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**“Rising to the challenge”: Using generalization in pattern problems to unearth the algebraic skills of talented pre-algebra students.**

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Summary: This study focuses on the generalization methods used by talented pre-algebra students in solving linear and non-linear pattern problems. A qualitative analysis of the solutions of three problems revealed two approaches to generalization: recursive-local and functional-global. The students showed mental flexibility, shifting smoothly between pictorial, verbal and numerical representations and abandoning additive solution approaches in favor of more effective multiplicative strategies. Three forms of reflection aided generalization: reflection on commonalities in the pattern sequence’s structure, reflection on the generalization method, and reflection on the “tentative generalization” through verification of the pattern sequence. The latter indicates an intuitive grasp of the mathematical power of generalization. The students’ generalizations evinced algebraic thinking in the discovery of variables, constants and their mutual relations, and in the communication of these discoveries using invented algebraic notation. This study confirms the centrality of generalizations in mathematics and their potential as gateways to the world of algebra.

*Classification:* H23 C33

*Keywords:* algebraic thinking; elementary algebra; pattern problems; generalization; educational research; lower secondary

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