

# Co-Designing Orchestration Support for Social Plane Transitions with Teachers: Balancing Automation and Teacher Autonomy

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**Abstract:** In classrooms, it can be difficult to implement adaptive activities that span social planes (e.g., whole class, group, individual) due to the demands on teacher attention. To make these activities more feasible in classrooms, orchestration tools, which support the classroom management, can be integrated. We present findings from co-design sessions conducted with seven teachers with the aim to understand how teacher autonomy and system automation can best be balanced to support adaptive transitions between activities in the classroom.

## Introduction

In K-12 classrooms, students often work across multiple social planes (e.g., whole class, group, individual). Within the classroom, the transitions between these social planes are points of high orchestration load for the teacher (Dillenbourg & Jermann, 2010). Currently, many classrooms require that students transition between social planes at the same time to make the orchestration load on teachers manageable. However, this limits the ability for students to work at their own pace and allow students to work collaboratively or individually when it would be most impactful for them. To have more fluid, but theoretically effective, transitions (i.e., not all students are transitioning synchronously) between social planes, greater orchestration support for social transitions is needed so the orchestration load is manageable for the teachers. Although a general understanding of classroom orchestration features has been explored (Dillenbourg & Jermann, 2010; Prieto et al., 2011), these features often have the teachers still responsible for all of the decisions and actions, which provides teachers with autonomy but does not necessarily lower the orchestration load enough for an activity to be feasible in the classroom. There is limited investigation into how classroom orchestration can be automated, reducing orchestration load, while teachers maintain their autonomy, especially around fluid social plane transitions. To account for the dynamics of the classroom, it is important to work with teachers throughout the design process (DiSalvo & DiSalvo, 2014; Windschitl & Sahl, 2002). In this poster, we present results from our co-design process for developing design recommendations for balancing automatic orchestration support and teacher autonomy for social transitions.

## Methods

A total of seven teachers participated (six females, one male) in the co-design sessions. The teachers ranged from teaching 2<sup>nd</sup> grade to 7<sup>th</sup> grade and came from five different schools. We conducted three 2-hour co-design sessions, two with two teachers, one with three teachers, along with a researcher who led the sessions. Each session was semi-structured discussing specific scenarios involving social transitions within the classroom. The scenarios highlighted the different types of transitions that could occur between social planes, such as “Consider the scenario where students are working individually but a few students are making the same mistakes continuously. Pairing some of the students would help them to learn the material more productively.” The scenarios also focused on transitions that occur from changes in group aspects (e.g., absences, tardiness, change in groups due to expertise). Through the design discussions, we intended to elicit past experiences and pivotal moments that the teachers had within their classroom, where they wanted to spend their time, and where they were willing to allow automation from the system. We captured each of the 2-hour co-design sessions with video. To analyze the results, we reviewed the videos to reveal salient themes and needs expressed during the co-design sessions. During the review of the videos, we took notes on the conversations as they related to the teacher needs around social transitions for a total of 147 items. Using these items, we went through an iterative process using affinity diagramming to find themes around social plane transitions by grouping and regrouping notes to reveal teachers’ underlying needs and current impediments in the classroom.

## Results and design recommendations

On the surface, the themes that emerged from the co-design sessions are common themes to orchestration: namely, the importance of planning and classroom monitoring and flexibility. However, more nuanced patterns emerged when analyzing the data in terms of the relationship between the system and the teacher that indicated important

areas in which system automation and teacher autonomy could be balanced. Across all three sessions, the main theme that all seven teachers discussed was that “so much of being a good teacher at this time is just their management”; however, they are willing to allow the system more control if it means they can spend more time working with students as “the reality of it is, we get so much more done, so much faster one-to-one while everyone else is going that if [the system] can move the chips around the room, keep the flow going.” Additionally, the teachers were willing to relinquish control of the system when they thought the system could perform the task better, such as when putting students in varying groups that still meet the necessary criterion, adapting quickly to “the fine details that we miss, that we do not know that we miss”, and monitor students as “there really isn’t a way to monitor [the groups].” Although the teachers were willing to relinquish control in some aspects, they still wanted to plan the “structure” and “routine” of the class and wanted “an override button” in real-time so that they could maintain control as it is still their job as a teacher and it is “intimidating” to put all of the trust in the system.

From the salient themes of the co-design findings, we extracted five design recommendations for how to balance system automation and teacher autonomy around the design of fluid transitions. One, provide tools for adaptable planning of fluid transitions for teachers to plan the activity before class but with a way for the tool to suggest groups. Two, automate the planned real-time decisions so that teachers can spend less time managing and more time supporting students on content learning. In other words, support autonomy during planning and provide automation during the execution of the plan. Three, have the system directly communicate information to the students so that the teacher does not have to spend all of their time monitoring the management. Four, provide high-level class monitoring to the teacher, which is a current feature that current orchestration tools often include. Five, allow teachers the flexibility to override system decisions, whether these are preplanned decisions or ones made by the system in real-time, which allows teachers to maintain autonomy over their class.

## Discussion

Although at the surface, the topics discussed in the co-design sessions echoed previous literature around orchestration, which has emphasized the need for planning, monitoring, and flexibility within orchestration support (Dillenbourg & Jermann, 2010; Prieto et al., 2011), our results add to this literature by proposing that teachers do not need complete control of the system at all times, specifically when relinquishing that control gives them more time to work with students or when they feel the system can do the task better than they can. For example, the teachers wanted to maintain control of the learning aspects of the classroom through the development of the lesson plan and supporting individual knowledge acquisition in the classroom. However, they were willing to allow the system control over the management of the monitoring and adaptation in the classroom so that they could focus on spending time with the students and because the system may be able to pick-up on things that they as teachers cannot and react faster. If something does occur, it is important to have a way for the teacher to intervene in real-time since there may be some classroom signals that the system cannot detect. By having more automation in the real-time management of the classroom orchestration, we can monitor and react faster to student actions as well as allow students to follow their own paths through the activity without having to create a bottleneck that depends upon the teachers time in the classroom.

## References

- Dillenbourg, P. & Jermann, P. (2010). Technology for classroom orchestration. In *New science of learning* (pp. 525-552). Springer New York.
- DiSalvo, B., & DiSalvo, C. (2014). Designing for democracy in education: Participatory design and the learning sciences. In *Proceedings of the 11th International Conference of the Learning Sciences*.
- Prieto, L. P., Dlab, M., Gutiérrez, I., Abdulwahed, M., & Balid, W. (2011). Orchestrating technology enhanced learning: a literature review and a conceptual framework. *International Journal of Technology Enhanced Learning*, 3(6), 583-598.
- Windschitl, M., & Sahl, K. (2002). Tracing teachers’ use of technology in a laptop computer school: The interplay of teacher beliefs, social dynamics, and institutional culture. *American Educational Research Journal*, 39(1), 165-205.

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