Examining Teacher Decision Making During Enactments of Novel Technology-Infused Curricula

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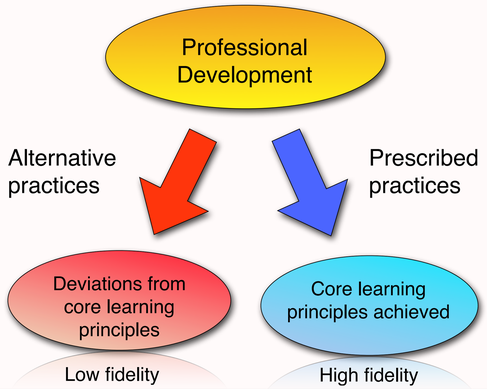
Abstract: *The implementation of computer-based curricula is not a simple process, but a complex issue that designers of innovations must address. In this study, we examine the pedagogical strategies teachers make when using a computer-based curriculum. We argue that teachers' apparent divergences from curriculum frameworks may be deviations only in a superficial sense and that teachers who follow curriculum guidelines literally may adapt the curriculum in unexpected ways.*

Teachers use of technology and designers of curriculum

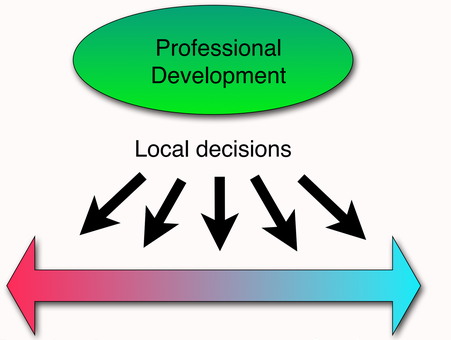
- Science education policy makers call for the integration of computers into the classroom (NRC, 2000)
- Designers of technology curricula need to address the role of teachers (Edelson, Gordin, and Pea, 1999).
- Many factors influence technology curricular enactments such as local environment and the teachers' perception of the curriculum (Songer, Lee & Kam, 2002; Squire, MaKinster, Barnett, Luehmann, & Barab, 2003).
- Alternative teacher conceptions can deviate from designers intentions (Brown and Campione, 1996)

Conceptual Models of Implementation

High Fidelity: The extent the program components were delivered as prescribed in program manuals and can be faithfully replicated (Dane and Scheinder, 1998)



Pro-adaptation: Differing contexts and practitioner needs necessitate that changes in the programs be made by each adopter (House, Kerins, & Steele, 1972)



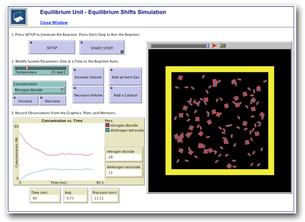
Research context and methods

- Case-study (Yin, 2006) to compare two teachers' of use of Connected Chemistry. We examined how teachers made connections between submicroscopic, macroscopic and symbolic levels and how they make those connections explicit for students.

- Researchers videotaped two 40-min. lessons for Mr. Jones and two 50-min. lessons for Mr. Davidson. Analysis focused on video, transcription and thematizing using a constant comparative method (Strauss & Corbin, 2007).

Research Question

- How do teachers' strict adherence or flexible adoption of a CBT science infused curriculum support the learning goals of the curriculum?



Connected Chemistry integrates NetLogo simulations that can dynamically display symbolic representations (graphs) with submicroscopic interactions (molecules)

Results

What did you do to the concentration of NO_2 (reference to simulation)? This would be on part E.2.1, it would be on the first page of that (looks down on the worksheet).

Ummm, increase it?

Increase it? Which way did the reaction shift? (20-second pause)

To the right.

It shifted to the right. Okay. So… the stress you added is what? The stress is what you do.

Added it

3 years of teaching experience; school ranked in the fourth decile statewide.

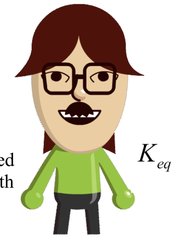
A couple people have said, 'I don't see a shift at all because K would stay at 0.724 (referring to the simulation). So there's no shift. It stayed at this (points to 0.724 on the board). Think about it. If I increase this amount here (points to the numerator) and it stayed at 0.724 in order for that to happen what would have to happen to these two concentrations? They would have to what?

Change.

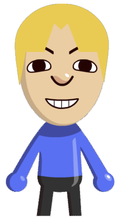
Change, right? You have an original concentration here and here (points to numerator and denominator) and it's at 0.724. You add some more N_2O_4, the equilibrium constant remains at 0.724. Can this concentration (points to N_2O_4) stay when you add the new one (refers to NO_2)?

No

15 years of teaching experience; school ranked in the seventh decile statewide.



$$K_{eq} = 0.724 = \frac{[N_2O_4]^2}{[NO_2]}$$



Mr. Jones' enactment

- Mr. Jones uses the worksheets as a pacing guide; he systematically reads each question out loud for the class.
- Although all the questions have been completed, he does not emphasize connections between the macroscopic, submicroscopic and symbolic levels that are consistent with the design principles of the curriculum.
- The questions asked stay mainly on the observation level (e.g. what did you do, what did you find?).
- Mr. Jones chose to only use the pre-developed curriculum materials (simulations and worksheets)

Mr. Davidson's enactment

- Mr. Davidson appears less concerned about completing each activity. Instead of using the activity as a script, he uses the worksheets as a guide to help students.
- When the simulations are useful, he addresses them directly using multiple levels and clearly articulating his level of reasoning. However, he is not constrained by the curriculum and abandons some activities..
- Ultimately, he bridges the gap between the students' observations of the simulations and their conceptual understanding of K_{eq}-values.
- Mr. Davidson also ties together the macroscopic observations and the symbolic representation through his self developed lab demonstration.

Findings

- Teachers that are tied too closely to the materials may lose sight of the overarching goals of the curriculum. Although Mr. Jones enacts the curriculum with high fidelity, we believe he diverges significantly from the intended learning objectives of the lesson.
- Mr. Davidson spent significant time connecting the submicroscopic observation, macroscopic demonstration and the symbolic representations. He is able to remain consistent with the goals of the curriculum despite an apparent lack of fidelity in his enactment.

Implications

- We argue that professional development (PD) opportunities for teachers who are seeking to enact technology infused curricula emphasize the goals of the curriculum, rather than strict adherence to the materials.
- PD for teachers should include opportunities to discuss how teachers can adopt curricular materials to meet the needs of local contexts and available resources.

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