Data Article

Game-changing perspectives: A dataset on student perceptions of sustainable mobility pre- and post escape room intervention

Silvia Sipone [a],*, Andrés Rodríguez [b], Marta Rojo [a], José Luis Moura [b]

[a] *Universidad de Burgos, C/ Villadiego s/n, Burgos 09001, Spain*
[b] *Universidad de Cantabria, Avda de los Castros sn, Santander 39005, Spain*

A R T I C L E   I N F O

A B S T R A C T

The dataset aims to examine the prior and acquired knowledge in an Escape Room (ER) experience on sustainable mobility. In addition, the data could also be used to identify possible correspondences between some mobility behaviors and the predisposition to learn sustainable mobility concepts to foster attitude change.

To meet these objectives, an ER on sustainable mobility was conducted and a questionnaire was given before and after the activity to 173 students from various schools between 5th grade of primary school and 1st year of compulsory secondary school (10–13 years old).

The questionnaire was divided into two parts. The first part included social demographics questions (gender, family members, place of residence) and mobility habits (number of cars in the family, bus use, cycling). The second part included questions related to sustainable mobility topics with 14 items.

Data was collected between December 2022 and February 2023.

---

* Corresponding author.
  E-mail address: ssipone@ubu.es (S. Sipone).

Specifications Table

Subject	Social Sciences/Education
Specific subject area	Education in sustainable mobility through interactive Escape Room and behavioral study.
Data format	RAW
Type of data	TABLE xlsx FORMAT
Data collection	Data were gathered using pre/post questionnaires from 173 students after an educational Escape Room session on sustainable mobility. Questions covered social demographics, mobility habits, and 14 items on mobility topics, collected between Dec 2022-Feb 2023
Data source location	Santander, Spain
Data accessibility	Repository name: Dataset on Student Perceptions of Sustainable Mobility Pre- and Post Escape Room Intervention Data identification number: 10.17632/ft64w7cckx.2 Direct URL to data: https://data.mendeley.com/datasets/ft64w7cckx/2

1. Value of the Data

- The data is used to measure the success of gamified learning, in particular through an Escape Room activity on sustainable mobility.
- The data may be useful to augment the growing literature on the use of Escape Rooms in education, especially in the context of sustainable mobility.
- Educators can use these insights to inform curriculum development and extracurricular activities aimed at improving students' understanding of environmental issues.
- The dataset can serve as a comparative baseline for future educational studies, allowing researchers to measure the longitudinal impact of similar interventions on students' perceptions and behaviors regarding sustainable mobility.
- This data can assist in the development of educational tools and strategies that prioritize sustainable practices, serving to make practical applications in school settings.
- The data would be valuable for the transition of Escape Rooms to virtual environments and the design of digital Escape Rooms to address sustainable mobility concepts and improve the fostering of attitude and behavioral changes, enhance learning and promote engagement of people of different age ranges.

2. Background

The use of gamification techniques to incentivize voluntary behavior change has been demonstrated in different research [1,2]. Among the many gamification techniques that facilitate learning, create engagement and promote positive behaviors, we find the Escape Room (ER) [3]. In the field of sustainable mobility its use and studies are scarce.

In different areas of knowledge, the effectiveness of ER educational experiences as a learning tool has been explored [4–6]. However, Piñero Charlo and José Carlos [7] point out that most authors do not provide evidence of the learning process during educational ER experiences. They highlight the lack of empirical evidence to support the impact of educational ER and game-based learning in general. They emphasise the need for transcripts of learning experiences and analysis of the learning process in educational ER.

Kinio et al. [8] propose a study to fill the gap of published information on the value of educational ER and assess the impact of escape rooms on student learning, readiness, retention and motivation.

Our data analysis provides information on how the knowledge gained and learning from the use of Escape Rooms on sustainable mobility issues with 10–13 year olds can be analyzed.

The dataset proposed, along with its creation details, provides fresh perspectives on the pedagogical efficacy of utilizing educational escape rooms and the correlation between mobility

habits and the assimilation of sustainable mobility knowledge in children. It serves as an initial foundation to facilitate the design of impactful educational escape rooms for imparting comprehension of sustainable mobility concepts. Additionally, it contributes to the limited literature on the use of escape rooms in the realm of sustainable mobility.

3. Data Description

Sustainable mobility has established itself as a critical issue in the field of environmental awareness [9], it is essential to promote sustainable behaviors for generations to come.

In this context, the dataset provided in this article explores the effect of an innovative educational approach: gamification through an Escape Room-based activity [10]. We analyze how this method impacts on students' understanding concepts related to sustainable mobility by comparing their knowledge before and after the activity.

The data, collected through questionnaires and stored in an xlsx file, reflect these changing perceptions. In addition, the original questionnaire is included in a separate Word file to provide a more detailed overview of the research process.

This research aims to provide a baseline tool for research that is intended to offer different perspectives on how gamification, and the use of ER, can influence the formation and diffusion of sustainable mobility concepts and, consequently, the promotion of behavioral changes.

These data types can be used to explain learning behavior through questionnaire responses as a function of socio-demographic characteristics and mobility habits and to model them with mathematical models, such as choice models, to further analyze these relationships and behavior between learning and mobility habits.

The questionnaire is divided into two parts: The first part includes 8 questions on social-demographic characterization (gender, family members, place of residence) and mobility habits (number of cars in the family, bus use, cycling), which are presented in Table 1, showing the frequencies and percentages of their answers.

The second part includes 14 questions related to mobility issues: Active Mobility; the difference between sustainable and non-sustainable means of transport; the basics of the Mobility Pyramid; the concept of car sharing for everyday trips and saving space in the city; the organization and planning of city spaces (Table 2). The data for the Mobility questions' initial and final parts are shown in Table 2.

Numerically, the data reveals an enhancement of roughly 4% among the students engaged in the activity. In particular, initial knowledge levels are remarkably high, with approximately 4 out of 5 people showing a mastery of the concepts prior to the activity. This confirms the current trend that the younger population is showing increased awareness of sustainability issues, especially regarding sustainable mobility.

This pattern implies that future research should contemplate modifying the questionnaire to encompass more intricate or precise concepts for evaluation.

4. Experimental Design, Materials and Methods

A story was designed around the challenges and the ER spaces were arranged using classrooms and rooms of the University of Cantabria with mobility-themed scenarios.

The story involved the students to be "Guardians of mobility" and, through the challenges, discover the basics of some concepts of sustainable mobility to be able to make decisions and adopt more sustainable behavior habits.

Click here to enter text.To create the ER, spaces in the classrooms and hallways of the University of Cantabria were arranged to depict scenarios related to sustainable mobility, incorporating elements such as traffic cones, informative posters, diverse modes of transportation, and reflective traffic vests. The narrative captivated students, leading them through challenges to explore

Table 1

Socio-economic characteristics of participants.

Variable	N	%
Gender (SEX)		
Men	87	50,29%
Woman	86	49,71%
Place of residence (RES)		
Village	40	23,12%
City	133	76,88%
Family components (TFAM)		
2	5	2,89%
3	35	20,23%
4	92	53,18%
5	27	15,61%
6	5	2,89%
More	9	5,20%
Having a bicycle (BIKE)		
Yes	129	74,57%
No	44	25,43%
Using bicycles to play (UBIKP)		
Yes	94	54,34%
No	79	45,66%
Using a bike to go places (UBIKG)		
Yes	82	47,40%
No	91	52,60%
Number of cars in the family (NCAR)		
0	25	14,45%
1	67	38,73%
2	69	39,88%
More	12	6,94%
Use of public transport (PT)		
Yes	112	64,74%
No	61	35,26%
Frequency of public transport use		
Sometimes (UPTS)		
Yes	69	39,88%
No	104	60,12%
A lot (UPTL)		
Yes	35	20,233%
No	138	79,77%

the essential principles of sustainable mobility, empowering them to make informed choices and embrace more sustainable behaviors.

The challenges were organized in a sequential format, as described by Wiemker et al. [11]. This sequential arrangement dictates that the challenges must be solved in a specific order to achieve the goal.

The decision to utilize the sequential structure was based on the interconnectedness of the tests: ideas discovered in earlier challenges acted as reference points and assistance for solving subsequent challenges.

To solve the challenges, students were divided into various groups of 5 to 6 members. They were given 50 minutes to overcome the challenge. At the beginning of the challenge, participants were shown a video that explained the scenario and outlined the objective needed to successfully complete the ER. Afterward, they were given the rules for participation, with the main goal being to stop a countdown timer using a code.

The challenges were designed and posed for students between the ages of 10 and 13, focusing on five fundamental mobility topics and each topic considered several aspects:

- Active mobility as an alternative form of travel using non-motorized means of transport such as bicycles, skateboards, skates, or walking.

Table 2

Mobility questions initial and final data in [brackets] (*) correct 1st option; (**) correct 2nd option; (***) correct 3rd option.

Questions	Response options	Result 1st option	Result 2nd option	Result 3rd option
(10) Do you know what bike lanes are for?	They are used to ensure road safety for bicycles, skateboards and roller skates. (*)	132 [134]	35 [30]	6 [9]
	They ensure that non-motorised means of transport do not travel on the road. (**)	36 [30]	95 [112]	42 [31]
	They are used by both pedestrians and cyclists. (***)	5 [9]	43 [31]	125 [133]
(11) Do you know what pedestrian zones are for?	They serve to allow pedestrians to walk freely and safely. (**)	121 [132]	41 [30]	11 [11]
	They serve to restrict the movement of cars. (***)	17 [13]	65 [85]	91 [75]
	They serve to reduce noise pollution, reduce the use of motorised vehicles, improve pedestrian safety and increase public space (shopping areas, green parks, squares, etc.). (*)	35 [28]	67 [58]	71 [87]
(12) Do you know what Low Emission Zones (LEZs) are for?	They serve to prohibit the circulation of all motor vehicles. (***)	55 [37]	72 [86]	46 [50]
	They create areas within cities where access to certain vehicles is restricted due to their emissions to improve air quality. (*)	97 [119]	43 [23]	33 [31]
	They are used to allow only public transport to circulate. (**)	21 [17]	58 [64]	94 [92]
(13) Do you know what bus lanes are for?	They serve to prohibit the circulation of all motor vehicles. (***)	37 [24]	23 [19]	113 [130]
	They serve to create a space on the road reserved for bus traffic. (*)	110 [114]	43 [41]	20 [18]
	They are intended for use by public transport only. (**)	26 [35]	107 [113]	40 [25]
(14) Do you know what car sharing is?	It consists of sharing a car with other people for a limited period of time. (**)	64 [41]	71 [93]	38 [39]
	It consists of sharing a car with other people, but only when I don't have my own car available. (***)	32 [24]	72 [43]	69 [106]
	It consists of sharing a car with other people to go to work, to school, to travel, etc. This practice can reduce congestion and pollution in cities reduce traffic congestion and pollution in cities. (*)	77 [108]	30 [37]	66 [28]
(15) Do you know what Public Transport is?	It is a collective means of transport, because it is used by many people, and it is sustainable. (**)	88 [76]	72 [80]	13 [17]
	It is a means of transport that has a timetable, established routes and can be used by purchasing a ticket. (*)	75 [86]	67 [64]	31 [23]
	It is a means of transport used only by people who do not have their own car (***).	10 [11]	34 [29]	129 [133]
(16) Do you know what Sustainable Mobility is?	It is to look for ways to reduce polluting gases from vehicles, by proposing different ways of getting around (**).	90 [93]	62 [59]	21 [21]
	It is the set of actions to reduce environmental pollution, to promote equality between people in terms of travel and to bring economic benefits by reducing costs and to bring economic benefits by reducing costs (*).	63 [61]	62 [81]	48 [31]
	It is to use only non-motorised means of transport such as bicycles and skateboards (***).	20 [19]	49 [33]	104 [121]

Table 2 (*continued*)

Questions	Response options	Result 1st option	Result 2nd option	Result 3rd option
(17) Do you know what Active Mobility is?	It is our ability to move around using non-motorised means (*).	104 [115]	38 [42]	31 [16]
	It is our ability to move around using motorised means (***).	44 [38]	62 [54]	67 [81]
	All modes of transport that will get to us soon (**)	25 [20]	73 [77]	75 [76]
(18) Do you know why it is important to plan a city to make its mobility more sustainable?	Because it helps not to create traffic. (***)	44 [33]	41 [37]	88 [103]
	Because it provides environmental and economic benefits and greater equality of mobility for all (*).	91 [109]	49 [33]	33 [31]
	Because it creates more order in the city and a better quality of life (**).	38 [31]	83 [103]	52 [39]
(19) Rank the following options in order of their degree of sustainability	Driving is the easiest way to get to school. (***)	49 [26]	31 [27]	93 [120]
	Walking allows you to think on the way to school (**).	97 [114]	44 [34]	32 [25]
	Going by bus allows you to get to school without help and with more people (*).	27 [33]	98 [112]	48 [28]
(20) Put these means of transport in order according to which one you consider more sustainable.	Train (**)	27 [22]	89 [116]	57 [35]
	Bicycle (*)	140 [142]	22 [21]	11 [10]
	Motorbike (***)	6 [9]	62 [36]	105 [128]
(21) Who should have mobility priority in a city that applies sustainable mobility?	Private cars and motorbikes (***)	39 [26]	31 [21]	103 [126]
	Pedestrians (*)	108 [134]	29 [21]	36 [18]
	All types of non-motorised transport (**)	26 [13]	113 [131]	34 [29]
(22) What is considered most important when travelling in a sustainable mobility environment?	Go by bus and enjoy the scenery during the journey (**).	60 [44]	80 [101]	33 [28]
	There should not be too many cars and it should not be dangerous to walk (*).	95 [112]	39 [39]	39 [22]
	Not to get tired and to get to where I want to be quickly (***).	18 [17]	54 [33]	101 [123]
(23) Which of these images best represents a sustainable city?	(***)	11 [6]	11 [6]	151 [161]
	(**)	35 [36]	127 [133]	11 [4]
	(*)	127 [131]	35 [34]	11 [8]

- The difference between sustainable and non-sustainable means of transport by analyzing the differences between them from the environmental, economic, and social points of view.
- The basics of the Sustainable Mobility Pyramid consider who has priority when moving around the city. Emphasis was placed on the hierarchy established between the various modes of transport and how priority is assigned.
- The concept of car sharing for commuting and saving space in the city.
- The organization and planning of a city's spaces to promote sustainable mobility with the creation of cycle lanes, bus lanes, pedestrian zones, and low-emission zones.

Several schools in the city of Santander (Spain) participated in the Escape Room experience, which was chosen precisely to socially represent most of the socio-economic strata that would allow for a base sample that would reflect reality as accurately as possible. Given that the participants were minors, written informed consent was obtained from the parents or legal guardians of all students involved, thus guaranteeing the ethics and legality of the study and meeting the requirements imposed by the Spanish LOPD [12].

To ensure the privacy of the students, the questionnaires completed after the experience were anonymized. All personal identifiers were removed, retaining only the information relevant to the analysis of the results.

Data collection took place between December 2022 and February 2023 at the University of Cantabria facilities. This environment provided a controlled and adequate setting for both the execution of the activity and the subsequent data collection, arranging the experiment in a homogeneous way for all participants and thus ensuring that responses were obtained under similar conditions.

The questionnaire was administered in Spanish (the native language of the participants), allowing students to respond clearly and accurately by adapting to the linguistic and cultural context of the participants.

As for the methodology of the questionnaire, ranking questions or order and classification questions were used, following the model described by Louviere et al. [13]. Students were asked to compare three definitions related to sustainable mobility issues and to rank them according to their opinion and degree of knowledge, from the most correct to the least accurate (Table 2). This technique can subsequently assess the level of understanding of sustainable mobility concepts before and after the gamification experience through the Escape Room, as the questions were maintained to ensure data collection and the evolution of the questions during the activity to which they were subjected.

This methodological approach, combined with an experimental design based on questions drawn from other similar studies developed by authors [14] and a homogeneous execution of the questionnaires and the experience, provided a consistent framework for evaluating the impact of the Escape Room as an educational tool on students' perception and understanding of sustainable mobility.

Limitations

Not applicable.

Ethics Statement

The authors of this manuscript declare that no ethical approval was required for data collection in this study. Therefore, we affirm that informed consent was obtained from all parents and legal guardians of the participants, in accordance with the recommendations of the Organic Law BOE-A-2021-8806 7/2021, of 26 May, on the Spanish General Data Protection Regulation (RGPD). In addition, the following relevant laws have been complied with:

- Organic Law 3/2018, of 5 December, on the Protection of Personal Data and the guarantee of digital rights.
- Organic Law 1/1996, of 15 January, on the Legal Protection of Minors.
- Organic Law 8/2015, of 22 July, and Law 26/2015, of 28 July, both refer to the modification of the system for the protection of children and adolescents.

At the beginning of the questionnaire, participants were shown a detailed informed consent form, which included information about their rights in relation to the information provided, thus respecting the current regulations on data protection and digital rights. This consent guaranteed participants' full knowledge and understanding of the use and purpose of their data, ensuring their right to privacy and the protection of their information.

Finally, we have ensured that the data acquired has been anonymized and that our research practices fully comply with the ethical requirements for publication in the Data in Brief journal.

Data Availability

Dataset on Student Perceptions of Sustainable Mobility Pre- and Post Escape Room Intervention (Original data) (Mendeley Data).

CRediT Author Statement

Silvia Sipone: Data curation, Conceptualization, Methodology, Writing – original draft, Visualization; **Andrés Rodríguez:** Formal analysis, Writing – review & editing; **Marta Rojo:** Resources, Supervision; **José Luis Moura:** Validation, Project administration, Supervision, Resources.

Acknowledgments

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] S.V. Gentry, et al., Serious gaming and gamification education in health professions: systematic review, J. Med. Internet Res. 21 (3) (2019) e12994, doi:10.2196/12994.

[2] W. Wang, H. Gan, X. Wang, H. Lu, Y. Huang, Initiatives and challenges in using gamification in transportation: a systematic mapping, Eur Transport Res Rev 14 (1) (2022) 41, doi:10.1186/s12544-022-00567-w.

[3] S. Bassanelli, N. Vasta, A. Bucchiarone, A. Marconi, Gamification for behavior change: a scientometric review, Acta Psychol 228 (2022) 103657 (Amst), doi:10.1016/j.actpsy.2022.103657.

[4] S. Lopez-Pernas, A. Gordillo, E. Barra, J. Quemada, Examining the use of an educational escape room for teaching programming in a higher education setting, IEEE Access 7 (2019) 31723–31737, doi:10.1109/ACCESS.2019.2902976.

[5] L.H. Taraldsen, F.O. Haara, M.S. Lysne, P.R. Jensen, E.S. Jenssen, A review on use of escape rooms in education – touching the void, Educ Inquiry 13 (2) (2022) 169–184, doi:10.1080/20004508.2020.1860284.

[6] N. Brown, W. Darby, H. Coronel, An escape room as a simulation teaching strategy, Clin Simul Nurs 30 (2019) 1–6, doi:10.1016/j.ecns.2019.02.002.

[7] J.C. Piñero Charlo, J. Carlos, Educational escape rooms as a tool for horizontal mathematization: learning process evidence, Educ Sci 10 (9) (2020) 213 (Basel), doi:10.3390/educsci10090213.

[8] A.E. Kinio, L. Dufresne, T. Brandys, P. Jetty, Break out of the classroom: the use of escape rooms as an alternative teaching strategy in surgical education, J Surg Educ 76 (1) (2019) 134–139, doi:10.1016/j.jsurg.2018.06.030.

[9] R. Kazhamiakin, A. Marconi, A. Martinelli, M. Pistore, G. Valetto, A gamification framework for the long-term engagement of smart citizens, in: Proceedings of the IEEE International Smart Cities Conference (ISC2), IEEE, 2016, pp. 1–7, doi:10.1109/ISC2.2016.7580746.

[10] E. M, P.F. Zoi Karageorgiou, Escape room design as a game-based learning process for STEAM education, in: Proceedings of the 12th European Conference on Game Based Learning, ACPI, Oct. 2019, p. 46, doi:10.34190/GBL.19.190.

[11] M. Wiemker, E. Elumir, and A. Clare, "Escape room games: 'can you transform an unpleasant situation into a pleasant one?,'" 2015. [Online]. Available: http://scottnicholson.com/pubs/erfacwhite.pdf.

[12] "BOE-A-2021-8806 Ley Orgánica 7/2021, de 26 de mayo, de protección de datos personales tratados para fines de prevención, detección, investigación y enjuiciamiento de infracciones penales y de ejecución de sanciones penales." Accessed: Nov. 30, 2023. [Online]. Available: https://www.boe.es/eli/es/lo/2021/05/26/7.

[13] J.J. Louviere, D.A. Hensher, J.D. Swait, W. Adamowicz, Stated Choice Methods: Analysis and Applications, Cambridge University Press, 2000, doi:10.1017/CBO9780511753831.

[14] S. Sipone, V. Abella-García, M. Rojo, L. Dell'olio, Using class craft to improve primary school students' knowledge and interest in sustainable mobility, Sustainability 13 (17) (2021) 9939, doi:10.3390/SU13179939.