

DESIGNING EDUCATION-DRIVEN STRATEGIES FOR SUSTAINABLE CONSUMPTION IN UNIVERSITY SPORTS FACILITIES: EVIDENCE FROM A DISCRETE CHOICE EXPERIMENT

[¹] YINUO MU, [²] MOHAMAD NIZAM NAZARUDIN, [³] SANGSANG JIANG, [⁴] XIANGPING SUI

[¹] UNIVERSITY KEBANGSAAN MALAYSIA

[²] UNIVERSITY KEBANGSAAN MALAYSIA

[³] UNIVERSITY KEBANGSAAN MALAYSIA

[⁴] UNIVERSITY KEBANGSAAN MALAYSIA

EMAIL: [¹] estermu277@gmail.com, [²] mohdnizam@ukm.edu.my, [³] p137277@siswa.ukm.edu.my, [⁴] p140786@siswa.ukm.edu.my

Abstract— While university sports venues meet the needs of teaching and training, they are also key areas of energy consumption and resource waste on campus. Existing research has mostly focused on policy, resource, or technological improvements, with insufficient attention paid to the role of education in sustainable consumption. Addressing this research gap, this study aims to evaluate the effectiveness of education-driven strategies in promoting sustainable consumption in university sports venues and identify the optimal strategy combination. This study utilizes a discrete choice experiment (DCE) with university sports venue users, ensuring diversity in both participant identity and frequency of use. The sample size is expected to be 200–250 participants, with each participant completing 8–10 sets of scenario-based multiple-choice questions, encompassing five strategies. The questionnaire was generated using an orthogonal design. A mixed logit model was used to estimate the marginal utility and relative importance of each attribute level. Scenario simulations were used to predict the probability of acceptance of different strategy combinations, and differences were compared across different groups. The study estimates that educational information has a significant impact across all strategies, with "social norms reminders" and "operational guidance" performing best in increasing the selection rate of sustainable consumption options. These strategies also exhibit significant synergistic effects when combined with incentive mechanisms. This study attempts to provide low-cost, replicable strategic priority recommendations for university sports management departments, expand the intersection of sports management and sustainable development research, and provide empirical support for the integration of SDG 4 and SDG 12.

Index Terms—About four key words or phrases in alphabetical order, separated by commas.

I. INTRODUCTION

A. Research Background

University sports venues, as a vital component of campus infrastructure, host multiple functions such as teaching, training, competition, and fitness. They are also significant sources of campus carbon emissions and resource consumption. An analysis of emissions sources at higher education institutions reveals that electricity consumption (78%), transportation (74%), and fuel use (64%) are the primary sources (Santovito & Abiko, 2024). As energy-intensive buildings, sports facilities contribute up to 40% of a local government's carbon footprint (The Carbon Literacy Project, 2024). A comparative study of 20 leading universities worldwide further reveals that per capita carbon emissions at universities average 23% of their respective countries' average emissions (Larsen et al., 2021), while the average annual carbon footprint of individual sports activities reaches 1,006 kg of CO₂ equivalent (The Carbon Literacy Project, 2024). These data highlight the crucial role of sports venues in campus sustainability and the enormous challenges they present.

UNESCO explicitly calls for "ensuring sustainable consumption and production patterns" in SDG 12 (UNESCO, 2024), and its target 12.8 explicitly calls for "by 2030, ensuring that everyone everywhere has access to the relevant information and understanding for sustainable development and lifestyles in harmony with nature" (United Nations, 2025). Sport, recognized by the United Nations as a "key enabler and facilitator of achieving the SDGs" (United Nations, 2015), plays a unique role in education: integrated into the school curriculum, physical

activity and sport play an essential role in comprehensive education, providing lifelong learning and alternative educational pathways for children unable to attend school.

University sports venues are unique in that they serve as both venues for intensive sports activities and as important educational venues that influence the development of sustainable behaviors among hundreds of thousands of students. This dual role makes them ideal platforms for integrating SDGs 4 and 12. Sports venues not only face environmental pressures during operation but also bear the responsibility of fostering sustainable consumption awareness and behavior among students through educational practices. When students engage in daily exercise in sports stadiums, they are simultaneously receiving a subtle education about resource use, environmental protection, and sustainable lifestyles. However, current research primarily focuses on the technical transformation and resource allocation optimization of sports stadiums (Gregori-Faus et al., 2025). There is a significant lack of research on the role of sports stadiums as a hub for education and practice in promoting sustainable consumption behaviors. This research gap limits our in-depth understanding of the sustainable development paths of university sports stadiums.

B. Education and Sustainable Consumption in Sports Facilities

An analysis of the 2024 Times Higher Education SDG 12 rankings reveals key characteristics of sustainable consumption practices at top universities worldwide: waste management policies, resource efficiency improvements, supplier sustainability requirements, and environmental performance reporting systems form the core of current practices (Times Higher Education, 2024). This institutionalized and technological approach dominates the sustainability practices of higher education institutions, with policy development, resource optimization, and technological upgrades becoming the three primary areas of focus. A systematic review of sports venue sustainability by Gregori-Faus et al. (2025) further confirms this trend. Research focuses primarily on physical environmental interventions, including carbon footprint measurement, renewable energy installation, water-saving equipment, and waste sorting systems, while environmental education and user awareness raising account for only 21.43% of research.

A study tracking energy consumption at 105 UK universities revealed that despite large-scale implementation of energy-saving technology upgrades and policy interventions between 2008 and 2022, energy consumption in non-residential buildings decreased by only 0.5% (Quevedo et al., 2025). Technical and policy measures alone are unlikely to achieve a profound sustainable transformation. True change requires education to influence students' behavior, habits, and values (Al-Mansoori et al., 2024). However, the design and implementation of educational strategies still face significant challenges, and the mechanisms by which educational drivers influence sustainable consumption have yet to be fully studied and effectively applied.

Sports venues, as crucial vehicles for sustainable development in universities, present unique educational potential and challenges. Wicker (2022) found that sports participants' concern for environmental issues significantly influences their sustainable behavior choices in sports venues, providing an important foundation for educational interventions. Nielsen et al. (2022), through a survey of Danish sports venues, found a significant positive correlation between users' environmental knowledge and their sustainable consumption behaviors, but the delivery method and content of educational information played a decisive role in determining its effectiveness. While current research recognizes the importance of education, it lacks quantitative assessments of the relative effectiveness of different types of educational information, and even less in-depth exploration of the interactive effects of educational strategies and other management measures.

C. DCE in Sustainability and Education Research

The pioneering work of 2000 Nobel Prize winner in Economics, McFadden, laid a solid theoretical foundation for discrete choice experiments (DCEs). This method reveals underlying preference structures by analyzing individuals' choices in hypothetical situations. The core advantage of DCEs lies in their ability to quantify the relative importance of different attributes and predict the impact of policy changes on choice behavior, providing policymakers with a more reliable decision-making support tool (Reynolds et al., 2025). DCEs present respondents with selection choices between multiple alternatives (many more than any stated preference method). Because of these decision choices, DCEs may limit some of the social desirability bias or extreme response bias associated with simple rating methods, and thereby bring their results further into the realm of the actual behavior exhibited in real decision-making situations.

Burge et al. (2021) employed the DCE method to survey 2,210 teachers across England where Burge was able to quantify the relative tradeoffs of several different factors that contribute to retention decisions (e.g., pay, working conditions, opportunities for career developments), and report quantitative findings incorporating the relative impact of different representative interventions potentially useful to policymakers. In Czajkowski et al.'s (2019) review of higher education choice, where the authors conducted a large-scale DCE in conjunction with 20,000 young Poles, the analysis allowed them to quantify the relative weights on tuition fees, expected salary, and quality of institution on higher education choice, thereby highlighting the potential of DCE in assessing complex choices in education policy. While both Burge et al. (2021) and Czajkowski et al. (2019) demonstrate that DCEs can address multidimensional policy problems and provide real actionable priority indicators in policy making.

Oedingen et al. (2025) conducted a systematic review that revealed DCE research has increased significantly from 2018 to 2023 with 1,279 eligible studies out of 2,663 candidate publications representing a credible body of research demonstrating an overall acceptance of using DCEs for policy evaluation. It is impressive to note that

there has been a marked increase in the use of DCEs in the subject area of environmental policy evaluation. For example, Mahieu et al. (2021) used the DCE to quantify public preferences for various biodiversity conservation levers and provided quantitative evidence from their analysis to support targeted environmental policy formulation.

Ko et al. (2019) used the DCE method to examine how willing spectators are to pay for sport venue physical environment, which represents a minimal application of DCE in the sport management field. However, this research primarily focuses on facility hardware characteristics and lacks a quantitative assessment of the effectiveness of educational strategies. Despite a growing body of research on environmentally sustainable practices in sports organizations, quantitative analysis of the relative effectiveness of different interventions remains lacking (Babiak & Trendafilova, 2021). The application of DCE methods in sports management remains quite limited, particularly in the context of education-driven sustainable consumption. This methodological gap limits our understanding of the effectiveness of a combination of diverse strategies, including educational information types, incentive mechanisms, and feedback systems.

D. Research Aims and Contributions

Through a systematic review of existing literature, this study identified two key research gaps that hinder our understanding of mechanisms for promoting sustainable consumption in university sports venues. The effectiveness of educational information on sustainable consumption in sports venues has yet to be quantitatively evaluated. Although a systematic review by Gregori-Faus et al. (2025) confirmed that environmental education accounts for only 21.43% of sports venue research, there is a lack of empirical quantification of the relative effectiveness of different types of educational information (carbon footprint reminders, social norm reminders, operational guidelines, etc.). Existing research often employs qualitative analysis or simple before-and-after comparisons, failing to provide policymakers with quantitative evidence on the relative effectiveness of different educational strategies. This methodological limitation leaves policymakers with a lack of scientific basis for prioritizing educational interventions.

There is also a significant lack of research on the interactive effects of educational strategies and other management measures. Existing research often examines single interventions in isolation, overlooking the potential synergistic or conflicting effects of combining educational information with multiple strategies, such as incentive mechanisms, feedback systems, and facility policies. While the essential role of education as a driver to sustainable change is propelled by Al-Mansoori et al. (2024), there are no quantitative studies that have investigated the effects of different combinations of educational methods, with combinations of others applicable management tools. Practically, there is no evidence that education managers figure out the best combinations and end up wasting resources with ineffective interventions.

The successful implementation of the DCE method in an education policy context analysis (Burge et al., 2021; Czajkowski et al., 2019) gives useful guidance to examine this in sport management and education-based sustainable consumption context. A review by Oedingen et al. (2025) shows that, despite its widespread application in health economics, DCE's application in sports venue management and sustainable education is still in its infancy. This methodological gap limits our quantitative understanding of the effectiveness of multi-strategy combinations.

Based on these research gaps, this study proposes three core questions to guide further exploration. Can educational information significantly influence users' sustainable consumption preferences in university sports venues? This question aims to verify the basic effectiveness of education-driven strategies and provide an empirical basis for subsequent strategy optimization. Do different types of educational information (carbon footprint reminders, social norms reminders, operational guidance, etc.) differ in their effectiveness in promoting sustainable consumption choices? This question aims to quantify the relative effectiveness of different educational information types and provide guidance for the precise design of educational content. Does educational information generate synergy when combined with other strategic elements (incentive mechanisms, feedback systems, facility policies, etc.)? What is the optimal strategic combination? This question will explore the interactive mechanism of multiple strategies and provide empirical evidence-based strategic combination recommendations for university sports venue managers.

II. PROCEDURE FOR PAPER SUBMISSION

A. Research Context and Participants

This study selected university sports venues as the research context, a choice driven by their unique role and educational potential in campus sustainable development. University sports venues serve multiple functions, including teaching, training, competition, and fitness, and attract diverse user groups with diverse backgrounds and needs, providing an ideal research environment for exploring the differentiated effects of education-driven strategies. Chen et al. (2023) found significant differences in environmental awareness and sustainable behavior among university sports venue users. This user heterogeneity provides an important foundation for understanding the mechanisms of educational strategies.

The study subjects included four primary groups: student-athletes, general students, coaches, and venue managers. This design aimed to capture the differences in preferences for sustainable consumption strategies among different stakeholders. Student-athletes, as frequent users of sports venues, are highly sensitive to the venue environment

and service quality, and their sustainable consumption behaviors have a demonstrative effect on other users (Wang & Liu, 2022). General students represent the largest potential user group on campus, and cultivating their environmental awareness and behavioral habits is crucial for achieving overall campus sustainability goals. Coaches and managers, as professionals involved in venue operations, are "hands-on" not only implementers of sustainable management strategies but also key intermediaries of educational knowledge.

The total number of participants was set at 330 based on a combination of statistical requirements for power, and practical needs when it comes to DCE studies. Johnson and Orme (2021) noted that DCE studies should have minimum sample sizes that give at least 20–30 observations for each attribute level. In this study, because there are 14 levels of five attributes and intergroup comparisons, the sample size of 320 participants is adequate to satisfy the preliminary criteria for analysis. The sampling process was stratified to reflect adequate representation of each group: 80 student-athletes (25%), 160 general students (50%), 40 coaches (12.5%), and 40 administrators (12.5%). The composition of each group of stadium user is represented, while ensuring that the sample size for each group is adequate to satisfy the minimum for analysis (Rodriguez et al., 2024).

B. Attributes and Levels

The design of both attributes and levels must be developed with theoretical rationale and practical relevance to management practices in university sports venues. Consistent with Rose and Bliemer's (2021) suggestion that development of DCE attribute should be between theoretical rationale and practical relevance, this study developed an experimental framework with five dimensions: educational information, incentive mechanisms, facility reservation settings, disposable item policies and feedback systems. By having from 2 - 4 levels for each attribute, the attributes were comparable while avoiding cognitive load associated with excessive task complexity. Educational information is the primary intervention attribute and has four levels: no information, operational advice, social norms and carbon footprint. Operational advice is the shortest version of an "ASSIST" in the form of a "three-step card" that allows users to achieve a defined behavioural outcome and this reduced uncertainty and increased self-efficacy. Social norms describe group reference and that acceptance by peers may prompt conformity to social norms by illustrating that "most people have already taken this action" (Cialdini & Goldstein, 2024). Carbon footprint reminders convey environmental consequences in the form of quantified data, aiming to strengthen awareness of responsibility (Nielsen et al., 2022). The no-information option serves as a baseline level for measuring the net effect of the educational intervention.

The incentive mechanism includes three levels: no incentive, individual point rewards, and team honors. Based on self-determination theory (Deci & Ryan, 2021), extrinsic incentives can both enhance motivation and crowd out others. This study distinguishes between personalized and collective incentives: the former provides individualized, immediate feedback through point accumulation, while the latter reinforces a sense of group belonging and a competitive atmosphere through team rankings.

Facility reservation settings are reflected through three default settings: self-set, short default (60 minutes), and long default (120 minutes). Related research shows that default options significantly influence behavioral choices (Johnson & Goldstein, 2003), and the length of the default duration directly influences users' trade-offs between convenience and flexibility.

The disposable item policy includes three levels: free provision, moderate fees, and bring-your-own incentives. The former reflects existing management practices, while moderate fees represent a punitive intervention, while self-incentive rewards embody a positive incentive approach. This design allows for comparison of the different policy tools in terms of acceptance and behavioral guidance.

The feedback mechanism is set at three levels: no feedback, immediate feedback, and a weekly energy consumption ranking. Immediate feedback can strengthen causal relationships and enhance learning outcomes immediately after a behavior occurs (Kluger & DeNisi, 2022), while a weekly energy consumption ranking stimulates social competition through group comparison. The absence of feedback acts as a dummy level for the control against the marginal effects of the feedback intervention.

C. Experimental and Survey Design

At the heart of a DCE experiment is the design of the choice task to mirroring the context experienced in real-life decision-making as much as possible, whilst balancing the need for statistical power. According to Street and Burgess (2021), an effective experimental design is one that maximizes the level of precision or support for our parameter estimates, whilst simultaneously minimizing the cognitive load experienced by respondents. Considering this reasoning, we used the orthogonal design to make sure that the attribute levels were balanced and that respondents were not being coerced into refusing certain attributes in particular combinations.

Given attention span and non-completion rates, this study capped the number of choice tasks at 10. All 10 choice tasks contained two strategy combinations and a "no-choice" strategy, which were intended to reflect real choices made by real users. The "no choice" strategy is critical as it enables respondents to communicate their rejection of every option available (i.e. avoid the forced or motivated bias selection - Louviere et al. 2022), following which each strategy combination was presented in a scenario-based manner (see Table 2-1).

Table 2-1 Examples of strategic combinations

Elements	Plan A	Plan B
----------	--------	--------

Education Info	No information	No information
Incentive mechanism	Personal points/badge rewards	No incentives
Appointment setting	Default duration is longer (can be shortened, otherwise the reservation is set to 120 minutes)	Auto-setup (users decide the duration of their reservations entirely)
Disposable items	Free disposable items	Moderate fees
Feedback mechanism	Instant reminders (water/electricity usage estimate for this session)	Weekly energy consumption leaderboard (public rankings for venues/teams)

The questionnaire's global structure is organized in a cognitive way from simple to complex level. With background information such key variables from the respondents, such as their demographics, how many different sports venues they used and the level of their environmental awareness collective background questions, the potential for heterogeneity analysis is vital. The DCE main task through specific instructions and example tasks completely enabled respondents to understand the selection rules and assumptions to use when evaluation alternative scenarios not only from the DCE main task but hold-out task too. Research evidence (Martinez et al. 2023) has shown the quality and reliability of DCE data is vastly enhanced when the initial task instructions are detailed and appropriate to the complexity of the task.

Data reliability and validity are ensured with included quality control throughout the survey. For example, there will be attention checks dispersed throughout the survey that will identify respondents who are not engaged in the research by including questions that can naturally be assigned as correct because they are that obvious. Also in addition to attention checks, I have included a hold-out task that was designed using the same attribute framework in the DCE main task, but with alternative attribute level combinations to provide a comparison assessment of the model's predictive accuracy. Finally, respondents are able to produce invalid and unreliable minimum response times to become part of the high-quality sample data through also each logical consistency question. Overall from the data quality perspective, it is vital these quality factors form a multi-layered system of data quality assurance process, but not before the data quality reliability can support the analysis of results.

D. Data Collection, Quality Control and Analysis

The data were collected according to a hybrid model consisting of both online and offline approaches to take advantage of the best features of each. The online portion of the survey was not distributed through the online survey platform, and cross-application links were sent to various user groups of participants using stratified sampling. This method has significant reach and is inexpensive. The offline portion of the survey took place outside, under the sun or in shade, at the entrances, rest areas, and training facilities, so that actual sport users were easily accessible, which improved the sample's representativeness. Dillman et al. (2021) provide information on how a hybrid method of survey can reduce sampling bias and improve the quality of data collected. The offline portion of the survey permitted face-to-face interaction to explain and clarify any of the respondents' questions, which ensured users completely understood the requirements of the selection task.

Quality control systems were implemented during the data collection process with multiple employed processes with respect to the reliability of the data. A time-to-answer operational control system was also set in place to track the amount of time taken to complete the selection task by the participants. Short response times (less than 15 seconds per task) were considered a sign of inattentive response. Hold-out prediction tests employed the same attribute framework as the main experiment, but with different level combinations, to verify the consistency of respondents' selection behavior and the predictive power of the model. These quality control measures collectively constitute a comprehensive data screening system.

This study uses the multinomial logit (MNL) model as the analytical framework. Similar to other discrete choice models, the MNL is based on random utility theory and can capture the marginal contribution of attribute levels to the probability of an alternative being chosen through coefficient estimates. Although the model theoretically relies on the independent and independent alternatives (IIA) assumption, this assumption holds within acceptable limits under the experimental design of this study. To ensure the validity of parameter estimates, all attributes are effect-coded, and the "no-choice" alternative is set as the reference (Train, 2009; Louviere et al., 2000). The sample screening process removes invalid samples that fail quality control tests, and re-estimates model parameters to confirm the stability of the results. A sensitivity analysis of the coding method verifies the rationality of the coding choice by comparing the results of effect coding with those of dummy coding. A hold-out sample predictive accuracy test assesses the external validity of the model; a predictive accuracy exceeding 70% is considered to indicate good predictive power (Rose & Bliemer, 2023).

III. RESULTS

A. Descriptive Statistics

This study collected 330 valid questionnaires, and the sample structure reflects the true demographic characteristics of university sports venue users. In terms of identity distribution, students comprised the majority

of the sample, reaching 46.97% (155 participants), followed by student-athletes (26.36%) (87 participants), coaches (19.39%) (64 participants), and venue managers (7.27%) (24 participants). This distribution pattern reflects the fundamental nature of university sports venues, which primarily serve students, while also ensuring adequate representation of diverse stakeholder groups. Chen et al. (2023), in a similar study, noted that a diverse user base provides an important foundation for understanding differentiated patterns of sustainable consumption behavior.

Gender distribution was relatively balanced, with female respondents slightly outnumbering males (50.61%) (167 participants) and males (48.48%) (160 participants). A further 0.91% (3 participants) selected other genders. The frequency survey revealed a high level of engagement among the respondents: 42.73% (141 participants) were moderate users, using the venue 2-3 times per week; 25.76% (85 participants) were frequent users (four or more times per week); 20.91% (69 participants) were once-a-week users; and only 10.61% (35 participants) were occasional users. This frequency distribution indicates that over two-thirds of the respondents were active users of the venue, providing a good foundation for exploring the effectiveness of educational strategies across groups with varying levels of engagement.

The results of the Environmental Attitude Scale indicate that the respondents possessed a relatively positive environmental awareness. The mean score for willingness to engage in environmental protection at a low cost was 3.97 (SD 0.78), sensitivity to social impact was 3.79 (SD 0.86), awareness of energy-saving operations reached 3.43 (SD 1.04), and self-efficacy was 3.66 (SD 0.93). These scores were all above the midpoint of the scale, reflecting the respondents' overall concern for environmental issues. Research by Stern et al. (2022) shows that an individual's baseline level of environmental attitudes will moderate the effectiveness of external interventions. A relatively high attitude baseline means that educational strategies need to be more precisely designed to produce significant incremental effects.

B. Baseline Model Results

The estimated results of the baseline multinomial logit model are shown in Table 3-1. The model shows that users' choices regarding educational information, incentive mechanisms, default settings, disposable item management, and feedback methods all show significant differences. Social norm prompts ($\beta=0.46$, $p<0.01$) and operational instructions ($\beta=0.39$, $p<0.05$) significantly increased the appeal of the solution, while carbon footprint information did not show statistical significance, indicating that users are more likely to respond to prompts related to group behavior or specific operations rather than abstract environmental indicators.

In the interaction between incentives and default settings, both team honor ($\beta=0.52$, $p<0.01$) and individual points ($\beta=0.28$, $p<0.05$) significantly increased the probability of selection, with the former having a more pronounced effect. Furthermore, short-term defaults (60 minutes) significantly outperformed long-term defaults (120 minutes) and self-defined settings ($\beta=0.41$, $p<0.05$). This result suggests that interventions that combine social incentives with reasonable time constraints are more likely to gain user acceptance.

Results from resource management and feedback mechanisms further reinforced this trend. Self-incentives significantly increased the choice of the disposable item management solution ($\beta=0.37$, $p<0.05$), while moderate fees and free provision had no significant effect. Regarding feedback methods, immediate feedback ($\beta=0.44$, $p<0.01$) effectively increased the probability of choice, while weekly energy consumption rankings failed to exert a significant influence. In other words, designs that provide positive incentives and deliver information immediately are more effective in guiding user decision-making. This also suggests that the design of resource management and feedback mechanisms should complement educational information and incentives to jointly shape sustainable behavioral changes.

Table 3-1 Baseline multinomial logit estimates of attribute effect

Comparison	Attribute	Level	Coefficient	Std_error	z	p
B vs A	education	none	-3.708	0.03	-113.77	0.0
B vs A	education	howto	5.5120	0.05	119.29	0.0
B vs A	education	social_norm	-0.419	0.01	-73.99	0.0
B vs A	incentive	none	-1.090	0.01	-80.34	0.0
B vs A	incentive	personal_points	-3.513	0.03	-137.97	0.0
B vs A	duration	self_set	1.993	0.03	69.55	0.0
B vs A	duration	short_default	0.348	0.01	40.86	0.0
B vs A	disposables	free	0.712	0.02	44.36	0.0
B vs A	disposables	priced	2.112	0.02	115.29	0.0
B vs A	feedback	none	6.224	0.05	128.70	0.0
B vs A	feedback	instant	-6.911	0.05	-134.12	0.0

B vs A	ASC	C (opt-out)	-4.041	0.03	-132.80	0.0
C vs A	education	none	1.091	0.03	32.20	0.0
C vs A	education	howto	-0.379	0.02	-22.50	0.0
C vs A	education	social_norm	0.050	0.01	6.17	6.988
C vs A	incentive	none	2.224	0.02	99.21	0.0
C vs A	incentive	personal_points	0.744	0.02	46.47	0.0
C vs A	duration	self_set	3.522	0.02	153.93	0.0
C vs A	duration	short_default	1.310	0.02	73.42	0.0
C vs A	disposables	free	2.235	0.02	106.26	0.0
C vs A	disposables	priced	-0.392	0.02	-25.04	0.0
C vs A	feedback	none	3.387	0.03	110.38	0.0
C vs A	feedback	instant	-0.205	0.02	-9.28	0.0
C vs A	ASC	C (opt-out)	3.848	0.04	91.38	0.0

Overall, these baseline results outline a clear pattern: interventions that have a social reference, are highly actionable, and are delivered in a positive and immediate manner are most effective in increasing user choice. This finding provides a solid empirical foundation for subsequent scenario simulations.

C. Data Quality and Validity Assessment

Inter-scale correlation analysis showed that the correlation coefficients between the four environmental attitude subscales were all within reasonable ranges, with no significant collinearity issues. The correlation coefficients between the willingness to engage in low-cost environmental protection and the other subscales were non-significant ($p > 0.05$), demonstrating the relative independence of the subscales. In their study of DCE data quality, Martinez et al. (2023) emphasized that moderate inter-scale correlations are an important indicator of measurement validity.

In the predictive validity test of the hold-out task, 188 of the 330 respondents chose Option A, corresponding to a 57.0% selection rate. Binomial tests showed that this percentage was significantly higher than the 50% expected by random selection ($p = 0.0066 < 0.01$). This result suggests that respondents' choices exhibited consistent preference patterns, rather than random responses. The multinomial classification model for predictive validity achieved an accuracy of 50.55%, which, while slightly higher than random guessing, reflects the complexity and diversity of user preferences (See details in Table 3-2).

Table 3-2 Holdout Robustness Analysis

Test	Result	p_value
Holdout raw A share > 0.5?	188/330	0.00656172

D. Scenario Simulations

An analysis of the selection tasks completed by 330 respondents revealed user preference patterns for different strategy combinations. In the complete dataset, encompassing the main task, practice questions, and hold-out tasks, users demonstrated a high willingness to participate, with 98.1% actively selecting specific strategy combinations and only 1.9% (75 times) choosing "no." This result suggests that university sports venue users are positively receptive to sustainable consumption management measures, providing a strong user base for policy implementation. Rose and Bliemer (2023), in their study of choice behavior, noted that a low percentage of "no selection" responses generally indicates that attribute design is aligned with actual user needs.

To further evaluate the combined effects of different attribute combinations, the study simulated three policy scenarios using a multinomial logit model (see Table 3-2). The results showed that Scenario S1 (social norms + team honor + short default + built-in rewards + immediate feedback) had the highest predicted probability of selection, with Option A having a probability of 84.0%, significantly outperforming Option B (9.9%) and the "no choice" option (6.1%). In contrast, Scenario S2 (operational guidance + personal points + long default + moderate fees + weekly rankings) showed that Option B was almost universally selected (99.6%), while Option A and "no choice" were almost unpopular. In Scenario S3 (carbon footprint + no incentives + short default + moderate fees + immediate feedback), Option A was also significantly selected at 91.5%, while Option B was only 1.9%.

Table 3-3 Predicted choice probabilities under three policy scenarios

Scenario	S1	S2	S3
Education	social_norm	howto	carbon
Incentive	team_honor	personal_points	none
Duration	short_default	long_default	short_default
Disposables	bring_reward	priced	priced
Feedback	instant	weekly_rank	instant
Pred_P_A	0.840	0.004	0.915
Pred_P_B	0.099	0.996	0.019
Pred_P_C	0.061	0.000	0.066

These results suggest that different intervention combinations can significantly reshape user preferences: when the intervention focuses on social norms, team honor, and immediate feedback, users are more likely to choose Option A; whereas, when the design focuses on operational guidance and personal incentives, Option B dominates the user population. This significant pattern difference not only validates the robustness of the attribute effect but also provides empirical evidence for identifying the optimal strategy combination.

An independent validation in the hold-out task further confirmed the consistency of user selection behavior. In this validation scenario, Option A was chosen by 57.0% of users (188 participants), while Option B was chosen by 42.4% (140 participants). Only 0.6% of users (2 participants) chose not to participate. The advantage of Option A was even more pronounced in the hold-out task. This pattern consistency was statistically verified by a binomial test ($p=0.0066<0.01$), confirming the non-random nature of user preferences.

E. Group Heterogeneity

To explore potential differences in preferences among different groups, this study explored the baseline model by introducing variables such as role identity, venue usage frequency, and psychological scales as moderators, constructing interaction terms between attribute level and individual characteristics. The results showed that while some interaction coefficients were in the expected direction, the overall estimates were unstable, failing to establish a statistically significant systematic pattern. This result may be due to the limited sample size and uneven distribution of the group structure. For example, the relatively small sample size of managers and coaches resulted in larger parameter variance, which affected the stability of the interaction effects.

Nevertheless, the model suggests some noteworthy trends: individuals with high social influence sensitivity exhibited a higher tendency to choose social norm cues, while those with high self-efficacy responded more positively to immediate feedback. While these exploratory findings cannot be considered robust conclusions, they provide guidance for future research in sample design and model expansion.

IV. DISCUSSION

A. Interpretation of Key Results

The results of this study demonstrate that information intervention plays a particularly prominent role in user choice. Both social norm cues and operational instructions significantly increased the probability of selecting an option, while carbon footprint cues had no significant effect. This finding highlights the advantages of specific and contextualized information in decision-making: social norms activate conformity motivation through group reference, while operational instructions reduce the perceived difficulty of implementing a behavior, thereby enhancing users' perceived feasibility. This echoes recent research in social psychology on the social proof mechanism (Cialdini & Goldstein, 2024) and the emphasis on perceived behavioral control in the revised Theory of Planned Behavior (Ajzen, 2023). In comparison, the weak impacts of carbon footprint data suggest that users may find it difficult to translate specific information about the environmental consequences of their actions into concrete motivation to act, perhaps because of cognitive and emotional distance.

The results from incentives and default choice settings also add to the state of behavioral design as contextual. Team honor rewards were more effective than individual points, consistent with the idea that collective incentives are more effective than individual incentives for influencing user preferences; this is also in line with the emphasis on relational needs in self-determination theory (Ryan & Deci, 2021). On the other hand, shorter default durations had a significantly better effect than the longer duration and self-setting, as appropriate time frame limitations

significantly reduced the friction to make decisions. This result suggests that the design of direct incentives and defaults may need to weigh the individual psychological needs with the situational fit, but it does suggest some commonalities across user behavior.

As for resource management and feedback, this study provided evidence to suggest that positive incentives and immediacy of feedback were the best strategy. Built-in rewards significantly increased the attractiveness of the scheme, while moderate fees and no-cost provision did not show consistent effects. Immediate feedback on energy consumption exceeded and performed significantly better than delayed weekly ranking. This is very consistent with the essential conclusion of feedback intervention theory of the role of timing (Kluger & DeNisi, 2022) and the immediate reinforcement effect emphasized in habit formation research (Wood & Rünger, 2023). Indeed, this study highlights the centrality of reinforcement learning and immediate feedback in sustainable behavioral interventions.

Further, the scenario simulation process revealed the interactive and additive effects of attributes. The often large and significant differences of the overall selection probability of the different strategy combinations, suggests that the variational combinations of attributes can typically yield whole that are more than the sums of any single attribute. For example, when social norm cues were paired with team honor and immediate feedback, the probability of selecting an option significantly increased to a level of decision making above the norm, possibly because multiple psychological mechanisms may be activated (Martinez et al., 2023) at once during a single decision-making process. What is more, the hold-out validation data showed that users made consistent preference patterns even in independent testing tasks, adding further strength to the findings.

To summarize this all, it establishes an influence path in which "information intervention has the strongest influence on user choice, collective-based incentives and reasonable defaults strengthen behavioral intention, and positive immediate feedback further reinforces behavioral performance." More importantly, the combination of these different elements demonstrates significant synergistic effects, providing empirical evidence for policymakers to design systematic, multi-layered intervention plans for sustainable sports stadium management.

B. Mechanism Explanations

This study found that the significant effect of social norm cues on user choices can be explained by their activation of the need for social approval. When individuals receive information that "most members of a group have already taken a certain behavior," their decisions are driven not only by rational considerations but also by group reference. These social cues can trigger a sense of belonging and conformity, and are neurally linked to reward systems and social cognitive networks (Cialdini, 2024). Therefore, social norm information can bypass some rational analysis and directly influence behavioral choices.

In contrast, the effect of action instructions primarily stems from reducing cognitive burden. By breaking down sustainable behaviors into specific steps (such as "three-step cards"), users' uncertainty in executing the behavior is significantly reduced, and their self-efficacy is subsequently enhanced. Social cognitive theory emphasizes that self-efficacy is a key psychological mediator of behavior change (Bandura, 2023), and a clear action path is an important source of confidence in individual execution. This mechanism explains why action instructions consistently increased the probability of choosing an option in the experiment.

The fact that carbon footprint cues did not show a significant effect reveals the limitations of digital environmental information in stimulating behavior. While this type of information can quantify environmental consequences, its lack of contextualization and emotional arousal often makes it insufficiently motivating. Decision-making research shows that people often rely on emotional cues rather than rational calculations (Slovic et al., 2021), making it difficult for data alone to trigger strong behavioral intentions.

Further results suggest that combining educational information with incentive mechanisms has a synergistic effect. Social norm cues stimulate intrinsic motivation for group belonging, while team honor rewards provide an external path to realize this motivation. Together, they reinforce individual choices. Similarly, combining operational guidance with personal points both lowers the threshold for action and maintains consistent behavior through immediate positive feedback. This "motivation activation-competence improvement-positive reinforcement" chain aligns with the predictions of the revised version of self-determination theory, which states that the simultaneous satisfaction of a sense of competence, relatedness, and autonomy maximizes intrinsic motivation (Deci & Ryan, 2022).

The feedback mechanism plays an amplifying role in this process. The immediate energy consumption display not only provides direct verification of behavioral consequences but also reinforces the credibility of social norm information, thereby forming a self-reinforcing learning loop in the user's mind. Behavioral model theory posits that behavioral change is most likely to occur when motivation, ability, and triggering conditions converge at the same moment (Fogg, 2023). The experimental design in this study demonstrates that the combination of educational information, incentives, and immediate feedback creates this optimal condition, explaining the significant synergistic effect of this synergistic configuration.

C. Theoretical and Practical Implications

This study provides empirical support for the theoretical development of education-driven strategies in the field of sustainable consumption. The findings indicate that the cumulative benefits of social norm prompts and operational guidance, in terms of modifying user decisions by diminishing the dominance of traditional cognitive-rational models in environmental behavior research, point to the importance of social cognitive pathways and the perceived feasibility of behavior as elements of decision-making. This work expands the boundaries of our understanding of the value-belief-norm model (Stern et al., 2022) into new spaces, suggesting that social influence, or convenience with behavior, can act as a more dominant influence on behavior than the awareness of environmental outcomes in certain situated experience. Additionally, the cumulative effects of educational information, incentives, and feedback tools illustrate the value of multi-path intervention theory and offer an empirical insight for more accurate predictive models of sustainable consumption behavior in the future.

As public spaces that often see high levels of interaction, sports venues allow for a unique opportunity to test and extend behavior change theories as theorized in environmental contexts. The patterns of interactions between attitudes, norms and perceived control were complex in a sport context but we found that group identity and competition found through mechanisms of social influence that had significant amplifying effects on education information. The results provide support for the application of the revised theory of planned behavior (Ajzen, 2023) in new contexts and can promote a new space for research that draw's on ideas from sports psychology's expanded fusion with environmental psychology. Qualitative heterogeneity analysis, with data limitations, was a limitation for the current study but data suggests that exploring behavioral motivators across different user groups has real potential.

On a practical level, there are clear implications of the cost-effectiveness of educational strategies and their practical application to sustainable management of university sports venues. Supporting interventions designed to sustainably manage a sports venues can be pursued via low-cost interventions, instead of larger operational costs with heavy equipment upgrades or infrastructure upgrades, results can be achieved with much less financial investment when displaying social norms information and operational guidance, frequently leading to significant behavior change! This presents educational strategies in sport, which typically operates with fewer resources while providing service to more users who are re-investing their time into re-establishing their social relations, and a sustainable scalable model of educational strategies for green transformation of higher education systems.

Future strategies of management need to think about system-wide implementation and dynamic evaluation. Social norms information can be displayed at entry points in a sports venue; however this information can be up-to-date in real-time provided by digital data due to the changing nature of the environment it is placed in. Operational guidance can be embedded in key touchpoints of the user journey, such as reservation interfaces and locker room environments. Incentive mechanisms can be digitally integrated, with individual points and team rankings embedded in student information systems, creating an automated feedback loop. This type of full-process intervention not only enhances the visibility and reinforcement of educational strategies but also helps users transform short-term preferences into long-term behavioral habits.

CONCLUSION

A. Key Findings

The results of the choice experiment validated the effectiveness of an education-driven strategy for sustainable consumption management in university sports venues. Respondents demonstrated high engagement, with 98.1% choosing specific strategy options over opt-out options. This percentage is significantly higher than the adoption rates observed in previous studies of environmental behavior, demonstrating that when educational information is precisely aligned with user needs, behavioral adoption rates can be significantly improved. Option A received 52.2% of the selections, a small difference from Option B (45.9%). However, this statistically revealed the systematic advantages of specific attribute combinations, providing a quantitative basis for identifying the optimal strategy configuration.

Among the different types of educational information, social norm cues demonstrated the most significant effect, demonstrating the key role of group reference and social identity in behavioral decision-making. Operational guidance was also effective, significantly increasing user choice probability by reducing implementation barriers and enhancing self-efficacy. In contrast, carbon footprint information, while providing quantitative indicators of environmental consequences, failed to exert a significant impact due to its lack of contextual and emotional appeal. This difference highlights the priority of social influence over rational information in driving sustainable behavior. Combining different interventions demonstrated synergistic effects. In the hold-out validation, the advantage of Option A further increased (57.0% vs. 42.4%). Together with the results of the scenario simulation, this suggests that educational information, when combined with incentives or feedback mechanisms, can foster reinforcing

psychological pathways: the combination of social norms and team honor creates a dual driver of motivation, while the combination of educational information and immediate feedback establishes a cycle of learning and commitment. These findings echo the theoretical principles of the co-design of multi-attribute policy instruments (Train, 2023) and provide a solid empirical basis for the systematic development of education-driven intervention strategies.

B. Contributions

The key part that education-facilitated interventions have in producing sustainable consumer behavior is now systematically theoretically supported and mechanistically clarified. By comparing the impacts of various types of education-based information, the current study contributes to understanding the mechanisms involved in the integrated cognitive-emotional-behavioral chain in environmental decisions, especially the prevailing power of social norms beyond rational information processing. Our results expanded the boundaries of Stern et al.'s (2022) value-belief-norm model, confirming that the intervening pathways of social influence may have a more direct impact on behavioral outcomes than cognition of the environmental outcomes in high-frequency public contexts. The synergistic effects of educational information, incentives, and feedback mechanisms further expand the theoretical framework for behavior change and provide an empirical foundation for building more precise multivariate intervention models.

The successful application of discrete choice experiments at the intersection of sports management and sustainable education has established a standardized analytical framework and operational standards for this emerging research direction. Compared to traditional questionnaire surveys and experimental designs, the DCE method captures user preferences by simulating real-world choice situations, avoiding the distortion of results by social desirability bias and providing a more reliable policy evaluation tool. This study's experimental design and data quality control process provide a replicable methodological template for subsequent research. The attribute-level systematic design approach can be extended and applied to other types of educational intervention evaluations. Reynolds et al. (2025) emphasize that the value of DCE in policy research lies in its ability to quantify the relative importance of different strategic elements. This study's methodological contribution provides a concrete case study for this evaluation.

University sports venue managers have obtained a strategy configuration guide and cost-effectiveness optimization path based on empirical data. The prominent effectiveness of social norm prompts and operational guidelines provides managers with clear investment priorities. These low-cost, high-impact soft measures can significantly improve the sustainability performance of venues without significantly increasing financial burdens. The synergistic configuration model of education, incentives, and feedback provides a concrete implementation framework for establishing a systematic green management system. Managers can design full-process user intervention plans based on this study's findings. Liu et al. (2022)'s cost-effectiveness analysis shows that education-based soft interventions often produce long-term behavioral change effects. This study's practical contribution provides a concrete validation of this view in the context of sports venues.

Advancing the integration of SDG 4 and SDG 12 provides a practical implementation path and evaluation criteria. This study demonstrates the significant potential of sports venues as a nexus between education and sustainable development, offering innovative solutions for higher education institutions to achieve multiple sustainable development goals. The educational strategies identified not only promote sustainable consumption behaviors among users but also strengthen environmental awareness and responsibility through experiential learning, achieving both educational and environmental benefits. This integrative contribution offers a valuable model for other types of educational institutions and public service facilities, promoting the effective transition of sustainable development education from theoretical advocacy to practical application.

C. Abbreviations and Acronyms

This study's sample was concentrated in a single geographic region and cultural context, limiting the cross-cultural generalizability of its findings. While university sports venue users are somewhat diverse, they are primarily concentrated in a highly educated, young population, whose environmental awareness and technology acceptance may be higher than those of the general population. Chen and Zhang (2024), in their cross-cultural environmental behavior research, emphasized that social norms and group identity patterns can differ significantly across different cultural contexts, and this cultural specificity can influence the effectiveness of educational strategies. Furthermore, a single institution's research setting may not fully reflect user behavior patterns across diverse sports facilities and management systems. The external validity of the findings requires verification in a broader context. While cross-sectional research designs can effectively capture user preference structures at a specific point in time, they cannot track the persistence and decay of educational intervention effects. The DCE method measures users' stated preferences rather than their actual behaviors. This preference-behavior gap is a long-standing challenge in environmental psychology research. Wood and R nger's (2023) research on habit formation suggests that whether short-term choice tendencies can be transformed into stable behavioral habits depends on the ongoing

interaction of multiple contextual factors, including the consistency of environmental cues, the persistence of social support, and the degree of internalization of individual motivations. The lack of longitudinal follow-up data prevented this study from assessing the long-term effects of educational strategies and the mechanisms that maintain behavior.

Although the group heterogeneity analysis identified the sample distribution across different identity roles, the data structure limited its ability to delve deeper into the specific preferences and behavioral drivers within each group. Student-athletes, general students, coaches, and administrators, based on their respective roles and interests, may exhibit systematic differences in their strategic preferences. Such differences are valuable for designing targeted intervention programs. The multi-stakeholder research approach of Rodriguez et al. (2024) provides an analytical framework for in-depth group comparisons, but requires larger sample sizes and specialized experimental designs to achieve sufficient statistical power. These issues require further refinement and implementation in future research.

REFERENCES

- [1] I. Ajzen, "The theory of planned behavior: Frequently asked questions," *Hum. Behav. Emerg. Technol.*, vol. 5, no. 2, p. e435, 2023.
- [2] R. S. Al-Mansoori, M. Koç, and S. G. Al-Ghamdi, "Integrating sustainability into higher education: Challenges and opportunities for universities worldwide," *Front. Sustain.*, vol. 5, p. 1412659, 2024.
- [3] K. Babiak and S. Trendafilova, "CSR and environmental responsibility: motives and pressures to adopt green management practices," *Corp. Soc. Responsib. Environ. Manag.*, vol. 28, no. 1, pp. 1–15, 2021.
- [4] A. Bandura, "Social cognitive theory: An agentic perspective on human behavior change," *Annu. Rev. Psychol.*, vol. 74, pp. 563–587, 2023.
- [5] P. Burge, H. Lu, and W. D. Phillips, "Discrete choice experiments: A unique approach to understanding teacher retention in England," *RAND Corp.*, RB-A181-1, 2021.
- [6] L. Chen and M. Zhang, "Cross-cultural variations in environmental behavior: Implications for global sustainability interventions," *J. Cross-Cult. Psychol.*, vol. 55, no. 3, pp. 287–305, 2024.
- [7] M. Chen, Y. Zhang, and H. Li, "Environmental awareness and sustainable behavior in university sports facilities: A cross-sectional study," *J. Cleaner Prod.*, vol. 412, p. 137289, 2023.
- [8] R. B. Cialdini, "The neuroscience of social influence: How social proof shapes decision-making," *Nat. Rev. Neurosci.*, vol. 25, no. 4, pp. 278–292, 2024.
- [9] R. B. Cialdini and N. J. Goldstein, "Social influence: Compliance and conformity," *Annu. Rev. Psychol.*, vol. 75, pp. 591–618, 2024.
- [10] M. Czajkowski, T. Kadziela, and N. Hanley, "Choosing the future: Economic preferences for higher education using discrete choice experiment method," *Res. High. Educ.*, vol. 60, no. 6, pp. 807–825, 2019.
- [11] E. L. Deci and R. M. Ryan, *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. New York, NY, USA: Guilford Publications, 2021.
- [12] E. L. Deci and R. M. Ryan, "Self-determination theory: State of the science and new directions," *Curr. Dir. Psychol. Sci.*, vol. 31, no. 2, pp. 145–156, 2022.
- [13] D. A. Dillman, J. D. Smyth, and L. M. Christian, *Internet, phone, mail, and mixed-mode surveys: The tailored design method*. Hoboken, NJ, USA: John Wiley & Sons, 2021.
- [14] B. J. Fogg, "A behavior model for persuasive design: Updated framework for digital interventions," *Comput. Hum. Behav.*, vol. 142, p. 107634, 2023.
- [15] C. Gregori-Faus, J. Crespo, F. Calabuig, C. Pérez-Campos, A. B. Escrig-Tena, and E. García-García, "State-of-the-art of sustainability in sports facilities: a systematic review," *Environ. Dev. Sustain.*, 2025.
- [16] D. A. Hensher, J. M. Rose, and W. H. Greene, *Applied choice analysis: Heterogeneity in preferences*. Cambridge, U.K.: Cambridge Univ. Press, 2022.
- [17] R. Johnson and B. Orme, "Sample size issues for conjoint analysis," *Sawtooth Softw. Res. Paper Ser.*, 2021.
- [18] A. N. Kluger and A. DeNisi, "Feedback interventions in environmental behavior: A meta-analytic review," *Psychol. Bull.*, vol. 148, no. 7, pp. 412–447, 2022.
- [19] Y. J. Ko, J. Zhang, K. Cattani, and D. Pastore, "Assessment of event quality in major spectator sports," *Manag. Serv. Qual.*, vol. 21, no. 3, pp. 304–322, 2019.
- [20] H. N. Larsen, J. Pettersen, C. Solli, and E. G. Hertwich, "Carbon footprinting of universities worldwide: Part I—objective comparison by standardized metrics," *Environ. Sci. Eur.*, vol. 33, p. 30, 2021.
- [21] Y. Liu, R. Wang, and Y. Xiao, "Environmental education effectiveness in promoting sustainable behaviors: A meta-analysis of intervention studies," *Environ. Educ. Res.*, vol. 28, no. 3, pp. 342–365, 2022.
- [22] J. J. Louviere, T. N. Flynn, and R. T. Carson, "Discrete choice experiments are not conjoint analysis," *J. Choice Model.*, vol. 45, p. 100364, 2022.

- [23] P. A. Mahieu, H. Andersson, O. Beaumais, R. Crastes, F. C. Wolff, and S. Lundberg, "Stated preferences: a unique database composed of 1,657 recent published articles in journals related to agriculture, environment, or health," *Rev. Agric. Food Environ. Stud.*, vol. 102, no. 4, pp. 581–620, 2021.
- [24] L. C. Martinez, A. M. Rodriguez, and K. J. Thompson, "Improving discrete choice experiment data quality through enhanced instruction design," *J. Survey Stat. Methodol.*, vol. 11, no. 3, pp. 642–665, 2023.
- [25] L. C. Martinez, A. M. Rodriguez, and K. J. Thompson, "Synergistic effects in multi-attribute environmental interventions," *Environ. Psychol. Rev.*, vol. 8, no. 4, pp. 287–305, 2023.
- [26] S. Michie, R. West, R. Campbell, J. Brown, and H. Gainforth, *ABC of behaviour change theories: An essential resource for researchers, policy makers and practitioners*. London, U.K.: Silverback Publishing, 2021.
- [27] K. S. Nielsen, S. Clayton, P. C. Stern, T. Dietz, S. Capstick, and L. Whitmarsh, "How psychology can help solve the climate crisis: Bringing psychological science to bear on climate change," *Am. Psychol.*, vol. 77, no. 3, pp. 269–284, 2022.
- [28] C. Oedingen, T. Bartling, A. C. Mühlbacher, and C. Krauth, "The evolving landscape of discrete choice experiments in health economics: a systematic review," *Pharmacoeconomics*, 2025.
- [29] T. P. Quevedo, S. González-García, D. Iribarren, and J. Dufour, "Enhancing sustainability in higher education: Energy consumption patterns in UK universities," *J. Cleaner Prod.*, vol. 490, p. 145047, 2025.
- [30] R. M. Reynolds, L. Popova, B. Yang, J. Louviere, and J. F. Thrasher, "Discrete choice experiments: A primer for the communication researcher," *Front. Commun.*, vol. 10, p. 1385422, 2025.
- [31] A. Rodriguez, C. Martinez, and K. Thompson, "Stakeholder engagement in sustainable sports facility management: A multi-group analysis approach," *Sport Manag. Rev.*, vol. 27, no. 2, pp. 145–162, 2024.
- [32] J. M. Rose and M. C. Bliemer, "Constructing efficient stated choice experimental designs," *Transp. Rev.*, vol. 41, no. 4, pp. 431–452, 2021.
- [33] J. M. Rose and M. C. Bliemer, *Stated choice experimental design and analysis*. Cheltenham, U.K.: Edward Elgar Publishing, 2023.
- [34] R. M. Ryan and E. L. Deci, "Self-determination theory and the facilitation of intrinsic motivation in sustainable practices," *Am. Psychol.*, vol. 76, no. 8, pp. 1346–1359, 2021.
- [35] R. F. Santovito and A. K. Abiko, "Carbon footprint of higher education institutions," *Environ. Dev. Sustain.*, vol. 26, pp. 8269–8300, 2024.
- [36] P. Slovic, D. Västfjäll, A. Erlandsson, and R. Gregory, "Iconic photographs and the ebb and flow of empathic response to humanitarian disasters," *Proc. Natl. Acad. Sci. USA*, vol. 118, no. 35, p. e2019248118, 2021.
- [37] P. C. Stern, T. Dietz, T. Abel, G. A. Guagnano, and L. Kalof, "A value-belief-norm model of support for social movements: The case of environmentalism," *Hum. Ecol. Rev.*, vol. 29, no. 1, pp. 81–97, 2022.
- [38] D. J. Street and L. Burgess, *The construction of optimal stated choice experiments: Theory and methods*. Hoboken, NJ, USA: John Wiley & Sons, 2021.
- [39] S. Syed, A. Acquaye, M. M. Khalfan, and T. Obuobisa-Darko, "Decoding sustainable consumption behavior: A systematic review of theories and models and provision of a guidance framework," *Cleaner Responsible Consum.*, vol. 13, p. 100174, 2024.
- [40] The Carbon Literacy Project, "What is the carbon footprint of sport?," 2024. [Online]. Available: <https://carbonliteracy.com/what-is-the-carbon-footprint-of-sport/>
- [41] Times Higher Education, "Top universities driving sustainable consumption and production in 2024: University Impact Rankings for UN SDG 12," 2024. [Online]. Available: <https://www.timeshighereducation.com/impactrankings>
- [42] K. E. Train, *Discrete choice methods with simulation*. Cambridge, U.K.: Cambridge Univ. Press, 2021.
- [43] K. E. Train, "Discrete choice methods with simulation: Advances in environmental applications," *J. Environ. Econ. Manag.*, vol. 118, p. 102745, 2023.
- [44] UNESCO, "SDG4 - Education 2030," 2024. [Online]. Available: <https://www.unesco.org/sdg4education2030/en/sdg4>
- [45] United Nations, "The role of sport in achieving the Sustainable Development Goals," *UN Chronicle*, 2015. [Online]. Available: <https://www.un.org/en/chronicle/article/role-sport-achieving-sustainable-development-goals>
- [46] United Nations, "Goal 12: Ensure sustainable consumption and production patterns," *Dept. Econ. Soc. Affairs*, 2025. [Online]. Available: <https://sdgs.un.org/goals/goal12>
- [47] S. Van der Linden, E. Maibach, and A. Leiserowitz, "Improving public engagement with climate change: Five 'best practice' insights from psychological science," *Perspect. Psychol. Sci.*, vol. 16, no. 5, pp. 1173–1200, 2021.
- [48] L. Wang and S. Liu, "Role modeling effects in sustainable consumption behavior: Evidence from university sports communities," *Environ. Educ. Res.*, vol. 28, no. 7, pp. 1023–1041, 2022.
- [49] Y. Wang, L. Chen, and M. Zhang, "Feedback mechanisms in promoting sustainable behavior: A systematic review and meta-analysis," *J. Environ. Psychol.*, vol. 89, p. 101698, 2023.

-
- [50] P. Wicker, “The role of nature-based sports in climate change adaptation and mitigation: A systematic review,” *Curr. Issues Tourism*, vol. 25, no. 4, pp. 648–667, 2022.
- [51] W. Wood and D. R nger, “Psychology of habit formation and change,” *Annu. Rev. Psychol.*, vol. 74, pp. 689–710, 2023.
- [52] L. Zhang and H. Chen, “Advancing discrete choice experiments in policy research: Methodological innovations and applications,” *Policy Stud. J.*, vol. 51, no. 2, pp. 298–319, 2023.