A RESEARCH-BASED RUBRIC TO ASSESS STUDENTS' CREATIVITY IN PROOF AND PROVING

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it is … …ming
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CPR

				…reproduces an …priate exemplar.
		…uct.	…nsiders new directions or approaches without going beyond the guidelines of the assignment.	Stays strictly within the guidelines of the assignment.
	Not only develops a logical, consistent plan to solve problem, but recognizes consequences of solution and can articulate reason for choosing solution.	Having selected from among alternatives, develops a logical, consistent plan to solve the problem.	Considers and rejects less acceptable approaches to solving problem.	Only a single approach is considered and is used to solve the problem.
Embracing Contradictions	Integrates alternate, divergent, or contradictory perspectives or ideas fully.	Incorporates alternate, divergent, or contradictory perspectives or ideas in a exploratory way.	Includes (recognizes the value of) alternate, divergent, or contradictory perspectives or ideas in a small way.	Acknowledges (mentions in passing) alternate, divergent, or contradictory perspectives or ideas.
Innovative Thinking *Novelty or uniqueness (of idea, claim, question, form, etc.)*	Extends a novel or unique idea, question, format, or product to create new knowledge or knowledge that crosses boundaries.	Creates a novel or unique idea, question, format, or product.	Experiments with creating a novel or unique idea, question, format, or product.	Reformulates a collection of available ideas.
Connecting, Synthesizing, Transforming	Transforms ideas or solutions into entirely new forms.	Synthesizes ideas or solutions into a coherent whole.	Connects ideas or solutions in novel ways.	Recognizes existing connections among ideas or solutions.

Three Categories of CPR

Making Connections

Ability to demonstrate links between multiple representations, and/or ideas from the current and/or previous course(s) that the student is in.

Taking Risks

Ability to approach a proof and demonstrate flexibility in using different or multiple approaches

Creating Ideas

Ability to state an original mathematical idea that is either pertinent to the proof or can be proven itself

Making Connections

Making Connections:	**Beginner**	**Developing**	**Satisfactory**
Between Definitions or Theorems	Introduces few definitions/theorems, some irrelevant	Recognizes some relevant definitions/theorems from the course or textbook and attempts to join them	Implements definitions/theorems from the course and/or prior knowledge (e.g. a prior course)
Between Representations[1]	Attempts a connection between two representations	Demonstrates connections between multiple representations either to enhance an idea or help understanding	Utilizes different representations to strengthen the proof
Between Examples	Generates one or two specific examples for the proof	Attempts to make connections between specific and general examples	Able to move freely back and forth between specific and general examples
Between Proof Techniques[2] *and Previous Proofs*	Does not show a connection between proof techniques of previous proofs	Attempts to utilize a proof technique due to its success in previous proofs	Recognizes an understanding of previous success with proof techniques and groups certain mathematical concepts with certain proof techniques

Clarifications

- Process vs. Product
- Relative vs. Absolute (Vygotsky, 1982; 1984)

Example

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Teaching Strategies with the CPR

- Setting up the environment in the classroom:
  - Discuss/demonstrate proving attempts
    - Emphasize that mistakes can help
  - Pose theorems that require multiple solutions
  - Assign conjecturing tasks in homework

So…

CPR

CALL NOW!

Thank you!

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*Side effects include: student collaboration, positive attitude towards proving, NO nausea, persistence and preparation for future proof courses

**NOT APPROVED BY THE FDA

***Results may vary…and we think that is OK!

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Questions?

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