Active Learning Spaces: Blending Technology and Orchestration

Elizabeth S. Charles, Dawson College, echarles@dawsoncollege.qc.ca
Chris Whittaker, Dawson College, cwhittaker@place.dawsoncollege.qc.ca

Abstract: In the last decade there has been increasing interest in building technology-rich active learning classrooms that support the enactment of social constructivist theories. We report on a six-year design-based research involving the evolution of such spaces at a college in Quebec, Canada. In particular, we discuss design principles of the technologies, including student-dedicated interactive whiteboards and cone-shaped tables, and the role they play in supporting the learning, student engagement and opportunities for teacher orchestration.

Introduction

Technology-rich collaborative learning environments, or active learning classrooms (ALCs), are drawing attention in post-secondary education. The architecture and furnishings of ALCs intentionally shift the object of instruction toward student-centered activity and reshape traditional authority structures. Instead of rows of front-facing desks, these new spaces feature pod-like clusters that promote peer collaboration. Commonly featured technologies in ALCs are large writable surfaces (e.g., whiteboards or writable walls), networked computing device (desk-top or personal) and projection systems (single or multiple) that allow for various display modalities – shared only with the pod of students, shared with the whole room, and so on. Research on how the design of such rooms impact collaboration and learning is beginning to draw interest among those in the CSCL community (e.g., Mercier, Higgins & Joyce-Gibbons, 2014; Slotta, 2010). The current study adds to this literature and reports on a six-year design-based research project that has lead to the construction of three ALCs at a large urban college in the province of Quebec, Canada. We describe how student engagement and group interaction patterns have guided the iterations of these designs, and when design alone is not enough.

Background

ALCs were designed to accommodate *active learning*. Active learning pedagogies bring into play tenents of social constructivist theories, many of which characterize learning as participation. Active learning often means creating joint-problem spaces and opportunities for students to engage in collaborative learning – i.e., the mutually coordinated engagement of individuals working together on specific tasks (Roschelle & Teasley, 1995).

Technology has played an important role in providing learning opportunities and facilitating requisite conditions for learning. Recent studies with shared digital interactive spaces include both the physical (Mercier, et al, 2014) as well as the virtual (Cakir, Zemel, & Stahl, 2009). Key feature of these spaces is how students' collaboration produces results that are co-constructions and can represent the collective knowledge. This current research uses these conceptual frameworks as a point of departure for evaluating the design of our first ALC.

Methods

This study is an example of a design-based research (DBR) project, with aspects of participatory action research. Data were collected from: (1) five years of classroom observations (~8 teachers, ~300 students); (2) student interviews (~60); (3) teacher interviews (~12); and (4) student surveys adapted from the National Survey of Student Engagement (~ 600 students, over 5 semesters).

ALC design iterations

The first generation ALC (ALC-V1) was designed on models from existing rooms (Priscilla Laws' Dickenson College in Pennsylvania being a primary influence). This version contained nine four-person pods each with two desktop computers arranged around the perimeter of the room so as to form a wide U-shape that flanked the teacher's space with a small movable table instead of traditional desk. Behind this table were two interactive whiteboards, dedicated for teacher use. These were connected to a projection system with two screens that anchored the far corners of the room allowing students to view the teacher's work even when their backs were turned away. Using an ethnographic approach the classroom observations revealed that students collaboration was hampered by the bottle-necking phenomenon that occurs with small screens and keyboards, as a single input device. Additionally, the four-person tables sometimes proved to be difficult to coordinate when students were absent and/or unprepared, creating groups that were less functional. An unanticipated use of the room came when several students ventured to use one of the writeable surfaces, and were later encouraged to use the

IWB, which until then had been reserved exclusively for teacher use. This marked an important change in practice among students.

Figure1. Arrangement of technologies within ALC-V3.

The second and third generation ALCs (ALC-V2 & V3) was based on the idea of putting IWBs into the hands of students. This process led to the reconceptualization of the student pods. Common table shapes for ALCs have been round tables but to put the emphasis on the student-dedicated IWBs tables were sculpted into cone-shaped tables (CST). The IWB located at the wide end of these tables and draw the pod's attention to the multi-user writable, interactive and public space.
Differences between second and third iteration of the ALC lies in the arrangement of the pods from a clustering to a horseshoe arrangement (see Figure 1). While the intention is to create a space that facilitates larger class-as-a-whole activities the student-dedicated IWBs and cone-shaped tables continue to be the most important technologies in the room design. What did change was how the teacher began to orchestrate the students' engagement. Creating activities that required students to stand up while using the IWBs.

What have we learned?

Unlike multi-touch tables, multi-touch IWBs, as designed into ALC-V2 and V3, provide opportunities for students to work together in truly public spaces. The large interactive surfaces not only afford student engagement in a physical joint problem-solving space but it is visible to other groups and the teacher. This design further facilitates teacher orchestration of activities and management of the groups. Specifically, teachers can scan the room to see the progress of each group and can interact with groups and the artifacts produced.

Learner agency also changes both as a result of design but more so as a result of the teacher orchestrational moves. The early design (ALC-V1) saw limited student agency with roles being more traditional collaboration between the dyads. Later designs (ALC-V2 & V3) showed new patterns of engagement, we identified three modalities: (1) tutor/tutee; (2) conference executive; and, (3) group learning. We discuss the third. The group learning mode illustrates the greatest amount of group agency. All students stand at the IWBs and use its capacity to create multiple sandboxes – editable workspaces. In this mode students were observed creating new resources such as temporary inscriptions and drawings (knowledge artifacts) to mediate their efforts to communicate and construct their thoughts. The temporary personal artifacts would allow a student to explain their understanding, and elaborate on a communication breakdown.

Design of the space and the location of the IWB technology has produced differences in the discourse and interactional patterns and resulted in different modes of student engagement. Interestingly, the most significant change in engagement observed was a result of the teacher orchestration. Further study is in progress.

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