Literature searches -
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Readings for Today

Distributed constructionism theory paper - using theory to guide design
https://dl.acm.org/doi/10.5555/1161135.1161173

Using SOLO taxonomy to guide data analysis
https://dl.acm.org/doi/10.1145/3291279.3339405

Using theory in CS education
https://dl.acm.org/doi/10.1145/3230977.3230992
Goals for today

Familiarize ourselves with multiple theories that drive CS Ed research

Learn how those theories are used in research

Discuss the three papers in relation to these theories and their uses

Be critical / opinionated (but obviously still respectful) -

We want to explore possible (reasonable) interpretations, not just say what we 100% believe
Theories Encountered So Far

Cognitive Load Theory
Constructionism
SOLO Taxonomy
Constructivism
Theories Encountered So Far

- Maslow’s Hierarchy of Needs
- Constructivism
- Distributed Cognition
- Constructionism
- Distributed Constructionism
- SOLO Taxonomy
- Cognitive Load Theory
Anti-Constructivism: Sage on the Stage
Constructivism

1. People understand through lens of existing knowledge
   a. The world is round - like a pancake or a ball?
2. They are active participants in building their knowledge / creators of knowledge
Designing Curriculum: Theory: Constructivism
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Designing Curriculum: Theory: Constructivism
Distributed Cognition

Cognition and intelligence are not attributes of an individual, but rather arise from interactions of a person with the surrounding environment.

Any relationship to Constructivism?
Anti-Constructionism:
Constructionism:

1. Constructing something
2. Personally meaningful, self directed
3. Public sharing of artifact

Similar ideas outside of CS Ed?

Inquiry-based learning
Open-ended projects
Distributed Constructionism: Ways to use networks to... 

Discussing Constructions

Sharing Constructions

Collaborating on Constructions
SOLO Taxonomy: 5 levels
SOLO Taxonomy: 5 levels

Prestructural: little to no understanding of the topic

Unistructural: understanding of a single aspect of the topic

Multistructural: understanding of several aspects of the task but each aspect is represented independently

Relational: understanding of several aspects of the task and how they are related

Extended Abstract: understanding of the aspects can be generalized beyond the context of the question
SOLO Taxonomy: in CS

Prestructural: significant misconception or preconception irrelevant to programming

Unistructural: Correct grapes of some but not all aspects of the problem (e.g. educated guess)

Multistructural: Understands all parts of the problem but does not exhibit an awareness of the relationships between the parts; the answer may be correct or not

Relational: Parts of the problem are integrated into a structure; the answer may be correct or not

Extended: The response goes beyond the immediate problem and links to a broader context
Cognitive Load Theory

Your mind:

- Has a limit on information
- Filters information

Instructional interventions should limit the amount of information so it doesn’t fill up working memory

Which is easier?

Two additional features

Visual and Auditory information do not compete ("Modality Effect") - better to narrate than add clutter to diagram.

Learned information in scheme treated as a single grouped item. Therefore, mastery before new things is better than learning many new things at once.
CLT Education Guidance

Adapt Presentation to Expertise

Reduce the Problem Space (amount to learn)

Integrate pieces of information rather than presenting separately

Take advantage of auditory + visual channels
How would we test a theory?

Construct an experiment that would help us gain insight into

  Constructionism

  Cognitive Load Theory

If any pertinent questions arise while discussing how to do this, share with the group to discuss. Write down any assumptions you’re making about Constructionism as you design your experiment.
Ways theory is used:
Ways theory is used:

- Guide designs
- Analyze data
- Interpret data
- Evaluate papers for publication
Guide Designs (advantages / disadvantages)
What would happen if we didn’t use theory?
What would happen if we overused theory?
Analyze Results (advantages / disadvantages)
What would happen if we didn't use theory?
What would happen if we overused theory?
Interpret Results (advantages / disadvantages)
What would happen if we didn’t use theory?
What would happen if we overused theory?
Judge Papers (advantages / disadvantages)
What would happen if we didn’t use theory?
What would happen if we overused theory?