

HS 525: Cognitive, Sociocultural and Critical Foundations of the Learning Sciences

Lecture 7: August 26, 2025
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Reflection

One thing I learned last time...

1. Constructivism - constructing knowledge based on experiences
2. Action oriented
3. Knowledge has instrumental value
4. Schemas
5. Assimilation, equilibrium, disequilibrium, accommodation
6. Cognitive conflict
7. Stages of cognitive development

One thing I found challenging last time...

1. Object permanence



Constructionism: A challenge to business as usual in schools

- Soap sculpture math: content driven by imagination, math used to “shape” their creations, melding of science/math and fantasy/imagination, setting off “trains of good scientific and mathematical ideas”
 - *It allowed time to think, to dream, to gaze, to get a new idea and try it and drop it or persist, time to talk, to see other people's work and their reaction to yours--not unlike mathematics as it is for the mathematician, but quite unlike math as it is in junior high school.*
 - Students appropriating science and mathematics
- Bricolage: Organization of work from the ground-up rather than from the top-down; constructing solutions or knowledge by “arranging and rearranging, by negotiating and renegotiating” between maker and the work in progress.



A challenge to business as usual in schools

- Style: Differences in ways of doing things - correlation with sociocultural characteristics
 - Preference for ways of thinking that stay close to physical/concrete things
- Construction kit projects allow for both bricolage and closeness to objects way of thinking, and formal, abstract way of thinking
- Possibility of expanding the repertoire of concepts or skills that are currently beyond the reach of children -> “new literacies”



What is constructionism?

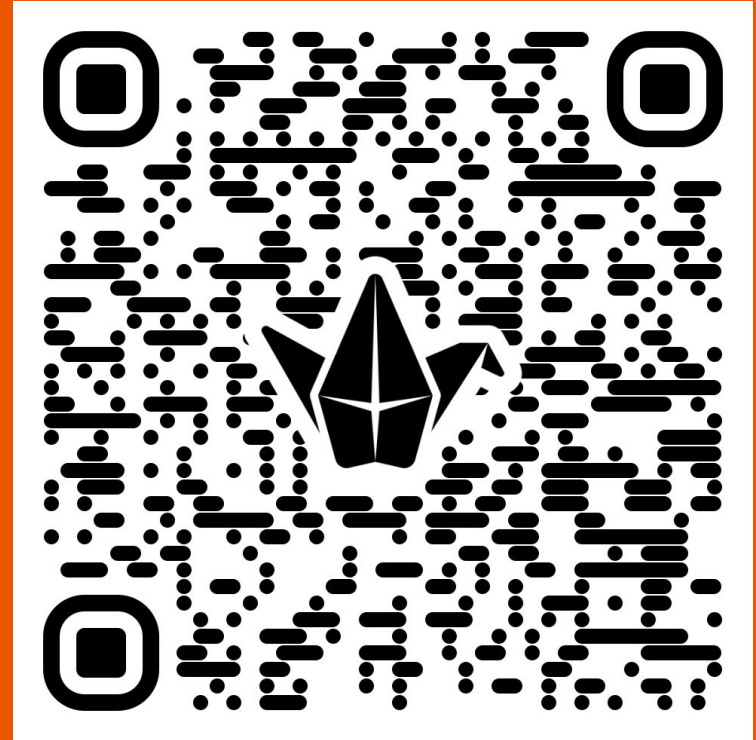
- Building knowledge structures (constructivism) through constructing public entities
- Constructionism vs. instructionism:
 - Favoring forms of knowledge based on working with concrete materials rather than abstract propositions
- Strong claim: Constructionism as the only learning framework that allows a wide range of thinking styles and preferences space to equilibrate



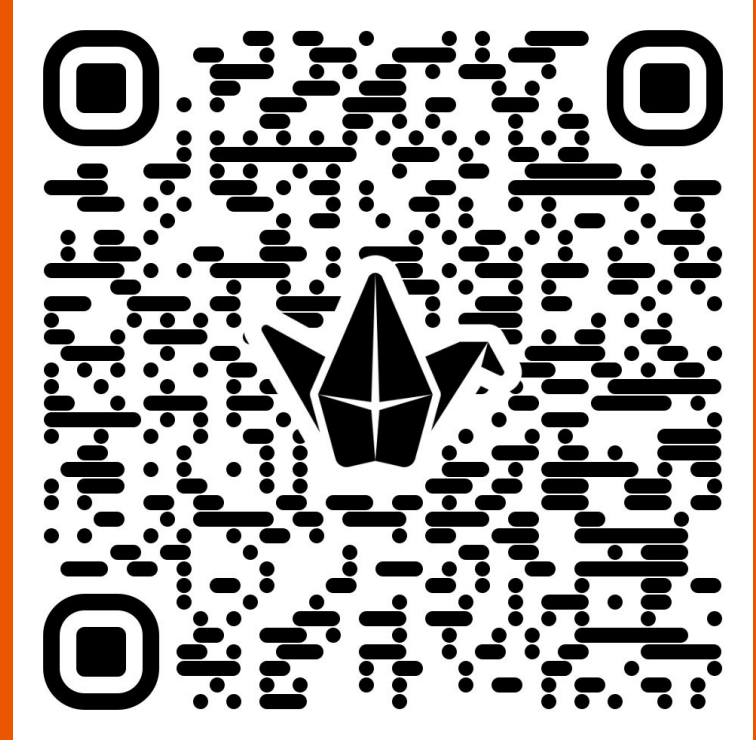
A student's “constructionist” experience of learning

A student had to build a computational model of a system she had designed and intended to build. Her goal was to use the computational model to get an estimate of the power the system would consume. She had two weeks to learn and do this because there was a conference paper submission deadline that she really wanted to meet. Being a new graduate student, she was yet unfamiliar with the tools and techniques of computational modeling. She set about doing this by practising typical computational modeling tools and techniques in her domain by making simple models of familiar systems. Next she used these tools to model her own system, testing and refining it as she went along. In the end she had a model for her system and an estimate of the power based on it. She wrote a paper and felt that she had learned computational modeling and acquired other knowledge along the way such as the fact that it is not possible to get a “true” estimate of power.

Think: Identify two
constructionist
mechanisms of
learning in this
episode (individual, 3
min)



Pair: Put your mechanisms together into a narrative of learning based on constructionism (pairs or groups, 5 min)



Share: Narrative of learning based on constructionism

- She used her old knowledge to create a computational skill and learned a new skill, and learned new skill on the side
- Personal stake, motivation to create -Started with a concrete goal
- She was creating a simulation using whatever she knew - tinkering/bricolage/trial and error
- She was constantly engaging the material - she kept changing the design based on the output - assimilation and accommodation through a conversation/negotiation with the material - pieces of code representing the model
- Final discovery was a big accommodation - nature of the value of power itself



Epistemology of Constructionism

- Difference in **nature of knowledge** and **nature of knowing** => Epistemological pluralism
- Challenging the hegemony (dominance) of certain types of knowledge (abstract, formal, impersonal, detached vs personal, concrete, close to objects) and ways of thinking (logical, planned, top-down vs bricolage, grounded, guided by the work).
- Computers (or any technology) goes beyond “first impact” when it challenges and fundamentally changes the way learning happens
 - Shifting from transfer of knowledge to production of knowledge by students
 - A tool based on abstract and formal mathematics has the affordances of making things concrete
- **Need to change school curriculum**



Implications for teaching and learning

“... an attitude of **respect** towards the **student**. If we want to teach thinking, we must have the **faith** that **students are able to think** and we must provide them with **opportunities** to do it.”

- “Knowledge is never acquired passively”
- Learners develop at different rates, so have **multiple activities** in a classroom
- The classroom as a space for **(re)discovering “truths”**



Implications for teaching and learning

- **Learning** is being able to **perform an activity** successfully.
- **Learners** have to **actively construct knowledge**
- **Language** used for **orienting** conceptual construction and force **reflection**.
- **Probe**/focus on students solution generation **processes**.
- **Learners** must feel **ownership** of the problem in order to focus attention -> create **useful problem situations** and **cognitive conflict**
- Rewards don't help foster understanding
- **Motivation** is developed by **overcoming** an obstacle, or **developing** principles/conceptual structures that are applicable in new situations



Educational Innovation and Design principles

- Radically change the way kids learn
- Change the context of learning
- Make children want to learn
- Better than improving our understanding of instruction
- Constructionist activities enhances teacher math instruction
- Not only computers
- Learning by teaching

Can we learn anything the constructivist/
constructionist way?



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