Brahim El Fadil & Ridha Najar
Université du du Québec en Abitibi-Témescamingue, (UQAT) Canada
elfadilb@uqat.ca

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Development of Functional Thinking in a STEM Context - Elementary Schools.

Many studies have shown that STEM education needs to begin in primary school and should aim to prepare young people for active participation in their learning and future (Kurup, Li, Powell, and Brown, 2019).

In Canada, the integration of STEM in project-based learning is an important educational initiative. However, in the province of Quebec, research that targets STEM integration at the elementary level is an embryonic field. Consequently, we need more studies – not only on how STEM activities are implemented in classrooms, but on which disciplines benefit from this integration.

According to Ponte (2013), the concept of function is rightly considered one of the most important in all of mathematics. Before being linked to a formula, functions in the 14th century were associated with curves describing not only motion of solids, but quantities of some physical parameters such as speed, heat, and density, by giving them qualities that can vary continuously. Historically, Galileo (1564-1642) was interested in the study of pendulum motions without any notion of function. He described the phenomenon by using curves and proportions to express functional relations.
Based on this historical context, the purpose of this study is to describe the effect of undertaking STEM projects on elementary students' motivation and learning of variables and functions in mathematics. We want to check how projects based on pendulums (their development and simulation) could enhance students' motivation and understanding of functional notions that may be difficult to highlight in a traditional context.

We have designed an experiment consisting of introducing two teaching sequences on pendulums (topic included in the Quebec Science Program) – one about designing and making a pendulum, and the other about using a simulation tool to get more insight into the interdependence between pendulum variables (length, mass, amplitude).

For this project, math and science education professors, two students, and an elementary teacher are working together to design and experiment the activity in a grade 4 classroom (April 2021).

Methodologically, students will fill pre- and post-questionnaires about pendulums and how they work. Then, they will make their own pendulums and test the variables. Later, they will use a simulation platform (Phet.org) to check if their findings are in accordance with theory. Finally, they will ask to complete a form about variables and functions to check their understanding.