Learning Trajectories

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Announcements

This is CMSC 209, Computers for Learning - NOT Intro to Data Science
Readings are due prior to class, not accepted late for credit (unless hospitalization, etc.)
Cannot change syllabus, so lab attendance is not for credit. Just remember that students who attend lab do better in the class, and we won’t extend deadlines due to procrastination.
Midterm will be a take-home, non-timed exam, so no proctoring / special circumstances apply
Basic Learning Strategies
(inspired by Constructivism)

Incrementally teach material
Build on prior knowledge (in school and at home)
Designing Curriculum: Theory: Constructivism

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Designing Curriculum: Theory: Constructivism
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Designing Curriculum: Theory: Constructivism
What is a Learning Trajectory?

• A learning trajectory is a path from students’ existing knowledge to some particular learning goal.

• One useful way to conceptualize an LT is to think of it as having three components:\n  – An overarching learning goal;
  – A partially ordered list of waypoints that suggest a pathway to the learning goal; and
  – A set of learning activities that help students move along the path.
How does theory influence Learning Trajectory shape?

(a) Learning Progression
Pieces of Knowledge

• What factors influence order in which knowledge is learned?

• How is Pieces of Knowledge different from prior views of Learning Progressions?
How does theory influence Learning Trajectory shape?

(b) Pieces of Knowledge
How does theory influence Learning Trajectory shape?

(c) Spiral Curriculum
Spiral Curriculum – 3 key aspects
Spiral Curriculum – 3 key aspects

• Same concepts revisited
• Revisited in more depth
• Connections made to previous visit
How does theory influence Learning Trajectory shape?

(d) Constructivism
Learning Trajectories

• Content, not teaching method
• Provide *possible orderings* for presenting material that builds upon itself
• Identifies points of understanding to focus on before going to next level
Let’s try making an LT

• Learning Goal (endpoint)
• Prior knowledge necessary / helpful
Let’s try making an LT

• Learning Goal (endpoint)

• Prior knowledge necessary / helpful

Is this useful?

Too coarse-grained – “division” is not one learning goal
Too much content – won’t teach this all in one activity
Potentially too easy – division (from products < 13) is memorization, not understanding
Stepwise Refinement – Break it Down!

Lower Anchor Point(s) (what they already know)

- Multiplication up to 10’s
- Division < 144 No remainder
- Long Division No remainder
- Long Division w/ remainder
Stepwise Refinement – Break it Down!

1. Multiplication up to 10’s
2. Divide by 10
3. Division < 144 No remainder
4. Long Division No remainder
5. Long Division w/ remainder

Lower Anchor Point

Divide by 5
Stepwise Refinement – Break it Down!

Lower Anchor Point

- Multiplication by 10’s, 5’s
- Divide by 10
- Divide by 5
- Division < 144 No remainder
- Long Division No remainder
- Long Division w/ remainder

- Multiplication up to 12’s
- Divide by 9
Stepwise Refinement – Break it Down!

Long Division
- w/ remainder
- No remainder

Division < 144
- No remainder

Multiplication
- by 10’s, 5’s
- up to 12’s

Divide by 10

Divide by 5

Divide by 9

Lower Anchor Point

How does your game teach?
How do students know it was correct?
How do they know what aspect they did wrong?
(These will be explored later in game design)
Stepwise Refinement – Break it Down!

Lower Anchor Point

Be able to divide x/10, x <= 100

Be able to multiply 5*x and 10*x, x <= 10

Be able to divide x/5, x <= 50

Be able to multiply x * y, x&y<=13

Be able to divide x/y, x <= 144 No remainder

Be able to divide x/y, x <= 144 No remainder

Long Division: Be able to divide x/y, No remainder

Long Division: Be able to divide x/y w/ remainder

How does your game teach?
How do students know it was correct?
How do they know what aspect they did wrong?
(t hese will be explored later in game design)

These are all *skills* - LT’s can also have *knowledge goals*
LT for Loops

How could this be improved?
Create an LT for Variables

1. Define an end learning goal
2. Define intermediate goals
3. Define lower anchor points
4. Identify dependencies between them
5. Draw it with boxes and arrows
Breakout Group

Make a learning trajectory for practice (do not need to be held to it for your final project)
Focus is on the granularity of learning goals (not too large) and ordering them

Use online resources for inspiration for individual learning goals (textbooks or standards if it is academic, other learning materials for other subjects)
Project

- Groups of 2-3
- Choose a subject to teach
- Choose what level to teach (3rd – 9th grade)
  - Use to identify lower anchor points
- Main target must be different from yourself in some meaningful way (age, interests, opportunities, culture, language, etc.)
Content Attributes

• Cannot be memorization (e.g. flashcards)
• Cannot teach through “quiz”
• Must have a character that moves
  – Must interact with other objects on screen
• Must have multiple “scenes” (backgrounds)
  – Opening / welcome screen with multiple choices
  – Internal screen with mini-games
Project

• Design
  – Complete design
  – No resource constraints (time, $)

• Implementation
  – Agreed-upon subset of full design
  – Reasonable to complete by end of quarter
  – Illustrates the design of the game and principles of course