Student Learning and Dynamic Transfer While Interacting with Constructing Physics Understanding Curriculum (CPU): A Case Study

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Sound and Wave Unit

Cycle I: Introduction to Wave Properties
- Cycle II: Sources of Sound, Harmonics and Quality of Sound
- Cycle III: Factors that Affect the Speed of a Wave
- Cycle IV: Interference and Diffraction

CPU Pedagogy & Waves and Sound - Cycle I

Elicitation activity
Set of Application Activities
- Group Consensus
Class Consensus Discussion
Set of Development Activities

Research Setting
- University of San Carlos, Cebu City, Philippines
- 6 incoming Senior Students
  - majoring in Physics-Chemistry teacher education
  - Physics-Mathematics teacher education
  - availability
  - 1 man and 5 women

Data Sources
- Worksheets
- Idea Journals
- Transcripts

Analytical Framework
- Dynamic Transfer Model

Research Questions

Phase I: To what extent is the Constructing Physics Understanding curriculum (CPU) effective in the University of San Carlos (USC) environment?

Phase II: How do students develop intellectually as they interact with Constructing Physics Understanding (CPU) unit?
Research Methodology

- Phenomenographic Approach\(^1\)
  - variations of thinking
- Constructivism Philosophy
  - Zone of Proximal Development\(^2\)
  - Conceptual Change\(^3\)

\(^1\) Creswell (1999)  \(^2\) Tharp and Gallimore (1998)  \(^3\) Duit (1999)

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**Phase I: Agreements and Disparities in CC-I**

<table>
<thead>
<tr>
<th>Knowledge Construction</th>
<th>Activity Disparity</th>
<th>Group Disparity</th>
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<tbody>
<tr>
<td>Phase I: Resolution of Disparities in CC-I</td>
<td>Discussion on Velocity-Wavelength-Frequency Equation and Linear Equation</td>
<td>Discussion of Errors</td>
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</tbody>
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**Phase I: An Example in Resolving Disparities in CC-I**

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Association I</th>
<th>Association II</th>
<th>Association III</th>
<th>Association IV</th>
<th>Final answer</th>
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Phase II: Emerging Themes From Transcript on Spring Activity

- Students extend other's ideas that fit to their knowledge structures
- Students' predictions being controlled by prior knowledge or activities
- Filtration of inputs into target concepts
- Target ideas from external inputs activate previous associations to create new associations

Phase II: Themes from Spring Activity Transcript

- Students' predictions being controlled by prior knowledge or activities
- Filtration of inputs into target concepts

Input
- Speed of wave investigation
- Sub-activity 6

Control
- Pulse speed
- The lengths of spring with string and spring without string

Association
- Prediction and investigation was limited to pulse speed

Output
- LONG TERM MEMORY Sub-Activity 1 to 4
- Sub-activity 4

Conclusion

Phase I: Extent of CPU's Effectiveness
- In some respect CPU applied at USC was an effective tool in meeting target ideas
- CPU created disparities between groups and activities
- Resolution of disparities need expert intervention "a time to tell"

Phase II: Students' Intellectual Development
- Students extend other's ideas that would fit their knowledge structures;
- Students' predictions could be controlled by prior knowledge or activities - filtration (Rebello, 2005)
- Target ideas from external inputs activate previous associations to create new associations (Rebello, 2005)
- Dynamic Transfer Model framework of analysis did help in mapping out students' knowledge elements and as well as evaluate the CPU curriculum

Implications for Instruction
- Be wary of "stand alone" materials. Students may interpret them differently than intended and may not scaffold as desired.
- Working equipment certainly will lessen disparities.
- The role of the instructor as a guide and mentor is indispensable. The "time to tell" is essential to students' intellectual development.

Further Research
- Look into other Cycle I activities in order to further gauge students' intellectual development
- Ownership of knowledge issue