

## Research Project on Learning Rationality in Strategic Behaviors: Interdisciplinary Educational Activities in Italian High Schools

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**Abstract :** The education process considers capabilities not only to be seen as a means to a certain end but rather as an effective purpose. Sen's capability approach challenges human capital theory, which sees education as an ordinary investment undertaken by individuals. A complex reality requires complex thinking capable of interpreting the dynamics of society's changes to be able to make decisions that can be rational for private, ethical and social contexts. Education is not something removed from the cultural and social context; it exists and is structured within it. In Italy, the "Mathematical High School Project" is a didactic research project is based on additional laboratory courses in extracurricular hours where mathematics intends to bring itself in a dialectical relationship with other disciplines as a cultural bridge between the two cultures, the humanistic and the scientific ones, with interdisciplinary educational modules on themes of strong impact in younger life. This interdisciplinary mathematics presents topics related to the most advanced technologies and contemporary socio-economic frameworks to demonstrate how mathematics is not only a key to reading but also a key to resolving complex problems. The recent developments in mathematics provide the potential for profound and highly beneficial changes in mathematics education at all levels, such as in socio-economic decisions. The research project is built to investigate whether repeated interactions can successfully promote cooperation among students as rational choice and if the skill, the context and the school background can influence the strategies choice and the rationality. A Laboratory on Game Theory as mathematical theory was conducted in the 4th year of the Mathematical High Schools and in an ordinary scientific high school of the Scientific degree program. Students played two simultaneous games of repeated Prisoner's Dilemma with an indefinite horizon, with two different competitors in each round; even though the competitors in each round will remain the same for the duration of the game. The results highlight that most of the students in the two classes used the two games with an immunization strategy against the risk of losing: in one of the games, they started by playing Cooperate, and in the other by the strategy of Compete. In the literature, theoretical models and experiments show that in the case of repeated interactions with the same adversary, the optimal cooperation strategy can be achieved by tit-for-tat mechanisms. In higher education, individual capacities cannot be examined independently, as conceptual framework presupposes a social construction of individuals interacting and competing, making individual and collective choices. The paper will outline all the results of the experimentation and the future development of the research.

**Keywords :** game theory, interdisciplinarity, mathematics education, mathematical high school

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