

COOPERATION AND ENVIRONMENTAL EDUCATION: AN EXPERIMENTAL STUDY WITH RECYCLABLE MATERIAL COLLECTORS

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RESUMO

O objetivo deste trabalho foi analisar como o jogo do bem público pode contribuir para a educação ambiental e influenciar positivamente o comportamento cooperativo dos catadores de materiais recicláveis. A dinâmica da metodologia experimental aplicada considerou o fato de que tanto para a preservação do bem público quanto para o trabalho dentro das cooperativas de reciclagem, a cooperação é um fator fundamental. Nesse contexto, para incentivar a cooperação, também foi testado o papel dos incentivos na forma de punição e recompensa. O principal resultado foi que, mesmo sem a aplicação efetiva de punições, a mera existência da regra foi suficiente para aumentar o envolvimento dos catadores no bem-estar coletivo. Isso indica que a cooperação em um grupo não depende apenas de incentivos financeiros, mas também da percepção de responsabilidade e das regras que norteiam a convivência entre os membros. Os resultados têm impacto direto na gestão das cooperativas e nas políticas públicas relacionadas à reciclagem e à sustentabilidade. Abordagens que promovam o senso de responsabilidade coletiva e definam regras claras para participação tendem a ser mais efetivas em comparação às recompensas individuais, pois fortalecem o engajamento e a colaboração entre os trabalhadores. Além disso, a pesquisa destaca que o comportamento humano dentro de grupos é fortemente moldado pelas normas sociais e pelo senso de justiça presente na comunidade.

PALAVRAS-CHAVE: Jogo do Bem Público, cooperação, catadores, bem-estar coletivo.

ABSTRACT

The purpose of this paper was to analyze how the public goods game can contribute to the environmental education and positively influence cooperative behavior in the recyclable material collectors. The dynamics of the Experimental methodology applied considered the fact that both for the preservation of the public good and for the work within recycling cooperatives, cooperation is a fundamental factor. In this context, in order to encourage cooperation, the role of incentives in the form of punishment and reward was also tested. The main finding was that, even without the effective application of punishments, the mere existence of the rule was enough to increase the collectors' involvement in collective well-being. This indicates that cooperation in a group does not only depend on financial incentives, but also on the responsibility perception and the rules that guide coexistence between members. The results have a direct impact on the cooperatives management and public policies related to recycling and sustainability. Approaches that promote a sense of collective responsibility and define clear rules for participation tend to be more effective compared to individual rewards, as they strengthen engagement and collaboration among workers. Furthermore, the research highlights that human behavior within groups is strongly shaped by social norms and the sense of justice present in the community.

KEY WORDS: Public Goods Game, cooperation, collectors, collective well-being.

INTRODUCTION

The reprocessing of materials contributes to environmental sustainability and provides income to thousands of workers in the recycling sector in Brazil. The country ranks fourth worldwide in the generation of plastic waste (ANCAT, 2023), which requires the expansion of reuse initiatives given the large volume generated. Therefore, associations of recyclable material collectors play an important role, as they are responsible for sorting and disposing of materials, modifying the way waste is discarded and minimizing impacts on landfills (SNIS, 2023). The transfer by PET to operator associations shows an increase of 400% compared to the amount allocated to self-employed professionals, demonstrating the formalization of collective activities (SNIS, 2023). In the national territory, there are approximately 2,018 cooperatives, of which 82% maintain activity in accordance with the standards, indicating the viability of organized recycling as a labor alternative that contributes to the reduction of environmental impacts (ANCAT, 2023).

Despite the growth of organizations and the sector, selective materials collection occurs only in 27.5% of the cities (SNIS, 2023). In terms of monetary transfers, the values vary: agents with ties to cooperatives that have contracts with public authorities receive, on average, R\$1,730.58, while those without such links receive R\$1,292.00 (ANCAT, 2023). In this scenario, it is important to know the work dynamics of the recyclable material collectors' groups, and the factors related to cooperation for the benefit of the group and the environment, especially when these issues are intrinsically related.

Recognized that there is a consensus around the importance of sustainability, particularly by acknowledging the changes suffered by the environment over recent decades (LEISEROWITZ, 2005). However, such acknowledgment has not yet caused significant changes in the conduct of individuals. To mitigate this problem, more participatory and cooperative behavior are suggested, as well as initiatives that can provide greater awareness of those involved (MEIJERS; STAPEL, 2011).

When considering on the skills for the future and how to educate them more adequately, we argue that the topic of cooperation for sustainability represents one of the pillars of this issue. Reflecting how these topics could be better transmitted to recyclable material collectors, we propose a transition from traditional expository methods to more participatory methods, including economic experiments. Individuals, in the role of active participants, can overcome the purely theoretical field of expository classes and tend to recognize the possible dilemmas and outcomes of decisions that require cooperation for the preservation of the environment, especially when these learnings can be directly used in the work dynamics of recycling cooperatives.

Given this context, we need to envision the contributions of the behavioral economics games, in particular, of the public goods game, to the environmental education, especially when the benefits of cooperation within the group can be demonstrated (JACOBSON, 2023). Public goods are non-excludable, which means everyone involved can enjoy its benefits, regardless of the contribution to its preservation. Considering that the preservation of the public good, as well as the environment, involves costs, the potential conflict between self-interest and collective interests is debated: even though mutual cooperation can bring greater benefits to a group, individuals have an incentive to take advantage of the contributions of others (CROSON; GACHTER, 2010; SOEST; STOOP; VYRASTEKOVA, 2016).

The purpose of this study was to analyze how the public goods game can contribute to the environmental education and positively influence cooperative behavior in the recyclable material collectors. Thus, we proposed field experiments aimed at the preservation of a public good for collectors of recyclable materials in three cities in the western region of the State of Paraná - Missal, Santa Helena and Santa Terezinha de Itaipu. This study represents an opportunity to research, once the preliminary review of the literature showed that few studies have addressed environmental education based on subsidies of experimental and behavioral economics, especially with recyclable material collectors' groups. The issue of the interdisciplinary approach is also highlighted as a way of discussing how cooperation between members of recycling cooperatives can be beneficial, with social and economic gains greater than those resulting from selfish behaviors.

METHODOLOGY

The public goods game was adapted from Fehr and Gächter (2000). Six experiments were carried out with groups of nine to eleven players each. Each round, players received two envelopes and 10 coins of \$ 1 to choose how many coins they wanted to allocate in a 'public account created for the preservation of the public good' (first envelope), and how many coins they wanted to allocate in their respective 'private accounts' (second envelope). Unlike the allocation of coins to the individual account of each player, those donated to the preservation of the reservoir would be summed and then multiplied by two (representing the social gains of preserving it) and redistributed equally among the players. The experiment approached two possibilities of treatment: (i) letting the player punish the others those who do not cooperate and, (ii) letting the player reward the others those who cooperate. In total, there were six rounds of control, followed by six rounds of treatment. In each round, participants could check the results of their donations, the results of others' donations and the total donated for public good.

The experiments followed the between-groups design, in which each participant is assigned to only a single treatment. The experiment was played under conditions of anonymity, so each participant was given only one number. The sample was made up of 60 recyclable material collectors who worked in cooperatives, of these, 30 participated in a treatment with the possibility of punishing those who do not cooperate and 30 participated in the treatment with the possibility of rewarding those who cooperate.

After analyzing the data obtained, recyclable material collectors participated in a focus group interview. The use of the technique of interviewing with focus groups has been used successfully in research that aims to verify the individuals understanding of themes related to environmental education. Being a survey for educational purposes, the focus group addressed the people interpretation about (i) conditions under which cooperation occurred, (ii) conditions under which cooperation did not occur, with further reflection upon the practical applications in work activities within cooperatives and in environmental preservation. The recyclable material collectors could understand the consequences of their decisions in the public goods game, as well as extrapolating this interpretation to the work context.



Figure 1: Photographic records of the experiment applications. Source: Prepared based on primary data.

RESULTS

Comparing the behavior of recyclable material collectors during the application of the experiment in both economic incentives, it was observed that donations for the preservation of the public good were higher and statistically significant ($p=0,0047$) when the group was submitted to treatment with the possibility of punishing those who don't cooperated. The average donations for the control rounds were R\$ 4.92; R\$ 6.00 for the punishable rounds; and 3.81 for the reward rounds. It is important to highlight that, although the mechanism of punishing was not applied, the possibility of using it was enough to increase levels of cooperation - materialized as a variable proxy of donations to the public good (FOSGAARD; HANSEN; WENGSTROM, 2014).

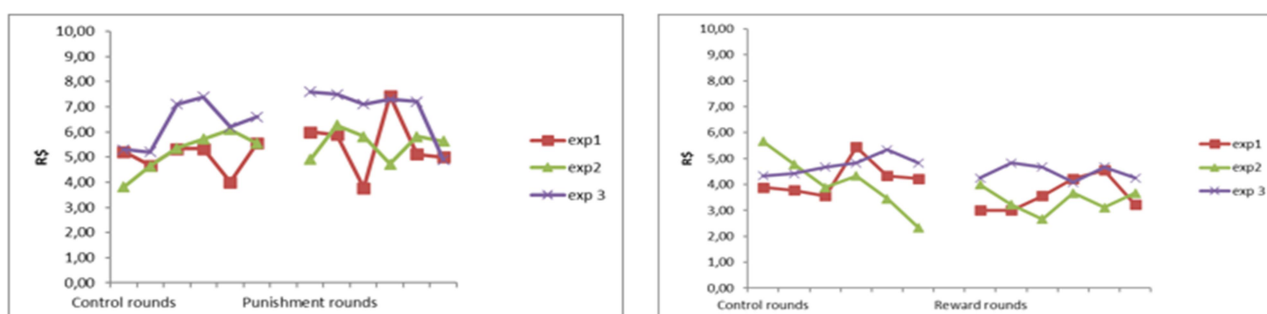


Figure 2: Trajectory of donations for the public good in treatments with punishment and reward. Source: Prepared based on primary data.

Similarly, it was observed that the collective gains and cooperative behavior of the group were higher with the punishment treatment, although the differences observed were not statistically significant ($p=0.25$). On the other hand, the possibility of rewarding those who cooperated the most proved to be harmful to the group, so that the collective gains were smaller and statistically significant ($p=0.012$).

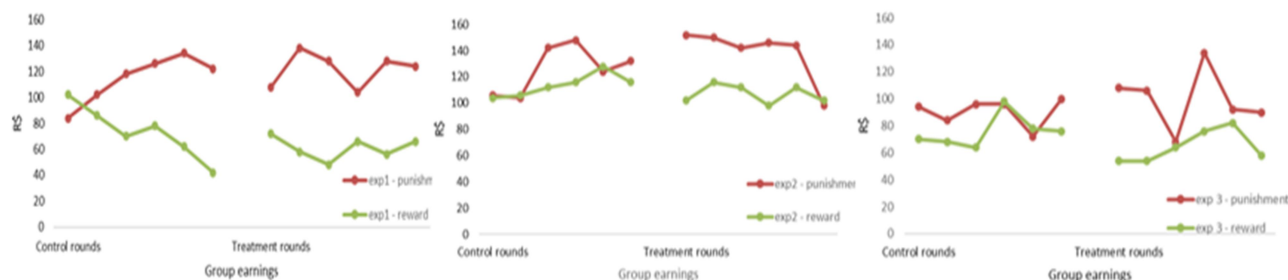


Figure 3: Collective earnings in the experiments. Source: Prepared based on primary data.

After the experiments analysis, all six groups went through a focus group session, conducted by the experimenter, lasting approximately 40 minutes each. The chart below summarizes the main results.

Frame 1. Summary of focus group sessions. Source: Prepared based on primary data

Topics covered	Speeches during the focus group session	Practical applications for the environmental education
1 - Signs of cooperative behavior in the punishment treatment	“[...] they tell the group to be united, to help each other, they always reinforce this. They tell new people that this makes a difference in their work[...] Everyone gives their all to resolve common things, they are aware that one day you may also need help from others” “[...] Everyone participates in everything. You rarely see anyone doing work alone, because others don't want to help... that doesn't exist [...] as the work is collective, no one likes to be punished individually, in front of others. This may reflect on the distribution of the cooperative's earnings	The importance of good examples and the cooperative behavior between the recyclable material collectors as an alternative way to demonstrate the possibility to achieve better results and higher earnings.
2 - Lack of cooperation in reward treatment	[...] I cooperate because I think it's right, not because I'm going to make some money [...] helping others would have to depend on the person's character, not how much they can receive	The feeling of help and belonging, added to the traits of altruism, in themselves, constitute enough conditions to promote cooperation between the group

The game addressed the decision for cooperation as a dilemma so that all players would be in better condition if they donated their coins to a public good, from which all benefit directly or indirectly. However, after noticing the others, a player can get even more money taking the donations for him/herself. In the context of recycling cooperatives work, individual activities are characterized by the separation of functions, involving collection, unloading, sorting, baling, storage, loading, among others. Individual gains, as in the public game experiment, depend on collective cooperation: in the experiment as well as in work activities, the greatest gains for the group will be obtained if everyone cooperates.

The lack of cooperation in the possibility of rewarding those who donated the most (cooperated) also provides valuable insights, considering that - both in the work within recycling cooperatives as in the applied experiment - the individuals cooperation were guided by altruistic behavior and a focus on the collective good. The economic return, in these circumstances, removed the implicit value of spontaneous altruistic behavior. These results are in line with Li *et al.* (2025) research, who assessed that the use of some monetary and non-monetary rewards can compromise the motivation to adopt behaviors in favor of the environment.

FINAL REMARKS

The purpose of this study was to analyze how the public goods game can contribute to the environmental education and positively influence cooperative behavior in the recyclable material collectors. The dynamics of the applied experiment considered the fact that both for the preservation of the public good and for the work within recycling cooperatives,

cooperation is a fundamental factor. In this context, in order to encourage cooperation, the role of incentives in the form of punishment and reward was also tested.

The findings of this study provide a significant reflection on how to promote collaboration in cooperatives of recyclable materials collectors. Contrary to what one might think, offering individual rewards did not prove to be the most efficient method for encouraging cooperation. In fact, it was the introduction of the possibility of punishing those who did not cooperate that resulted in more supportive and collective behavior. The main finding is that, even without the effective application of punishments, the mere existence of the rule was enough to increase the collectors' involvement in collective well-being. This indicates that cooperation in a group does not only depend on financial incentives, but also on the responsibility perception and the rules that guide coexistence between members.

These results have a direct impact on the cooperatives management and public policies related to recycling and sustainability. Approaches that promote a sense of collective responsibility and define clear rules for participation tend to be more effective compared to individual rewards, as they strengthen engagement and collaboration among workers. Furthermore, the research highlights that human behavior within groups is strongly shaped by social norms and the sense of justice present in the community. Therefore, this study offers insights into how cooperatives can improve their internal processes and how public policies can be designed to reinforce the circular economy, in addition to ensuring more effective recyclable waste management.

As limitations of the research, we can mention the relatively small sample of participants in the experiment. For this reason, it suggests the replication of the research - for educational purposes - in other cooperatives.

REFERENCES

1. ANCAT – Associação Nacional dos Catadores e Catadoras de materiais recicláveis. Reciclagem em números. 2023. Disponível em: <<https://atlasbrasileirodareciclagem.ancat.org.br/reciclagem-em-numeros>>. Acesso em: 18 fev. 2025.
2. CROSON, Rachel; GÄCHTER, Simon. The science of experimental economics. **Journal of Economic Behavior & Organization**, v. 73, n. 1, p. 122-131, 2010. DOI: <https://doi.org/10.1016/j.jebo.2009.09.008>.
3. FEHR, Ernst; GÄCHTER, Simon. Cooperation and punishment in public goods experiments. **American Economic Review**, v. 90, n. 4, p. 980-994, 2000. DOI: 10.2139/ssrn.203194.
4. FOSGAARD, Toke R.; HANSEN, Lars Gårn; WENGSTRÖM, Erik. Understanding the nature of cooperation variability. **Journal of Public Economics**, v. 120, p. 134-143, 2014. DOI: 10.1016/j.jpubeco.2014.09.004.
5. JACOBSON, Sarah. Ore money ore problems: A resource extraction game. **The Journal of economic education**, v. 54, n. 2, p. 158-176, 2023. DOI: 10.1080/00220485.2023.2171521.
6. LEISEROWITZ, Anthony A. American risk perceptions: Is climate change dangerous?. **Risk Analysis: An International Journal**, v. 25, n. 6, p. 1433-1442, 2005. DOI: 10.1111/j.1540-6261.2005.00690.x.
7. LI, Linyi et al. Promoting Sustainable Choices: A Large Scale Randomized Field Experiment. 2025. Disponível em: <<http://dx.doi.org/10.2139/ssrn.5127815>>.
8. MEIJERS, Marijn H.; STAPEL, Diederik A. Retracted: Me tomorrow, the others later: How perspective fit increases sustainable behavior. **Journal of Environmental Psychology**. 2011. DOI: <https://doi.org/10.1016/j.jenvp.2010.06.002>.
9. SNIS - Sistema Nacional de Informação. Diagnóstico Temático Manejo de Resíduos Sólidos Urbanos: SNIS, 2023. Disponível em: <https://antigo.mdr.gov.br/images/stories/ArquivosSNSA/Arquivos_PDF/Snis/RESIDUOS_SOLIDOS/DIAGNOSTICO_TEMATICO_VISAO_GERAL_RS_SNIS_2023_ATUALIZADO.pdf>.
10. SOEST, Daan; STOOP, Jan; VYRASTEKOVA, Jana. Toward a delineation of the circumstances in which cooperation can be sustained in environmental and resource problems. **Journal of Environmental Economics and Management**, v. 77, p. 1-13, 2016. DOI: <http://dx.doi.org/10.1016/j.jeem.2015.12.004>.