Readings for Today

Efficiency of Learning from Proof Blocks vs Writing Proofs
https://dl.acm.org/doi/10.1145/3545945.3569797

Using Foundational CS1 Curricula for Middle School & Early High School Computer Programming Education
https://dl.acm.org/doi/10.1145/3545945.3569877

But first!!!! Let’s learn a little theory
Goals for today

Familiarize ourselves with multiple theories that drive CS Ed research
Learn how those theories are used in research
Discuss good presentation design
Discuss the two papers in relation to the levels of research design

Be critical / opinionated (but obviously still respectful) -
We want to explore possible (reasonable) interpretations, not just say what we 100% believe
Affordances Boggle

I give you a raw material(s)

You think of all of the things you can make with that material (with little else)

Scoring:

For each idea, 1 point for each opponent who did not think of it

I will group ideas into a higher-level concept if very detailed
Leaves
Blind Spots:
Novices vs Experts

https://www.youtube.com/watch?v=_4IRMYuE1hI
Guitar Hero Musical Notation
Affordances

**Visible**: A comfy chair for some

**False**: Too deep for short people

**Hidden**: A stool with right incentive
Design fails for females / minorities

- Non-wheelchair-accessible rooms / buildings / etc.
- Facial recognition misidentifying people with darker skin
- Central A/C set to temperatures comfortable to men, freezing for women
- Seat belt designs for pregnant women?
- Several short females got killed by air bags when they first became standard
- Gym equipment is too high for some people
- Questionnaires about families assume you have a mother and a father - genders, single parents, grandparents, etc., are outliers
Design fails for females / minorities

- **Air bags**
  - Crash test dummies were adult male sized
  - Killed children and small females in passenger seat
  - Killed small female drivers from steering wheel airbag

- **Ill-fitting PPE (masks too large and won’t seal)**

- **Body armor doesn’t account for female chests**

- **Facial recognition software (minorities falsely accused)**

- **Department “unisex” sweatshirts last year - this year they got W & M sizes**

- **Voice recognition software (recognizes male voices, California American English accent)**

Guess the Probability Game

I will have a program with a certain probability that it will report 0 or 1

Possibilities are: 0, 10, 20, 30, 40, 50, 60, 70, 80, 90 100

Each person gets one guess

1st correct guess gets 10 pts

2nd correct guess gets 5 pts

Incorrect guess gets -5 pts
What technical material does this game expose?
What do we learn about learning?

If you are careful about the mechanics, students have to really think about the technical material and what it means.

More engaging
What do we learn about learning?

More active, less passive during game

Might learn more when I’m engaged

May not get the actual learning goal unless made explicit
Gamification

1. Use the **incentives** in games to encourage students to complete learning tasks
2. Apply motivation theory and game theory to education
Elements:

**Mechanics**: The game itself - rules, game elements, etc.

**Dynamics**: The ways in which the mechanics cause interactions during gameplay

**Aesthetics**: The resulting emotions that the player feels from the interactions

The *designer* creates *mechanics*, which in turn cause dynamics

But the *player* feels the *aesthetics* first, which are caused by dynamics & mechanics

The designer should identify emotions, then identify the dynamics that would cause those emotions, and finally design mechanics.

Therefore, a designer should design right to left.
Elements:

**Mechanics**: Lessons, activities, software, policies

**Dynamics**: The ways in which the mechanics cause interactions during class

**Aesthetics**: The resulting emotions that the player feels from the interactions

**Learning**: The resulting learning that occurs as a result of the interactions

The **designer** creates *mechanics*, which in turn cause dynamics

The **learner** feels the *aesthetics* first, which are caused by dynamics & mechanics

The **teacher** feels the *aesthetics*, but also controls many of the dynamics
The designer profile learners, decide on learning goals, identify emotions, then identify the dynamics that would result in the combination of the desired learning goals emotions, and finally design mechanics. Therefore, a designer should design right to left.
Presentation: Proof Blocks
Attributes of a good set of slides (according to Diana)

- Motivation at the very beginning
- Images to add to the motivation
- Add titles to the slides
- Related work: added pictures and explained the relationship between related work and our work
- Wait on details until you’ve set up the problem well
- Include all pertinent research study design details
- The slide order is important!
Attributes of a good delivery

- Not reading the slides verbatim, but expand on them (use images when possible)
- Loud enough for everyone to hear
- Look at the audience, not the slides
- Not a monotone voice
Proof Blocks

Discuss papers

What was their idea?

How did they analyze it?

*What do you think about it? Do you think it would have worked for you? (why or why not)*

In groups, you answer the following question

In what ways did the paper use CS Ed theory?

What are the limitations in the research design?

What are next research steps?
Foundation CS1 in middle / high school
In-class Activities

Discuss papers

  What was their idea?
  How did they analyze it?

  **What do you think about it? Do you think it would have worked for you? (why or why not)**

In groups, you answer the following question

  In what ways did the paper use CS Ed theory?
  What are the limitations in the research design?
  What are next research steps?
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