

## **Designing Learning Trajectories with Interactive Tabletops**

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**Abstract:** This presentation focuses on challenges of designing for comparatively brief (twenty minutes) small group interactions using a multitouch table when the aim is to integrate this group work into a trajectory of whole class learning activities that span several hours. The multidisciplinary task for middle school students (age 12-15) is related to architecture design. The context for the activity is a traveling exhibition produced by a museum and a national organization that promotes art and culture in schools.

### **Framing the research**

The research presented in this workshop investigates two main pedagogical design challenges related to multitouch tabletops for middle school students (age 12-15). First, we explore the ways in which interactions with knowledge representations on multitouch tabletops can be productive for learning in small group work. Second, we investigate ways in which comparatively brief small group interactions may be made relevant for learning when incorporated into a longer, whole class activity that includes other technologies and platforms, such as mobile phones, cameras, and RFID scanners and tags. Both of these challenges are concerned with design issues related to the roles of the participants – peers, teacher, and museum educator, the task and instructional design, the complexity of the multimodal knowledge representations, the technical and visual features of the multitouch interface, and its relation to other technologies and infrastructures.

The context for the activity is a traveling exhibition on 'architecture' produced by a museum and a national organization that promotes art and culture in schools. The students are assigned the task of collaborating in groups to design a new building for cultural events in their local environment, modeling their inquiry and design process on architects' expert knowledge practices. The educational material includes digital renderings and technical drawings, analogue material samples and architectural models, and filmed interviews with architects at the Norwegian firm Snøhetta, internationally renowned for such buildings as the library in Alexandria, Egypt and the new opera house in Oslo.

### **Theoretical perspective**

We draw on socio-cultural perspectives (Vygotsky, 1978) and concepts from activity theory (Engeström, 1987; Daniels et al., 2009) in the design of activities and tools that mediate a collective learning activity, directing attention and orienting the learners in their collective efforts. Vygotsky's (1978) principle of 'double stimulation' frames the relation between the tasks formulated by the teachers and the curriculum (first stimulation), and how these intentions are strengthened and prompted by the learning environment (second stimulation). We use this concept to address how the multitouch interface should direct activity, both implicitly by the means of prompts, and explicitly, as a trajectory of actions to be performed by the learners.

The pedagogical design involves modeling experts working (Brown, Collins, & Duguid, 1989), specifically, architects working with materials, creative inspiration, sketching, and modeling, in a sequence of design development that involves negotiations with different stakeholders. Modeling is frequently used in pedagogical design, prompting students to master both procedural and conceptual knowledge relevant to a discipline, including ways of talking, social rules, and organizing their collective efforts to solve tasks. Modeling thus provides direction and scaffolding for students as they develop their own skills (Vygotsky, 1978, 1986). In this project, each class will be organized into groups that take on different roles and are required to develop design solutions from four perspectives; 'place,' 'climate,' 'environment,' and 'inspiration.' These perspectives will be represented in different analogue

and digital forms, including students' sketches, models, pictures, film, audio, and brought to the table to simulate, model, and collectively negotiate a design. Resources and scaffolds are designed to support this activity.

### Method

The co-design process to develop prototypes and a pilot study has involved a national museum, a leading international architecture firm, a commercial multitouch software developer, teachers, students, and university learning researchers, programmers and interaction designers. A series of exploratory workshops (Pierroux, 2009) were first conducted to broadly articulate the conceptual domain, the trajectory of pedagogical activities, the different technological devices, and the array of resources students and teachers will bring into the activity.



*Fig 1: A sketch from one of the workshops; an idea integrating the multitouch table, a wall projection, and a camera that 'places' an image of a cardboard building into an image of the surroundings.*

Weekly meetings were then held with a smaller group of stakeholders and InterMedia's lab and researchers to further develop features of the multitouch applications, specifically, the design of shared objects from multiple perspectives that both mediate a domain of knowledge, and model the expert architect's design process. Experimental use of the table and applications by teachers and students in our lab has also been central to the design development.

### Prototypes and pilot

The design will consist of several interconnected components:

- A multitouch application that has four modes that allow for the four different roles or expertise that the students take on (relating to 'place,' 'climate,' 'environment,' and 'inspiration') and a means for providing prompts for negotiation and alignment between these perspectives. This application will have means for e.g. experimenting with materials and form, the placement of the building in a landscape, issues of function and use etc.
- A social media platform (with wiki functionality) that serves as a means for bridging activity on the table with preparations and follow-up activities in the classroom. It does so by means of information and videos that trigger specific perspectives on the architectural process, and serves as a repository for the students' finished architectural projects.
- A mobile service gateway that will support upload of user-generated content, such as pictures and videos, to be used on the table. The gateway will support using mobile phones by means of Bluetooth and wifi.

In the workshop, we will present the research design, the pedagogical activities, and the in-progress development of applications planned for the pilot in a Norwegian middle school planned for fall 2010.

## References

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