ZEPs: Zero-Expectation Problems in IBL

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IBL&T Conference
May 31, 2018
Austin, TX

A scenario…

In a set-theory, intro-to-proof, or discrete course:

“Suppose you have set manipulations: intersection, union, subset inclusion, set minus. Create and prove one conjecture using four or more sets.”

What are your expectations for your students?

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Another scenario…

What are some similarities and differences between base 10 and base 5? What do you notice and wonder about the following numbers?

432

432_5

What are ZEPs?

Problems that allow students to:

- Make connections
- Take risks
- Play with important underlying mathematical concepts of the course
- Be curious

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Think, Pair, Share

What are some ZEPs that you can create for Calculus 1 (limits and derivatives)?

Think, Pair, Share(!) part 2

1. What are the advantages to ZEPs?

2. What are some characteristics of classroom environment that prepare students to engage in ZEPs?

3. How can one assess ZEPs?

4. How can one handle ZEPs in the classroom?

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Portfolio Problems – A way to intro ZEPs

Student Comment: Based on what we have done so far [in this class], it reminds me of Andrew Wiles' process. The portfolio problems are very similar to what he did but on a much smaller scale….I think how we solve these problems is also very ***creative*** because everyone uses different problem-solving strategies.

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CPR - A way to “assess” ZEPs

MAKING CONNECTIONS:	Beginning	Developing	Advancing
Between Definitions/Theorems	Recognizes some relevant definitions/theorems from the course or textbook with no attempts to connect them in their proving	Recognizes some relevant definitions/theorems from the course and attempts to connect them in their proving	Implements definitions/theorems from the course and/or other resources outside the course in their proving
Between Representations	Provides a representation with no attempts to connect it to another representation	Recognizes connections between representations	Uses connections between different representations
Between Examples	Generates one or two specific examples with no attempt to connect them	Recognizes a connection between the generated examples	Uses the key idea synthesized from generating examples

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CPR - A way to “assess” ZEPs

TAKING RISKS:	Beginning	Developing	Advancing
Tools and Tricks[2]	Uses a tool or trick that is algorithmic or conventional for the course or the student	Uses a tool or trick that is model-based or partly unconventional[3] for the course or the student	Creates a tool or trick that is unconventional for the course or the student
Flexibility[4]	Begins a proof attempt (or more than one proof attempt), but uses only one approach	Acknowledges and/or uses more than one proving approach, but only draws on one proof technique	Uses more than one proof technique
Posing Questions	Recognizes there should be a question asked, but does not pose a question[5]	Poses questions clarifying a statement of a definition or theorem	Poses questions about reasoning within a proof
Evaluation of Proof Attempt	Examines surface-level[6] features of a proof attempt	Examines an entire proof attempt for logical or structural flow	Examines and *revises* an entire proof attempt for logical or structural flow

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It must not be forgotten that the basic law of children's creativity is that its value lies not in its results, not in the product of creation, ***but in the process itself***. It is not important what children create, but that they do create, that they exercise and implement their creative imagination. (Vygotsky, in 2004 translation, p. 72)

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Thank you!

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