

Problem

- We want to know how cooperative relations are, inside a pre-existent social network of a primary school classroom.
- Then, we want to see if the structure of cooperation are related/can explain other school outcomes of members of that classroom. Specifically Academic Performance.
- Experimental Game Theory has been proved to be a good way of measuring cooperation in the lab, and that allows you to measure revealed preferences, eluding bias.
- But we have to consider that cooperation in the classroom is between students who have repeated, non anonymous interactions, a history and a future, embedded in a complex social network.
- In summary: We want to take the advantages of both methods and try to avoid their weaknesses.

Solution

We propose a new approach!

- To elicit a preexistent cooperative network in the classroom using a non-Anonymous dyadic social dilemma game.
- Do a one-shot dyadic non anonymous game between every possible couple in the classroom.
- Then, with every play we built a directed link between the two players in order to construct a complete weighted directed network of the classroom.
- This is, we built the network with the sent/received tokens in a social dilemma.
- In order to decrease cognitive barriers and make an engaging task, we propose to build the game in a video-game like interface.
- Finally, we're going to test if topological measures of centrality of this cooperation network are related with academic performance measured by the student's GPA, controlling by multiple factors.

The Game

The game we implement is a modified version of the Dictator game. In our study, we make both players simultaneously perform the role of the "Allocator" and the role of the "Recipient". Traditional research in experimental game theory has mainly focused on anonymous agents. However, group and dyadic social dilemmas in real life are often played between known subjects with previous and future history, embedded in a social network structure. To elicit the preexisting social network of cooperation, we propose to play in a non-anonymous frame, with $n - 1$ rounds in a class of n . Each round every student play with a different classmate, in order to map a complete network of relations inside the classroom.

In the game, students are endowed with 10 tokens per round, that they can share or keep (cooperate or defect). The total number of tokens that a student gets in a round is equal to the number of tokens they kept plus twice the number of tokens they received. Hence, the group maximizes the total number of tokens earned when everyone cooperates, but students maximize their tokens when they defect and everyone else cooperates.

Data

46 Classrooms in 14 different public schools. These are located San Bernardo County, a suburb in the outskirts of Santiago, Chile.

Classes are from third to fifth grade. Both mixed and single-sex education. 57.7% girls. Data was collected during 2017 school year (June-July and August-October). We also collected information from school report as class attendance and GPA.

We implemented two surveys:

- A self-report survey on bullying, fighting and victimization indicators.
- A peer nomination survey on aggressiveness, popularity and prosociality indicators.

All implementations were made following a strict protocol of instructions for experimenters and students in order to make clean replications. Individuals doesn't get feedback after each play, but only a final aggregated result of sent, received and total tokens.

There were no money or any other payments after the game.

This experiment and treatment of all data were carefully inspected and approved by UDD Research Ethics Committee

RESULTS

With game decisions, we built a weighted network of cooperation for each classroom, with weights equal to the amount of tokens received by each student in each dyadic game

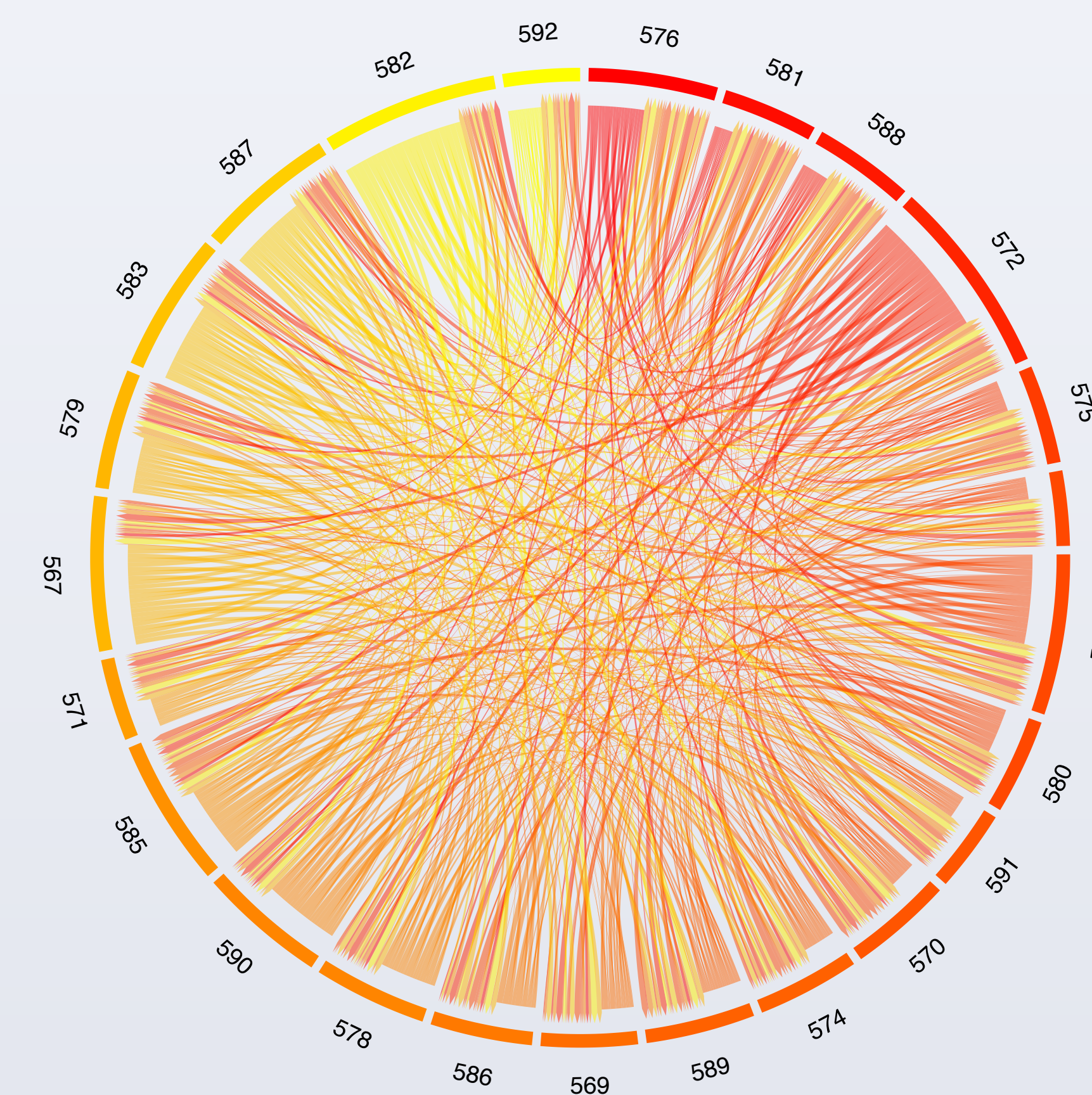


Fig 1: A Classroom Cooperative Network. Every student is labeled with a tag to protect privacy. Color indicates GPA, highest in red and lowest in yellow. Width of the arrows represent the amount of tokens.

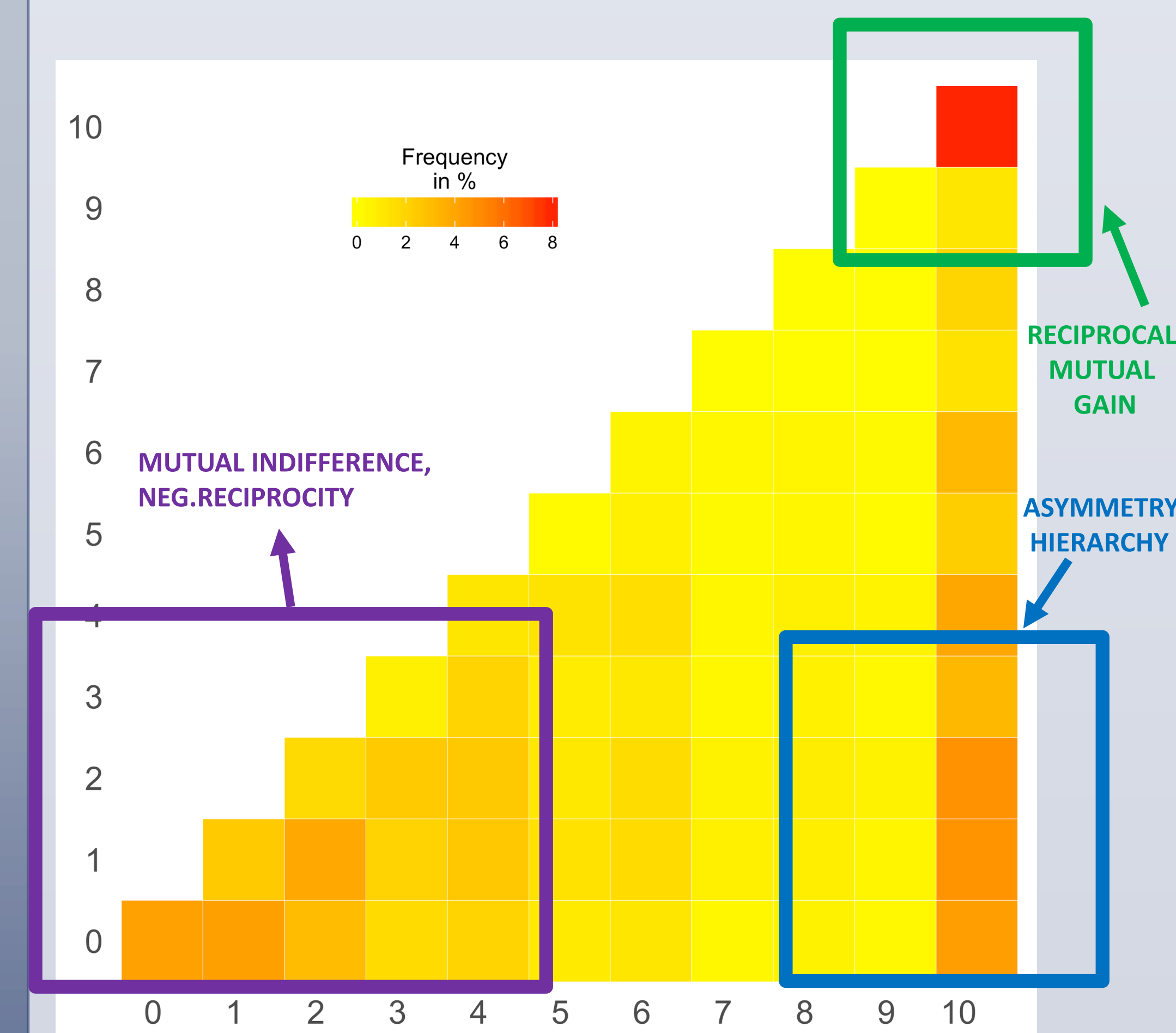


Fig. 2: Aggregated Heatmap of dyadic interactions. This Figure is a map that considers all dyadic outcomes of games played in the 46 classrooms. We observe that three patterns emerge:

- Reciprocal mutual gains (Both students mutually sent all their tokens)
- indifference (or negative reciprocity). This would be the expected Nash Equilibrium of the Game.
- Hierarchy (one of the parties benefits at the expense of the other party)

With these networks per class, we normalized the data of all the different classrooms by centering every variable on the average for that class, and then dividing for the standard deviation in that class, in order to get every variable in Normalized SD Units. Then, we run different regression models using GPA as the dependent variable.

	Dependent variable: GPA (z-score per class)					
	(1)	(2)	(3)	(4)	(5)	(6)
Weighted in-Degree (z-score per class)	0.416*** (0.029)	0.370*** (0.028)	0.109*** (0.034)	0.130*** (0.035)	0.130*** (0.036)	0.117*** (0.039)
Sex (Male)		-0.190*** (0.055)	-0.086 (0.053)	-0.088 (0.054)	-0.099* (0.056)	-0.125** (0.060)
Last-Semester Class Attendance		0.296*** (0.028)	0.269*** (0.026)	0.272*** (0.026)	0.281*** (0.027)	0.299*** (0.029)
Popularity Nomination (z-score per class)			0.211*** (0.034)	0.204*** (0.034)	0.180*** (0.035)	0.172*** (0.037)
Aggressiveness Nomination (z-score per class)			-0.151*** (0.031)	-0.139*** (0.032)	-0.144*** (0.034)	-0.128*** (0.035)
Prosociality Nomination (z-score per class)			0.236*** (0.032)	0.232*** (0.032)	0.230*** (0.034)	0.234*** (0.036)
Self-Reported Bully				-0.254*** (0.083)	-0.262*** (0.088)	-0.267*** (0.091)
Self-Reported Victimization				-0.005 (0.064)	-0.022 (0.067)	-0.051 (0.071)
Self-Reported Fighter					0.157* (0.082)	0.145 (0.089)
Guardian Level of Schooling					0.071*** (0.023)	0.051** (0.025)
Religion (Protestants/Evangelicals)						-0.122** (0.058)
Religion (Non-Religious)						-0.058 (0.135)
Constant	-0.009 (0.028)	0.072** (0.036)	0.017 (0.034)	0.035 (0.038)	-0.176** (0.086)	-0.022 (0.098)
Observations	1,005	952	952	949	873	768
R ²	0.175	0.265	0.364	0.372	0.381	0.387
Adjusted R ²	0.174	0.263	0.363	0.366	0.374	0.378
Residual Std. Error	0.888 (df = 1003)	0.837 (df = 948)	0.780 (df = 945)	0.776 (df = 939)	0.776 (df = 862)	0.775 (df = 755)
F Statistic	212.243*** (df = 1; 1003)	114.062*** (df = 3; 948)	90.164*** (df = 6; 945)	81.849*** (df = 9; 939)	53.052*** (df = 10; 862)	39.761*** (df = 12; 755)

Fig 3: Model (1) is just with weighted in-degree. The variable is positive and significant, explaining more than 17% of the variance. Model (2) incorporates controls of class attendance and Gender. Model (3) incorporates controls from peer nomination surveys between the students. Model (4) incorporates self-report data. Model (5) and (6) have less observations because of missing data in incorporated variables. In all models, weighted in degree holds its sign and significance. These results suggest a relation between Received cooperation and Academic Performance

At Fieldwork

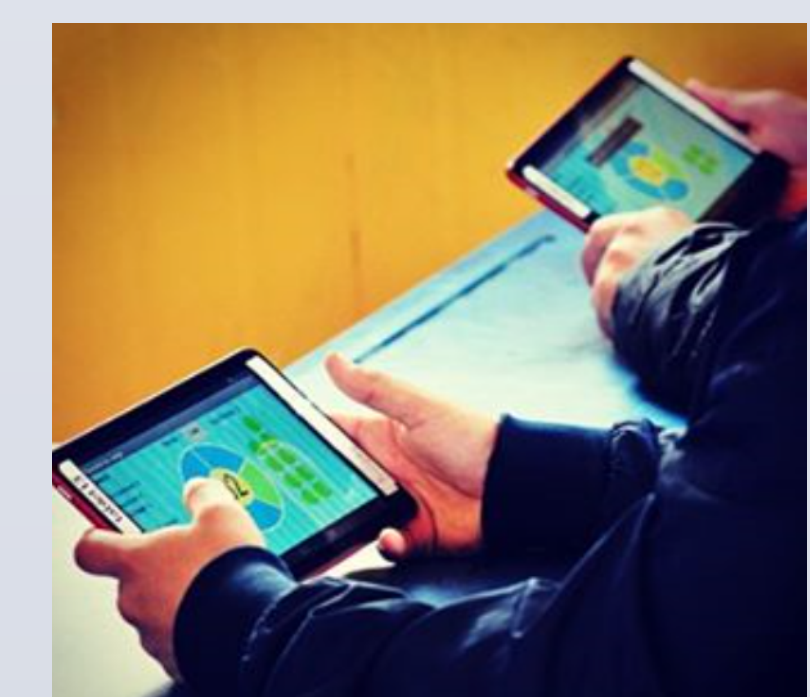


Fig 4: Kids Playing

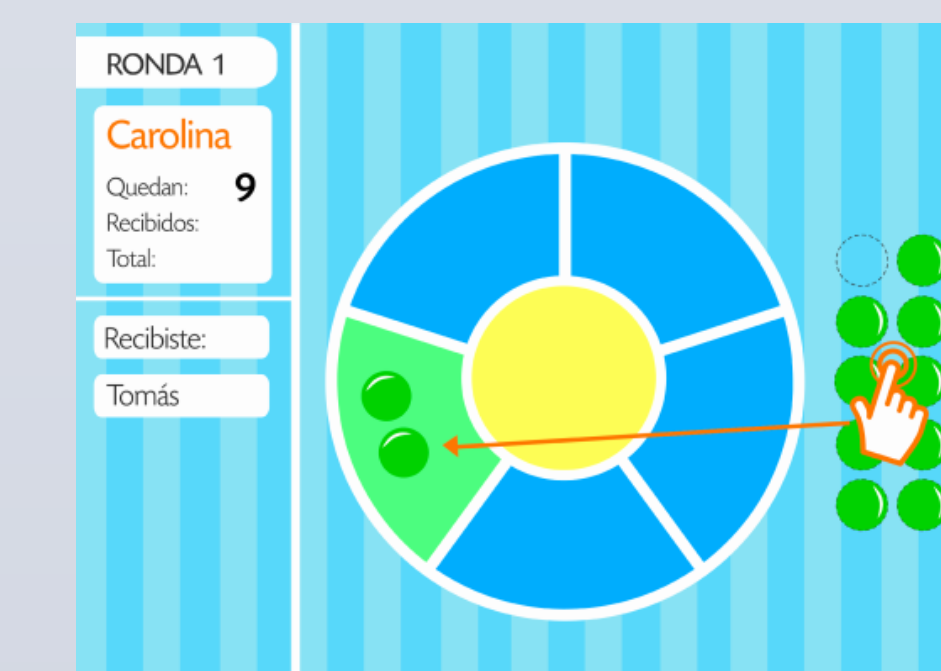


Fig 5: How the game looked like



Fig 6: Implementation in Classroom

MORE INFO



Fig 7: Link to MIT Media Lab project



Fig 8: Link to Video of the project



Fig 9: Link to UDD CICS project