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Generation of mathematical knowledge through heuristic refutation

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Mathematical philosopher Imre Lakatos described one aspect of mathematical practice where mathematics develops through mathematical activity involving proofs and refutations. In our PRinDGE project, we have aimed to introduce this activity into school mathematics so that students can experience authentic mathematical practice. To date, we have shown how tasks can be designed to engage students in mathematical activity consisting of conjecturing, proving, and refuting (Komatsu, 2017; Komatsu & Jones, in press). We are currently adding another dimension, the generation of mathematical knowledge (such as mathematical definitions and theorems), to this mathematical activity. This is consistent with Lakatos's research in which he argued that some mathematical definitions (e.g., polyhedra and uniform convergence) were proposed during the process of dealing with counterexamples. In this presentation, we report on an intervention study implemented in a lower secondary school in Japan (students aged 14–15). In the implemented lessons, tasks designed using specific principles, and the teacher's roles, supported the students in finding and proving the inscribed quadrilateral theorem through addressing counterexamples they discovered.