Classroom (co)Orchestration

Emily Schindler and Pooja Saxena

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Classroom (co)Orchestration

An invisible feature of technologically-mediated learning environments made visible

Authors

Emily Schindler, Director of Education, Comic-Con Museum, emilywardschindler@gmail.com

Pooja Saxena, Cottey College, psaxena@cottey.edu

Abstract

This report summarizes current research related to classroom (co)orchestration, a concept that describes how teachers and students negotiate social configurations and technological tools so that learning can occur. Classroom orchestration refers to tech tool management and workflows undertaken solely by the teacher, and classroom (co)orchestration describes when these tools and workflows are co-negotiated by teachers and students in learning environments. In addition to providing the scholarly background, this report details issues of interest to practicing educators, educational researchers, and technologists. Finally, this report details opportunities and challenges for scholars and practitioners who collaborate to build knowledge elucidating classroom (co)orchestration, so that this knowledge can inform the design and scaling of educational technologies and practices, as well as the educational systems in which they are situated.

Keywords

Classroom orchestration, classroom (co)orchestration, collaborative design of educational technology

Overview

As learning scientists, we are interested in understanding the tension between designing inquiry-based lessons and delivering them in classrooms, as they are mediated and orchestrated in both traditional and technology-enabled ways. Therefore, classroom orchestration describes the managerial moves educators undertake in order to manage tools and people in their classrooms so that learning can occur. More recently, scholarly interest has centered upon co-orchestration, or the moves undertaken by students and teachers collaboratively to manage the tools and social configurations in a given learning environment. Scholars refer to the amount and subsequent burden of these managerial tasks using the term "orchestrational load", which often comprises a unit of analysis for research seeking to reduce it. In this report, we use "(co)orchestration" to refer to current prior conceptual scholarship on classroom orchestration and co-orchestration collectively, and we use the terms "classroom orchestration" and "co-orchestration" to refer to the concepts separately.

The audiences for this Rapid Community Report are many. Most importantly, educational practitioners (like teachers and administrators working in K-16 in- and out-of-school environments) may find this useful as a verbal illustration of the tacit (embodied) expertise that enables their moment-to-moment work in classrooms. However, we want to stress that the strategies for classroom (co)orchestration are unlikely to emerge from research and industry-based environments absent of practitioner leadership, as stakeholders from research and industry backgrounds possess descriptive, not practical, expertise when it comes to strategies for enacting classroom orchestration successfully. Therefore, our intention with this Rapid Community Report is to outline common scholarly thinking, language, and understanding on the topic of classroom (co)orchestration to ease communication amongst different stakeholders with respect to this important topic, which is an integral part of teaching and learning with technology. Still, to scaffold the conversation of expertise related to classroom (co)orchestration, we offer a list of tasks and strategies that afford automation, and those that are best performed by humans, in the hope of reinforcing that tool-assisted classroom (co)orchestration must seek to augment, rather than replace, human teachers.

Kollar and Fischer (2013) first characterized orchestration as a useful metaphor, noting the parallels between orchestration of a musical performance and orchestration of a technology-enhanced learning (TEL) scenario. Some classrooms use TEL scenarios, but more often than not, practitioners adapt analog classrooms to use digital tools for learning. The understanding here is of scripts or patterns (and contingencies) that play out in learning environments bolstered by tech tools. A teacher has to manage both scripts and contingencies while they conduct multilayered activities in their classrooms and manage affordances and constraints of various tools and contexts (Dillenbourg, 2013). To identify both intended and unintended learning outcomes in technology-mediated physical spaces, like classrooms, it is imperative that instructional designers take into account how teachers facilitate their lesson and how technology enables them to optimize time on task as they navigate through a variety of tools and activities in their classroom. Dillenbourg (2013)

offers a continuum classification of classroom activities, moving from center to periphery: core activities (such as curriculum), emergent activities (which are contingent on learners), envelope activities (routinized, e.g., copying from blackboard), extraneous events (e.g., fire drills/power outages), and infra activities (i.e. logging into Canvas). Roschelle, et al. (2013) suggest that designers of tools for classroom orchestration ought to pursue more information related to enactment, or what teachers do on the micro-level, in order to design tools that are responsive to teacher design and re-design over the course of teaching. Tools that assist classroom orchestration have the potential to enhance both the cognitive and affective aspects of learning and make the intellectual demands of teaching manageable while both students and teachers integrate digital tools in collaborative environments. For example, an orchestration tool, the independent open learner model (IOLM) can help optimize cognitive density, enable diagnostic powers, metacognitive processes, and data-driven decision making, and, as a result, assist teachers in enhancing their classroom orchestration (Dillenbourg et al., 2009). Or, more recently, classroom (co)orchestration has informed the design and development of commercially-available, voice-enabled smart assistants designed for classroom use (e.g., Symphony Classroom; Schindler, et. al 2021). Additionally, recent scholarship on classroom orchestration suggests that rather than being a teacher-only activity, that students and teachers co-negotiate social groupings and technologies together as a matter of routine (Olsen, et. al 2020), and therefore what has been theorized as orchestration is better understood as co-orchestration.

Though this body of scholarship shows a promising start, it has yet to explore the full range of issues falling under the umbrella of classroom (co)orchestration. Notably absent are studies which expand beyond patterns of social groupings and design-based implementations of tool prototypes to examine the classroom context, where tech tools and applications proliferate, increasing the orchestrational load exponentially. Additionally, at the time of this writing, more studies are needed on how adapting to teaching during the COVID-19 worldwide pandemic, and the increased scaling of technology-mediated teaching and learning, impact our understanding of classroom (co)orchestration processes, despite the promise of emerging work (e.g., Lawrence, et. al 2021).

Overall, the concept of classroom (co)orchestration is worthy of attention from practicing educators, learning scientists, and educational technologists because it seeks to explain how teachers and students collaboratively work within technologically-enhanced learning environments, which may help educational technologists design scalable technologies to streamline and augment the capacity of teachers and learners.

Key Lessons

Classroom (co)orchestration describes the processes teachers and students undertake collaboratively to manage tools, resources, and social configurations in order for learning to occur.

Classroom (co)orchestration may seem an obvious concept to practicing educators, who hone their orchestrational skills in order to create conditions where learning can occur as a constitutive feature of their teaching practice. However, patterns of classroom (co)orchestration have only been taken up relatively recently in educational research and scholarship, primarily through the lens of scalable educational technology development outcomes and processes. For instance, scholarship on "ArgueGraph" depicts teams of learners with conflicting opinions. These conflicting opinions are collected using individual questionnaires, and research suggests these processes can be automated to save teachers time and use the results to dive into the complexity of the arguments or one-on-one instruction for the students who need it (Dillenbourg & Jermann, 2010). Additionally, scholarly discussions have focused on the utility of "orchestration" as a metaphor for these managerial practices, suggesting instead that the metaphor ought to center on conducting, rather than orchestrating (Tchounikine, 2013). Further, Kollar and Fischer (2013) propose "arrangement" as the applicable metaphor to describe these practices. Regardless, this discussion of appropriate metaphor matters because it demonstrates the productive struggle educational scholars undertake in order to study and communicate what teachers and students do to prepare learning environments before, during, and after conceptual inquiry takes place. As practitioners and researchers refine the concept of classroom (co)orchestration, they will be able to more clearly articulate what actually happens in learning environments, like classrooms. Hopefully, this work will aid interested parties, like educational technologists, for example, to build useful, scalable tools to reduce orchestrational load, making the work of everyday teaching and learning more seamless.

Classroom (co)orchestration = classroom management + tech tools

While the concept of classroom (co)orchestration is still in the early stages of scholarly research, it's easiest to understand as classroom management tasks in technologically-mediated learning environments. So, when a teacher takes attendance in a synchronous, hybrid learning environment while making sure all students are logged into the appropriate platforms and apps, and that their devices are functioning properly, that is classroom orchestration. When a teacher encounters a bug in this process (perhaps the

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internet connection is slow), and students call out potential solutions, or in some cases, approach the teacher's computer and attempt to solve the problem themselves, that is an example of co-orchestration. This is particularly salient in inquiry-, project-, and problem-based learning environments, which prioritize the design for small group and individual choice-based learning. Additionally, the concept of classroom orchestration figures heavily into models of personalized and participatory learning, because in both of those models, students spend a lot of time moving between individual and group configurations, often in response to changing interests and forms of production.

Classroom (co-)orchestration is a particularly useful concept for technologists and practitioners to explore as a collaborative problem space

While this concept may feel obvious, and perhaps unsurprising to practicing teachers, it is particularly captivating to educational technologists and learning scientists, who strive to design solutions to streamline classroom instruction by reducing "orchestrational load", or the amount of orchestrating teachers and students must undertake collaboratively to produce the conditions for learning. Again, scholarship on this topic is rapidly developing, but a productive goal for educational technologists would be to off-load administrative tasks, like attendance taking, searching for and opening slide shows, logging into applications, to smart assistants. Additionally, perhaps because classroom orchestration is such an embedded, tacit feature of teaching and learning, the concept itself represents a productive problem space for educators, researchers, and technology designers to collaborate directly. In addition to the practical outcomes of increased collaboration between these stakeholders, design collaborations for classroom orchestration are an excellent opportunity for educator voice to be inscribed early in the design of educational technology, increasing the likelihood of scalable solutions.

By centering this collaboration across roles, institutions, and interests, diverse stakeholders will be able to attack complex problems facing teachers and learners today. Only in this collaborative context can practitioners, researchers, and technologists identify which classroom orchestration tasks afford automation, perhaps using AI solutions to augment human capacity, and which tasks must be undertaken by humans, as integral components of the social work of teaching and learning. For instance, examples of tasks that might be best offloaded to devices meant to ease teacher orchestration load include switching between devices, time management assistance, and other administrative tasks, like taking attendance or recording reminders. Examples of tasks that are implicated in classroom orchestration, but which do not afford the assistance of digital solutions include managing conflicts and emotional components of classroom interaction. This human-to-human work is a necessary part of teaching and learning, and designs for classroom (co)orchestration should seek to create time and space for these important interactions to occur.

Issues

How do issues related to classroom orchestration interact with classroom management strategies? How do approaches to classroom (co)orchestration intersect with issues of justice in dignity-affirming learning environments, both in and out of school?

Classroom management is inextricably linked to student achievement, equity, and anti-racist teaching, particularly in the United States. Therefore, any area of scholarship seeking to impact classroom management methods, particularly one that addresses the role of technology, must also consider how tools designed to improve classroom (co)orchestration reify or interrupt problematic power dynamics in classrooms. For instance, AI smart assistants hold great promise to streamline administrative tasks in the classroom. However, issues of privacy, accessibility, and bias must be meaningfully accounted for in their product design, so that designer bias doesn't become inscribed in the object of the design itself (e.g., Bender & Friedman, 2018).

Additionally, technology-mediated teaching and learning occurs in classrooms and other learning environments which already negotiate issues of justice as instrumental to practice. As such, design processes of technology meant to augment teaching and learning must align with the efforts and strategies underway, and at the bare minimum, must not exacerbate social injustice.

The best way to ensure that new tools for classroom (co)orchestration meet these requirements is to engage practicing educators, instructional leaders, and educational technologists in collaborative design processes which intentionally center these issues. In this way, the development of tools and processes attendant to classroom (co)orchestration will present opportunities for design-based researchers to learn more about what constitutes classroom (co)orchestration, and further, how the tools they design can streamline teaching and learning.

How does classroom (co)orchestration sync with existing scholarship on classroom management and technology implementation?

While the excitement of learning scientists and technologists often propels educational innovation, practitioner expertise and existing scholarship can easily be obscured by the desire to find the next new educational solution. This fact is particularly important for educational researchers and scholars, who bear a responsibility to test their theoretical contributions and design-based research outcomes in authentic environments, and to humbly revise their thinking and design in response to peer review and practitioner input. This is especially important when one considers the forms of power that impact knowledge and relationships between educational researchers and

practitioners. On the one hand, researchers have access to prior scholarship, time to review it, and the ability to form and access social networks where they can suss out the features of classroom (co)orchestration. On the other hand, educational practitioners mobilize the power of learning by doing, and therefore have much to teach researchers about this concept. Therefore, classroom (co)orchestration conceptual scholarship benefits mightily from collaborative production: it is one of many educational concepts that require collaboration across roles and perspectives to approximate truth.

In the case of classroom (co)orchestration, the practical activities that comprise the concept are already well known to practicing educators and to scholars of teacher education. Therefore, it is incumbent upon learning scientists and educational technologists to situate their innovations in the context of existing expertise. One way to do this is to undertake technology design processes for classroom (co)orchestration in real world contexts with diverse teachers and students. In the learning sciences, these collaborative design processes are most aptly situated within research-practice-industry partnerships (RPIPs; Peppler & Schindler, 2022) where researchers act as the go-between for practitioners and designers.

How does our framing of the concept of classroom (co)orchestration impact the design of potential technological supports, like AI smart assistants, for example?

The concept of classroom (co)orchestration represents fertile ground for the development of technological solutions to enhance and streamline teaching and learning. However, there is still much more to learn. One potential area of future research is to understand how various modalities of educational technology interact with the various modalities practitioners and learners call upon in order to orchestrate their classroom. For instance, some new technologies for the classroom use voice as the primary means of device control. As teachers implement these new technologies, how does completing a task with one's voice, as opposed to one's hands clicking a mouse, affect a teacher's orchestrational practice? Often, a teacher uses different parts of their body as orchestrational tools: for instance, a teacher may move closer to a student when they want them to stop talking, or stand in a certain position in the classroom when they need to get their students' attention. The embodied aspect of (co)orchestration has implications for the design of new tools (e.g. VR-enabled tools; see Ilie, et. al, 2020, for a current inquiry into the role of these embodied actions in classroom learning). As tech tools take over orchestrational tasks, how does that affect social and conceptual learning processes that often go unacknowledged, but are nevertheless part of the fabric of classroom learning environments? The answers to these exciting questions remain to be seen.

Conclusion

Overall, the concept of classroom (co)orchestration represents a rapidly changing understanding of how digital tools mediate and enable learning, especially in light of the widespread changes to instruction caused by remote learning during the COVID-19 pandemic. This Rapid Community Report describes the key dimensions of scholarship, collaboration, practice, and issues surrounding the concept of classroom (co)orchestration. Hopefully, this "stake in the ground" will help to seed fruitful collaborations amongst researchers, industry technologists, and educational practitioners toward the goal of the responsible and ethical development and implementation of technology.

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