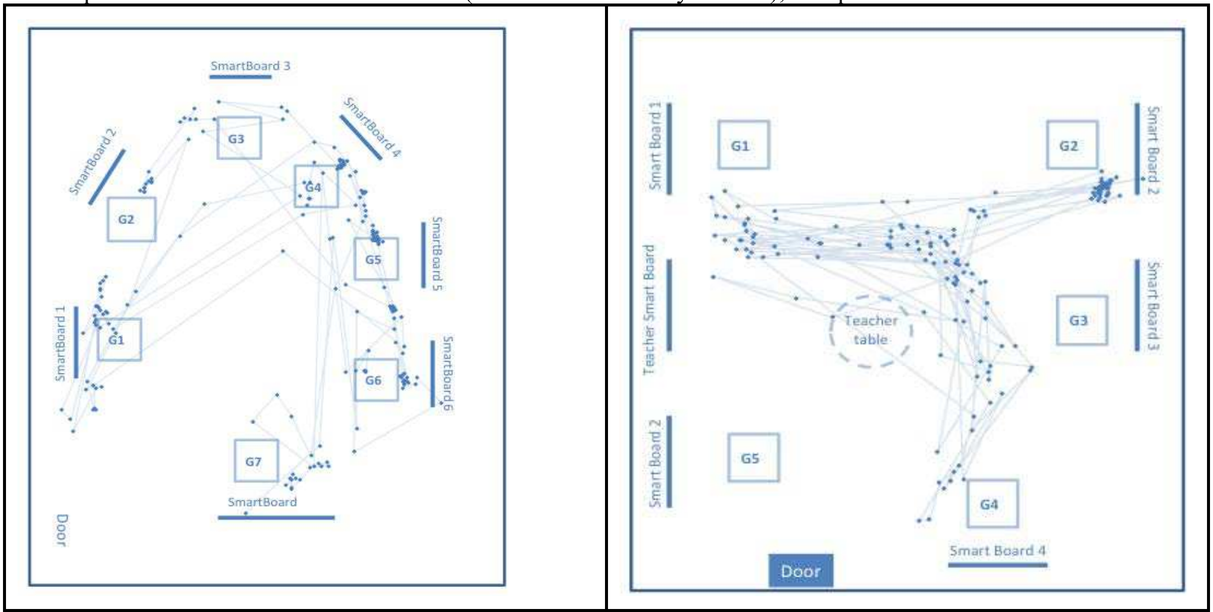
This exploration used data from a larger ethnographic study that collected classroom video data from two differently designed ALCs (classroom A & classroom B). Each classroom consisted of pod-like seating for groups of 6-7 students with group-dedicated interactive whiteboards. Classroom B, however, had a fixed central podium for the teacher, and each group table held three desktop monitors. The data selected were from two teachers, each early adopters of their respective ALCs. Collection of the video data followed a set protocol: two micro cameras (GO-PROs), one mounted on the front and another on the back walls of the classroom. An average of 12 sessions were video recorded for each teacher, the selected data is representative of the teacher.

Adapting Tracker software to follow the teacher's movement

Tracker software, is an open source video analysis and modeling tool designed to be used in physics education. In this case study, it is repurposed to locate the physical position of the teachers in the classrooms, determined as a function of time (every 5 seconds). The basic idea is quite simple: to determine a position vector relative to the camera, all one needs is the angle and the distance from the camera. Perspective dictates that the further from the camera, the smaller the image on the camera sensor. To determine the relative size of the teacher's image, it is necessary to track two vertical points on the teacher in each frame. One point was the top of the teacher's head, and the other the teacher's waist. This, together with the angle on the video relative to the camera, gives a good indication of where the teacher is located in the room to within ~1m, after the necessary camera-specific calibration for each measure (angle and distance, and accounting for the absolute waist-head distance for a specific teacher) is made.

Results

Figures 1(a & b) show the results of the Tracker analysis (on 15 minute data segment) with the dot representing the physical position of the teacher every 5 seconds - connecting lines show the path. Interestingly, this visual representation allows us see differences between the two teacher's patterns of accessing the student groups - one aspect of orchestration. Figure 1a, shows the teacher is with each group, in a somewhat even distribution (density of dots); and, the path is varied but more often sticks to the perimeter, occasionally stopping between tables (see G4-G5 and G5-G6). By contrast, Figure 1b shows the teacher moves back and forth close to the central podium with one main move to G2 (based on the density of dots), compared to the other tables.



Classroom A	Classroom B

Figure 1. Tracking analysis of the teacher's physical location within classroom A and classroom B.

Discussion

Our aim was to explore the use of the Tracker software to help examine the movement of teachers within new learning spaces (ALCs), as part of the larger question about classroom orchestration. The results suggest that the visualization produced by the software can show differences between teacher movement, which can then be further analyzed and interpreted. We posit that this method holds potential for those doing this type of classroom research and interested in questions of classroom orchestration.

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