Working Group on Instrumented Learning Spaces

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Driving Questions / Purpose

Collaborative learning in the real (vs online) world is notoriously difficult to assess. Ethnographies do not scale, and frequent surveys are disruptive.

Multi-modal sensing technologies are now affordable and small enough to bring into the classroom or learning environment

Understanding collaborative processes in an instrumented learning space calls on convergent expertise -- from learning sciences, from psychology, from computer science, and from design.

What will happen if we record a multi-modal data set of design activities in a makerspace using a bunch of academic researchers as both experimental designers and subject?

Participants

Backgrounds: learning sciences, human-computer interaction, organizational studies, technology

Win Burleson
Gustavo Almeida
Xavier Ochoa
Kayla DesPortes
Mike Tissenbaum
Veronica Newhardt
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Matthew Berland
Marcelo Worsley
Tom Moher

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Peter Wardrip
Ingrid Erickson
Dani Herro
Paulo Blikstein
Robb Lindgren
Luke Dubois
Liz Gerber
Noel Enyedy

Anne-Laure Fayard
Yoav Bergner

Process

Pre/post in-person event

Four sub-groups: **Constructs, Tasks, Instrumentation, Data**; virtual meetings co-ordinated by subgroup leaders, with summit meetings. All documentation and planning tracked in AirTable

In-person event

Working in different four-person groups, participants designed and prototyped a cup and saucer in the NYU Tandon Makerspace. Skeleton tracking, multi-channel audio, and radio-located positions were recorded throughout. Day two included reflection and planning sessions.

Findings

Multimodal sensing of individual design activities (our task) is still very challenging; our on-the-cheap approach was only partially successful, and work on audio reconstruction has turned out harder than we anticipated.

Converting research findings into actionable inputs is a delicate design issue. No one wants "clippy" for collaboration, but assistance in expertise/knowledge diffusion could help.

Being "part of the experiment" made the signal underdetermination problem salient; e.g., how to disambiguate intentions in movement

There is not enough cross-talk between research on collaboration in education and organization studies.

Principles

[New or reframed principles / insights for the design of STEM learning environments within your theme]

Instrumentation can be in competition with learning design. The technical challenges of using multi-modal sensing technologies can easily overwhelm the design efforts of instrumented learning spaces, sometimes pushing aside important questions of "purposeful evidence."

Need to be aware of many "peripheral" factors. Makerspace support staff (TAs) are an important part of a makerspace ecosystem and dependencies related to them must be accounted for in assessment of group work and process. Design of the space itself (cultural norms) can also influence outcomes.

Surprises & Tensions

Participants found the format of a workshop where we actually built things refreshing. It enabled new insights into:

> What would the data really show? Where should the camera have been? What about all of the design artifacts we made? What about the cultural norms felt in the makerspace itself (flagship products were cars and rockets).

In the rush to create a visible design product, assigned roles and scripts were cast aside, even by (especially by?) the researchers themselves.

Recommendations

Immediate: Instrumented learning spaces will benefit from support for more communication and collaboration opportunities between organizationists, educationists, and technologists.

Near-term (3-5 years): Assessment and measurement models for project-based learning environments can take innovative forms when coupled with multi-modal data streams. We needs to explore richer socio-techno-cognitive models.

Longer term: What we measure affects what we do (in a makerspace). Let us try to make sure we are setting up to count what should count.