Students Attitude and Behavior towards Circular Economy to Achieve Sustainable Development Goals

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Abstract
The latest strategy to replace the linear economy is thought to be the circular economy. Circular economy understanding and sustainable practices are still at par in the setting of higher education institutions. Recent studies demonstrate that university students still lack a broad understanding of the circular economy. This study was conducted to gauge undergraduate students' attitudes about and behavior toward the circular economy idea. In this study, 35 undergraduate students at Universiti Teknologi Malaysia were surveyed using a questionnaire as part of a quantitative technique. The questionnaire items' moderate reliability is indicated by their Cronbach's alpha rating of 0.69. Using SPSS software version 20, the data was examined and published in a descriptive manner. According to the study's findings, there are seven items in the circular economy domain and eight items in the area of circular economy attitudes. While the mean score for the conduct domain is 3.89, demonstrating a high degree of behavior towards the circular economy, the mean score for the attitude domain is 3.50, indicating a moderate level. This study found that undergraduate students recognize the value of the circular economy and have taken constructive steps to implement it. Despite their high level of behavior and intermediate level of attitude, there may be a chance to raise their awareness and grasp of concerns related to the circular economy. This creates possibilities for more study and instruction in this area. The circular economy helps to achieve the objective of sustainable development by optimizing the utilization of natural resources and minimizing adverse effects on the environment.

Introduction

Circular economy plays an important role in achieving the Sustainable Development Goals (SDG) (Khan et al., 2022; Valls-Val et al., 2023). In an effort to create a sustainable and quality future, SDG 12 (Responsible Production and Consumption) and SDG 13 (Action Against Climate Change) are very appropriate (Pires et al., 2022). The circular economy promotes wise consumption and waste reduction, which is in line with the principles of SDG 12 (Fatimah et al., 2020). In addition, it also helps to reduce the negative impact of economic activities on the environment, in line with the objectives of SDG 13 (Pradhan et al., 2021; Terra dos Santos et al., 2023).

University students, as the future generation that will face the challenges of sustainable development, play an important role in achieving these two SDGs (da Silva et al., 2023; Kjellgren & Richter, 2021). They are the young generation who will be the leaders and shapers of the future. Understanding their attitude and behavior towards the circular economy is important because they will bring about changes in economic and environmental practices in the future (Shamuganathan & Karpudewan, 2017; Wolok et al., 2022). This study will focus on the extent to which students' attitudes and behaviors are about the importance of the circular economy concept in achieving SDG 12 and 13, and to what extent their attitudes and practices are aligned with these goals. Students' attitudes reflect their awareness of sustainability issues and their willingness to take appropriate action. Therefore, this study aims to identify the level of attitude and behavior of university students towards the circular economy in order to achieve the Sustainable Development Goals.

Literature Review University Students Attitude and Behavior Towards Circular Economy

Attitude refers to a person's views, evaluations, and feelings towards a topic or issue (Anora, 2020; Corneille & Stahl, 2019). In this study, the attitude of university students towards the circular economy includes their understanding of this concept, their confidence about its importance, and the extent to which they agree with the values of the SDGs. Behavior refers to the actions a person takes in response to their attitude (Yanti et al., 2020). The behavior of university students includes their actions to practice circular economy principles in daily life, participation in projects related to sustainable development, or support for initiatives that promote the SDGs.

University students, during their studies, are exposed to a variety of knowledge and experiences that can shape their views (Pisica et al., 2023; Trinder & Herles, 2013). In the context of the circular economy and sustainable development issues, the teaching and education they receive play an important role in shaping their attitudes and behaviour (Başalan Iz, 2023; Natalia et al., 2023). The attitudes and behaviors of these students, in turn,

are able to provide a clear picture of how their thoughts and actions can impact the achievement of the Sustainable Development Goals (SDGs) (Duong, 2023). With the important role that university students play in society, it is important to acknowledge that they have great potential to influence the direction of development (Pu et al., 2022). If they show a positive attitude towards the circular economy and the SDGs and practice it in their behavior, they have the potential to be very effective agents of change in shaping society towards better sustainability and sustainable development (Ferrer et al., 2023).

Singhal et al (2019) investigates the views and tendencies of university students in India in the purchase of refurbished products for electronic devices. Through structural equation modeling, this study identifies factors such as attitudes, personal benefits, knowledge about renewed products, risk perception, subjective standards, and market strategies that influence customers' purchase intentions. The conclusion of this study emphasizes the importance of providing comprehensive information about renewable products to influence consumer attitudes towards the circular economy and, in turn, support efforts to achieve the SDGs. Qu et al (2023) looked at how college students at the Henan Institute of Science and Technology in China felt and behaved about garbage segregation. According to a questionnaire study of 1213 respondents, first-year students behaved more positively toward trash separation than second- and third-year students. The study's conclusions demonstrate how attitudes affect behavior in college students. In other research, Deda et al (2022) examined a competition created by the Portuguese Sustainable Campus Network's Circular Economy Working Group to promote innovation and the creation of circular economy projects in higher education institutions. According to the study's findings, students believe that product recovery and optimization are key aspects of the circular economy. In order to produce partners with a new vision for society and the economy related to sustainability, environmental education can be promoted by higher education institutions. They can also build knowledge, values, attitudes, and behaviors relevant to the circular economy. In addition, Galati et al (2022) also conducted research on the University of Palermo students' purchasing behavior as well as associated variables that affect it. The results indicate that consumers are highly sensitive to prices for mineral water bottles built with green packaging, sometimes known as green bottles. This explains the importance of companies considering the attitudes and behaviors of university students in planning marketing strategies involving the circular economy and achieving the Sustainable Development Goals. Nikolić et al (2022) examines the attitudes, actions, and knowledge of Generation Z in Bosnia-Herzegovina and Serbia towards products that promote sustainability. Through an online study of 1338 Generation Z students at various levels of education, this study found a significant relationship between attitudes towards sustainability and the circular economy, as well as a relationship between behavior and sustainability. These results show that understanding and supporting the concept of a circular economy can have a positive effect on behavior that supports the Sustainable Development Goals (SDGs).

Methodology

A descriptive survey research design was adopted in this study. The study's target group is Universiti Teknologi Malaysia (UTM) undergraduate students. According to Kerlinger & Lee (2000), a quantitative study should have a minimum of 30 samples. As a result, 35 students participated in the research by answering the given questionnaire. A structured questionnaire that was taken from Dewi et al (2022) was used as the data collection method. The

questionnaire is divided into two parts, Part A and Part B. Part A gives background information about the participants, including their gender, race, course of study, and faculty. Part B covers the participants' attitudes and behaviors related to the circular economy.

A five-point Likert scale was used to score each item: 1 meant "Strongly Disagree," 2 meant "Disagree," 3 meant "Not Sure," 4 meant "Agree," and 5 meant "Strongly Agree." It was discovered that Cronbach's alpha validated the instrument's dependability in terms of instrument dependability. The calculation of Cronbach's alpha value is based Konting (2005); Pallant (2010); Sekaran (1992) as shown in Table 1 below.

Table 1
Reliability index classification

Indicator	Alpha Cronbach Value
Very high	>0.90
High	0.7 – 0.89
Moderate	0.3 – 0.69
Low	<0.30

The attitude and behavior domains yielded a Cronbach Alpha value of 0.69, which is below 0.70 based on a pilot study involving 35 undergraduate students at UTM. This may indicate that the study questionnaire has a moderate degree of construct internal consistency, as recommended by (Konting, 2005; Pallant, 2010; Sekaran, 1992). The case of moderate reliability, as reflected by Cronbach's alpha value of 0.69, indicates that this research instrument, although usable, may require revision and improvement to further increase its reliability. In order to increase the reliability of the research instrument, several things can be considered, such as adding quality items (Hong et al., 2018), eliminating weak items (Mokkink et al (2018), doing factor analysis (Shrestha, 2021; Sürücü & Maslakçi, 2020), and retesting on a larger sample (Enkavi et al., 2019). The design of the question should be clear (Taber, 2018) and getting expert consultation is the most recommended way (Ghomi & Redecker, 2019). Test-half and test-retest can also be used to measure consistency (Van Patten et al., 2021). However, in this article the researcher did not implement the mentioned steps.

The survey was distributed to respondents electronically through a Google form. The URL was provided to UTM instructors to share with undergraduate students across all faculties. Data collection took place over a period of two weeks. After being obtained and cleaned, the data from the sources was entered into SPSS version 20 for analysis. The outcomes of the procedure are shown in tabular form. The researcher interprets the students' attitudes and behaviors towards the circular economy by using the citation of the mean score interpretation found in Table 2 by (Pallant, 2010).

Table 2
Mean score interpretation

Mean score	Interpretation
1.00 – 2.33	Low
2.34 – 3.67	Intermediate
3.68 – 5.00	High

Results & Discussion Demography Characteristic

As indicated in Table 3, the demographic data on the respondents' gender, race, faculty, and field of study have been analyzed. Men make up 31.4% of responders, while women make up 68.6%, according to gender data. Malay students made up 91.4% of the respondents, followed by chinese (5.7%), other races (2.9%), and no Indians. In this study, the Faculty of Social Sciences and Humanities contributed 34.3% of the respondents, followed by the Faculty of the Built Environment and Surveying with 20%, the Faculty of Computing with 14.3%, the Faculty of Science with 11.4%, and the Faculty of Management, Faculty of Civil Engineering and Faculty of Electrical Engineering are each less than 10% of the respondents.

Finally, whereas 85.7% of respondents were undergraduates, 14.3% of respondents were diploma students.

Table 3
Respondents' demography characteristic

Demography characteristic			
Gender	**Frequency**	**Percentage (%)**	
Male		11	31.4
Female		24	68.6
	Total	35	100
Race	**Frequency**	**Percentage**	
Malay		32	91.4
Chinese		2	5.7
Indian		0	0
Others		1	2.9
	Total	35	100
Faculty	**Frequency**	**Percentage**	
Faculty of Civil Engineering		2	5.7
Faculty of Electrical Engineering		2	5.7
Faculty of Computing		5	14.3
Faculty of Science		4	11.4
Faculty of Built Environment and Surveying		7	20.0
Faculty of Social Sciences and Humanities		12	34.3
Faculty of Management		3	8.6
	Total	35	100
Course of study	**Frequency**	**Percentage**	
Diploma		5	14.3

Degree	30	85.7
Total	65	100

University Students Attitude Towards Circular Economy

The attitude domain measures eight items in identifying students' knowledge of the circular economy as suggested by previous studies. The mean value for each item was calculated and discussed. Table 4 displays data for the domain of students' knowledge towards circular economy.

Table 4
Mean value for domain attitude

Domain: Students' attitude towards circular economy Statements	Mean (M)	Interpretation
In my opinion, the activity of separating household waste based on organic (wet waste) and inorganic (plastic, metal, glass) groups is a waste of time.	2.26	Low
I think it's better to buy used stuff than new one.	3.09	Intermediate
I feel that it is better to fix something that is broken than to buy a new one.	3.66	Intermediate
Using raw materials as cheap as possible to reduce production costs is very important in running a business.	2.83	Intermediate
The use of very cheap raw materials poses a high risk to consumers.	3.60	Intermediate
If I have a business, I will consider the product or packaging to be reusable or recyclable even if it costs more to produce.	4.09	High
If I have a business, I would use an online based system.	3.94	High
University programs should teach how to be an environmentally conscious entrepreneur (reducing waste and pollution; extending the life of products and materials and supporting the regeneration of natural systems).	4.54	High
Total	**3.50**	**Intermediate**

Table 4 illustrates the attitude level of students towards circular economy to achieve Sustainable Development Goals (SDG). Based on the analysis, one item shows a low level of mean score. Item in which students are asked "In my opinion, the activity of separating household waste based on organic (wet waste) and inorganic (plastic, metal, glass) groups is a waste of time" gives mean value M = 2.26. Three items show a high level of mean score. The items are (i) If I have a business, I will consider the product or packaging to be reusable or recyclable even if it costs more to produce (M = 4.09), (ii) If I have a business, I would use an online based system (M = 3.94) and (iii) University programs should teach how to be an environmentally conscious entrepreneur (reducing waste and pollution; extending the life of products and materials and supporting the regeneration of natural systems) (M = 4.54). Meanwhile other four items show intermediate level of mean score. Overall, the students feel that they have an intermediate attitude towards the circular economy to achieve Sustainable Development Goals.

This result is contrary to the findings of Dewi et al (2022) who stated that students' attitudes are high towards the circular economy, only some aspects in the attitude domain show that students do not show a positive attitude. However, the intermediate attitude level of UTM students may show a positive potential to accept green products if they are provided with enough information (Galati et al., 2022) and tend to behave in a way that supports the Sustainable Development Goals when they understand the concept of circular economy (Nikolić et al., 2022). The intermediate attitude level of UTM students can indicate that they need more information to form a more positive attitude towards the circular economy (Singhal et al., 2019). So, although the level of intermediate attitude of UTM students may not be completely in line with the findings of Galati, Nikolic and Singhal's study, it indicates that these students have the potential to be influenced and given further education about circular economy and sustainability.

University Students Behavior Towards Circular Economy
Seven student behavior items that had been suggested by earlier studies were examined in order to determine how students behaved toward the circular economy. In Table 5, the mean value for each domain is computed and analyzed.

Table 5
Mean value for domain behavior

Domain: Students' behavior towards circular economy

Statements	Mean (M)	Interpretation
I am used to carrying my own grocery bag when shopping.	3.80	High
I only buy new things when needed.	4.20	High
I am used to renting things I need instead of buying.	2.54	Intermediate
I still own and use the clothes I bought over 5 years ago.	4.11	High
I am used to give used things to others instead of throwing them away.	4.11	High
I am used to bringing water bottle with me instead of buying them.	4.34	High

I try not to throw away used items but reuse them (for example by changing their function, giving them to others, or selling them).	4.14	High
Total	**3.89**	**High**

As shown in Table 5, only one item shows intermediate level of mean score. Respondents stated that they were at a moderate level in renting the necessary items compared to buying. While other items under the behavior domain are at a high mean score level. Overall, the mean score for this domain is 3.89 indicating a high level of behavior. This finding shows that the behavior of UTM students tends towards the circular economy. The findings of this study correspond to the findings of a study by (Rahmatika Dewi et al., 2022) which shows that behavior towards CE is categorized as high. This finding also supports the study by Qu et al., (2023) and Deda et al., (2022) which shows that the attitude of university students affects their behavior. This means that students who have a positive attitude towards product recovery and optimization, as recommended by Deda et al., (2022), tend to adopt behaviors that support the circular economy concept, as suggested by Qu et al., (2023).

Conclusion

This study revealed that undergraduate students understand the importance of the circular economy and have shown positive actions in the practice of the circular economy. Although their level of attitude is intermediate and behavior is high, this may indicate an opportunity to increase their awareness and understanding of circular economy issues. Based from the outcome, it is recommended that further research can evaluate the factors that affect the level of students' attitudes towards the circular economy and why their behavior is so high. This will help in planning more effective programs or approaches to increase positive attitudes and actions towards the circular economy. Other than that, future study may assess the impact of existing or future educational programs in increasing students' awareness and understanding of the circular economy and promoting sustainable behavior.

Continuing the research to study the social and environmental impact of the circular economy, as well as how students can play a role in achieving the goals of sustainable development through this practice is also recommended. Findings from the study on students' attitudes and behavior towards the circular economy can be used as a starting point to encourage innovation in various fields, such as education and entrepreneurship. Innovation is believed as the key in achieving sustainable development goals in the context of the circular economy. Circular economy is a suitable approach to achieve many more SDGs, not just SDG 12 and 13. By maximizing the use of natural resources and reducing the negative impact on the environment, the circular economy contributes to the goal of sustainable development.

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