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Assessment of Knowledge, Attitude and Practice Towards Sustainable Consumption Among University Students in Penang, Malaysia

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ABSTRACT. The study aimed to assess the knowledge, attitude, and practice of sustainable consumption among university students in Penang, Malaysia. Sustainable consumption is one of the crucial goals in Sustainable Development Goals that foster environmentally friendly behaviour in the Malaysian community. mitigating negative impacts of consumption patterns. A quantitative data collection took place over five days by distribution of online questionnaires to a diverse sample of students, evaluating their knowledge of sustainable consumption principles, attitudes towards sustainable lifestyles, and actual consumption practices. The preliminary findings showed a high level of knowledge among university students regarding sustainable consumption principles. However, there were variations in attitudes towards sustainable lifestyles, with some showing moderate commitment while others exhibited a more indifferent approach. A gap between knowledge and practice was identified, indicating disconnection between students' comprehension regarding sustainable consumption and their implementation of sustainable behaviours. Influential factors, such as personal values, perceived barriers, social norms, and awareness of sustainable alternatives, shaped students' knowledge, attitude, and practice towards sustainable consumption. The role of educational institutions, peers, and media in promoting sustainable consumption was also found to be significant.

Key words: Sustainable consumption, Environmental management, Knowledge, Attitude, Practice

INTRODUCTION

Applying sustainable environmental strategies to operations, goods, and services is anticipated by the United Nations Environment Program (UNEP) to improve resource utilization efficiency and, as a result, lower risks to human health and the environment as a whole (Luken & Navratil, 2004). This concept aligns closely with several of the 17 United Nations Sustainable Development Goals for the year 2030 (SDG 2030), particularly SDG 9 (Industry, Innovation, and Infrastructure) and SDG 12 (Responsible Consumption and Production) (Cao Minh & Nguyen Thi Quynh, 2024). Sustainable consumption behavior relates to an awareness of the long-term consequences of individual consumption behavior for the natural or social environment, and it is often described using words such as responsible, environmentally friendly, or socially friendly consumption behavior. Although the field has been developing

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intensively in recent years, it concentrates mainly on environmentally friendly consumption and disregards other forms of sustainability, such as socially friendly consumption behavior (Kadic-Maglajlic et al., 2019).

Sustainable consumption is defined differently by researchers and institutional bodies (Quoquab & Mohammad, 2020). Sustainable consumption criteria often highlight the environmental effects of consuming behaviours. Nonetheless, some other scholars contend that sustainable consumption is a critical issue for both society and enterprises.(Kastner & Matthies, 2014; Xu et al., 2018). The concept of sustainable consumption, initially defined at the Oslo Symposium on Sustainable Consumption in 1994, entails using goods and services that meet basic needs and enhance quality of life while minimizing the use of natural resources, toxic materials, and waste emissions across their life cycle (Glavič, 2021). The goal is to avoid compromising the needs of future generations. A few studies propose that sustainable consumption entails adopting a conscientious approach throughout the life cycle of goods and services, encompassing their acquisition, utilization, and disposal. This approach emphasizes the significance of curbing excessive consumption and advocating for responsible usage practices (Falcão & Roseira, 2022; van Oosterhout et al., 2023).

Study done by Haider et al. (2022) further elaborate that sustainable consumption encompasses socially and environmentally aware behaviors in acquiring and using products, considering factors beyond just taste, convenience, and price (Haider et al., 2022). Study indicates that sustainable consumer behaviour may be shown via several actions, including the selection of eco-friendly items and the avoidance of purchases from unethical companies (Liang, 2024). Furthermore, people may aid in environmental conservation by implementing resource- and energy-efficient activities (Corbos et al., 2023). A recent study has shown that one can observe a certain level of awareness about environmental issues, among university students; but remains confined(Cernicova-Buca et al., 2023). Gender and residential status (on-campus/off-campus) serve as potential variables that differentiate university understanding of and involvement in environmental cases. The identified traits could serve as the ground on which custom-made practices and strategies could be developed to engage the students in the environmental causes (Cernicova-Buca et al., 2023).

Malaysian Government Initiatives on Sustainable Consumption Practices

Malaysia, together with other world leaders adopted the 2030 Agenda for Sustainable Development during the United Nations General Assembly in New York on 25th September 2015 (Lee et al., 2025). In line with this agenda, Government Transformation Programme (GTP), Economic Transformation programmes (ETP), New Economic Model (NEM), National Transformation (TN50), the 11th Malaysia Plan (11MP) and other national policies are driving to promote sustainable development as the main focus to achieve being an economically rich nation. The aim is to empower population from all ages and various walks of life to make fundamental changes on how our societies produce and consume goods as well as services towards sustainable and resource efficient society. Hence, to materialise this, the core concern of government is to strengthen its policy and institution framework shifting to Sustainable Consumption and Production (SCP) patterns at all levels. The SCP is the government's initiative to ensure that consumers and industries work hand in hand and enable the change towards SCP practices in daily life and also businesses well. Fundamentally, SCP's overarching objective is to connect the dots between SCP and SD. The

phenomenon of climate change, water scarcity, energy shortage of energy, global health, food security, women's empowerment, the loss of biodiversity, atmospheric pollution and waste are the challenges for SD (Oswald Spring, 2020).

Malaysia is touted as an example of a successful developing country having a well-documented environmental policy which significantly addresses issues of cleaner production and resource efficiency; therefore, such economic developments are expected to contribute to reduce environmental pollution in the country. However, the main issue in maintaining the sustainability of resources and reducing the environmental pollution is excessive consumption of natural resources which are highly subsidised and underpriced by the government (Ghosn et al., 2024). Malaysia aspires to achieve Target 12.2 of goal 12 through sustainable management and efficient use of natural resources by 2030 (Department of Statistics Malaysia (DOSM) (2020). The consumption of natural resources among the general public is relatively high as compared to the recommended use of resources by the United Nations. Malaysians have fair levels of environmental awareness and actively represent conservation behaviour; ironically, the awareness is largely cost and convenience driven. The SCP agenda has been incorporated into Malaysia's development plans and transformation initiatives, including the New Economic Model (NEM), Economic Transformation Programme (ETP), and 10th Malaysia Plan (10MP). Other environmental policies that encourage sustainable behaviour include the National Renewable Energy and Action Plan (NREPAP), the National Green Technology Policy (NGTP), and the National Climate Change Policy (NCCP). However, there is currently no comprehensive action plan for SCP development in Malaysia (Adham et al., 2015).

According to Adham et al. (2015), governments must play a crucial part in putting sustainable consumption in place. The government can exercise its responsibility in promoting sustainable consumption in a variety of ways, including lowering wasteful consumption as the economy advances and minimizing resource use by encouraging production process efficiency. On the other hand, by implementing sustainable consumption, the government can also set a good example for environmental conservation among its people. This can be accomplished, among other things, by creating regulations, putting them into effect, and encouraging a transition to sustainable consumption through the use of economic and social tools. Government must place a strong emphasis on increasing sustainable consumption awareness programs in order to instill sustainable consumption ideals.

"KAP"—knowledge, attitude, and practice—are the most widely used research technique in the field of health-seeking behavior. The survey is a quantitative approach that accesses both quantitative and qualitative data by using prepared questions organized in standardized questionnaires (Launiala, 2009; Sitotaw & Philipos, 2023). Misconceptions or misunderstandings that could be impediments to the initiatives we want to put in place or possible obstacles to behavior change are revealed by KAP surveys (United States Agency International Development, 2011). They are representative of a given population and used to gather data on what is known, believed, and practiced in regard to a specific topic. According to Andrade et al. (2020), knowledge consists of several understandings, including those of science. Additionally, one's ability to imagine and style of perceiving are both a part of it. It is not a given that someone will follow a health activity just because they are aware of its benefits. An attitude is a tendency to respond in a particular way to specific circumstances, to see and interpret events in accordance with particular

predispositions, or to arrange opinions into logical and interconnected frameworks. As such, attitude is a result of intricate interactions between values, beliefs, and feelings. The observable acts taken by a person in response to stimuli are referred to as practices or behaviors. This is something that relates with activities and the real world (Andrade et al., 2020). KAP surveys frequently ask on the utilization of preventative measures or other healthcare choices. Since hypothetical questions are frequently posed, it is rare for claims to be made concerning real practices; instead, it reveals information about people's behaviors or what they are aware should be done (Launiala, 2009). KAP surveys can be designed, carried out, analyzed, and interpreted with relative ease. As a result, KAP surveys have gained popularity, particularly in the field of public health, where the surveys contribute to the provision of useful information for resource allocation in, planning of, and execution of public health programs. Ideally, a KAP survey should come before an education or intervention program (Zarei et al., 2024).

The triple planetary crises of climate change, biodiversity loss, and pollution are consequences of unsustainable production and consumption patterns, as evidenced by Malaysia's significant forest loss due to deforestation for economic purposes. According to a study done in Malaysia deforested 6.3 million hectares since independence, with 91% occurring before the 1992 Earth Summit pledge to maintain a minimum of 50% forest cover. However, under economic and population pressure, deforestation continues, particularly in Sarawak, the largest contributing state to the country's current forest cover of 54.8% (Koh et al., 2023). This environmental degradation threatens both human wellbeing and the achievement of Sustainable Development Goals. A primary driver of unsustainable consumption is the lack of public awareness about sustainable practices integrated into daily routines (de Oliveira et al., 2022). Therefore, the study aims to assess the knowledge, attitudes, and behaviors of Penang University students towards sustainable consumption. Specific objectives include measuring students' knowledge levels, understanding their perspectives on increasing sustainable consumption, and identifying their current practices in this regard.

METHODOLOGY

Study Area

The targeted group of respondents is university students in Penang. There are several universities in Penang, but the study focuses only on three public universities located in the peninsula Penang, Seberang Perai. Two of the universities targeted mainly offer engineering and hospitality courses, such as chemical, mechanical, and civil engineering or culinary, pastries art, and hotel management. On the other hand, the other public university targeted hubs students with health science and pharmacy study backgrounds. The reason these three universities were chosen is because the study wanted to compare and contrast the knowledge, attitude, and practice level between students that receive formal health science education with ones that do not learn it in their syllabus of studies. The study is focused on university students as they carry an important role in society. Being able to study and acquire knowledge in the 21st century is a privilege that they have, and they will be using the education in order to help the country henceforward. It is considered crucial for one to have basic science and technology intelligence in developing a nation. Through this study, the students are able to show and express their understanding towards sustainable consumption, and also give suggestions on the topic.

Data Collection

The KAP study is conducted to monitor the level of understanding on sustainable consumption among university students. The target respondents were from three public universities located in the Seberang Perai area. The investigation was conducted in April until May of 2023. A total of 105 full-time undergraduate university students in Penang were the subjects of a survey questionnaire used to collect data. The questionnaire in the form of Google Form link was spread out within various WhatsApp group chats and numerous students that came across the link were asked to kindly fill in the form. The items included in the questionnaire were adapted from a study conducted by Ahamad & Ariffin (2018). A pre-test was carried out before the survey to determine the validity of the questionnaire.

There are a total of 4 sections in the questionnaire, that are; Section A: Demographic Data, Section B: Knowledge on Sustainable Consumption, Section C: Attitude on Sustainable Consumption, and Section D: Practices on Sustainable Consumption. The first section of the questionnaire; Section A, the demographic backgrounds of respondents are studied. Age and gender of the respondent are among the personal data that are required, as well as details about their studies, including the course program they are enrolled in and their current year of study. Meanwhile in Section B, Section C, and Section D, statements are related to how respondents know, behave, and make choices when consuming goods and services, such as how they handle trash and incorporate conservation practices into their everyday routines and purchases. The majority of these statements are positive in nature, and replies are requested by choosing one answer from a set of selection, which are “True” and “False”, or “Strongly agree”, “Agree”, “Neutral”, “Disagree”, and “Strongly disagree”.

Data Analysis

The results from the study were analyzed using Statistical Package for Social Science (SPSS) version 27. Additionally, computer programs, namely Google Forms was used as the medium in collecting responses from the respondents and Microsoft Excel was used to compile the data before data cleaning and analysis was performed. SPSS was used for descriptive analysis of the respondents' demographics as well as for the responses on the knowledge, attitude and practices toward sustainable consumption. Chi-Square analysis was performed using SPSS to determine the association between knowledge, attitude and practices. For the result presentation, data were organized into the appropriate categories. Tables were used to visually illustrate the significance of the data's findings.

RESULTS AND DISCUSSION

This study has found that 71% of the students involved in this study as the respondents are female while 28.6% (n=30) are male. It was found that 50.5% (n=53) of respondents aged between 21 to 23 years old followed by 45.7% (n=48) aged between 18 to 20 years old and 3.8% (n=4) aged between 24 to 26 years old. Moreover, 21.9% (n=23), 31.4% (n=33) and 39% (n=41) of the respondents were currently studying in year 1, 2 and 3, respectively while 48.6% (n=51) of the respondents currently attended the Environmental Health Programs in the university. Table 1 show the demographic information of respondents.

Table 1. Demographic information of respondents.

Variables		**Frequency (n)**	**Percentage (%)**
Gender	Male	30	28.6
	Female	75	71.4
Age	18 - 20 years old	48	45.7
	21 - 23 years old	53	50.5
	24 - 26 years old	4	3.8
Current year of study	Year 1	23	21.9
	Year 2	33	31.4
	Year 3	41	39.0
	Year 4	2	1.9
	Year 5	6	5.7
Attended programme	Environmental Health	51	48.6
	Medical Laboratory Technology	9	8.6
	Nursing	14	13.3
	Occupational Therapy	12	11.4
	Physiotherapy	19	18.1

N=105

Based on the findings it was found that the respondents have good knowledge on the sustainable consumption in which 100% (n=105) of the respondents knew that quality of local environment have direct impact on human health and access to natural resources is essential aspect of life quality. Moreover, 97.1% (n=102) and 99% (n=104) of the respondents know that ecosystem services highly affected human behaviour and water resources need to be safeguard from pollution, respectively. In regards to sustainable consumption related to waste management issues, 96.2% (n=101) and 98.1% (n=103) of the respondents knows that plastic use needs to be reduced as it harmful to environment while the 3Rs (recycling, reusing and reducing) can significantly reduce waste generation. Besides, 88.6% (n=93) of the respondents acknowledge that natural resources are limited while 99% (n=104) of them know that it should be preserved for the future generation. Respondents also exhibit good knowledge on the renewable and non-renewable sources in which 96.2% (n=101) know that uncontrolled use of the non-renewable resources now will reduce the stock in the future and 98.1% (n=103) acknowledge that there is a pressing concerned in finding renewable resources. Furthermore, 98.1% (n=103) of the respondents said that energy efficient products are among innovative ways to minimize resources utilization and 98.1% (n=103) of them know that 3Rs are a way to reduced resource utilization. Table 2 show the knowledge on sustainable consumption among university students in Penang, Malaysia.

Table 2. Knowledge on sustainable consumption among university students in Penang, Malaysia

Items	True n (%)	False n (%)
The quality of local environment has a direct impact on human health	105 (100)	0 (0)
Access to natural resources (e.g. fossil fuels, natural vegetation, water, minerals) is an essential aspect of quality of life	105 (100)	0 (0)
Ecosystem services (e.g. air purification, flood regulation, water cycle) are highly affected by human behaviour	102 (97.1)	3 (2.9)
We need to safeguard water resources from pollution	104 (99)	1 (1)
The use of plastic is being reduced as they are harmful to the environment	101 (96.2)	4 (3.8)
The 3Rs (recycling, reusing and reducing) can significantly reduce waste generation	103 (98.1)	2 (1.9)
Natural resources (e.g. fossil fuels, natural vegetation, water, minerals) of the Earth are limited	93 (88.6)	12 (11.4)
Natural resources (e.g. fossil fuels, natural vegetation, water, minerals) should be preserved for the future generation	104 (99)	1 (1)
The uncontrolled use of non-renewable resources now reduces the stock available in the future	101 (96.2)	4 (3.8)
There is a pressing concern to look into renewable resources as natural resources are depleting	103 (98.1)	2 (1.9)
Energy efficient products are among the innovative ways to ensure minimal resource utilization	103 (98.1)	2 (1.9)
Carrying out the 3Rs are one of the ways to cut down our resource utilization.	103 (98.1)	2 (1.9)

N=105

In regards to attitude (Table 3) on sustainable consumption among university students in Penang, Malaysia, it was found that several items indicate that the respondents have good attitude such as 96.2% (n=101) of the respondents get irritated by smoke from open burning activities, 99% (n=104) of them care for environmental quality as its provides basic needs for human and 93.3% (n=98) of the respondents value the beauty the place where they live. Moreover, 99% (n=104) of the respondents also said more efforts need to preserve the environments and 91.4% (n=96) of the respondents stated that use of renewable energy sources should be increased. The findings show mixed perceptions of recycling among university students, with 27.6% (n=29) agreeing that recycling is difficult, 29.5% (n=31) remaining neutral, and 42.9% (n=45) disagreeing. The perception of difficulty may stem from limited facilities, lack of awareness, or inconvenience in sorting recyclables. However, the significant disagreement suggests that many students find recycling manageable, likely due to better access to facilities and awareness. The neutral stance indicates an opportunity to further educate and engage students in recycling efforts. To improve recycling participation, universities should enhance accessibility, raise awareness, and promote sustainable practices through targeted initiatives.

Interestingly, 80% of respondents agreed that development should take precedence over the preservation of the natural environment, suggesting a possible misinterpretation or lack of attention in their responses. Nonetheless, if this outcome really represents students' perspectives, it indicates a considerable emphasis on economic growth at the expense of environmental preservation, possibly influenced by cultural and economic forces. This may signify heightened awareness and education on the significance of environmental conservation alongside development. Future research may use other measures, like reverse-coded items and qualitative assessments, to precisely reflect the

true attitudes of respondents.

Table 3. Attitude on sustainable consumption among university students in Penang, Malaysia

Items	SA+A n (%)	Neutral n (%)	SD+D n (%)
I get irritated by smoke produced from open burning activities.	101 (96.2)	4 (3.8)	0 (0)
I care for our environmental quality as nature provides our basic needs (e.g. water, clean air, land, forests)	104 (99)	1 (1)	0 (0)
I value the beauty of the place where I live/stay.	98 (93.3)	7 (6.7)	0 (0)
I favor environmentally friendly products (e.g. products made from recycled materials).	91 (86.7)	14 (13.3)	0 (0)
I am ready to reuse items such as plastics, bottles and paper.	95 (90.5)	10 (9.5)	0 (0)
I am willing to be involved in any programs to look after the environment.	88 (83.8)	16 (15.2)	1 (1)
Development should be given priority over the protection of the natural environment.	84 (80)	6 (5.7)	15 (14.3)
More efforts are needed to preserve the environment.	104 (99)	1 (1)	0 (0)
The use of renewable energy sources should be increased.	96 (91.4)	8 (7.6)	1 (1)
Recycling is difficult to do.	29 (27.6)	31 (29.5)	45 (42.9)
Recycling campaigns launched by the government is a waste of money and resources.	25 (23.8)	10 (9.5)	70 (66.7)
Bringing reusable bags is inconvenient.	31 (29.5)	8 (7.6)	66 (62.9)

N=105

*SA = Strongly agree, A= Agree, SD = Strongly disagree, D = Disagree

The data indicate that a majority of students (66.7%, n=70) disagreed with the statement that government recycling campaigns are a waste of money and resources, reflecting a generally positive perception of such initiatives. This suggests that most students recognize the importance and value of government efforts in promoting recycling and environmental sustainability. Their disagreement may stem from awareness of the environmental benefits of recycling and confidence in the effectiveness of these campaigns. However, 23.8% (n=25) of students agreed with the statement, indicating skepticism about the efficiency or impact of government-led recycling programs. This perception could be influenced by factors such as lack of visible results, inadequate implementation, or limited engagement with students. Additionally, the 9.5% (n=10) of students who remained neutral may indicate uncertainty or a lack of awareness regarding the effectiveness of these initiatives. Building on previous findings related to recycling attitudes, the data reveal that a significant portion of students (42.9%, n=45) disagreed with the statement that recycling is difficult to do, suggesting that many students perceive recycling as manageable and accessible within their environment. This positive perception may be attributed to the availability of recycling facilities, exposure to sustainability initiatives, and a growing culture of environmental responsibility within the university setting.

Results showed that 27.6% (n=29) of the students find recycling challenging due to factors such as inconvenience, lack of facilities, and lack of knowledge. This indicates that better infrastructure for recycling and clearer guidelines is needed in order for students to overcome these challenges. In contrast, 29.5% (n = 31) of students feel that recycling is not particularly difficult and, on the other hand, probably are uninformed or do not hold any view regarding the practice of recycling. This, therefore, shows that the students have to be enlightened further with focused awareness

programs. From a sustainable use of resources perspective, the level of disagreement among students in feeling inconvenience in bringing their own reusable bags: 62.9% (n=66). This positive outlook likely signals the impact of awareness campaigns and institutional efforts to develop sustainable habits. However, 29.5% (n=31) of students still feel that it is inconvenient, perhaps because they often forget or find it hard to make it a habitual practice. Approaching these with encouragement and behavior-change strategies may help to engender a greater sense of commitment to sustainability among the students. Additionally, 7.6% (n=8) of students remained neutral, suggesting that while they may not find reusable bags particularly inconvenient, they may not be fully committed to their consistent use either. This study found that majority of the items in regards to practice on sustainable consumption indicated moderate practices among the university students in Penang, Malaysia. It was found that 74.3% (n=78) of the respondents always practice carrying their own reusable water bottles, 58.1% of the respondents always dispose waste in a responsible manner, 58.1% (n=61) of them also always bring their own reusable bags when shopping and 57.1% (n=61) of them do practice carry out full-load laundry. Moreover, 59% (n=62) of the respondents sometimes spend recreation time in natural landscape, parks or forest while 61% (n=64) of them sometimes practice purchasing products that can be recycled. Study also found that 57.1% (n=60) of the respondents sometimes utilize things that they cannot used anymore. One of items with highest percentages for 'Never' practices among university students in Penang, Malaysia which was 33.3% (n=35) of the respondents stated they never report an illegal open burning activity when they see one. However, 33.3% (n=33) of the respondents also have mentioned they never leave the pipe on while brushing teeth. Table 4 show the practice on sustainable consumption among university students in Penang, Malaysia.

Table 4. Practice on sustainable consumption among university students in Penang, Malaysia

Items	Always n (%)	Sometimes n (%)	Seldom n (%)	Never n (%)
I dispose waste in a responsible manner.	61 (58.1)	42 (40)	1 (1)	1 (1)
I report an illegal open burning activity when I see one.	15 (14.3)	33 (31.4)	22 (21)	35 (33.3)
I occasionally spend recreation time at natural landscapes, parks or forest (e.g. hiking, jogging, picnic).	33 (31.4)	62 (59)	10 (9.5)	0 (0)
I opt for energy efficient appliances (e.g. choosing appliances with energy efficient rating (EER) labels).	35 (33.3)	52 (49.5)	15 (14.3)	3 (2.9)
I keep potted plants in my household.	49 (46.7)	35 (33.3)	16 (15.2)	5 (4.8)
I attend seminars, workshops, conferences or exhibitions concerning the environment.	15 (14.3)	38 (36.2)	40 (38.1)	12 (11.4)
I bring my own reusable bags when shopping (e.g. grocery or retail shopping).	61 (58.1)	37 (35.2)	3 (2.9)	4 (3.8)
I use less polluting modes of transport (e.g. public transportation).	36 (34.3)	43 (41)	22 (21)	4 (3.8)
I carry my own reusable water bottle.	78 (74.3)	17 (16.2)	7 (6.7)	3 (2.9)
I purchase products that can be recycled.	27 (25.7)	64 (61)	14 (13.3)	0 (0)
I participate in environmental activities organized by institutions or organizations (e.g. tree planting activity, beach clean ups).	26 (24.8)	39 (37.1)	33 (31.4)	7 (6.7)
I practice recycling in my household.	36 (34.3)	50 (47.6)	16 (15.2)	3 (2.9)
I make decisions more consciously in effort to	47 (44.8)	49 (46.7)	8 (7.6)	1 (1)

avoid over consumption.				
I advise others (i.e. family, friends) to reduce consumption of resources (e.g. water, electricity).	45 (42.9)	48 (45.7)	11 (10.5)	1 (1)
I utilize things they cannot be used anymore.	28 (26.7)	60 (57.1)	14 (13.3)	3 (2.9)
I leave electrical appliances on standby mode when not in use (e.g. TV, computer, water heater, WiFi).	21 (20)	41 (39)	26 (24.8)	17 (16.2)
I leave the pipe on while brushing teeth.	11 (10.5)	28 (26.7)	31 (29.5)	35 (33.3)
I reuse empty back pages of used papers.	57 (54.3)	36 (34.3)	10 (9.5)	2 (1.9)
I try to avoid printing whenever I can.	37 (35.2	43 (41)	17 (16.2)	8 (7.6)
I normally carry out full-load laundry (i.e. only when it is full).	60 (57.1)	34 (32.4)	9 (86)	2 (1.9)

N=105

In determining the level of knowledge, attitude and practice among the respondents, this study has provided scoring for each of the responses among the respondents in which for knowledge the scoring for each of 'True' answer was given 1 while 'False' was given 0 with maximum total sums of twelve items for knowledge was 12. For attitude, score was provided between 4 to 0 following 'Strongly agree', 'Agree', 'Neutral', 'Disagree' and 'Strongly disagree' with maximum total sums of twelve items for attitude was 48. Scoring for practices range from 3 to 0 following the 'Always', 'Sometimes', 'Seldom' and 'Never' with maximum total sum of scores for twenty items was 60. The score of each item for each respondent was then calculated before converted these scores into percentage by dividing total score of each item for each of the respondents with the maximum total sum of knowledge, attitude and practice, and times them with 100. Table 5 show the knowledge, attitude and practice level toward sustainable consumption among university students in Penang, Malaysia.

Table 5. Knowledge, attitude and practice level toward sustainable consumption among university students in Penang, Malaysia

Sustainable consumption level	**High**	**Moderate**	**Poor**
	n (%)	**n (%)**	**n (%)**
Knowledge	104 (99)	1 (1)	0 (0)
Attitude	25 (23.8)	77 (73.3)	3 (2.9)
Practice	14 (13.3)	69 (65.7)	22 (21)

This study has assigned percentage below 60% as poor, 60% to 80% as moderate level and above 80% as high levels. It was found that 99% of the respondents have high level of knowledge while 1% have moderate level of knowledge on the sustainable consumption. In regards to attitude, only 23.5% of the respondents have high attitude toward sustainable consumption while 73.3% of them have moderate level and 2.9% of them have poor level of attitude toward sustainable consumption. Moreover, it was found that 13.3%, 65.7% and 21% of the respondents have high, moderate and poor level of practice toward sustainable consumption, respectively. This indicate that even though majority of the respondents have high level of knowledge but most of them have moderate attitude and practices toward sustainable consumption (Table 5).

Thus, Chi-Square Test of Association was used to analysed the association between knowledge level with attitude and practice levels toward sustainable consumption among university students in Penang, Malaysia. It was found that there was no significant association between attitude (X^2=.367, p=.832) and practice (X^2=3.809, p=.149) level with knowledge level among university students in Penang, Malaysia where p>.05. Thus, it can be said that even though respondents have high level of knowledge on the sustainable consumption, knowledge alone does not affect or influence their attitude and practices toward sustainable consumption. Due to this, additional analysis has been done and found that there was significant association (X^2=29.526, p<.001) between attitude and practice levels toward sustainable consumption among university students in Penang, Malaysia. This indicate that the attitude of respondents may have influence their practices toward the sustainable consumption. Hence, it can be said that having high level of knowledge does not guarantee the respondents to have high attitude and practices toward sustainable consumption among the university students but high attitude level may result in high level of practices toward sustainable consumption among the respondents. Table 6 show the association between knowledge with attitude and practice levels toward sustainable consumption among university students in Penang, Malaysia

Table 6. Association between knowledge with attitude and practice levels toward sustainable consumption among university students in Penang, Malaysia

Variables		**Knowledge levels, n (%)**		***X²***	***p-value***
		High	Moderate		
Attitude	High	25 (23.8)	0 (0)	.367	.832
	Moderate	76 (72.4)	1 (1)		
	Poor	3 (2.9)	0 (0)		
Practice	High	14 (13.3)	0 (0)	3.809	.149
	Moderate	69 (65.7)	0 (0)		
	Poor	21 (20)	1 (1)		
Variables		**Attitude levels, n (%)**		***X²***	***p-value***
		High	Moderate	Poor		
Practice	High	9 (8.6)	5 (4.8)	0 (0)	29.526	<.001
	Moderate	16 (15.2)	53 (50.5)	0 (0)		
	Poor	0 (0)	19 (18.1)	3 (2.9)		

N=105

DISCUSSION

Knowledge Towards Sustainable Consumption

The majority of participants acknowledged that local environmental conditions have an immediate effect on the health of the people, whilst natural resources are vital for sustaining quality of life. The finding agrees with earlier investigations showing that university students in Malaysia are very mindful about their environment; thus, it testifies to the efficacy of environmental educational courses in this nation (Jusoh et al., 2018). Similarly, study conducted in China showed that college students had an elevated concern for the environment, notably linked to issues of health

affiliated with ecological decline (Fu et al., 2017; Li et al., 2024). A vast majority of survey participants, 97.1% (n=102), were aware of how human behaviour affects ecosystem services like air purification and flood regulation. On water pollution, 99% (n=104) said it is vital to protect them from being contaminated. Such findings depict that students have a good knowledge on the link between human activities and healthy ecosystems; this is corroborated by a similar study done on Malaysian students where they also emphasised the need for conservation of freshwater sources for proper sustainable development (Augustine & Mohd Hanafiah, 2019). The respondents were likewise found to have a sound knowledge on sustainable waste management practices. Nearly all, or about 96.2% (n=101), knew that the reduction of plastic is important to preserve the environment, while 98.1% (n=103) acknowledged that there are the 3Rs (recycling, reusing, and reducing) in limiting waste production. This awareness is important as the world faces a crisis of plastic waste. Studies revealed that mismanaged plastic waste contributes significantly to marine pollution and therefore reflect the urgent necessity for increased awareness and action at individual level (Jambeck et al., 2015). Furthermore, the vast majority of the respondents (88.6%) acknowledged this as already being finite when it comes to natural resources and 99% believed that these should be saved for succeeding generations. Young adults are becoming aware on a global scale of the need to conserve natural resources to ensure that they will continue to exist in the future. For example, a study conducted at Manipal University of Higher Education (MAHE) in Karnataka showed that university students knew very much about how depletion of natural resources takes place and sustainable management practices were required. The respondents also had a strong knowledge about the 1% admitting there was an urgent requirement for alternative sources based on renewability. Moreover, 98.1% (n=103) would think energy-efficient products are modern inventions focused on reducing wastefulness in terms of resources consumption. Similarly, a research carried out in Malaysia found out that there is increasing anxiety among students concerning renewable energy sources and energy efficiency towards sustainable development (Zakaria et al., 2019). The high level of knowledge about sustainable consumption among university students in Penang, Malaysia, indicates a positive trend towards environmental stewardship and sustainable practices. This awareness is crucial for fostering a culture of sustainability and addressing environmental challenges. Educational institutions play a vital role in promoting this knowledge, and continuous efforts are necessary to maintain and enhance students' understanding of sustainable consumption.

Attitude Towards Sustainable Consumption

The findings show that, on the whole, there is support for environmental issues; where there is an average or negative attitude towards recycling and other practical actions these are found to be polarizing. Majority of respondents in our study had a positive attitude towards environmental quality and sustainability. A total of 96.2% (n=101) of respondents were irritated by smoke from open burning indicating strong resentment against air pollution activities. It has been noted that despite the high pollution levels, a large number of young people in Malaysia are becoming more environmentally conscious according to various writers (Tiong et al., 2021). Moreover, a staggering 99% of participants express concern for the quality of the environment, acknowledging its crucial role in meeting fundamental human requirements. Furthermore, an impressive 93.3% (n=98) place great importance on the aesthetic appeal of their surroundings, indicating a strong admiration for their environment. Nearly all of the participants (99%, n=104) expressed the view that further measures are required to save the environment, while 91.4% (n=96) support

the greater use of renewable energy sources. These findings reflect the growing environmental awareness among college students, which is part of the broader global trend as evidenced by studies conducted in many countries. For example, a parallel survey conducted in China found similarly positive attitudes toward environmental conservation and renewable energy use (Chen et al., 2023; Hast et al., 2015). The survey found that a significant majority—86.7% (n=91)—preferred environmentally friendly products. Additionally, an impressive 90.5% (n=95) of respondents expressed a willingness to reuse materials such as plastics, bottles, and paper, indicating a strong interest in adopting sustainable practices. Moreover, a significant majority of respondents, namely 83.8% (n=88), expressed their willingness to engage in environmental programs, demonstrating a strong inclination to actively contribute to sustainability projects. These results indicate that there is a strong basis of favourable attitudes that may be used to promote and support sustainable activities. Although there was a generally favourable outlook, the survey revealed that attitudes towards sustainable consumption were only moderately to poorly perceived in several sectors.

The findings indicate a generally positive attitude toward sustainable consumption, with most students rejecting the notion that recycling and eco-friendly practices are inconvenient or ineffective. A majority (42.9%) disagreed that recycling is difficult, suggesting that existing facilities and awareness efforts have made recycling more accessible. However, some students may still face challenges that need to be addressed through improved infrastructure and education. Similarly, 66.7% of students disagreed that government recycling campaigns are a waste of resources, reflecting trust in these initiatives and their role in promoting sustainability. Meanwhile, 62.9% of students disagreed with the inconvenience of bringing reusable bags, indicating a growing acceptance of sustainable habits in daily life, likely influenced by awareness efforts and policy support.

A research conducted on recycling behaviour in Malaysia revealed that the main obstacles to recycling were perceived annoyance and inadequate facilities (Yu et al., 2022). Similarly, a study in the United Kingdom identified inconvenience as a key deterrent to recycling behavior (Boulay et al., 2020). The results indicate that even while individuals have a strong understanding of environmental issues, they may face practical difficulties and experience hassles that impede their ability to engage in sustainable behaviour. University students in Penang, Malaysia, have a notable awareness and favourable inclination towards environmental concerns and sustainability, as seen in their attitudes towards sustainable consumerism. Nevertheless, the existence of actual obstacles to measures like recycling highlights specific areas that need development. To overcome these obstacles, it is necessary to improve the infrastructure, effectively communicate the advantages of recycling, and make sustainable activities easier. This will help increase participation in sustainable consumption behaviours. Educational institutions and governments have a crucial role in promoting and enabling these favourable attitudes and converting them into tangible actions.

Practice Towards Sustainable Consumption

The findings imply that there is a reasonable degree of involvement in sustainable practices, although some regions have lower levels of participation, indicating the presence of possible obstacles that need attention. Approximately 74.3% of the participants routinely bring their own reusable water bottles, indicating a significant dedication to minimising the use of disposable plastics. This behaviour is consistent with the results of a research that shows that university students throughout the world are increasingly incorporating the use of reusable bottles into their daily routines as a way to reduce plastic waste (Coelho et al., 2020; Wang et al., 2022). Furthermore, a significant proportion

of respondents, namely 58.1%, consistently carry reusable bags while shopping, while 57.1% engage in full-load washing, demonstrating a deliberate effort to minimise resource usage. These actions are essential for reducing the negative effects on the environment and advancing the principles of sustainability. The survey revealed that a significant proportion of participants sometimes engage in sustainable actions, such as allocating their leisure time in natural environments (59%) and acquiring things that may be recycled (61%). The amount of involvement shown in this study aligns with prior research conducted in Malaysia, indicating that while individuals are aware of sustainable practices, their level of participation is typically influenced by factors such as convenience and accessibility (Moh & Manaf, 2013). The research conducted by Moh and Manaf (2013) emphasised that while Malaysians possess knowledge about recycling, the implementation of recycling is often impeded by the absence of easily accessible recycling facilities. In addition, 57.1% of the participants sometimes make use of objects that are no longer functional, while 49.5% choose energy-efficient appliances, demonstrating their awareness of the need of conserving resources. Nevertheless, even modest levels of involvement indicate that there is room for improvement in promoting persistent sustainable behaviours. Significantly, the survey identified regions with low levels of engagement in sustainable activities. For instance, a notable 33.3% of participants do not report instances of unlawful open burning, indicating a substantial deficiency in proactive environmental responsibility. This discovery is alarming, considering the harmful effects of open burning on the quality of air and the well-being of the populace. The research conducted by Khairil et al. (2018) highlighted the significance of public engagement in reporting environmental infractions to improve the enforcement and adherence to environmental legislation. A research conducted by Schultz et al. (1995) found that convenience and perceived efficacy are significant variables that influence recycling behaviour (Schultz et al., 1995). Although students exhibit dedication to certain sustainable behaviours, such as using reusable water bottles and bags, obstacles such as perceived inconvenience and scepticism about recycling efforts impede broader acceptance. In order to promote sustainable consumption patterns, it is crucial to overcome these obstacles by implementing specific interventions, enhancing infrastructure, and conducting educational campaigns that highlight the ease and significance of sustainable behaviours. Educational institutions and governments have a vital role in enabling these transformations and promoting a culture of sustainability among students.

Knowledge vs Attitude vs Practice Towards Sustainable Consumption

The results emphasise that while respondents had significant knowledge about sustainable consumption, this does not always correspond to strong attitudes or behaviours towards sustainability. The survey revealed that an overwhelming 99% of participants had a profound understanding of sustainable consumption, while an only 1% exhibit a moderate degree of awareness, and none display a lack of knowledge. This extensive level of knowledge is consistent with other studies, such as the investigation conducted by Jusoh et al., which documented a substantial degree of environmental consciousness among university students in Malaysia. This demonstrates the successful spread of knowledge and instruction about environmental issues throughout colleges in Malaysia (Jusoh et al., 2018). Although the respondents had a high level of knowledge, only 23.5% of them exhibited a strong inclination towards sustainable consumption. The majority of respondents (73.3%) had moderate attitudes, while a minor percentage (2.9%) had bad views. In a similar vein, a mere 13.3% of participants demonstrated a high level of sustainable consumption patterns, while 65.7% and 21% displayed moderate and bad practices, respectively. These results

indicate a lack of connection between knowledge and both attitude and practice. Wang & Zhang (2021) emphasized that knowledge alone is insufficient to promote sustainable practices without positive attitudes and favorable environmental conditions. The Chi-Square Test of Association revealed that there is no statistically significant relationship between knowledge levels and both attitude ($X^2 = .367$, $p = .832$) and practice levels ($X^2 = 3.809$, $p = .149$) towards sustainable consumption. This suggests that having a high level of knowledge does not necessarily impact attitudes or behaviours. This conclusion aligns with other research indicating that knowledge does not always result in changes in behaviour (Kollmus & Agyeman, 2002). Nevertheless, a notable correlation was seen between attitude and practice levels ($X^2 = 29.526$, $p < .001$), suggesting that attitudes might have a considerable impact on sustainable consumption patterns. This implies that cultivating favourable dispositions towards sustainability may be more impactful in encouraging sustainable behaviours than just enhancing knowledge. This is corroborated by the theory of planned behaviour, which asserts that attitudes, in conjunction with subjective standards and perceived behavioural control, are fundamental factors influencing behavioural intents and acts (Ateş, 2020).

CONCLUSION

The objective of this research was to evaluate the comprehension of sustainable consumption among undergraduate students at three public institutions situated in Penang, including the areas of knowledge, attitude, and behaviour. The results indicated that students had a profound awareness of sustainable consumption, displaying a robust comprehension of the importance of conserving resources and protecting the environment as essential elements for upholding environmental sustainability. Although students possess a solid understanding and favourable views, their implementation of sustainable consumption behaviours remains at a modest level, highlighting a notable disparity between knowledge and action. This highlights the enduring presence of detrimental behaviours among the youth, despite their knowledge on the significance of sustainable consumption and its potential ecological advantages. In order to fill this void, it is vital to adopt a comprehensive strategy that not only emphasises the acquisition of information, but also promotes positive attitudes and offers the necessary support and infrastructure to effectively use that knowledge. In addition to the role of educational institutions, government efforts play a crucial part in promoting sustainable consumption practices (SCP). The findings indicate that a majority of students support government-led recycling campaigns, highlighting the importance of continued governmental initiatives in raising awareness, providing necessary infrastructure, and implementing policies that encourage sustainable behaviors. Collaboration between educational institutions and government bodies can enhance the effectiveness of sustainability programs by ensuring comprehensive support, resource allocation, and long-term engagement. Strengthening policy frameworks, increasing public outreach, and offering incentives for sustainable actions can further reinforce students' positive attitudes toward SCP and encourage widespread participation.

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AUTHOR CONTRIBUTIONS

Nur Ainul Shuhada Mokhtar is involved in experimental design and methodology development, **Nur Qamarina Ain Kamarul Zaman** is assisted in literature review and editing, **Nurul Amira Shafira Zawawi & Wan Amyzatul Aida Salehfuddin** is conducted data analysis and prepared tables, **Alia Qistina Zakaria & Nurul Syifa Aqila Ali** is worked on data interpretation and writing the initial draft, **Murni Amirra Mohd Aminuddin** is contributed to statistical analysis and proofreading, **Siti Nurshahida Nazli & Nurhidayah Sabri** is responsible for visualization and manuscript formatting, **Tengku Nilam Baizura Tengku Ibrahim** is supervised the project, provided resources, and guided manuscript development. Final approval of the version to be published.

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The authors declare that there are no competing interests.

COMPLIANCE OF ETHICAL STANDARDS

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