Orchestration in a Networked Classroom: Where the Teacher's Real-Time Enactment Matters

Chee-Kit Looi[1] & Yanjie Song[2]

[1]National Institute of Education, Nanyang Technological University, Singapore
[2]Hong Kong Institute of Education, Hong Kong
Email: cheekit.looi@nie.edu.sg

Abstract

Designing for orchestration needs an emphasis on the criticality of the teacher's agency, skills and understanding of pedagogies and technologies in orchestrating the classroom beyond the provision of material scripts and technological supports. Drawing on data from the collaborative classrooms that use a collaborative technology called GroupScribbles (GS), we share the work of a teacher who successfully orchestrated the class activity. Yet at the same time, we noted that not all lessons were as well orchestrated like this despite using similar pedagogical and technological designs. The agency in appropriating and enacting these designs in the classroom lies in the attitudes, capacity and mind of the teacher and therefore must be a critical aspect of the overall plan in designing for orchestration.

Keywords: orchestration; teacher's enactment; teacher's agency

Orchestration

From a social constructivist perspective, the teacher's role is one of orchestrating a range of activities that lead to knowledge creation rather than a knowledge provider transmitting information to students (Beauchamp, Kennewell, Tanner, & Jones, 2010; Dillenbourg, Järvelä, & Fischer, 2009). According to Dillenbourg (2012), orchestration refers to the real time management of multi-layered activities and multiple constraints; it expands instructional design to cope with what he calls extrinsic activities and constraints. The author calls for design for orchestration as a means of traction for impacting educational practices in schools.

Dillenbourg presents four learning environments to illustrate the teacher's role of orchestration in regulating various activities (emergent, envelope, extraneous and infra) and constraints around the core activities. Indeed, Computer-Supported Collaborative Learning (CSCL) is embedded in social context which includes complex factors. Different core activity learning designs require different pedagogies and affordances of collaborative technologies, hence contributing to different activities and constraints. This, in turn, requires different ways of

orchestration that bring out the real-time adaptive yet effective enactment of activities that lead to desirable processes and outcomes.

In designing for orchestration, we want to emphasize the criticality of the teacher's agency, skills and their understanding of pedagogies and collaborative technologies in orchestrating the classroom beyond the provision of material scripts and technologies used for orchestration -- an issue which is not well developed in Dillenbourg's position paper. This draws on our experiences with supporting teachers to run collaborative classrooms and mobile learning classrooms in Singapore (Looi, So, Toh & Chen, 2011; Looi, Zhang, Chen, Seow, & Chia 2011). In this short response, we will use some data from the collaborative classrooms that use a collaborative technology called GroupScribbles (GS), to make our argument. We first present our core design, pedagogy and affordances of the GS collaborative technology followed by the design for orchestration of the activities and constraints that expand this intended core design.

Core design of a Collaborative Classroom

Our core design is concerned with progressive inquiry supported by GS. The progressive inquiry approach is proposed by Hakkarainen (2003) for young learners' knowledge creation in a CSCL environment. Five principles are included in the core design, aiming at elucidating the processes and dynamics of collaborative inquiry and guiding the progressive inquiry pedagogical approach. The five principles are: (a) working on authentic problems, (b) encouraging diverse ideas, (c) making progressive inquiry, (d) providing collaborative opportunities, and (e) doing formative assessment.

Affordances of Collaborative Technology - GroupScribbles

A typical GS classroom is equipped with an Interactive Whiteboard (IWB), and each student in the classroom has a Tablet PC with the GS client software installed (Fig. 1). GS allows students to create, publish and edit lightweight multimodal expressions (text, drawing, and painting) for group activities. The GS user interface presents each student with a two-paned window. The lower pane is an individual work area, or a private board, with a virtual pad of fresh scribble sheets of different sizes. The upper pane is a group work area, or a group board. Students can draw or type on the scribble. They can also drag and drop the scribble into different screen arrangements on the group board in the upper pane. Other participants' screens are updated to reflect changes on the group board. The teacher can access the group postings on the public board.

Design for orchestration in GS-supported progressive inquiry classrooms

Making use of the GS affordances, the teacher's orchestration of the inquiry class can be designed holistically at three levels: individual, group and whole class activities (see Fig. 2). (S)he can orchestrate the multiple level activities interchangeably according to the pedagogical goals enabled by GS. As GS provides the teacher with a bird's-eye view of the participation and performance of individual students and groups, it helps the teacher monitor the ongoing process and performance of the students more effectively. Table 1 shows the design for orchestration at multiple-levels in a mathematics lesson on fractions in a Primary 5 class (Looi & Chen, 2010).

Fig. 1 GS classroom seating arrangement

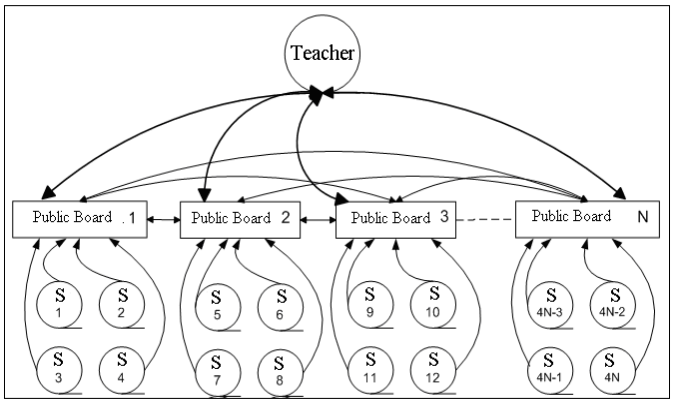

Fig. 2 Model for social interaction in a GS classroom

Table 1 Design for orchestration at three-levels

Activity level	Orchestration	Purpose
Individual level	GS postings are anonymous to the students. However, the teacher can activate the function of "show student names" on	Monitor individual participation

	GS. By viewing the student names on the group board, the teacher can get a gallery view of individual student contributions (Fig. 3).	
Group level	Based on the number of contributions of each group work and a quick sense of some of the contributions, the teacher can get an overview of which group has actively participated in the discussion, and which groups have not done so (Fig. 4).	Monitor group participation
	Based on the contributions of each group work, the teacher can identify which group members have used multi-modal representations required by inquiry tasks, and which group members have not done so.	Monitor group task performance
	Based on the physical proximity of the postings on each group board, the teacher can view the intra- and inter-group comments.	Monitor intra- and inter-group embedded assessment and social interactions
Whole class level	The teacher can project group work from the group board onto the white board, and ask the class key questions raised from the group board.	Lead whole class embedded assessment and arouse students' awareness of key points in progressive inquiry

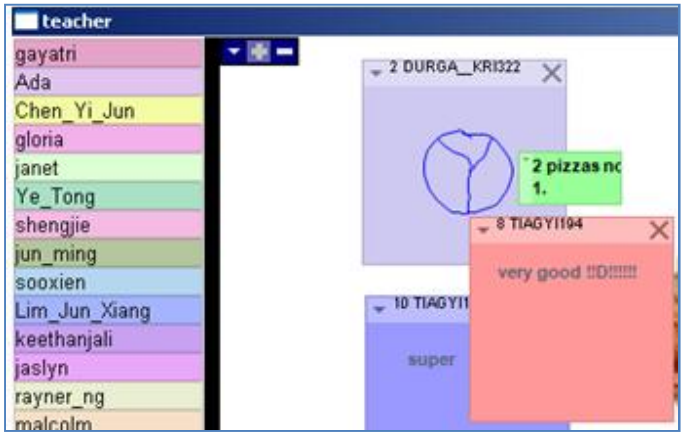

Fig. 3 Monitoring individual participation

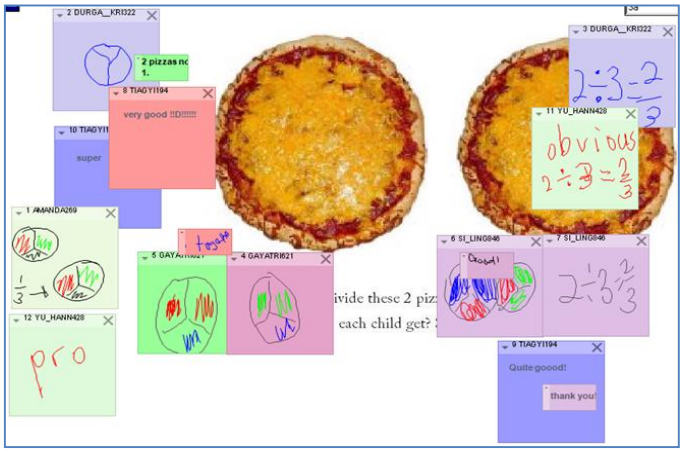

Fig. 4 Monitoring active participation

With GS, the teacher can orchestrate the activity from one level to another anytime to address different pedagogical needs such as:

- guiding the students to participate more actively in the discussion if the teacher finds fewer postings on the group board;
- asking students to perform tasks requiring multi-modal representational use if the teacher identifies that only one form of modality is used;
- encouraging groups to do more intra- or inter group embedded assessment if the teacher finds few of such postings;
- complimenting the groups if the teacher finds the postings are multi-modal, adjacent and adequate so that the groups are motivated to perform better, and other groups can learn from them;
- highlighting a specific posting if the teacher finds its content valuable or controversial, and thus more students can learn from it or further improve it;
- commenting on a group's work with other peripheral groups in close physicality possibly benefitting from the teacher's facilitation too through "eavesdropping".

These are generic moves built on the teacher's understanding of the pedagogical principles of what constitutes a productive collaborative discussion. Deeper adaptation of the lesson plan occurs when the teacher seizes on emergent teachable moments and opportunities, and scaffolds the students towards productive inquiry.

We observed one Primary 5 mathematics lesson on division and fractions, and coded one scenario of how the teacher orchestrated student progressive inquiry into ways of dividing two pizzas among three children at the three activity levels supported by GS (see Fig. 5).

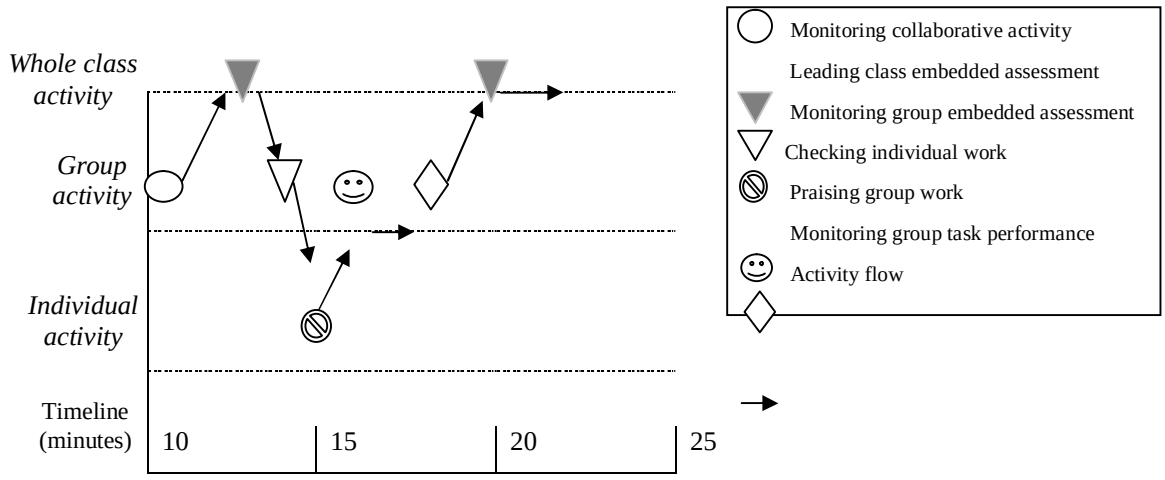

Fig. 5 Class activity patterns orchestrated by the teacher

Fig. 5 shows that the teacher orchestrated the class scenario. While the general script is to guide and monitor the students progressing from individual to group and to class-level work, the actual improvisation is done in real-time at different activity levels for different purposes to make the progressive inquiry run smoothly and productively. Our example of shared group and class spaces in GS provides a platform for the teacher to grow awareness of individual, group and class work and to be able to improvise in real-time to manage intra- and inter-group interactions. Emergent improvisation requires the teacher to have principle-based understanding of the pedagogy and how it is enabled by the technology. In Song & Looi (2012), we presented a detailed account of how two teachers with differing beliefs, skills and practices enacted a common GS lesson script but with different learning processes and outcomes for the students.

In our other work on curricular designs for mobile learning classrooms (Looi et al, 2011), while the pedagogies and affordances of the technologies are different, a very similar challenge emerges --- how to help the teacher seize the teachable moments from the interactions and artifacts created by students via the mobile technologies. Consistent with Dillenbourg's design principle of minimalism, our approach has been to design simple and minimalistic technology support for empowering teacher orchestration, rather than complex technology use for supporting less flexible teacher orchestration moves.

We have shared the work of a teacher who successfully orchestrated the class activity. However, out of the over hundred GS and mobile learning lessons enacted by teachers in Singapore classrooms, there are also some lessons that were not as well orchestrated like this lesson, and thus did not "work well" despite using the same technological design and learning

activities. Reasons include: teacher succumbing to some constraints like lack of curriculum time to complete the lesson, or their inability to leverage teaching moments at the individual, group or class levels due to variability in their beliefs, technological, pedagogical, and content knowledge. A networked classroom can be inadequately orchestrated if teachers have no good understanding of pedagogical principles and poor capability to integrate the affordances of technologies into the classroom activities, and do not take into account the ability of students and the characteristics of different disciplinary knowledge.

The design of a learning environment, unlike traditional instructional planning, involves more unpredictable elements. While orchestration itself is unplannable, good pre-design can provide cues, structures and scaffolding to support and guide a teacher what to do. The agency in appropriating and enacting these designs in the classroom lies in the attitudes, capacity and mind of the teacher – and that must be a critical aspect of the overall plan in designing for orchestration. Orchestration depends on what is happening in real time classroom and how the teacher handles the dynamic environment. Thus, we emphasize the agency, the beliefs and the skills of the teachers, and their understanding of the pedagogical principles as well as of the technology, providing a more holistic view of designing for orchestration.

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