



## Research article

## Differences in behavior, engagement and environmental knowledge on waste management for science and social students through the campus program

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## ABSTRACT

It is proven that the educational environment contributes to increasing knowledge about waste. Therefore, this study aims to investigate the environmental education process in higher institutions with various policies and programs in good waste management. It focuses on the behavior, engagement, and environmental knowledge of students in the science and social department at Syiah Kuala University, Indonesia. Furthermore, it examines the differences in behavior, engagement, and environmental knowledge of waste management through campus programs. This study collected data from 279 social science and science students with characteristics of 123 males and 156 females with an average age of 18.4 years from 18-20 years spread across Syiah Kuala University, Indonesia. The study data were collected through a questionnaire involving 279 students related to environmental behavior, engagement, and knowledge in waste management. Data analysis used descriptive and multivariate analysis of variance (MANOVA) one-way using SPSS version 23 application for windows. The results showed that the students have good environmental attitudes, engagement, and knowledge in waste management with various existing policies and programs. Generally, the average score majoring in social and science from the behavioral variables is [(3,71), (3,62)], engagement is [(3,39), (3,52)] and environmental knowledge is [(3,43), (3,67)] for waste management. Their environmental behavior majoring in social science was higher. Similarly, in environmental engagement and knowledge, students majoring in science were higher than in social science. These results provide an understanding that programs and policies related to environmental conservation have a significant impact on environmental behavior, engagement, and knowledge for sustainable development free of waste. Therefore, institutions at all levels should provide education on environmental conservation with various policies and programs to support a free waste environment.

## 1. Introduction

The rate of urban gross production has dramatically increased due to population growth, fast-growing economy, rapid urbanization, and rising living standards (Khair et al., 2019; Minghua et al., 2009), in developing countries such as Indonesia. Furthermore, the activities and population of the country cause waste generation to increase. Due to this, the volume and type of waste produced also increased without being accompanied by proper management, which has become a problem in most cities (Raharjo et al., 2017; Santibañez-Aguilar et al., 2017). Similarly, Zurbrugg stated (2002) that increased production of waste and pollutants is a major problem related to environmental issues. Therefore, it is necessary to

make various efforts and actions to reduce it since environmental problems are complex and very terrible. Garbage is dumped on poor roads and rivers, which may affect air quality (Parker, 2018). During the last decade, an increase in global environmental science study using the theory of planned behavior (TPB) showed great implications for analyzing individual behavior, and environmental and socially sustainable management (Ding et al., 2018; Li et al., 2019).

Measures that can be taken to physically resolve these issues include law enforcement (George et al., 2020; Listiyani and Said, 2018), provision of adequate infrastructure (Donnell et al., 2017; Mamirkulova et al., 2020), technological measures (Adanu et al., 2020), and social engineering (Liu, 2017). Meanwhile, non-physical measures include

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socialization (Jia et al., 2017), training opportunities (José and Jabbour, 2013; Pinzone et al., 2019), environmental education (Baltazar et al., 2016; Novo-corti et al., 2017), increasing capacity regarding environmental behavior, attitudes, knowledge, and actions (Fielding and Head, 2011; Janmaimool and Khajohnmanee, 2019) as well as participation in the learning, family, and community areas (Huang et al., 2018; José and Jabbour, 2013; Prager et al., 2015).

Educational institutions as part of creating a generation to protect and preserve the environment are an important force that should always be implemented. This process differs in every country and education level in cultivating environmental knowledge, behavior, and engagement. Oztekin et al. (2017) provided an overview of TPB, which is a promising framework used to analyze the factors that influence environmental management intentions or behavior. The growing awareness of environmental education can be attributed to the threat of damage in the 1960s, such as increasing air, water, and soil pollution, population growth, and shrinking natural resources (Gough, 2013). These have come to the attention of scientists (Ader, 1995; Carson, 1962; Ehrlich, 1968), and were formally recognized at the United Nations meeting on the human environment held in Stockholm, Sweden in 1972. Furthermore, it resulted in the statement of the United Nations Meeting on the human environment.

Following the UN Declaration, experts, groups, and organizations have proposed definitions of environmental education and study to clarify educational approaches (Gough, 2013). Bill Stapp and a group of colleagues from the University of Michigan's School of Natural Resources have developed a definition for this approach. It aims to effectively educate humans about their relationship with the environment. Furthermore, they also formulated the goal of environmental education to produce citizens that are knowledgeable about the biophysical environment, and its related problems, as well as possible solutions (Stapp, 1969). In contrast, Lucas developed a descriptive model of environmental education to understand the concept of environmental education (Lucas, 1972).

In 1990, several university leaders signed the Talloires Declaration in Talloires, France, guiding higher education institutions in setting environmental goals and actions. There were 675 colleges and universities in the United States that joined the alliance on sustainable development by 2012, covering a third of students. In addition, 50 countries have participated in this program, but environmental education is still an underdeveloped area in higher education institutions (Sundermann and Fischer, 2019), especially in Asian countries (Fryxell and Lo, 2003) such as Indonesia (Acciaoli and Affif, 2018).

Along with the TL declaration, several studies were conducted to provide an investigative view concerning environmental education. A study showed that environmental programs have provided information about the nature and characteristics of the implementation of education (Wilson, 1996). This is because environmental knowledge and awareness are important for teachers, students, and parents in solving related problems (Kyburz-Graber, 1999; Legault and Pelletier, 2000; Strong, 1998). Furthermore, students that were raised in developed or less developed environments have significantly different levels of general environmental awareness even though they were exposed together with institutionalized education (He et al., 2011). Other studies also examined changes in knowledge, attitudes, behavior following relatively short courses or experiences in environmental education (Ballantyne, 1999; Benton, 1993; Corral-Verdugo, 1993; Harvey, 1990; Kuhlemeier et al., 1999; Schultz and Oskamp, 1996; Vining and Ebreo, 1992).

The study by Zsóka et al. (2013) showed a strong relationship between the intensity of environmental education and students' knowledge, especially at the university level. Others showed that the workplace in a green university environment is largely determined by pro-environmental behavior (Blok et al., 2015). Furthermore, in a study conducted by Vicente-Molina et al. (2013), an overview of student motivation and also the effectiveness of environmental education programs as the most important variables that significantly influence their pro-environmental behavior was

provided. The study on a large project of recycling at a UK university for sustainable development showed that the engagement of students and other stakeholders forms a framework to facilitate changes in environmental values, attitudes, and habits. Therefore, they are meaningful long last time behavioral changes (Cleverdon et al., 2017). Theoretically, pro-environmental behavior is a model used to identify can identify and analyze the behavior of high school students with educational interventions (De Leeuw et al., 2015; Karimi et al., 2021). The Theory of Planned Behavior (TPB) in other studies showed that there is a positive and significant relationship between environmental knowledge and adolescent environmental behavior in terms of green purchases (Amoako and Dzogbenuku, 2019). Furthermore, this theory determines individual engagement in waste management behavior (Janmaimool and Denpaiboon, 2016; Safa and Mohammadian Saghinsara, 2020). From the literature, higher education becomes important as a place to give birth to a generation that has awareness of caring for the environment (Emiru and Waktola, 2018; Tlebere et al., 2019). Environmental education in colleges or universities increases awareness (Baltazar et al., 2016), and in Indonesia, the policies are implemented in the form of courses such as environmental education (Ikhsan et al., 2019; Nomura, 2009; Parker and Prabawa-Sear, 2019; Prihantoro, 2014), and disaster (Dwiningrum, 2004; Rizal, 2017; Suckale et al., 2018).

Therefore, the content of environmental education is of particular concern in higher education for two reasons. First, some studies show that waste and pollution problems are often caused by a collection of everyday behaviors (Fryxell and Lo, 2003). Second, environmental education can integrate concerns, behaviors, and knowledge into the professional context of students' future to ensure sustainability after graduation (Butt et al., 2014; Malik et al., 2019). As a special group with a high level of knowledge, student awareness and behavior have an important impact on the environment (Li et al., 2019; Malik et al., 2019). This is because higher education bears an important responsibility in developing talent for society (Coman, 2008). However, there are still many challenges faced by campuses in integrating sustainable development (Ramos et al., 2015). This problem causes the campus not to become a comfortable place to conduct the learning process when the environment is not clean.

In Indonesia, waste management policies are regulated by law number 18 of 2008 (Ministry of Environment, 2008). According to Lestari & Trihadiningrum (2019), the law regulates waste management that should be conducted by the government and the community without exception in the higher education environment. Furthermore, it regulates the implementation of waste management maintenance, such as the reduction and handling policies that involve the government and the community in realizing a good and healthy living environment (Purba and Erliyana, 2020). Particularly, the government cooperates with related institutions for the implementation of waste management in the community (Zurbrugg, 2002), the Adwiyata program from the ministry of the environment (Nurwidodo et al., 2020; Prabawa-Sear, 2018; Tanu and Parker, 2018; Yusuf et al., 2020) and a collaborative program between the ministry of research and higher education in the context of sustainable development (Ikhsan et al., 2019; Nomura, 2009; Novawan and Aisyiyah, 2020; Prihantoro, 2014). Based on data from the Ministry of Environment and Forestry (KLHK), waste production in 2020 nationally has reached 67.8 million tons, which means that there are 185,753 tons of waste produced every day. With 270 million residents, it means that around 0.68 kg of waste are produced per day (Indonesia, 2021). Furthermore, the Institute of Sciences showed that Indonesia is the second-largest plastic waste-producing country after China with 39 million tons (Vriend et al., 2021). This increase was caused by Large-Scale Social Restrictions (PSBB) and Work From Home (WFH) during the COVID-19 pandemic (LIPI, 2021).

Based on the explanation of the previous literature, conceptually, this research is based on the theory of planned behavior (TPB). As stated by Ajzen (1991), TPB is a theory that explains human behavior. This theory assumes that several reasons or constructs, including attitudes, subjective

norms, and perceived behavioral control, are involved in forming intentions to perform certain behaviors. Furthermore, several studies support other arguments that reveal that TPB can help predict waste separation behavior (Ghani et al., 2013). Theoretical studies and previous research studies are beneficial for researchers to strengthen the analysis that researchers will use to analyze differences in waste management. The difference in waste management is based on three variables related to the theory of planned behavior, which consists of variables of involvement, behavior, and environmental knowledge of Syiah Kuala University students from various disciplines with programs or policies produced by universities. Students are just past their teens and generally perceive knowledge in various sectors from their peer group. A person's environmental behavior is directly determined by the level of environmental knowledge (Zareie and Navimipour, 2016). Another study by He et al. (2011) on environmental knowledge, attitudes, and behavior among students highlights that the lack of factual knowledge, lack of understanding complete knowledge of global issues, or knowledge of waste management has led to a low number of correct responses. A study revealed by Kuruppuarachchi et al. (2021) states that there are differences in general environmental knowledge from various disciplines, so more attention needs to be given, especially for students with non-science disciplines. Further explanation of how the involvement, behavior, and knowledge of the environment needs to be researched will be explained in the next paragraph.

The engagement, behavior, and environmental knowledge of higher education students are important in waste management. This is evidenced by the study which states that the success of waste management is caused by the environmental behavior level (Janmaimool, 2017; Ulhasanah and Goto, 2018) of students followed by an increase in their knowledge (Mukherji et al., 2016). Furthermore, other studies show that the level of environmental engagement conducted by students can lead to an environment that is zero waste (Viebahn, 2002), and the level of literacy can affect behavior in good waste management (Goldman et al., 2018). Waste management is a pro-environmental behavior related to factors such as attitudes, norms, and behavioral control which are important determinants (Liao and Li, 2019). In the context of higher education, environmental education provides knowledge, influences attitudes towards waste management, and directs them to good and correct waste management intentions and behaviors (Liao and Li, 2019; Muniandy and Anuar, 2020). The theory of planned behavior (TPB) provides a theoretical framework in identifying factors that influence pro-environmental behavior such as, environmentally friendly purchases (Yadav and Pathak, 2016; Yazdanpanah and Forouzani, 2015) and travel behavior (Amaro and Duarte, 2015), and waste management (Heidari et al., 2018).

Several studies reveal that the level of environmental behavior in waste management is also caused by gender, especially in responsive women (Oztekin et al., 2017; Talalaj and Walery, 2015; Uma et al., 2020). This is also caused by the level of education possessed by the community (Debrah et al., 2021; Grodzińska-Jurczak, 2003). Some also showed that it is caused by the integration of environmental education into the curriculum (Aleixo et al., 2017; Baltazar et al., 2016). Therefore, students and teachers have good environmental knowledge and behavior in waste management. Some studies on this topic were also based on the cultural values of the community (Kaplan Mintz et al., 2019). It is necessary to conduct an in-depth investigation on the distribution of student programs regarding the environment through campus policies.

Based on the various kinds of literature that have been disclosed, to achieve the process of environmental preservation through sound waste management in a university environment, other variables are needed, such as the level of behavior they have and the level of involvement and knowledge they have. The analytical model is used to see the difference in waste management carried out at universities with the policies or programs they have. Population emphasis is targeted at students, based on the number of students who carry out the lecture process at Syiah Kuala University with 27920 students. The increase in the number of

students produced, apparently unconsciously, also produces more waste than before. So that in 2016 a policy was issued that requires all undergraduate students to take general courses in Disaster and Environmental Education. Furthermore, in 2018 Syiah Kuala University also made a policy calling on all campus communities not to use plastic bottles and another packaging to create a waste-free campus. The target population in this study is those involved in the program produced by Syiah Kuala University. Based on this explanation, it is necessary to analyze the policies or programs that have been implemented to see waste management among students as agents who implement or target environmental conservation programs based on behavioral variables, involvement, and knowledge from various existing departments.

The campus policy starts from adding environmental education as contained in the curriculum, green campus, and policies with student programs. However, there is still a minimum of assessing waste management as seen from the level of environmental behavior, engagement, and knowledge. This is based on campus policy through environmental education content and a waste-free campus, especially at different levels of majors or scientific disciplines.

Therefore, this study focuses on the three variables of environmental behavior, the level of engagement, and students' knowledge in line with campus policies or programs. This includes the addition of environmental education to the curriculum and waste-free policy management in the higher education environment. Furthermore, the aim of the study is explained in the hypothesis and literature section of each variable.

## 2. Literature review and development of hypotheses

Waste management in higher education institutions is emerging as a sustainable development roadmap to achieve comprehensive environmental protection with global attention. It is caused by several factors that determine success among existing environmental behavior, engagement, and knowledge required. This is conducted in the higher education environment with the help of supporting campus policies and programs. Therefore, this section will explain the concepts regarding environmental education, environmental behavior, engagement, knowledge, and campus programs that support waste management. In addition, the hypotheses of each variable are also presented.

### 2.1. Environmental Education

Environmental education started with the growth factor regarding the awareness of problems and efforts in the process of promoting a good living environment (Stevenson, 2007). It is partly influenced by behavioral factors, attitudes, and knowledge related to the environment (Kasapoğlu & Turan, 2008; Zsóka et al., 2013). Primarily, it aims to provide solutions to environmental problems (UNESCO, 1978). Heimlich & Ardoin (2008) defined environmental education as a process in producing citizens that can make policies and also take action for sustainable development. This concept has been implemented with a different success rate from others.

Over the last decade, environmental education has defined the nature and scope of environmental education as an education that promotes the development of responsible behavior (Howe and Disinger, 1991; Hungerford and Volk, 1990). In line with that, environmental educators have provided opportunities for students to acquire the knowledge, attitudes, values, commitments, and skills needed in solving problems (Eulefeld, 1979). In contrast, there are several principles in developing the scope of environmental education which include the development of knowledge, skills, attitudes, and behavior (Uzzell, 1999). The scope includes the need to develop a caring attitude, curiosity, and concern for the environment such as knowledge, skills, attitudes, and behavior (Department of Education and Science, 1988).

Since it was established as a pedagogic field, environmental education has become a policy to be applied in schools (Nomura, 2009; Nurwidodo et al., 2020; Prabawa-Sear, 2018; Tanu and Parker, 2018) and

universities (Ikhsan et al., 2019; Novawan and Aisyiyah, 2020; Prihantoro, 2014). Since 1994, the government has instructed schools to teach the local environment. Therefore, environmental issues are included in various subjects such as science, social studies, religion, and physical education (Nomura, 2009). Also, a study showed that campus policies and culture, curriculum implementation, and learning methods have a positive influence on environmental education (Ikhsan et al., 2019).

## 2.2. Environmental behavior

The pattern of human behavior greatly determines the surrounding environment quality. Students of the younger generation of society bear the burden of past and present indifference to the environment (Shafie and Maleksaeidi, 2020). Many environmental challenges are rooted in human action (Abun, 2017), therefore, it is believed that problems will be reduced by promoting good behavior (A. Akintunde, 2017; Bleys et al., 2018; Dornhoff et al., 2019).

In addition, many studies have been carried out to explain the environmental behavior of social groups in society, especially students (Chen et al., 2017; De Leeuw et al., 2015). Good waste management is based on how the resulting environmental behavior supports the concept. This is evident in the results which reveal that environmental behavior is a determining factor for an environment with zero waste (Ulhasanah and Goto, 2018). Therefore, it is important to study the environmental behavior of students, as they are the guardians, planners, decision-makers, and educators of future environmental problems. An in-depth examination was conducted for the different findings and information. Therefore, the first hypothesis is:

**Hypothesis 1 (H1).** There are differences in environmental behavior between social science and science students in waste management

## 2.3. Environmental engagement

Environmental issues have become the focus of today's global discussions, and society has realized the need to be involved. It is intended to raise awareness about environmental issues, build knowledge through education about the impact of human behavior on nature to increase sustainability (Bian et al., 2019). Environmental engagement refers to the actions adopted to protect nature, create awareness of environmental problems and participate in education programs (Dean et al., 2018; Javornik and Mandelli, 2012). This is important for campus organizations in understanding the factors that can generate voluntary interest between students and lecturers in waste management (Tian and Robertson, 2019). Environmental engagement refers to the theory of planned behavior (TPB) which is adapted to engagement in waste management. Generally, it is developed to understand behavior in many fields including, sociology, education, psychology, and environment (Foster et al., 2020). Several studies have shown that TPB can predict waste management behavior and intentions (Tam et al., 2018). Another study showed that engagement through recycling attitudes towards waste sorting is a major contributor (Tonglet et al., 2004). This was supported by other studies on the main predictors of behavioral intention to engage in waste management (Bortoleto et al., 2012; Knussen et al., 2004; Ramayah et al., 2012).

As youth and young adults, the environmental engagement of students in the campus environment is very important and has a role as the front line in the waste management movement. Various studies have been conducted in association with community engagement. Garnett and Cooper (2014) stated that public engagement plays a role in making waste management decisions. Furthermore, waste management between communities and organizations has a significant role (Dururu et al., 2015). Also, another study showed that student engagement programs in higher education institutions can increase awareness and engagement in sustainable development in good waste management (Brugmann et al.,

2019; Chaplin and Wyton, 2014; Cleverdon et al., 2017). Therefore, the following hypothesis was proposed:

**Hypothesis 2 (H2).** There is a difference in environmental engagement between social science and science students in waste management

## 2.4. Environmental knowledge

Education is one of the important tools to create awareness among the people, especially in developing countries. Environmental education is not only information about the environment, it also strengthens critical thinking, helps solve problems, and enables effective decision-making skills (Ernst and Monroe, 2004; Fraser et al., 2015). Furthermore, increasing awareness, knowledge of environmental problems and enabling individuals to provide facts or opinions about environmental problems enable responsible decision-making (Debrah et al., 2021).

Environmental knowledge is used to describe concepts and behavior patterns related to the environment (Laroche et al., 2001). Meanwhile, environmental education is a field that seeks to promote awareness and understanding as well as human relations with the natural environment (Chams and Garcí a-bland ó n, 2019; Roberts, 1997). The most important key in higher education is the development of students' knowledge of the environment, which supports human life (Novo-corti et al., 2017). Increasing environmental knowledge improves awareness of better waste management (Tangwanichagapong et al., 2017). It also results in increased awareness of problems which enables individuals to take action to protect the environment (Bamberg and Möser, 2007). Furthermore, knowledge about waste management or environmental problems depends on the field of study that students have and is also added to their existing experience (Kurupparachchi et al., 2021). Therefore, it was concluded that the knowledge of each student has an effect on the waste management process, and the hypothesis is formulated as follows:

**Hypothesis 3 (H3).** There is a difference in knowledge between social science and science students in waste management

## 2.5. Campus program

Considering the large amount of waste generated by mankind and its impacts, environmental management has become an international issue, politically, economically, and concerning education. Syiah Kuala University with 27920 students, 1636 lecturers, and 1453 employees and other supporting components has the potential to produce more waste from existing activities. In 2018, the University together with the State Electricity Company (PLN) collaborated in creating a comfortable campus environment. One of the programs conducted was on Indonesian tree planting day on November 18. The two institutions carried out an action to plant 1,045 trees to create a green campus and environmental preservation (Unsyiah, 2018). This activity has a good impact on the environment (Bewket, 2003; Whitburn et al., 2019).

Furthermore, Syiah Kuala University (USK) starting the 2016/2017 academic year inaugurated the compulsory Disaster and Environmental Knowledge (PKL) course for all students. This aims to produce students that are sensitive to disaster and environmental issues (Atmaja et al., 2021; News, 2016). In 2019, a Garbage Bank was established as a program that cares for the environment. The program was founded based on concern for the surrounding environment, especially the University, which is getting worse day by day because of the lack of attention to waste (Putriyanti, 2021). As the oldest and most well-known university in Aceh Province, it continues to make breakthroughs in disasters and the environment. Apart from the programs previously mentioned, this University has a Tsunami and Disaster Mitigation Research Center under the Syiah Kuala University Disaster Mitigation Unit which conducts programs with various partners (Bisri and Sakurai, 2017; Oktari et al., 2015). Therefore, the policy in environmental preservation and waste management is to establish a disaster mitigation research center, the existence of

compulsory general courses, collaborative programs with partners, and the creation of a waste bank.

Policies through these campus programs, especially the Waste Bank, and the Disaster and Environmental Education courses are an effort to support the waste management program at Syiah Kuala University, Indonesia. Therefore, it is expected to overcome the problem of waste and pollutants in the environment.

### 3. Methodology

#### 3.1. Research design

This study used a comparative survey design and was conducted at the University of Syiah Kuala which consisted of students from the faculty of social and political science as well as mathematics and natural sciences. Furthermore, the comparison is used to differentiate environmental behavior, engagement, and knowledge of students majoring in social and science through campus programs.

#### 3.2. Research sample

This study includes students from the faculty of social sciences and students from the mathematics, and natural sciences faculty enrolled in the even semester of 2019/2020 at Syiah Kuala University, Indonesia. The sample was collected online through a non-probabilistic approach with a random sampling technique from 949 students in the even semester of 2019/2020 (Table 1). Given the high sample size, this analysis took a random portion of the current population using the Slovin formula to measure the sample size of the study (Consuelo et al., 2007), resulting in a total of 279 students with characteristics of 123 males and 156 females with an average age. 18.4 years from the age range of 18–20 years spread at Syiah Kuala University, Indonesia.

After determining the size of the sample for students, the sampling technique using proportional random sampling was used to determine the study sample based on the number of each student-faculty group (Johnson and Christensen, 2019). A more detailed explanation can be seen in Table 2.

#### 3.3. Research procedure

Data collection was conducted through a questionnaire distributed to students. Google Form was used to measure the aspects that want to extract both information related to environmental behavior, engagement, and knowledge in waste management using the 1–5 Likert scalar. The research questionnaire was distributed to students who took the even semester 2019/2020 lectures through the WhatsApp group. Before this research was conducted, the ethical permission procedure was carried out first, and the researcher made the consent form for the students who were the research samples, which are detailed in section 3.6. Ethical approval. By writing an active mobile number in filling out the questionnaire, 20 out of 279 lucky participants will get a mobile phone credit of Rp.50,000.

This study explains that when a questionnaire is used anonymously, it will not associate names or other private information except the data provided. This was conducted for 2 months starting from 6-7 months of 2020 after the even semester 2019/2020. The criteria for the sample are students spread across the faculty of social and political science as well as

Table 2. Research sample.

No.	Faculty Group	total	Calculation	Sample	Sample (Rounded)
1	Social science	466	$n = \frac{466}{949} \times 279$	137,1	137
2	Science	483	$n = \frac{483}{949} \times 279$	141,9	142
<b>Total</b>		<b>949</b>		<b>279</b>	<b>279</b>

mathematics and natural sciences that have taken general compulsory courses in disaster and environmental education.

#### 3.4. Data collection instrument

The quantitative data was based on environmental behavior, participation, and waste management knowledge, which contains 33 statements. Furthermore, the environmental behavior instrument was developed based on the work carried out by Heidari et al. (2018), amounting to 11. The environmental engagement instrument was developed based on the work carried out by Zhou (2010) amounted to 10 and environmental knowledge instruments developed based on the work carried out by Liao and Li (2019) totaling 12 statements. This questionnaire is measured using a 5-point Likert scale from the participant's approval level: "Strongly Agree (5)," "Agree (4)," "Neutral (3)," "Disagree (2)," and "Strongly Disagree (1)". Those developed based on the objectives of open and closed are divided into two parts. Part A contains respondents' personal information such as gender, course major, age, engagement in campus programs, and environmental conservation communities on and off-campus. In Part B, each questionnaire that was compiled with alternative responses 1 to 5 is closed or is open allowing respondents to express their opinion. Open-ended questions allow them to share their views and formulate their answers without obstacles (Phellas et al., 2011).

After the instrument was compiled and developed following the objectives, the instrument was tested to examine the validity and reliability of the questionnaire used. The trial of this instrument consisted of 40 students from the social sciences and science majors. Furthermore, the selection was based on those that have taken the 2019/2020 Disaster and Environment Education course for the 2019/2020 semester. Some respondents spent 5–7 min completing the questionnaire. The instrument testing using SPSS 2.3 for windows showed the results of the validity and reliability of each variable in Table 3.

Table 3 showed that the validity and reliability of each statement of each variable is feasible to use because it has Cronbach's alpha value >0.60 and the validity of each statement >  $r_{table}$  0.312 (Ghozali, 2013).

#### 3.5. Data analysis

The data was processed and analyzed using statistical applications for the social sciences (SPSS version 23). In addition, the analysis used one-way MANOVA after the data were tested for normality, linearity, homogeneity, and Box's M, as a prerequisite test. The results of the normality test of the two groups of social science and science departments for the three dependent variables show the results of the Tests of Normality where the sig value is greater than 0.05. Therefore, all dependent variables in the two sample groups are declared normal and the data description can be explained in Table 3.

The Kolmogorov-Smirnov test was conducted to analyze the normality of data in each department. The results show that data on environmental behavior in the social [W (137) = 0.048, p = 0.088] and the science departments [W (142) = 0.045, p = 0.200] are normally distributed. Furthermore, data on environmental engagement in the social [W (137) = 0.049, p = 0.073] and the science departments [W (142) = 0.048, p = 0.200] were normally distributed. Data on the results of environmental knowledge in the social [W (137) = 0.044, p = 0.200] and

Table 1. Research population.

No	Population Group	Total
1	Social Sciences	466
2	Science	483
<b>Total</b>		<b>949</b>

**Table 3.** Scores of instrument validity and reliability.

Variabel	N	Number of items	Cronbach's alpha	Validity
<b>Environmental Behavior</b>	40	Item 1	0,898	0,419 (0,007)
	40	Item 2	0,902	0,402 (0,010)
	40	Item 3	0,895	0,683 (0,000)
	40	Item 4	0,898	0,518 (0,001)
	40	Item 5	0,899	0,521 (0,001)
	40	Item 6	0,899	0,419 (0,007)
	40	Item 7	0,899	0,417 (0,007)
	40	Item 8	0,899	0,387 (0,014)
	40	Item 9	0,898	0,444 (0,004)
	40	Item 10	0,898	0,372 (0,018)
	40	Item 11	0,898	0,531 (0,000)
<b>Environmental Engagement</b>	40	Item 12	0,896	0,581 (0,000)
	40	Item 13	0,898	0,383 (0,015)
	40	Item 14	0,898	0,431 (0,005)
	40	Item 15	0,898	0,444 (0,004)
	40	Item 16	0,898	0,414 (0,008)
	40	Item 17	0,899	0,391 (0,013)
	40	Item 18	0,899	0,414 (0,008)
	40	Item 19	0,897	0,474 (0,002)
	40	Item 20	0,899	0,383 (0,015)
	40	Item 21	0,898	0,529 (0,000)
<b>Environmental Knowledge</b>	40	Item 22	0,899	0,435 (0,005)
	40	Item 23	0,897	0,524 (0,001)
	40	Item 24	0,896	0,620 (0,000)
	40	Item 25	0,895	0,655 (0,000)
	40	Item 26	0,899	0,381 (0,015)
	40	Item 27	0,898	0,398 (0,011)
	40	Item 28	0,895	0,633 (0,000)
	40	Item 29	0,898	0,423 (0,007)
	40	Item 30	0,894	0,668 (0,000)
	40	Item 31	0,899	0,393 (0,012)
	40	Item 32	0,895	0,626 (0,000)
	40	Item 33	0,898	0,564 (0,000)

the science departments [W (142) = 0.048, p = 0.200] were also normally distributed (Table 4). The resulting Box'M value is 11,510 (p = 0.075), therefore the convarian matrix between groups is assumed to be the same.

**3.6. Ethical approval**

This study has received ethical approval from the Research Ethics Committee of the Nursing Faculty, Universitas Syiah Kuala (No: 113004141019). While the respondents' identities were removed from the dataset. The respondents provided written approval for their engagement in the study.

**4. Results**

First, this study presents descriptive and correlations for the three attitude dimensions and the results of multivariate analysis of variance.

**4.1. Descriptive and correlation for behavioral, engagement, and environmental knowledge variables**

The descriptive results showed that social sciences and science students have good environmental behavior in waste management (M = 3.66, SD = .37). They have a good level of environmental engagement in waste management with campus programs (M = 3.45, SD = .40). The

social science and science students have a good level of environmental knowledge in waste management on campus (M = 3.55, SD = .40), and the correlation showed that the three variables are statistically correlated. The students positively have environmental knowledge through the campus programs (\*\*p < .01). Furthermore, the respondents positively have high environmental behavior in waste management (\*\*p < .01). Students positively have a good level of environmental engagement in waste management through the campus programs (\*\*p < .01) (Figure 1).

**4.2. Differences in behavior, engagement, and environmental knowledge of social and science students on waste management through campus programs**

Table 5 demonstrates the differences in behavior, engagement, and knowledge of social and science students on waste management through campus programs using SPSS.

The multivariate test results showed that there were significant differences in the behavior, engagement and environmental knowledge of students from different departments, F (3, 275) = 11,877, p < 0,001; Wilk's  $\lambda$  = 0,885,  $\eta^2$  = 0,115. Also, the univariate results showed that there were differences in environmental behavior between students majoring in social and science [F (1, 277) = 5,026, p = 0,026],  $\eta^2$  = 0,018]. In the environmental engagement between students majoring in social and science there is also a difference [F (1, 277) = 6,755, p = 0,010],  $\eta^2$  = 0,024]. Similarly, knowledge shows that there are differences in environmental behavior between students majoring in social and science [F (1, 277) = 25,850, p = 0,001],  $\eta^2$  = 0,085] (Tabel, 6).

Table 5 above is the results of the one-way MANOVA test where the Tests of Between-Subjects Effects showed that student majors between social science and science as independent variables affect other dependent variables such as environmental behavior, engagement, and knowledge of students.

Table 6 shows that the mean value of environmental behavior is a statistically significant difference between social science and science students (p < 0.05). The mean value of the environmental engagement variable statistically had a significant difference between social science and science students (p < 0.05). The environmental knowledge variable was also statistically different between them (p < 0.05).

**5. Discussion**

Waste management is an issue and actions should be taken now. As the waste increases daily, good and proper management is a solution that can be carried out in addition to reducing the amount. Good and correct management is determined by environmental behavior is produced by the community, especially students. Generally, the findings showed that there are differences in environmental behavior (H1), engagement (H2), and knowledge (H3) of social sciences and science students in waste management through campus programs. This is in line with the data that are disclosed in the results section (Figure 1). Furthermore,

**Table 4.** Data normality test results.

Variable	Departments	Kolmogorov-Smirnov <sup>a</sup>		
		Statistic	df	Sig.
Environmental Behavior	Social Sciences	.048	137	.088
	Sciences	.045	142	.200*
Environmental Engagement	Social Sciences	.049	137	.073
	Sciences	.048	142	.200*
Environmental Knowledge	Social Sciences	.044	137	.200*
	Sciences	.048	142	.200*

\* This is a lower bound of the true significance.

<sup>a</sup> Lilliefors Significance Correction.

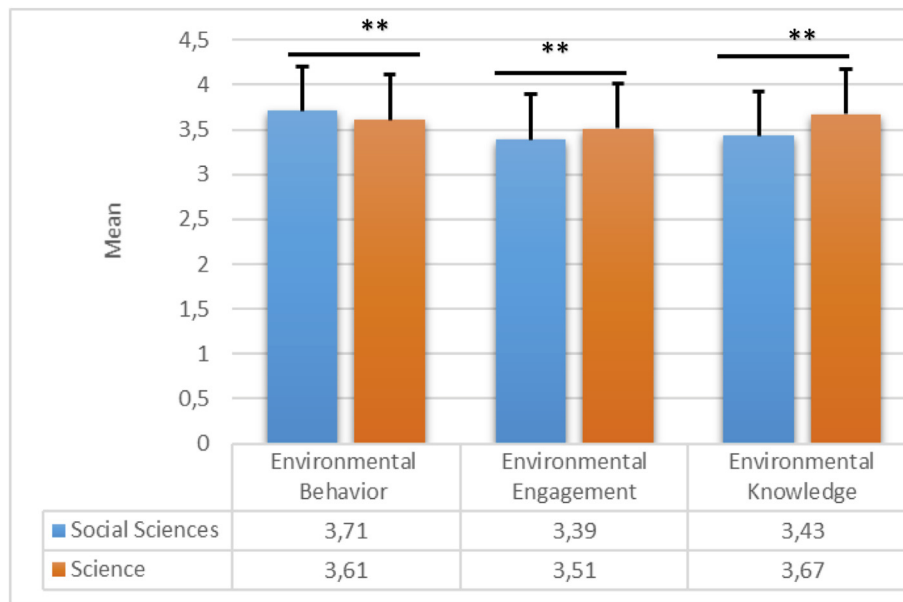


Figure 1. Descriptive and correlation of behavioral variables, Engagement and environmental knowledge in waste management.

Table 5. Multivariate tests.

Multivariate tests <sup>a</sup>		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	,996	24874,888 <sup>b</sup>	3,000	275,000	,000	,996
	Wilks' Lambda	,004	24874,888 <sup>b</sup>	3,000	275,000	,000	,996
	Hotelling's Trace	271,362	24874,888 <sup>b</sup>	3,000	275,000	,000	,996
	Roy's Largest Root	271,362	24874,888 <sup>b</sup>	3,000	275,000	,000	,996
Departments	Pillai's Trace	,115	11,877 <sup>b</sup>	3,000	275,000	,000	,115
	Wilks' Lambda	,885	11,877 <sup>b</sup>	3,000	275,000	,000	,115
	Hotelling's Trace	,130	11,877 <sup>b</sup>	3,000	275,000	,000	,115
	Roy's Largest Root	,130	11,877 <sup>b</sup>	3,000	275,000	,000	,115

<sup>a</sup> Design: Intercept + Departments.

<sup>b</sup> Exact statistic.

environmental behavior is also caused by the engagement level of the community and students in the environment (Garnett and Cooper, 2014). This is in line with the study that a high level of engagement can reduce the number of landfills and can increase a clean environment (Figure 1). This was also supported by Muniandy et al. where it was stated that pro-environmental behavior greatly determines the quality of the resulting environment (Muniandy et al., 2021). Furthermore, Oztekin et al. (2017) provides an overview of his research, stating that TPB is a

framework that can analyze factors that influence environmental management intentions or behavior.

The student's skills and knowledge of the environment promote good waste management. Moreover, the knowledge taught directly in the curriculum and also through the environmental movement based on campus policies is more supportive. Environmental education in colleges or universities refers to increasing environmental awareness (Baltazar et al., 2016). Per Indonesia's environmental policy on higher education,

Table 6. Pairwise comparisons.

Dependent Variable	(I) Departments	(J) Departments	Mean Difference (I-J)	Std. Error	Sig. <sup>b</sup>	95% Confidence Interval for Difference <sup>b</sup>	
						Lower Bound	Upper Bound
Environmental Behavior	Social Sciences	Science	,099*	,044	,026	,012	,186
	Science	Social Sciences	-,099*	,044	,026	-,186	-,012
Environmental Engagement	Social Sciences	Science	-,124*	,048	,010	-,218	-,030
	Science	Social Sciences	,124*	,048	,010	,030	,218
Environmental Knowledge	Social Sciences	Science	-,239*	,047	,000	-,331	-,146
	Science	Social Sciences	,239*	,047	,000	,146	,331

Based on estimated marginal means.

\* The mean difference is significant at the, 05 level.

<sup>b</sup> Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

environmental education is implemented in the form of environmental education courses (Ikhsan et al., 2019; Nomura, 2009; Parker and Prabawa-Sear, 2019; Prabawa-Sear, 2018) and disaster and environmental education at the research sites (Atmaja et al., 2021; Rizal, 2017; Suckale et al., 2018; Wahyuniati et al., 2017).

The actions or policies are consistent with campus program arrangements. Some of these include the importance of keeping the environment clean, waste bank programs, content for waste management courses, and environmental conservation through the Disaster and Environmental Education program. Furthermore, Syiah Kuala University prohibits using plastic bottles and promotes dormitory policies for good and correct waste management.

The following is a discussion related to behavioral, engagement, and environmental knowledge variables in waste management. This is also related to the actions or policies that are consistent with the campus program arrangements.

### 5.1. Waste management environmental behavior

The results showed that the student department influenced the level of environmental behavior generated in terms of waste management (Figure 1). The difference is supported by the resulting data, where the social and science department have an average environmental behavior in waste management of 3,71 and 3,61 respectively (Figure 1). This is supported by a study, where social science students have a high level of interaction in terms of the environment which affects good waste management behavior (Luo et al., 2020; Meyer, 2016; Vicente-Molina et al., 2013). Furthermore, this behavior is also caused by a supportive interaction environment (Kaplan Mintz et al., 2019). This has also confirmed the previous study related to the theory of planned behavior conducted by Yadav and Pathak (2016). In this study, the buying behavior of people was affected by green attitudes, which has an impact on the waste produced. Furthermore, TPB is used to predict intentions and behavior in various disciplines (Chen et al., 2009; Han et al., 2010). Following the results of research that confirms TPB as a framework for understanding students' pro-environmental intentions and behaviors; Attitudes, subjective norms, and perceived behavioral control can account for a large part of the variance in intentions to engage in environmentally friendly behavior and intentions along with perceived behavioral control result in good predictions of reported behavior (De Leeuw et al., 2015).

Environmental behavior carried out by social science students is more supported due to the process of social interaction and the experience gained in the community. Meanwhile, the environmental behavior of science students is supported as a result of the learning process they get, which is then primarily applied in the social community. However, most of the research results reveal that a person knows the environment but does not have environmental behavior that maintains and preserves the environment (Braun et al., 2017; Liobikien and Poškus, 2019). Most studies reveal that direct experience of environmental practices affects the formation of environmental behaviors that protect and preserve the environment (Fröhlich et al., 2013; Lee et al., 2013; Poudel et al., 2016). Pro-environmental behavior can also consist of various types of behavior, determined by various combinations of causal factors (Bamberg and Möser, 2007; Gilg et al., 2005; Mohd Yusoff et al., 2022). It is essential to distinguish between pro-environmental behavior in the public sphere (eg petitioning environmental issues), in the private sphere (eg green buying, recycling, etc.), and within organizations (Stern et al., 1995). Based on the study, the discipline studied can affect the individual's environmental knowledge, which has a relationship between attitudes, beliefs, and pro-environmental behavior (Stern et al., 1995). Social science students study environmental subjects more about environmental behavior than science students (Talay et al., 2004). Some individuals are attracted to academic disciplines because of their psychological characteristics and personal beliefs (Young, 1996), which is reasonable to expect social science students to be more sensitive to social topics such as environmental protection.

Based on the results, it was found that the high standard of both departments is inextricably linked with the disaster and environmental education programs offered by the professors in these courses. Furthermore, programs carried out by universities, especially waste banks, make student behavior more responsive to environmental management. This is consistent with the study that the level of material content taught can create clean environmental behavior (Atmaja et al., 2021; George et al., 2020). The level of activity towards living clean from waste also triggers environmental behavior in good waste management (Boca and Saraçlı, 2019). Sensitivity possessed by students majoring in social is one of the factors determining the high behavior in good waste management. Also, the level of material and socialization consulted through the campus program is another determining factor for both departments. This study provides an overview of how important it is to teach environmental education content in the lecture process. In addition, the results of this study provide an overview of student environmental behavior that occurs based on programs or policies produced by Syiah Kuala University. This description can be used as a guide and basis for other universities including environmental content through campus programs to improve student environmental behavior.

### 5.2. The engagement of waste management environment

To investigate the potential factors that determine individual engagement in environmental behavior, experts have created hypotheses based on the theory of planned behavior (Janmaimool and Denpaiboon, 2016). Generally, the results on environmental implications in waste management are in line with previous studies (Bian et al., 2019). Based on the data reported, there are differences between social and science departments in respondents that are the subject of environmental engagement, especially in waste management (Figure 1). Furthermore, science students are more responsive to environmental engagement than social departments (Figure 1). This is due to several things including waste-free movement and environmental conservation activities, as well as the demands of disaster and education lectures. Based on the data collected, it turns out that students majoring in science are more involved in the free waste movement implemented by Syiah Kuala University. Many of them volunteered for the waste bank program. Therefore, they actively participated in waste management organized by the Syiah Kuala University environment. Activities or programs from the campus allow students to participate in various environmental conservation programs. The involvement of students and other stakeholders can form a framework to facilitate changes in environmental values, attitudes, and habits so that there will be meaningful changes in environmental behavior (Cleverdon et al., 2017; Yusuf et al., 2022). The theory of planned behavior is often used in determining individual involvement in waste management behavior (Janmaimool and Denpaiboon, 2016; Safa and Mohammadian Saghinsara, 2020). The students showed a positive attitude when engaged in environmental conservation activities by evaluating the results of their respective behaviors (Ajzen, 1991; Han et al., 2010; Haridhi et al., 2021). They are consistent with the theory of planned behavior in predicting a person's intentions and attitude (Han et al., 2010). This theory explains environmental behavior and engagement (Yadav and Pathak, 2016). It has been applied to subjects such as green hotels and restorers (Han et al., 2010), energy-saving products (Tan et al., 2018), management engagement in the campus environment (Brugmann et al., 2019; Heidari et al., 2018) and predicts recycling behavior (Largo-Wight et al., 2012).

Environmental engagement is becoming increasingly important to be conducted by the community for sustainable development. Based on the results, it was stated that Syiah Kuala University students had good environmental engagement outside the campus from various existing communities. This preservation activity also exists on the campus which was built and formed because of volunteerism regarding concerns about bad environmental conditions. Both social and science students have almost the same level of engagement in independent programs in



environmental preservation both on and off-campus. This is evidenced by the results on independent programs from the community both inside and outside the campus (Figure 1). Therefore, the engagement level of Syiah Kuala University students in terms of environmental preservation, especially waste management, is high. This is consistent with the study conducted, where the environmental engagement is determined by the student participation level (Figueredo and Tsarenko, 2019) of the community (Garnett and Cooper, 2014) towards activities or programs (Brugmann et al., 2019). On the contrary, it was stated that clean environmental management requires awareness and participation from the community and students (Tian and Robertson, 2019). Awareness and participation are divided into two things, starting from living cleanly and not littering (Kiessling et al., 2017). Furthermore, they are also needed in the form of being involved in cleaning up the surrounding environment (Charnley and Engelbert, 2005). Furthermore, several previous studies reported a positive relationship between community norms and individual engagement in waste management (Bamberg et al., 2003; Fornara et al., 2011; Matthies et al., 2012).

Furthermore, the level of environmental engagement in waste management is also caused by the educational content taught. The Syiah Kuala University campus has an educational program that is set out in compulsory courses for all undergraduates. Disaster and environmental education courses cause students to be involved in environmental conservation. Engagement is expressed in the form of lecture assignments from the material taught. One of the lecture materials taught is flood disasters in urban areas. In the material content, the task of lecturing is to identify the factors causing flooding in Banda Aceh city. It was discovered that garbage dumped carelessly was one of the strongest factors causing the flooding in Banda Aceh, where Syiah Kuala University was founded. Therefore, the reporting disclosed by students causes them to be involved in socialization and participation in proper and correct waste management. Based on the results which stated that the level of student engagement conducted through lecture assignments is very supportive (Cubillos, 2020). Following the theory of planned behavior, there is a positive and significant relationship between environmental knowledge gained during lectures and environmental behavior and involvement in waste management (Amoah and Addoah, 2020; Janmaimool and Denpaiboon, 2016). It also showed that the socialization and participation factors were conducted to create awareness of the importance of protecting and preserving the environment (Ntanos and Kyriakopoulos, 2018). Furthermore, the results became the capital for community participation in proper and correct waste management (Gilal and Chaana, 2019).

### 5.3. Waste management on environmental knowledge

It is generally accepted that environmental education influences knowledge, especially among university students. Their educational intensity greatly affects environmental knowledge (Schmitz and Rocha, 2018). Environmental knowledge and awareness are important issues for teachers, students, and parents in solving environmental problems (Legault and Pelletier, 2000; Strong, 1998). Having sufficient knowledge, such as clear instructions given in communication and collection campaigns, can increase the likelihood of recycling behavior (Welfens et al., 2016). Based on these results, there are differences in environmental knowledge in waste management between students majoring in social and science  $p < 0,05$  (Table 7). Science students have more knowledge than social science departments (Figure 1).

Environmental knowledge of science students is more conceptual as taught in natural science learning. In comparison, the environmental knowledge possessed by social science students is more practical knowledge of the environment, such as knowledge of maintaining and preserving the surrounding environment. The research results state that science students knowledge who take compulsory science courses significantly influence students' environmental knowledge (El et al., 2019; Gokmenogle et al., 2011). Meanwhile, for social science students,

environmental knowledge in the form of practical knowledge they get from daily experience in a community environment naturally encourages physical activity to protect the environment (Kuruppuarachchi et al., 2021), and the material taught is related to sociology and the environment (Porcelli and Besek, 2021). A study states that environmental knowledge is highly correlated with attitudes and responsibilities when students are involved in outdoor activities (Teksoz and Sahin, 2012).

Furthermore, it is also obtained from activities or programs in the form of a garbage-free movement in the campus environment which is socialized by a special team. Environmental knowledge refers to an individual's knowledge of the environment (Diamantopoulou et al., 2003). Like environmental concerns, environmental knowledge relates to general knowledge about the environment and not specific knowledge about green products or their environmental impact. The theory of planned behavior in a study revealed a positive and significant relationship between environmental knowledge and adolescent environmental behavior in purchasing green products (Amoako and Dzogbenuku, 2019; Moon et al., 2019). Environmental knowledge is an important factor in behaving responsibly towards waste management (Sun et al., 2018). The theory of planned behavior showed that environmental knowledge has a positive effect on perceptions and behaviors of green products to save waste (Tan et al., 2018).

During the learning process, courses in disasters and environmental education impart knowledge about disasters and the environment. In particular, this course teaches about environmental preservation as an effort in sustainable development. Also, the proposed educational program can significantly improve students' knowledge of proper environmental management. This is consistent with the study which stated that educational programs taught in schools and colleges about the environment can make a significant contribution for teachers and students (Gomera et al., 2018). Similarly, it is also stated that environmental education is important to ensure students have the necessary knowledge and a positive attitude towards waste management (Bakri et al., 2017). Another study has reported that the environmental knowledge of college students has a positive influence on pro-environmental intentions and behavior in their waste management (Liu et al., 2020). The attitude and behavior of a person are directly proportional in association with TPB. This relationship increases the possibility of others imitating the behavior (Yadav and Pathak, 2016). Others have shown that environmental knowledge influences the intention to buy friendly products (Amoako and Dzogbenuku, 2019).

Furthermore, environmental knowledge on waste management in Syiah Kuala University students is obtained from other programs and activities at the university. The waste-free movement has a positive effect in terms of environmental preservation. This movement was accompanied by socialization on proper waste management. Each student that receives the Bidik Misi Scholarship is required to live in a dormitory for 1 year as a form of campus concern for those with less economic needs. During their stay, they are educated to form characters of loving the country, religion, and also clean living with proper and correct waste management. Activities in the dormitory cause them to have good and correct environmental knowledge, especially in terms of waste management. This is in line with the study which reported that off-campus activities such as extracurricular events can form a high sense of environmental awareness (Tanu and Parker, 2018). In contrast, it was also reported that socialization activities had a significant impact on both the community and students (Jain and Pant, 2010).

Generally, there are differences in environmental management between students majoring in the social and science departments. This is based on three variables ranging from behavior, engagement, and environmental knowledge. In addition, social students have a higher level of environmental behavior in terms of management than science. Regarding environmental engagement in waste management, science students have a higher level. This difference is also felt in the environmental knowledge variable, where students majoring in science have a higher level, especially in terms of waste management than those in social.

**Table 7.** Tests of between-subjects effects.

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Departments	Environmental Behavior	,680	1	,680	5,026	,026	,018
	Environmental Engagement	1,075	1	1,075	6,755	,010	,024
	Environmental Knowledge	3,967	1	3,967	25,850	,000	,085
Error	Environmental Behavior	37,504	277	,135			
	Environmental Engagement	44,068	277	,159			
	Environmental Knowledge	42,509	277	,153			

## 6. Contribution and implications

This study also contributes to the literature on waste management in higher education which is influenced by three variables, namely environmental behavior, engagement, and knowledge. This is unique because it classifies and compares the opinions of two teaching programs in universities with various majors (Social and Science) in turn, this can help educational leaders to create and identify programs and policies for future waste management in depth. Campus programs and policies that are based on these results can provide an initial understanding for all education levels. Therefore, educational institutions at all levels can strive to provide education on environmental preservation with various policies and programs. This should be conducted in support of an environment that is zero waste as a form of sustainable development.

In addition, further studies should be conducted in analyzing and exploring waste management as seen by policymakers or programs on campus. Therefore, it can provide a comprehensive overview of the implementation of programs and policies that support waste management. This study only focuses on waste management in association with three specific variables for students.

## 7. Conclusion

This is one of the first studies to explore the effects of environmental behavior, engagement, and knowledge on joint waste management at the University of Indonesia with campus programs and policies. To fulfill the primary aims, it can be carried out as follow. First, it describes the environmental behavior, engagement, and knowledge of students majoring in social and sciences, which affect waste management at Syiah Kuala University. Second, it explains the differences in environmental behavior, engagement, and knowledge about waste management with campus programs and policies.

The results showed that social students played a role and had a good level of environmental behavior in terms of waste management compared to the sciences. However, for the science group, the level of engagement and environmental knowledge was higher than social. Furthermore, this study stated that the factors causing the high engagement of science students were due to their high level of engagement in the waste management program initiated by the campus. This level was higher in the Syiah Kuala University Waste Bank program as volunteers in preserving a garbage-free environment. The high level for science students was caused by the content of the majors that has a relationship with the environment. Therefore, students majoring in science get more environmental knowledge as well as being obtained in the Syiah Kuala University Waste Bank program such as socialization. Also, the environmental behavior of social science students is caused by the interactions they have. The material content obtained causes them to have a greater level of environmental behavior than social science even though the level of magnitude is not too high. In addition, disaster education courses make a major contribution to the behavior, engagement, and knowledge of students in both social and science departments.

## 8. Research limitation

This study analyzed 279 student questionnaires from a total population of 949 from Syiah Kuala University, Indonesia. This is limited to the social and political faculties (for example, government science, political science, communication science, and sociology) and the mathematics and natural sciences (e.g. biology, physics, chemistry, mathematics, statistics, pharmacy, and informatics) at Syiah Kuala University. Furthermore, the undergraduates are required to take general courses in disaster and environmental education. Therefore, data collection in each existing department can lead to differences in subjects taught even though the students are expected to take general courses on disaster and environmental education.

### Declarations

#### Author contribution statement

Rusli Yusuf: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Iwan Fajri: Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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#### Data availability statement

Data included in article/supplementary material/referenced in article.

#### Declaration of interests statement

The authors declare no conflict of interest.

#### Additional information

No additional information is available for this paper.

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