

Summary

This thesis focuses on collective argumentative processes in mathematics classrooms.

Argumentative practices are promoted by Italian and European institutional documents and are broadly investigated in Mathematics Education. Argumentation is considered in Mathematics Education from various and sometimes contrasting viewpoints. Despite the numerous studies and perspectives, a rich discussion is still ongoing, inviting further contributions.

With this thesis, we aim to contribute to the strand of research on argumentation, by exploring aspects that have been overlooked in mathematics classrooms, such as the importance of interactions. We are also interested in considering formative assessment strategies in relation to argumentative processes, acknowledging the influence of assessment practices on the teaching-learning process and addressing a gap in the literature concerning the assessment of argumentative practices.

The aim of this thesis is to investigate the development and characteristics of argumentative processes as collectively carried out by upper secondary school students engaged in learning probabilistic thinking. For this purpose, two teaching experiments were conducted in two upper secondary school classrooms over two consecutive years. The two teacher-researchers of these classrooms are part of the research group. Classroom activities were thoroughly designed with the dual aim of fostering interactive argumentative processes and introducing students to probabilistic thinking. Activities unfolded from the Problem of Points, a historical problem related to the development of classical probability, presenting characteristics that make it particularly suitable for our project.

Chapters 1 to 3 introduce the study. Specifically, Chapters 1 and 2 provide the background of the research. Chapter 1 offers an overview of argumentation from different perspectives. First, we briefly consider the (Western) historical development of argumentation to provide an overview of the various perspectives that have influenced and may still influence Mathematics and, particularly, Mathematics Education. Then, we examine the relationship between argumentation and education, considering various studies on education (including those outside Mathematics Education) and Italian and European institutional documents. Finally, we specifically discuss Mathematics Education studies on argumentation, highlighting the perspectives that have primarily influenced this thesis, and positioning the project within the extensive literature.

Chapter 2 presents the theoretical frameworks of this thesis, focusing on three main areas: the functions of argumentation and the argumentative perspective adopted in this thesis, i.e. Mercier and Sperber's (2017) perspective; formative assessment theories and strategies; and the epistemological and didactical aspects of probability, specifically the classical approach.

Chapter 3 describes our project. We outline the rationale of this thesis and its aims, and state the research questions. Additionally, we describe the methodologies and the teaching experiment activities. An extensive description of the structure of the thesis, specifically on the collected papers, is also provided.

Chapters 4 to 9 compile the main papers developed during my doctoral studies. The papers are divided into two subcategories: Chapters 4 to 7 are theoretical and empirical papers that investigate specific aspects of the argumentative process in mathematics classrooms. Chapters 8 and 9 are the author's translations of the two papers written with the two teacher-researchers of our research group and published in an Italian journal aimed at teachers and researchers. These two papers focus more on classroom practices.

Finally, in Chapter 10, we collect the main results, discuss them, outline the limitations of the study and suggest further perspectives.