USING BRAIDS TO INTRODUCE GROUPS: FROM AN INFORMAL TO A FORMAL APPROACH

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Short description of the workshop: aims and underlying ideas

The workshop proposes a hands-on activity, particularly suitable for high school teachers, who can then propose the workshop in a classroom. Goals are to introduce or review some basic group theory and gain ideas to communicate topics in an engaging way.

Braids are rich topological objects that can be easily turned into algebraic objects. The key concepts of the workshop are: 1. The formalization of braids as algebraic objects; 2. The operation of composition and the structure of group; 3. A comparison between the composition of braids, the sum of integers numbers and the multiplication of non-zero real numbers; 4. Non-commutativity of the composition; 5. Distinguishing braids using invariants: the permutation associated with a braid.

These concepts will be discovered and examined by the participants through a concrete guided activity in small groups.

Planned structure:

Planned timeline	Topic	Material / Working format / presenter
10 minutes	Introduction, motivations, aims.	Demonstration by the presenter using physical objects.
1 hour	Formalization of braids as algebraic objects. The operation of composition and the structure of group. A comparison between the composition of braids and numerical operations. Non-commutativity of the composition. An invariant of braids.	Participants will follow hand-outs and experiment with physical objects (ropes to make braids). Work in small groups with feedback from the presenter; short plenary discussions to ensure every group is making progress and to agree on

		notation.
20 minutes	Final plenary discussion and summary of the content of the workshop both in an informal and in a formal way, highlighting the connections between "manual braiding" and the abstract formulation of the problems.	Guided discussion. In this phase, we will possibly show a few minutes of the movie Braids [Dalvit].

References

Dalvit, E. (2011). Braids. A journey through the mathematical theory of braids, http://matematita.science.unitn.it/braids/