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STUDENTS' RELATIONSHIP WITH WASTE: THE EXPERIENCE OF THE ZERO WASTE APPROACH IN EDUCATIONAL CONTEXTS † *

Introduction.[1] – Waste is often understood as the final link in the production and consumption chain, something to be disposed of at some point. This is not often the reality, but what it reveals is a desire to minimize waste's impact. Concerning waste – and given the increasing urgency of the issue – it is both appropriate and necessary to ask questions about its overall production and the various ways its different fractions are managed and treated.

Data allow us to comprehend the phenomenon better and recognize the progressively and alarmingly growing trends. Despite interventions implemented in recent decades across various scales and sectors to manage the multidimensional problem of waste production sustainably, the challenge persists. A few years ago, the World Bank sounded an alarm,

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* All authors contributed equally to conceptualising, drafting and editing sections *Introduction* and *Conclusion: for a research agenda on waste and education*. Venturini wrote the first draft of sections *The problem of waste and the Zero Waste approach, The 'Zero Waste and Tourism Sustainability' research project* and *Discussion: reflections for waste prevention and education,* and Guaran of sections *The activities in the school* and *The «activation» questionnaire*. All authors contributed equally to editing the final draft of the manuscript.

[1] This contribution, together with *Rethinking agricultural waste for bioenergy in rural areas: an application model for the province of Foggia* from Marilena La Bianca and three more articles in the next issue of *Documenti Geografici,* is part of a collection of papers dedicated to the expanding field of waste studies, emerging from discussions held at the EUGEO 2023 conference, held in Barcelona, particularly within the 'Exploring the interconnection between geography, waste, and power dynamics for sustainable futures' panel. The title itself reflects the ambitious intention to investigate, through the geographical lens, the theme/problem represented by waste, evaluating its fundamental political dimension, considering the power relations that revolve around it, and trying to understand how much the concrete realization of the principles of sustainability is closely anchored to the waste issue.

identifying a significant 65 percent increase over a 30-year period (Kaza et al., 2018). This projection foresees a production of 3.4 billion tons by 2050, based on the 2.01 billion produced in 2016. Notably, less affluent countries are expected to contribute significantly, nearly doubling per capita production. For instance, citizens of the East Asian macro-region are projected to increase from 0.79 to 1.45 kilograms per day from 2020 to 2050, and inhabitants of sub-Saharan Africa from 0.47 to 0.72, although still well below the 2.33 kilograms of a North American citizen.

While, on one hand, waste should be interpreted within the principles of the circular economy – not as a weak and conclusive link, but as one stage of a process characterized by circularity, capable of transforming waste into resources – it is equally fundamental to address waste production upstream (European Commission, 2020). Therefore, it becomes crucial to understand and explore the Zero Waste model and endeavor to promote its principles and values.

Analyzing the wider implications for modern waste management and exploring the potential of the Zero Waste approach, this study presents an action-oriented research initiative carried out in Friuli Venezia Giulia.

This study focuses on four popular tourist destinations in the Friuli Venezia Giulia region, namely the coastal resorts of Grado and Lignano Sabbiadoro and the mountain destinations of Sappada and Tarvisio. These resorts are characterised by significant tourist flows and waste generation peaks seasonally, causing high quantities of waste per capita and low separate collection rates, see table 1. Tourism is an increasingly important sector of the economy, both for induced activities and for the actors employed, and this leads to a significantly higher share of waste production (Mateu-Sbert et al., 2013; Kaza et al., 2018).

Table 1 – *Main tourist resorts in Friuli Venezia Giulia: waste production and management*

	Population	Waste production per capita (Kg)	% separate collection
Grado	7.658	918.919	50.29
Lignano Sabbiadoro	6.842	2400.874	56.42
Sappada	1.314	783.010	67.67
Tarvisio	3.966	674.477	53.30
Friuli Venezia Giulia	1.192.191	470.791	69.10

Source: ARPA 2023

The focal point of this research centers on educational initiatives designed to cultivate an increased consciousness regarding waste management, while also disseminating Zero Waste methodologies within a younger demographic.

We begin with an exploration of the issue of waste and the implementation of the Zero Waste approach. We then delve into the 'Zero Waste and Tourism Sustainability' research project, followed by an examination of the activities conducted in the school setting. The 'activation' questionnaire is introduced as a key component of our research methodology. Subsequently, we present reflections drawn from our project experience and provide insights into the broader implications and lessons learned. Finally, we propose some considerations for a research agenda that focuses on the intersection of waste and education.

The problem of waste and the Zero Waste approach. – Waste constitutes an escalating concern, exerting far-reaching consequences on both the environment and broader society. A particularly striking statistic underscores this issue: a substantial 18% of methane (CH4) emissions stem from landfills and waste (Jackson et al., 2020). While in the European Union, the overall volume of waste steadily rose since 1995, as of 2021, each person produced an average of 527 kilograms of municipal waste per year. Unfortunately, only 49% of this waste was recycled or composted (Eurostat, 2024).

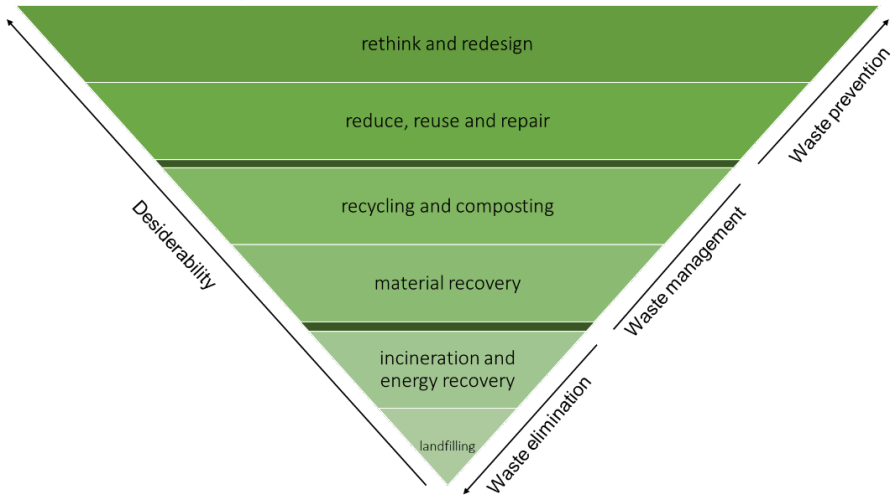
Although improvements are being made in recycling endeavors, a pivot towards waste prevention is imperative. Addressing this multifaceted challenge requires a comprehensive approach that interweaves production, technology, policy, and lifestyle considerations. In this intricate tapestry, the role of education emerges as a key force (Venturini, 2021). Educating ourselves and others becomes crucial to comprehend the complexity of the issue, to find alternative solutions, and to put in practice transformative shifts on both individual and collective levels.

The Zero Waste approach (Zaman, 2022) presents a pivotal strategy within this project, offering a framework that we depict in fig. 1, a symbolic inverted pyramid. This visual model encapsulates a spectrum of behaviors that are essential in guiding us towards a sustainable future, with the most environmentally beneficial practices positioned at the pyramid's pinnacle, and the less optimal practices are found towards its base.

This pyramid structure encompasses three distinct tiers, each representing a fundamental facet of waste management. The initial tier, termed *waste prevention*, comprises two key principles: "Rethink and Redesign," and "Reduce, Reuse, and Repair." "Rethink and Redesign" embody a thoughtful re-evaluation of our roles as consumers, urging us to re-examine and modify our behaviors. Through creative redesign, products can be optimized for longevity, resource efficiency, and potential for repair and recycling. The concept of "Reduce, Reuse, and Repair" advocates conscious purchasing decisions, prolonged product utilization through reusing, and valiant efforts to repair items to extend their lifecycle.

Transitioning to the second tier, *waste management*, we encounter the vital procedures of "Recycling and Composting," along with "Material Recovery." "Recycling and Composting" delve into the extraction of useful materials from waste streams, with a primary focus on paper, glass, metals, and specific plastics. Meanwhile, composting tackles organic waste, generating valuable soil-enriching resources. "Material Recovery" complements this by outlining techniques to reclaim materials from mixed waste, further salvaging reusable resources.

Fig. 1 – *The inverted pyramid model Zero Waste*



Source: elaboration of the authors on the Zero Waste pyramid

Descending to the base of the pyramid, we find *waste elimination*, encompassing "Incineration and Energy Production," as well as "Land-

filling." "Incineration and Energy Recovery" involve the controlled combustion of waste within specialized facilities, such as incinerators or waste-to-energy plants, culminating in energy generation. "Landfilling" refers to the containment of remaining waste within designated sites.

As we ascend the inverted pyramid's tiers, a progression of virtuous waste management behaviors unfolds. The uppermost echelons, representing waste prevention, embody the most aspirational practices, as they proactively prevent waste generation. Unfortunately, while focusing on recycling, the wider society often neglects these aspirational practices, and the educational system fails to adequately address them.

Conversely, the lower levels, entailing waste elimination, are intended to be minimized due to their environmental impact. The pyramid's configuration serves as a visual reminder of the trajectory we must undertake to achieve effective waste management and foster a sustainable future (Connett, 2011; Ercolini, 2018).

The 'Zero Waste and Tourism Sustainability' research project. – The 'Zero Waste and Tourism Sustainability'[2] research project was developed with the intention to heighten awareness and provide education to a diverse audience encompassing students, citizens, municipal elected officials, tour operators, and tourists. The primary focus centers on waste reduction and its proper management and prevention. Conveying the importance of environmentally responsible practices and behavior becomes paramount, urging the need for initiatives that instil this understanding across various segments of society. The core emphasis is placed on initiating environmental awareness and educational campaigns targeted specifically at waste management and societal conduct. This paper focuses on the educational activities in schools, aiming to initiate a self-perpetuating cycle. Education about waste is not widely incorporated into the Italian school curriculum (Guaran, Venturini, 2022). The aspiration is to cultivate a sense of environmental consciousness among students, which in turn may extend to their parents, thereby fostering a heightened communal sense of responsibility.

[2] This research project is conducted by the University of Udine as part of an implementation agreement between the Department of Languages and Literatures, Communication, Education and Society and the Friuli Venezia Giulia Region. More information at: zerowaste.uniud.it

The project successfully engaged around 600 students in a series of activities meticulously designed to impart knowledge and provoke thought. These activities encompassed a range of informative and instructional workshops orchestrated collaboratively by scholars from the University of Udine and the innovative communicators of the "La Fa Bù" theatre company[3]. The approach was distinguished by its use of theatrical animation, which effectively amplified the impact of the messages conveyed (D'Ambrosio, 2015). The use of active methodologies, derived directly from the techniques of theatrical animation, has the advantage of eliciting motivations in students that are likely to foster a reflective and questioning attitude toward the issue of waste (Nardon, 2013). The objective is to explore potential solutions and hypotheses that can be applied in daily life. This includes efforts to reduce individual and family waste production, and, concurrently, to identify habits and virtuous behaviors that can promote more mindful management of the waste generated by each child or pre-adolescent in various places and life contexts.

Four middle schools[4] (with students 11-14 years old) located in Grado, Lignano Sabbiadoro, Sappada, and Tarvisio partook in these enriching activities. Additionally, the scope expanded to involve four Hotel vocational schools[5] (with students 14-19 years old) specializing in "services for food and wine and hotel hospitality" from the wider Friuli Venezia Giulia. Through this approach, we targeted students aged 12 to 15, a crucial stage for enhancing environmental and waste awareness (Tomažič, Vidic, 2011). The collaborative efforts of these institutions and the immersive workshops collectively contribute to the overall vision of fostering a community that prioritizes responsible waste management and mindful behaviors.

The school activities aimed to engage participants in retracing and analyzing their everyday behaviors. These activities also sought to impart

[3] The La Fa Bù company was founded as a Cultural Association in August 2002 ìwith the aim of promoting the theatrical culture, with particular attention to the youth and school world and to relations with the institutional and associative realities of the territory, placing a special emphasis on respect for the individual, the environment and the community to which they belong.

[4] Namely the Comeglians Comprehensive Institute in Sappada, the "Marco Polo" Comprehensive Institutes of Grado, the "Giosuè Carducci" of Lignano, and the "Giovanni XXIII" of Tarvisio.

[5] Specifically, the "Jacopo Linussio" of Codroipo, "Sandro Pertini" of Grado, "Enrico Mattei" of Lignano Sabbiadoro, and "Federico Flora" of Pordenone.

knowledge on waste management and the principles of the Zero Waste approach. Moreover, a key objective was to foster self-reflection among participants and encourage them to envision potential changes in their behavior. Emphasis was placed on understanding the importance of individual contributions for the greater common good (Guaran, Venturini, 2022).

Through these activities, students were prompted to engage and develop a range of distinct skills, and notably, a significant emphasis was placed on fostering a pathway of knowledge co-construction. It involves experimenting with the principles of laboratory teaching that aim to place the learner at the center of their learning and maturation. This approach fosters the development of the learner's ability to express their own point of view, compare it with that of their peers, and initiate reflection on their thoughts and maturation throughout the activities (Calvani, Trinchero, 2019; Sandrone, 2004). Ultimately, the goal is to propose or ideally create situations and problems that challenge learners to "be thoughtfully present regarding to the experience" (Mortari, 2013, p. 13).

As students participated in these endeavors, they were encouraged not only to absorb information but also to actively contribute to the construction of knowledge. This approach transformed the learning process from a passive absorption of facts to an interactive exchange of ideas and perspectives. Students became co-creators of their learning experience, collaborating with peers and educators to build a shared understanding.

This pathway of knowledge co-construction went beyond traditional classroom dynamics, inviting students to express their viewpoints, ask questions, challenge assumptions, and collectively shape the learning journey. This not only deepened their grasp of the subject matter but also nurtured vital skills such as critical thinking, effective communication, and collaborative problem-solving. Ultimately, our intention with this approach was to cultivate a feeling of ownership and empowerment among students, imparting not only valuable insights for a lifetime of learning about waste prevention but also fostering behaviors that align with active citizenship (Poudrier, 2017).

The activities in the school. – Multiple educational methods were utilised in the activities in the schools. Non-formal educational methods (theatrical animation workshops, discussion techniques, presenting litter-free objects) were used together with standard procedures (online question-

naire, presentation) to arouse students' interest, activate different skills (public speaking, working in a group) and increase personal awareness.

All students took an initial online questionnaire and then participated in a 2-hour workshop designed and conducted by the authors of this study (Chambr[6], seminar, groups activity). The activity is structured in three distinct parts to engage students in a lively exploration of waste-related topics. First, a playful online debate encourages students to work in groups and collaboratively respond to questions about waste (similar to the debate teaching technique). Following this, a dialogue presentation delves into waste management and the Zero Waste approach. The final segment invites students to create lists of ten guidelines (decalogues) for promoting virtuous waste management in various settings, such as at home, in school, within the city, and even in the kitchen and restaurant halls.

All middle schools' students participated in the "Rifiuti in piazza"[7] events and the school that selected this opportunity also had the chance to take part in activities with Playback theatre approach.

The «activation» questionnaire. – A dual-purpose questionnaire was designed to achieve two key objectives: firstly, to amass crucial insights into students' behaviors and comprehension concerning waste management; and secondly, to effectively stimulate their pre-existing knowledge on the subject. The implementation of strategies to activate prior knowledge is widely acknowledged for its ability to enhance comprehension and bolster knowledge retention (Spires, Donley, 1998; Hattan, Alexander, Lupo 2023.). Our questionnaire served as a strategic tool not only to stimulate familiarity with key terminologies but also to spotlight individual practices in waste management and prevention. By employing this questionnaire as a preliminary step before our forthcoming 2-hour seminar, our intention was to optimize the impact of our educational activities.

[6] Chambr is a web-based, gamified platform that runs learning activities on its own. Players solve scenario-based challenges and receive feedback from their peers. For more information please consult https://www.f6s.com/company/chambr#about

[7] The "Rifiuti in piazza" events are organized to collaboratively examine the contents of collected waste with citizens, aiming to inform and educate them on proper collection and sorting methods. In a designated area, a waste collection lorry unloads a portion of its load, and technicians then open the waste bags on a table for analysis. This involves separating different fractions based on type and materials. After the analysis, the various waste fractions are weighed, and an evaluation is conducted to determine the accuracy of the waste differentiation process.

We received 226 questionnaires from the Middle schools and 282 from the Hotel vocational schools – almost all of the student participants. The online questionnaire was completed prior to the 2-hour seminar, either at home or during class on the preceding days. In some instances, students completed the questionnaire on the same day as the workshop. Regrettably, not all students were able to complete the questionnaire, either due to their absence from class on the day of distribution or because they inadvertently overlooked its completion at home.

The questionnaire was structured around seven topics (Personal information, Knowledge and personal behaviour, Lifestyle and habit, At home, Food waste, Personal reflection on waste) and slightly different between the middle schools and vocational schools given the age difference and educational focus.

It's crucial to emphasize that the responses are based on the respondents' self-evaluations of their habits. Consequently, the true extent of their actual behaviours remains uncertain, since there have been no opportunities to test at school how students act in relation to waste generation and management[8].

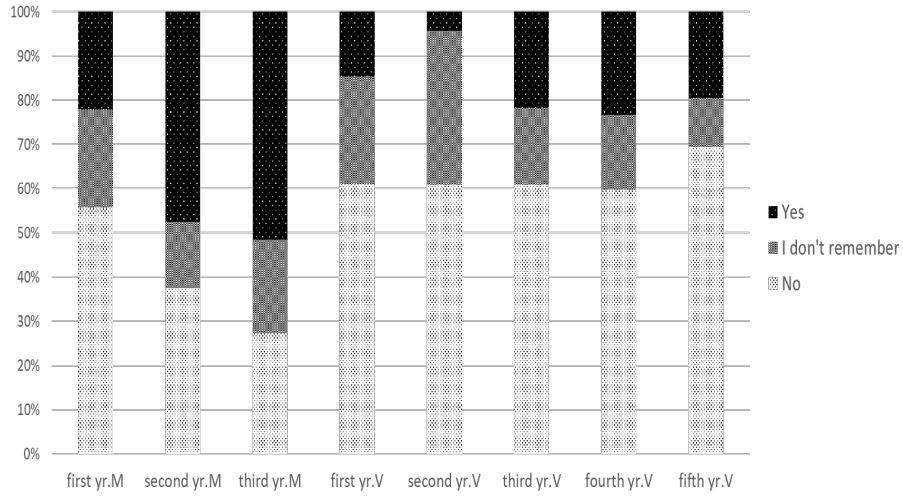
In the upcoming section, we delve into an analysis of select questionnaire results.

It was decided to commence the questions by asking individuals to declare their willingness or unwillingness to curb waste production, despite the expectation that the overwhelming majority – at the end over 90% of respondents – would express their willingness to contribute to reducing waste. The objective was twofold: first, to understand and evaluate the inclination towards sustainable behavior and subsequent actions, and second, to uncover the motivations of the few but significantly impactful representatives of a resigned and not pro-environmental or pro-social thinking (ARPAV, 2014). These individuals constitute only a small minority when considering the overall population. They are convinced that their efforts will not be able to change the status quo, leading them to believe that there is no point in making an effort or adopting virtuous behavior.

[8] The only control pertained to the containers of the selectable fractions upon returning to the classroom after the recreational break. This action has undoubtedly enabled us to collectively assess the accuracy of the deliveries, uncovering doubts and triggering requests for clarification. In some instances, assumptions of responsibility have emerged, indicating positive prospects for potential changes in habits.

It is important to mention that this result predates any activities within this project. We strongly believe that participation in the workshop course will play a crucial role in reducing the number of young people who are initially opposed to any form of collaboration and commitment. While it may not be objectively measurable, we are convinced that the course provides an opportunity for participants to reconsider their positions, even if only to some extent.

Fig. 2 – *Do you participate in campaign on waste prevention?*



Source: elaboration by the authors

To better assess individual commitment levels, we found it insightful to inquire about direct experiences related to waste management. Specifically, we asked if the students had previously taken part in information and waste prevention campaigns. Examining the graph, we can discern two overarching trends. The first indicates a gradual rise in student participation in waste prevention campaigns during middle school, while the second reveals consistent negative responses at the Hotel vocational school level, slightly surpassing those of the first-year middle school.

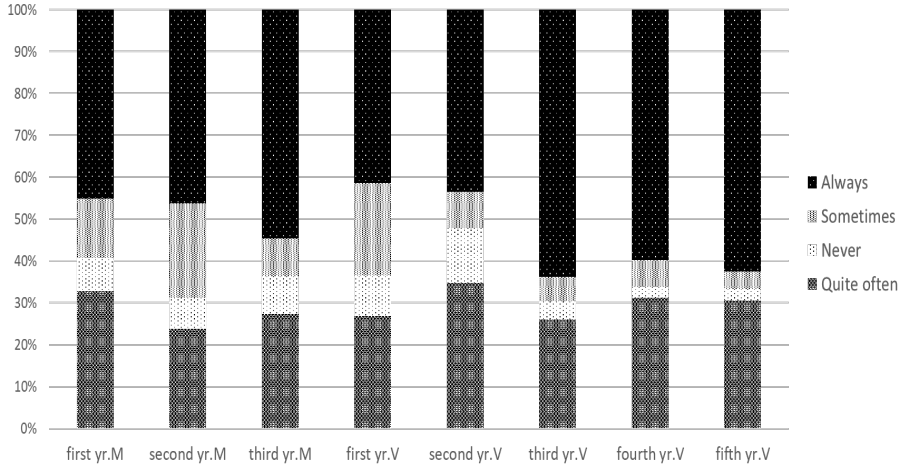
For these tendencies, we have two possible explanations. On one side, this may be a recent trend where more and more new waste prevention activities or campaigns (such as ecological days dedicated to collecting litter) are being organised during secondary school, and we are now seeing the first effects. On the other side, the fragmentation of subjects

at the high school level may contribute to students forgetting these concepts. This is exacerbated by the fact that there are fewer opportunities to participate in initiatives like the ones mentioned. Additionally, ecological civic engagement initiatives don't always have a consistent teaching figure as a reference.

The exploration of the link between waste issues and environmental sustainability prompted an inquiry into whether survey respondents viewed responsible waste management as an expression of care and concern for the environment. Ninety percent of the respondents answered this question with "Enough" or "A lot," a factor that leads us to assert that students possess a broad comprehension of the connections between appropriate waste management behaviors and sustainability.

While the percentage of respondents expressing skepticism that effective waste management contributes to environmental sustainability is low (0.4% for "Nothing" and 9% for "Little"), it is crucial to analyze the underlying reasons. Such non-pro-environmental behaviors are not uncommon among adults (Mikuła, Raczkowska, Utzig, 2021). 57% of cases justify a lack of attention or personal commitment, often citing the belief that individual actions have little impact unless others behave similarly. Additionally, 32% express a lack of willingness to pay attention to waste disposal, suggesting that the difficulty of sorting makes some individuals feel it is not worth the effort.

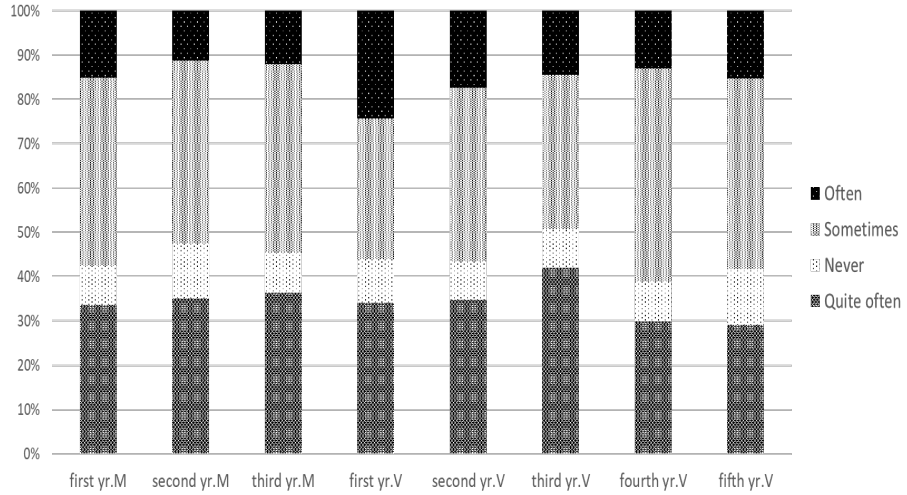
Fig. 3 – *At home do you contribute to separate waste collection?*



Source: elaboration by the authors

In the "At Home" questionnaire section, a remarkable 90% of respondents express a belief in the importance of timely and meticulous waste management and they cite personal actions such as assisting their parents in waste sorting. This overwhelmingly positive response underscores the impact of educational campaigns promoting recycling, which evidently bear fruit throughout individuals' educational experiences. Notably, this inclination towards responsible waste management is particularly pronounced during adolescence, as evidenced by a significant decrease in the proportion of respondents indicating "never" or "only sometimes".

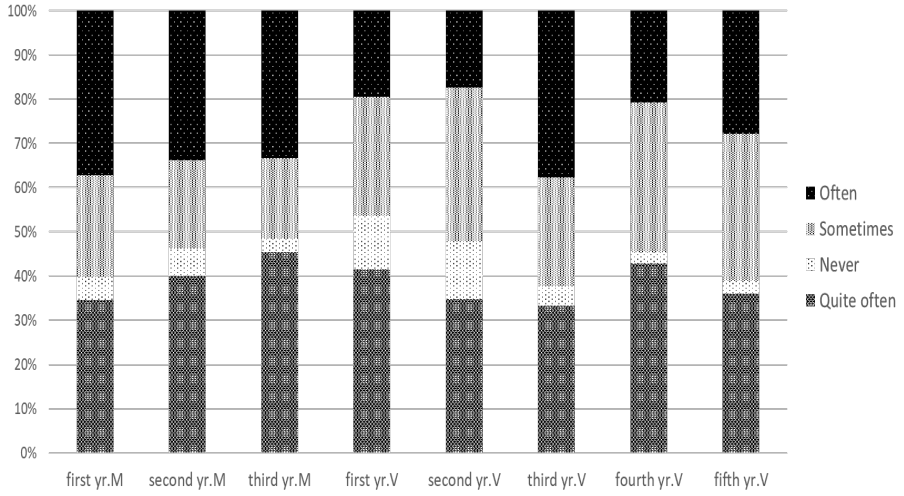
Fig. 4 – *Do you use items produced or made from recycled materials (e.g. notebooks, clothes, containers)?*



Source: elaboration by the authors

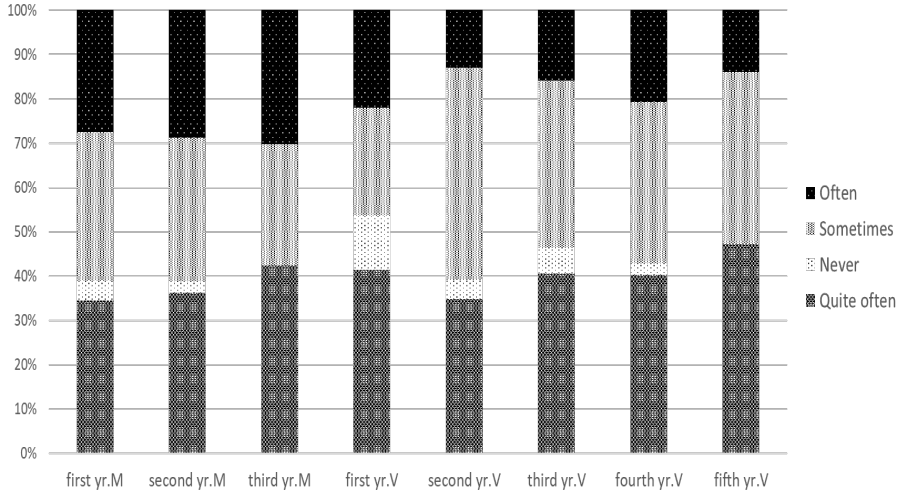
Looking ahead, the respondents' statements do not provide complete comfort, particularly regarding certain positive behaviors aligned with the higher parts of the pyramid. These behaviors involve regularly purchasing school materials and clothes made of recycled materials, actively engaging in repairs instead of discarding broken items, and embracing reuse by repurposing functional objects that can still serve a purpose.

Fig. 5 – *When an object no longer works (or is ruined), do you try to fix it by yourself or by someone else before throwing it in the waste?*



Source: elaboration by the authors

Fig. 6 – *Have you happened to reuse, instead of throwing away, waste material (e.g. cans, sheets of paper, containers, etc.)?*

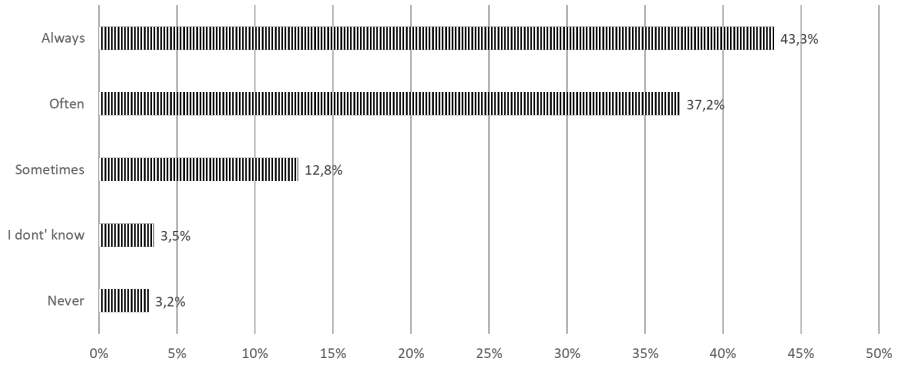


Source: elaboration by the authors

Examining all three graphs, it is evident that the responses remain consistent, underscoring a still not too high presence of any waste reduction projects at both the Middle and Vocational school levels. This high-

lights the imperative to devise educational projects centered around the upper echelons of the waste hierarchy.

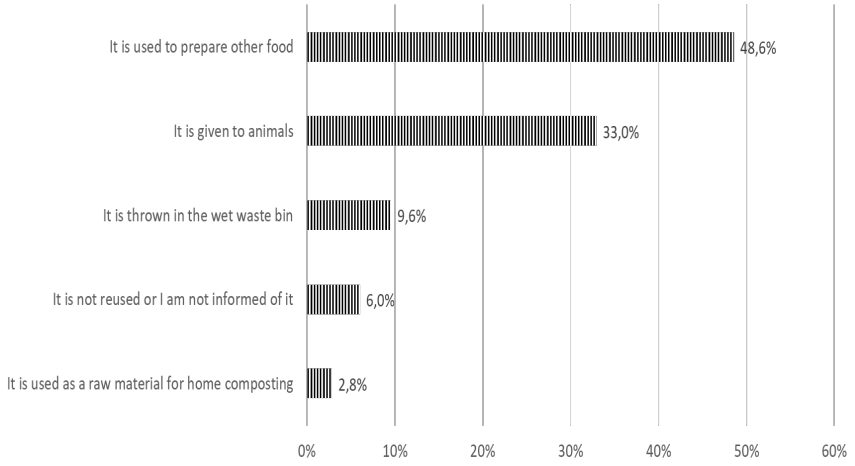
Fig. 7 – *At your home when food is left over at the end of a meal, is it somehow reused?*



Source: elaboration by the authors

Specifically for the Vocational students, it was crucial to prompt the young respondents to contemplate household dynamics. This was due to the significant concern of food waste and the generation of organic waste, the most substantial component of municipal waste. A significant majority of respondents indicated that they always, or at least quite often, consume leftovers from prior meals that have been repurposed in the preparation of new dishes.

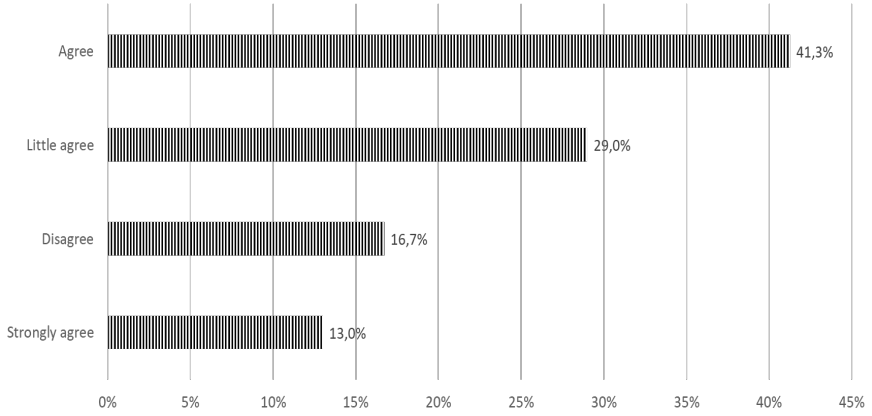
Fig. 8 – *If so, how is left over food used?*



Source: elaboration by the authors

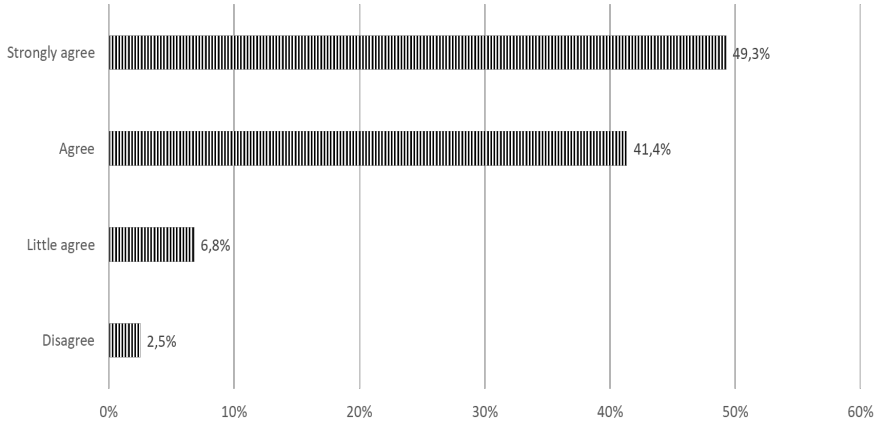
There is a widespread awareness of the importance of food recovery at home, with the vast majority stressing that surplus food be either re-purposed for new meals or (secondarily) given to animals. However, although not overwhelmingly, there is also a prevailing number of those who are convinced that to curb the creation of food waste, it is necessary to act upstream of food preparation in the kitchen, by paying attention to quantity when they buy food.

Fig. 9 – *When do you agree with the following statements to reduce food waste when shopping? Buying products close to their expiry date on offer*



Source: elaboration by the authors

Fig. 10 – *When do you agree with the following statements to reduce food waste when shopping? Order only what you know you can consume*



Source: elaboration by the authors

Almost all participants agreed that it is wise to only purchase or order at the restaurant what they know they can consume to reduce food waste. However, the option of "buying products close to their expiry date when they're on sale" shows an increase in the number of people who do not agree. It appears that products nearing their expiry date, even when discounted, raise concerns. By doing so, the food remains unsold on the shelves and requires complex management procedures by the vendors. This represents a waste of energy and materials used in the production of the food, along with additional costs for its disposal.

Discussion: reflections for waste prevention and education. – In this section, we present reflections drawn from our research on waste prevention and education.

Our activities have revealed that students, despite initial reservations about the topic of waste, are receptive to its importance. However, there are prevalent misunderstandings regarding waste generation and prevention. Notably, we have identified a strong willingness among students to modify their behaviors for better waste separation and, crucially, to minimize waste production. While the majority show interest, a small percentage remains uninterested in changing their habits. Consequently, along with Tomažič and Vidic (2011), we recognize the central role of educational processes in realigning practices and values, guiding students toward a more sustainable future that integrates both environmental and social well-being.

Turning attention to the waste pyramid, students exhibit a clear understanding of effective waste management, especially recycling. Yet, the complexities of the higher tiers[9], particularly waste prevention, are less comprehended and infrequently translated into action. Therefore, there is a pressing need to shift focus towards cultivating waste prevention behaviors, not just by providing examples but by catalyzing actionable change. Delving into waste allows students to explore the intricate interplay between waste generation and prevailing patterns of production and

[9] Higher tiers of the waste pyramid can be considered more complex because they are require more thinking and planning compared to recycling. Recycling mainly involves sorting and correctly collecting waste, whereas waste reduction and prevention require a more strategic approach involving shifts in behavior and creative thinking for new solutions.

consumption, offering a pathway to engage with sustainability on a broader societal level.

However, challenges persist. Waste currently lacks priority in both student and school/teacher agendas, not being obligatory as per Italian educational guidelines. Shifting focus from recycling to comprehensive waste prevention faces hurdles, including unfamiliarity among students and the absence of a well-established framework. Funding, too – particularly for external expertise needed in certain activities – poses a challenge.

Looking ahead, we plan to include more schools, with a focus on vocational schools, especially those in the hotel and tourism sectors. Building on past experiences, we are developing new activities and teaching materials to enhance the overall educational experience for students.

Conclusion: for a research agenda on waste and education. – In conclusion, our contribution aims to enrich the ongoing dialogue on waste prevention and education by offering reflections that can guide the development of a future research agenda.

Our perspective is grounded in the conviction that effectively addressing issues related to waste production and management necessitates active citizenship, which in turn is contingent upon comprehensive educational processes (Alipour, Rahmati, Akbarbeyki, 2015).

Looking ahead, we advocate for a dual focus in future projects. First, we propose the development of educational processes that center on imparting sustainability skills, equipping students with practical tools for their daily lives. Second, we encourage a concerted effort to promote the cultivation of global citizenship values within educational initiatives. By aligning waste prevention with broader global citizenship principles, it transcends a singular practice and becomes emblematic of a commitment to sustainable living, ethical consumption, and the well-being of both local and global communities.

However, we anticipate challenges, notably the prevalent belief in technological interventions as the ultimate solution to waste-related issues. This perspective, ingrained among decision-makers, officials, teachers, and students, hinders individual agency and perpetuates a deficit in individual awareness. Overcoming this challenge requires addressing the prevailing delegation principle embedded in societal structures.

As a way forward, we recommend the development of educational

pathways that empower students through self-aware learning (Mortari, 2013; Poudrier, 2017). While including waste prevention in official school curricula may be ambitious, we propose training teachers in waste prevention and reduction. This approach aims to establish self-sustaining educational programs that extend beyond isolated initiatives. What such initiatives are often lacking is the necessary expertise (Martínez-Borreguero et al., 2019), but by equipping educators with the necessary knowledge and tools, these programs can endure over time, contributing to a more conscious and sustainable society.

BIBLIOGRAPHY

ALIPOUR S., RAHMATI F.S., AKBARBEYKI M. "The role of citizenship education and participation in waste management", *Cumhuriyet Üniversitesi Fen Edebiyat Fakültesi Fen Bilimleri Dergisi*, 2015, 36, 3, pp. 3918-3935.

ARPAV, *Analisi dei bisogni: la Scuola e l'educazione ambientale. Un esempio nella Scuola Secondaria di primo grado*, 2014 (http://www.arpa.veneto.it/servizi-ambientali/educazione-per-la-sostenibilita/educazione-ambientale).

CALVANI A., TRINCHERO, R., *Dieci falsi miti e dieci regole per insegnare bene*, Roma, Carocci, 2019.

CONNETT P., *Rifiuti zero. Una rivoluzione in corso*, Bozzano, Dissensi, 2011.

D'AMBROSIO M., *Teatro come pratica pedagogica. Ricerca-azione per la formazione al teatro-scuola*, Lecce, Pensa Multimedia, 2015.

ERCOLINI R., *Rifiuti zero. I dieci passi per la rivoluzione ecologica del Premio Nobel per l'ambiente*, Milano, Baldini e Castoldi, 2018.

EUROPEAN COMMISSION, *Communication from the Commission to the European Parliament, the Council, The European Economic and social Committee and the Committee of the Regions. A new Circular Economy Action Plan. For a cleaner and more competitive Europe*, 2020 (https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM%3A2020%3A98%3AFIN).

EUROSTAT, *Municipal waste statistics*, 2024 (https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Municipal_waste_statistics#Municipal_waste_generation).

GUARAN A., VENTURINI F., "Zero Waste for geographical education on sustainability", *Geography Notebooks*, 2022, 5, 1, pp. 77-85.

HATTAN C., ALEXANDER P.A., LUPO S.M., "Leveraging what students know to make sense of texts: What the research says about prior knowledge activation", *Review of Educational Research*, 2023, 94, p. 73-111.

JACKSON R.B. ET AL., "Increasing anthropogenic methane emissions arise equally from agricultural and fossil fuel sources", *Environmental Research Letters*, 2020, 15, 7, s.p.

KAZA S. ET AL., *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*, Washington, World Bank, 2018.

MARTÍNEZ-BORREGUERO G. ET AL., "Knowledge analysis of the prospective secondary school teacher on a key concept in sustainability: Waste", *Sustainability*, 2019, 11, 4, s.p.

MATEU-SBERT J. ET AL., "The impact of tourism on municipal solid waste generation: The case of Menorca Island (Spain)", *Waste management*, 2013, 33, 12, pp. 2589-2593.

MIKUŁA A., RACZKOWSKA M., UTZIG M., "Pro-environmental behaviour in the European Union countries", *Energies*, 2021, 14, 18, s.p.

MORTARI L., *Cultura della ricerca e pedagogia. Prospettive epistemiche*, Roma, Carocci, 2013.

NARDON A., *Laboratorio teatro. Proposte per fare teatro nella scuola*, Roma, Dino Audino, 2013.

POUDRIER C., "Environmental education and active citizenship", J*ournal of Applied Technical and Educational Sciences*, 2017, 7, 4, pp. 31-36.

SANDRONE BOSCARINO G., "La Didattica laboratoriale", *Scuola e Didattica*, 2004, 9, s.p.

SPIRES H.A., DONLEY J., "Prior knowledge activation: Inducing engagement with informational texts", *Journal of Educational Psychology*, 1998, 90, 2, pp. 249-260.

TOMAŽIČ I., VIDIC T., "Assessing primary school pupils' knowledge of and behaviour concerning waste management", *Acta Biologica Slovenica*, 2011, 54, 1, pp. 77-90.

VENTURINI F., "Circular Economy and Zero Waste for Environmental Education", *Semestrale di studi e ricerche di geografia*, 2021, 23, 1, pp. 143-161.

ZAMAN A.U., "A strategic framework for working toward zero waste societies based on perceptions surveys", *Recycling*, 2017, 2, 1, pp. 1-15.

ZAMAN A., "Zero-Waste: A New Sustainability Paradigm for Addressing the Global Waste Problem", in *The Vision Zero Handbook: Theory, Tech-*

nology and Management for a Zero Casualty Policy, Cham, Springer International Publishing, 2022, pp. 1-24.

Il rapporto degli studenti con i rifiuti: l'esperienza dell'approccio Rifiuti Zero in contesti educativi. – La tematica relativa alla produzione e gestione dei rifiuti è spesso trascurata, ma i dati preoccupanti ne evidenziano l'urgenza. L'approccio Rifiuti Zero, sviluppato con l'obiettivo di evitare la produzione di rifiuti e ripensare i modi di produzione e consumo, emerge come soluzione cruciale. Questo studio presenta una ricerca-azione nel Friuli Venezia Giulia, focalizzata sulla sensibilizzazione e diffusione dell'approccio Rifiuti Zero in alcune località turistiche della regione. Coinvolgendo all'incirca 600 studenti di scuole secondarie di primo grado e scuole professionali, i risultati iniziali indicano una comprensione generale della gestione dei rifiuti e un interesse nei confronti dei principi di Rifiuti Zero, mostrando la volontà degli studenti di agire per un futuro sostenibile.

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