Collaborative Learning in STEM Education

Theory and Practice

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In a few minutes, outline your answers to the following questions:

• What happens when someone “learns” a scientific idea?
• What does it mean to “know” something?
Constructivism has been conceptualized in several ways, but all versions contain a few basic properties:

- Knowledge is actively constructed by the individual.
- The role of cognition is to organize one’s experiential world.
- The process of human interaction results in shared meanings.

Because of the widespread adoption of constructivist points of view across settings, it is often presented more as a philosophy or worldview, rather than a specific theory.
Collaborative Learning: Theory
Piaget and Vygotsky

- For the purposes of argument, consider a couple of (broad) versions of constructivism in an educational setting:
  - **Piagetian constructivism**: Piaget focused educators on the “internally driven mental activity of the student”, the construction of meaning and knowledge for oneself. Cognitive development proceeds in stages that are universal and predictable.
  - **Vygotskian social constructivism**: functioning in a group/society/culture, individuals negotiate and construct knowledge through discourse. The resulting knowledge is a *culture* of shared meanings.

Collaborative Learning: Theory
Zone of Proximal Development

- A useful Vygotskian concept is the **zone of proximal development (ZPD)**.
- The ZPD is the “gap” between what a learner can accomplish on their own and what they can accomplish with the support of a teacher/others.
- In the context of SEP-CyLE, this is useful to think about in two ways:
  - The Learning Objects on their own can help expand a student’s ZPD.
  - The collaborative learning components may further expand the ZPD.

Collaborative Learning: Practice
What can collaborative learning look like? An example.
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• Students spend much of their time explaining to one another ("recognition opportunities").
Collaborative Learning: Practice
What can collaborative learning look like? An example.

• I don’t lecture (ever).
Collaborative Learning: Practice
What can collaborative learning look like? An example.

• Students learn to figure out a lot of their own problems; take ownership over learning.
## SEP-CyLE Activity

### Backwards Design

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<thead>
<tr>
<th>Desired Outcomes</th>
<th>Assessments</th>
<th>Learning Activities</th>
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<tbody>
<tr>
<td><strong>Desired Outcomes</strong>: What core “enduring understandings” are desired?</td>
<td><strong>Assessments</strong>: How will we know a student has developed these enduring understandings? What can they perform, solve, address?</td>
<td><strong>Learning Activities</strong>: What activities, resources, and/or materials will help students to achieve the desired outcomes?</td>
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SEP-CyLE Activity
Designing LOs with collaborative learning in mind

• While engaging in the backwards design process, think particularly about what a team/group of students might do together (or virtually together) while working through your LO.
• Remember that student discourse is helpful, and may support learning more effectively than having them work an LO alone.
SEP-CyLE Activity
Designing LOs

• Get into groups (Peter arranged) based on LO topics.
• Begin the backwards design process by identify the desired outcomes of your LO (1-2 outcomes only – LOs should be short learning experiences!): 20 minutes
• We will then get back together to discuss.