Applying social media to environmental education: Is it more impactful than traditional media?

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Design/methodology/approach: This is a qualitative study based on a semi-structured interview with student participants. The questions used in the interview were developed by on the Integrated Waste Reduction Model by Nishio and Takeuchi (2005) and the enhanced model proposed by Ho *et al.* (2018).

Purpose: This study explored how social media help promote environmental education and pro-environmental behaviours by analysing (i) how young adults access social media and traditional media to obtain environmental information differently, (ii) how environmental ideas are disseminated through social media, and (iii) how people perceive and realise environmentalism.

Findings: Our results indicate that young adults agree and accept that living environmentally friendly lifestyles is an important goal. Although they acquire environmental information from social media, they seldom share or interact with those social media posts. This behaviour implies that they are information receivers when dealing with such contents.

Originality/value: The finding of this study provides insight for stakeholders on how to promote related knowledge and encourage people to be "greener" more often and construct a friendlier atmosphere for fostering more in-depth environmental discussions on social media.

Keywords: Environmental education; environmentally friendly behaviours; social media; social media strategy; social network; recycling; waste management

Introduction

Recent mercurial climate changes have evoked many stakeholders' and environmental organisations' consciousness of environmental issues and sustainable development (Binder and Blankenberg, 2017; Nguyen *et al.*, 2016). The urgent appeal to awaken the public's awareness of environmental education and protection is thus essential as well

(Hamid *et al.*, 2017). Moreover, a fundamental method to foster environmentally friendly behaviours is by sharing sufficient information to the public (Nguyen *et al.*, 2016).

When considering message deliverers in the modern age, social media provide channels to disseminate information (Ellison and Boyd, 2013). Social media platforms have a growing number of users, especially in young generations, and those activities online have occupied a part of their daily lives and hence are valuable to analyse (Andersson and Öhman, 2017). Therefore, we conjecture that social media are robust channels on sharing environmental knowledge and promote eco-friendly lifestyles to youngsters (Ho *et al.*, 2019).

Previous literature provides fruitful findings of how traditional mass media might bring their influence into play and enlighten people to live "greener" lifestyles (for example, Ho and So (2017) and Nishio and Takeuchi (2005)). However, how social media affect the public's perceptions of environmentalism and eco-friendly lifestyles is hampered by the scarcity of related studies (Andersson and Öhman, 2017; Hamid *et al*., 2017; Ho *et al.*, 2018). Consequently, the research gap is the effectiveness of utilizing social media as platforms to promote the concepts and the habits of green living and hence raise university students' awareness of environmental education and protection, from a holistic perspective (Ardoin *et al.*, 2013).

The findings of this research are precious to the following stakeholders:

Research participants: When answering the interview questions, students may recall their personal environmentally friendly behaviours and practices, social media interactions, particularly those environmental-related, garbage handling, and environmental protection.

Practitioners in the fields of environmental education and protection: The research provides practical feedback on how information related to the environments

disseminate to university members and the public through social media, indicating practical suggestions of how social media strategies can be adopted for conveying information and knowledge pertinent to environmental protection, sustainable development, and green living.

Social media developers: Developers and software engineers of social media can accordingly improve their social media platforms to offer a better user experience of information sharing based on the feedback from users.

The study emphasises on arousing the awareness of environmental education through students and universities by publicizing those ideas and knowledge properly through social media. The study firstly reviews several studies in the related research fields and constructs our research framework based on previous studies (Ho et al., 2018). We focus on environmental participation, green living, waste management, recycling, and reduction. We want to investigate how social media, traditional media, and a person's social network impact on one's understanding and habits of the above topics by analysing our participants' perceptions and habits of these topics. To sum up, we are interested in the following four research questions (RQs):

RQ1: What are students' reactions to accessing social media and traditional mass media, particularly on environmental-related issues and green living topics

RQ2: How do students utilise social media as channels to advocate and popularise environmental education and environmentalism?

RQ3: What are students' practices and perceptions of environmentally friendly lifestyles?

RQ4: How do social media and social networks direct students' attitudes and behaviours?

Literature review

Traditional media and social media as information sources

Nowadays, traditional mass media publishers can easily update news, articles, broadcasts, television programs on websites, social media pages, or mobile apps synchronously, while at the same time keep using their original channels and forms to contact with a bigger audience, which researchers (Jurin *et al.*, 2010; Lin, 2013; Potter, 2013) call this phenomenon the "convergence" of different media.

Although the boundary between traditional mass media and other new media is somehow ambiguous these days, mass media should not be defined only by their particular channels (Potter 2013). Whether publishers are systematic organisations that adopt regular customs to convey the information, or whether the audience is widespread are not decisive parameters. This study adopts the term "traditional media" to indicate those media disseminate in their existing channels other than social media. For instance, browsing news through Websites or apps is reckoned as a practice of using traditional media; on the contrary, skimming over news posted on social media timeline by some publishers is regarded as using social media.

Different from traditional media, social media disseminate information otherwise. Carr and Hayes (2015) defined social media as "Internet-based channels that allow users to interact opportunistically and selectively self-present, either in real-time or asynchronously, with both broad and narrow audiences who derive value from user-generated content and the perception of interaction with others" (p. 50). There are some common features on social media platforms, such as profile pages, friends/followers lists, and information sharing through social networks (Craig, 2019; Ellison and Boyd, 2013). It is the existence of social networks that make social network sites different from traditional media such as television or radio (Ellison and Boyd, 2013).

However, it is challenging to conceptualize social media precisely (Ellison and Boyd, 2013) because the features of social media are innovating continuously and rapidly (Carr and Hayes, 2015; Hogan and Quan-Haase, 2010). Thus, we generally hold that social media are platforms in the form of mobile apps and Websites (viz social network sites, SNSs) that proffer services which users can (1) post and share texts, images, and videos; (2) browse other users' posts in one's social media timeline; (3) leave comments, emojis, or GIFs beneath the posts; and (4) press "Likes" or some similar functions.

Regarding information shared on social media, there is a growing body of literature remark that social media are composed of user-generated content (UGC), particularly in the fields of social media marketing (Morra *et al.*, 2018; Smith *et al.*, 2012). User-generated contents are diverse information in the form of texts, blogs, images, and videos (what people generally use the buzzword "posts" in the context of social media) produced or composed and shared on social media (Ellison and Boyd, 2013; Kaplan and Haenlein, 2010). Such contents are likely to influence other users' views (Smith *et al.*, 2012). Moreover, user-generated content is another trait that makes social media and traditional media distinct (Terry, 2009).

In the same vein, value co-creation (VCC) initially refers to the collaboration of values by sellers, customers, and other stakeholders, in the fields of business marketing (Alves *et al.*, 2016; Paredes *et al.*, 2014; Ranjan and Read, 2016). In the context of social media marketing, the inherent affordances of social media hence become the proper "hothouses" where information is integrated, and value co-creation thus proceeds (Carlson et al., 2019; Costanza, 2017; Dolan et al., 2019; See-To and Ho, 2014; Singaraju *et al.*, 2016; Sorensen *et al.*, 2017) with those user-generated contents. These studies offer precious empirical applications of social media strategies to foster value co-creation by social media users with multiple intensives and motivations.

Motivations and influences of social media

With the development of mobile technology that decreases the barriers of communication, the yearning for connecting, interacting, and socialising with others sparks people's motivations to employ social media (Ellison and Boyd, 2013). Scholars categorised that people use social media for interacting with others, expressing comments, sharing and seeking for information, keeping renewing other friends' recent status, merely looking for amusement and recreation, or even as peer pressure (Leiner *et al.*, 2018; Quan-Haase and Young, 2010; Whiting & Williams, 2013). Hassan *et al.* (2018) categorised social media users into five types, including creators, critics, collectors, joiners, and spectators, which build up a social media ecology to understand better the essential incentives of using social media.

From the perspective of information diffusion, Rogers (2003) suggested that people who share a similar social network or values are more likely to communicate ideas and had a more substantial influence in convincing their fellows to change their behaviours or attitudes. Indeed, prior empirical research (for example, Carpenter and Amaravadi (2019), Choudhary *et al.* (2019) and Majid *et al.* (2019)) showed that social media contents made by social media "friends" or fan pages are potentially affected other individuals' perceptions, behaviours, and norms. Also, Warner-Søderholm *et al.* (2018) argued that a social media user with many followers would have more influence on other users. Especially when that person reveals or updates information very often, it tends to shape a convincing impression to others. They further indicated that young adults under twenty, females, frequent social media users, Instagram and LinkedIn users are likely to believe what others posted or shared on social media is plausible compared with other users.

Further, we can observe the effectiveness of a social media post through some quantitative dimensions. Prior studies (for example, Hassan *et al.* (2018) and Rossmann *et al.* (2016)) suggested that the number of posts, likes, shares, followers, and comments would have an impact on other users. On the other hand, concerning the contents posted on social media, some kinds of posts are not popular when compared with some interesting contents; while at the same time, social media users are likely to post some positive contents on social media to shape their image on Cyberspace (Jeong *et al.*, 2019; Pham *et al.*, 2019).

Motivations and obstacles of green living and environmentally friendly lifestyles

"Pro-environmental behaviours" is a buzzword that broadly means people's all kinds of contribution to being eco-friendly (Kaida and Kaida, 2016). A person's environmentally friendly behaviours might be developed based on one's viewpoints, his or her family and friends' attitudes, and the level of environmental education that the person had received (Prabawa-Sear and Baudains, 2011; Taylor and Todd, 1995). Scholars believe that people's biospheric values are effective in stimulating one's subjective norms to engage more frequently and actively in environmentally friendly behaviours (Nguyen *et al.*, 2016; van der Werff *et al.*, 2013; Ünal *et al.*, 2018). Celebrity marketing in promoting environmentalism is as well as a popular strategy to attract people's attention (Craig, 2009). Furthermore, the perceived advantages of living an eco-friendly lifestyle is a decisive motivation that is highly influenced by the type of conceived information (Nanggong and Rahmatia, 2019; Stern, 2000).

People who engage in environmentally friendly behaviours have stronger inner well-being to do so, whereas there might exist a grey area between people's perceptions and their actual performance (Binder and Blankenberg, 2017; Tsarenko *et al.*, 2013). Also, people tend to connect the green living with higher time or monetary cost involved

(Nishio and Takeuchi, 2005; Stern, 2000), which might construct a potential barrier to lower people's willingness to lead an environmentally friendlier lifestyle. Lastly, insufficient information on environmental friendliness is another hurdle of living a greener life since people have no idea what and how to do (Hynes and Wilson, 2016).

For stakeholders and policymakers, it is decisive to arrange projects efficiently to provide environmental information, knowledge, and appeals to the public (Jurin *et al.*, 2010). It is because biased perceptions between environmental organisations and their target audience may be developed if the channels of communication are not built deliberately (Godfrey and Feng, 2017).

Traditional media and environmental issues

Nishio and Takeuchi (2005) design the Integrated Waste Reduction Model to explore the parameters that influence Japanese people's perceptions of domestic waste management and practices of recycling, indicating that traditional mass media is one of the variables that could encourage people to engage in recycling or affect people's attitudes towards environmental issues. Likewise, Ho and So (2017) adapt the Integrated Waste Reduction Model by Nishio and Takeuchi (2005) to investigate undergraduate students in Guam to realize how traditional media, people's beliefs, cultures, and multiple dimensions related to recycling, waste management, and environmental issues affect each other. Their results show that stakeholders should employ media as channels to promote the advantages of environmentally friendly lifestyles towards the public to decrease people's concerns about the increasing costs under living "greenly." Further, they believe that a person's eco-friendly behaviours may be affected by one's social network, especially those people who are essential to that person.

Concerning the contents, Craig (2019) argues that media that promote environmental lifestyle lay stress on giving suggestions to the environments and making

efforts to foster sustainable development. He further articulates how different sorts of media disseminating environmental issues in their unique fashions by analysing the characteristics of newspapers, advertisements, television programs, and social media with several real-world cases.

Social media for environmental education

Social media can be powerful instruments to disseminate information and knowledge about living an environmentally friendly lifestyle and achieving sustainable development. However, there is limited research in this field (Hamid *et al.*, 2017). A social media profile would possibly shape one's public impression on cyberspace, and thus peer pressure and self-esteem may be incentives to stimulate one's social network to involve in pro-environmental activities (Hynes and Wilson, 2016; Tsarenko *et al.*, 2013). However, to our disappointment, Hynes and Wilson (2016) found that social media are not powerful enough to change people's perceptions of environmentally friendly food, indicating that information or instructions of environmentally friendly food and environmentally friendly behaviours are not provided correctly or being understood well.

In high schools and universities, sustainable and environmental education has been integrated with forms of workshops or special programs, and some of them had gained a great success (Dmochowski *et al.*, 2016; Hamid *et al.*, 2017; Prabawa-Sear and Baudains, 2011). Some studies also discovered that young people are now using social media as a platform to discuss environmental and sustainability issues (Andersson and Öhman, 2017).

Research gaps

To sum up, prior research suggests that social media and traditional media can both be a suitable media to disseminate environmentally friendly information to the community.

However, scant research has been performed to gain a better understanding on whether the social media would be a better media to approach the younger generation which is more familiar with the technology and social media. Therefore, in this study, we explored how social media help promote environmental education and pro-environmental behaviours by analysing (i) how young adults access social media and traditional media to obtain environmental information differently, (ii) how environmental ideas are disseminated through social media, and (iii) how people perceive and realise environmentalism. In this study, we aim at broadening the scope of environmental education in a daily context. We emphasize that information on social media is mainly generated collaboratively by the users, viz the UGC (Morra *et al.*, 2018), where VCC is being developed (Carlson *et al.*, 2019; Costanza, 2017), instead of literally "learning" particular materials. Thus students can acquire practical environmental knowledge from those user-generated content when using social media.

Methodology

Framework construction

Based on the fruitful empirical results proffered by the Integrated Waste Reduction Model by Nishio and Takeuchi (2005), the framework has been adapted in some prior studies (Ho and So, 2017; Ho *et al.*, 2018). Ho *et al.* (2018) adapted their research model by adding some other parameters by presenting several rationales to comprise social media in the model as essential parameters:

(1) The affordances of social media are inherently capable of propagating the significance and practical measures of green living, waste management, and recycling to more people through users' online participation.

(2) The diffusion and repercussions of social media are unique and remarkably dissimilar to traditional mass media.

(3) The rival relationship between traditional media and social media is becoming more competitive these days.

Based on the finding from prior literature, we noted that user-generated contents, value co-creation, and those common operational features are all peculiar traits of social media and can address the first two issues. For the third issue, we specify that the "convergence" of media (Jurin *et al.*, 2010; Lin, 2013; Potter, 2013) is precisely a concrete example. Consequently, similar to the prior literature, Ho *et al.* (2018) hypothesised that social media are adequate platforms to foster, to guide, and to transfer users' cognizance, comportment, and customs of environmentalism.

Dimensions of the interview questions based on the theoretical framework

In this study, we adopted the theoretical framework of Ho *et al.* (2018) into our qualitative research to illustrate how people receive, deliver, and transmit the news, information, ideas, and knowledge related to environmentalism, waste management, and recycling through traditional mass media and social media. In particular, we would explore "how" and "why" that previous quantitative research could not adequately provide, especially in the context of university students. Different from prior research (Nishio and Takeuchi, 2005; Ho and So, 2017), we attempt to explore whether social media can be the "hothouses" for promoting and sharing environmentalism by realizing students' perceptions in different dimensions and perspectives. Our interview questionnaire involved 16 themes, with 51 questions (see Appendix A). For the specific context in this study, we had increased and modified several questions about the relationship between social media and these dimensions in each part.

Data collection and analysis

The participants we recruited in our study are ten young adults in Hong Kong, including five undergraduate students and five postgraduate students aged between 21 and 27, with their average age 23 years old. Among the ten participants, two are male, and eight are female.

Before the interview started, the researchers had briefly introduced the exemplars of traditional media and social media, reminding the participants that those common apps people use daily such as WhatsApp, are not in the range of social media but short message service (SMS), short message service (Carr and Hayes, 2015). The total interview length was scheduled for 60 minutes, but most of the interviews finished within 35 minutes. The interviews were proceeding in semi-structured to understand the subjects' perceptions of our topics in-depth.

Based on the above literature review, we arrived at a set of theoretical dimensions and second-order themes that served as the initial theoretical lens for data analysis. Altogether, we developed five theoretical dimensions and 16 second-order themes (see Table 1). We coded our data using a mix of open, axial, and selective coding (Strauss and Corbin, 1998). Next, we distil the data collected using the selective coding and list out the first-order concepts, which we classified according to the appropriate themes and dimensions (Dacin *et al.*, 2010). The findings through the interviews then presented based on the 16 themes.

Findings

Traditional media contact (MC)

No participants regarded traditional media as their primary sources of information or environmentalism, except they still utilized traditional media to access to environmental-

related contents through TV programs. A participant felt that watching TV was more relaxing compared with other traditional media. Notably, some participants mentioned that documentary films were the most attractive environmental media for them to get information about the environments. One of them believed that documentaries were more convincing compared with other kinds of media. In other words, those environmental TV channels were regarded as authoritative and reliable sources.

Most of them did not use pamphlets to obtain environmental information. While there are still some placards "posted around the road towards work and school in billboards or bus commercials or (subway) commercials, it is a bit sarcastic to send those printed papers to promote eco-friendly lifestyles." All of them showed interest in environmental exhibitions. One of the reasons was "the environment is a fascinating topic for us nowadays when we see the environment being trashed and rising amount of extreme climates, now affecting our lives, understanding our environment might help ease the issues." Besides, some participants mentioned that they would pay attention to environmental-related booths if there were something novel or artistic, such as environmental photographs.

Social media contact (SMC)

All participants regarded social media as their primary source of average information as well as environmental issues. The daily total using time depended on their timetable of a day, but often over 2 hours in most of the cases. High frequency of usage, convenience, and accessibility were the reasons why social media were their primary sources of information. A participant also mentioned that one could enjoy a higher updating speed and a batch of related, in-depth reports through other web links at the same time on social media.

Generally, each genre on social media has its fans. For example, four participants were article lovers fond of environmental videos or short clips. In particular, a few participants indicated that environmental documentaries would attract them the most. As for the contents related to the environment, a participant said that she would like to know "how the trash that humans made pollute the oceans some statistic stating how severe the air pollution is that affect people's health." Another said that she followed some fan pages about forest ecology and protection, and "animal rescues" knowledge.

Some of the participants often browsed the posts about environmental issues published by environmental organisations. They pressed the "Like" button depending on the content, topics, and personal interest, but they seldom shared the posts to others. Besides, four of them were following some fan pages about environmental education. The data showed that the participants did not interact much (e.g., press "Likes") with those environmental posts.

Value co-creation - Behavioural alignment (BA)

A participant thought that the essence of social media is "to see other people's lifestyles, which sometimes motivates me to try other things that I have not done, and to do things that I always want to improve but do not have enough motivation before." Another participant answered that "social media is a window for me to know what is going on in the world to understand different human behaviours online. Social media platforms are a way for me to stay connected to friends who live in other continents and even meet new friends." Besides, a participant used social media to observe and realise whether his friends were doing well or not.

Most people felt a huge change in daily life if they stop using any social media. Apart from disconnection with friends, they mentioned it is "the main sources of my

information," "I would miss information posted by others if I were offline," and "my social life heavily relies on social media instead of real-life meet-ups."

Value co-creation - Empowerment and control (EC)

Most participants claimed they are reasonable when using social media. Half of the participants said the number of likes of a post would influence their perceptions of it. A subject argued that the number of likes might represent the "quality" of a post, while some participants mentioned the number of likes would relate to their curiosity about the site. On the contrary, the other half of the participants claimed they did not care about the number of likes. They would prefer to skim over the content of a post directly.

The participants had different opinions on the influence of the comments on them. Some interviewees said they were sensible, and they had enough judgment when glancing around those comments. One participant said she preferred being an onlooker to see how others perceive the original post, and other participants noted reading those comments could sway their original opinions in some ways.

Environmental involvement (EI)

Among different environmental protection activities or customs, the participants indicated that they did recycling (bottles, clothes, papers, etc.) the most. Some other responses were saving water and electricity, carrying their tumbler, and using eco-friendly products. Some of them had found practical tips on how to "live an eco-friendly lifestyle" through social media, such as short videos. However, most of the participants would not consider the production process of goods before their purchase decision because they often needed the products right away.

The participants showed interest in diverse environmental issues: three mentioned the seriousness of marine pollutions and debris; other responses included the problem of

air and water quality, batteries contamination, food safety, forest fire, and plastic products. Besides, social media did impact their recognition of these environmental topics. One felt that "social media enhance the terror of these issues spreading out even more vicious than before." However, only one participant could correctly name the 3Rs, i.e., reuse, reduce, and recycle (Dijkers, 2019).

Perceived cost (PC)

Generally speaking, thought that it could be a bit humdrum, all participants agreed on making efforts to arrange garbage. Some said that it is essential to do so to prevent pollution, and it would not cost a lot. All the participants did not acquire much information about how to decrease the cost of waste management from social media.

Perceived benefit (PB)

All participants believed that handling refuse properly would help solve waste problems. Because at least, the waste would not be scattered, making the surroundings more sanitary. Besides, they believe that people could enjoy a higher-quality life through such behaviours. One participant argued that the noxious pollution produced or emitted by the waste or the waste would decrease accordingly, and thus restore the ecosystem, leading to sustainable development. Another participant expressed optimism on this issue and argued that people could preserve the environment by changing some harmful habits. Seven participants thought flinging into waste management was connected with the household budget, mainly because people would rethink if such products had demand after processing the waste. There were different opinions on whether social media could disseminate the advantages of living a better, healthier life, and managing household budgets.

Rule acceptability (RA)

Our participants perceived different extents on the convenience of recycling since it depends on the recycling system of a place. Some of their apartments did not equip with recycling support because of no related regulations, and thus it was inconvenient for them to do recycling. On the contrary, some expressed that recycling support at some public places was reasonably handy. While the participants would generally like to have municipal waste management policies and guidelines, most of them would search for Websites online. Only half of the participants had the habit of cleaning up household waste daily, but none of them would post or share this kind of practice with others on social media.

Subjective norm (SN)

Family's attitude towards rubbish disposal might depend on the neighbourhood's waste management regulations since some of their places did not have to do recycling compulsorily. Most participants reflected that their family members cared about waste management as their day-to-day routine. However, all the participants did not know much about how their neighbourhood perceive waste arrangement, but they noticed the waste collection area in their neighbourhood was quite orderly in most cases. Likewise, most of them did not know about their friends' attitudes towards waste management or recycling. Among their friends and acquaintances, some participants would occasionally share or write posts about environmental and sustainable policies, such as the promotion of using fewer plastic products. However, our participants did not see these posts regularly, and they chose to press likes or leave comments depending on the contents of the posts. In general, they would skim those environmental posts willingly.

Attitude towards waste reduction (ATT)

All participants were supportive of waste management, while some argued that stakeholders should make more efforts to promote the importance and demonstrating the actual practices of waste disposal. Such policies would affect how people deal with the trash of a place after all. Seven participants had seen some social media posts related to voluntary environmental protection events, and five among them had joined voluntary beach or park clean-ups, while only one of them had participated in a clean-up event launched on social media. One said that it was peer pressure to make her a clean-up volunteer. Unfortunately, most participants had not advertised or promulgated the significance of environmental education and rubbish arrangement on personal social media news feeds, and only two of them shared it from time to time. Six participants had searched the keyword "waste management" online, i.e., through search engines such as Google, but not through any social media platforms.

Recycling (R)

According to our participants, the disposable products they consumed included plastic/paper straws and cups, plastic bags and tableware, and paper pack beverage, even though they knew that they had better not use these products. They generally encountered social media proffering some ideas to decrease disposable products to some extent. On the other hand, when it came to the practices to manage garbage, they recycled recyclable waste by categories, such as plastic bottles, batteries, cans, paper, carton, and clothes. In specific, some of them had containers for holding recyclable waste in their place before dumping them away. Moreover, they also got knowledge from traditional media such as posters and local websites, as well as from family members and schools.

Reducing household waste (RHW)

Eight participants claimed that they would not purchase over-packaged goods according to their observations. One said that it would feel a "sense of guilt" when buying those over-packaged commodities. They would look for other substitutes in simpler packages. None of them acquired such information about packaging quality from social media.

Green perceived behavioural control (PBC)

All participants regarded environmental protection and green living as an important business, and they would try their best to protect the environment and live "greenly." Some of them thought that people should act immediately rather than keep saying hollow slogans. As mentioned, even though they seldom shared the practices on social media, they embraced some methods to live eco-friendlier, such as avoid using disposable and plastic products and bring their bags for shopping.

Two participants had joined environmental organizations/communities before. Some respondents did know friends who were very environmentally conscious or regarded themselves as environmentalists. A participant knew one of her friends launched a challenge to decrease the amount of garbage made in a week, uploaded the process on social media in forms of videos, and passed the challenge to other friends. Another participant's mother is an environmentalist who would share those environmental hints and knowledge with her social media friends through social media.

Environmental behavioural beliefs (BB)

Generally, all the participants expressed that living an eco-friendly lifestyle was associated with being a better person because society is making significant efforts to protect our environments. Besides, they believed green living would lead to a healthier life, since the quality of air and water might improve accordingly, food would be less

polluted, and the marine eco-system would be cleaner. One said that being environmentally friendly could be "healthier both mentally as we know we are helping the environment and physically as the environment quality gets better." Besides, many believed that being eco-friendly would help improve the environment indeed.

However, a respondent argued that green living could still consume much junk food and sport less. Furthermore, the respondents seldom shared their green lifestyles to others on social media as they were more information receivers or onlookers when using social media.

Motivators (MOT)

Most of the participants believed the motivation of living an environmentally friendly lifestyle could protect our planet. Some others regarded engaging in pro-environmental behaviours as a part of self-realisation because it could make them pleased and satisfied. Only one respondent did so for reducing expenditure.

Barrier (BAR)

Many participants considered the main difficulty of green living was insufficient information: the lack of practical knowledge and practices of what and how to do hindered people's willingness to live eco-friendly. Besides, time and monetary costs involved were other obstructions. A participant thought that "there are so many other distractions and temptations just to consume more to live comfortably," and that "all the consumptions around us are potential waste, but we still consume them since we have no other choices."

On the other hand, the respondents believed that social media could proffer functional information and knowledge to live a "greener" lifestyle. When some related posts appeared frequently and repeatedly, they would pay more attention to it, believe the content is correct and feasible, and thus change their behaviours into pro-environmental

ones. A respondent mentioned that social media was her primary information source, and thus she would understand the environmental situations through social media to evoke her awareness of environmental protection.

Nevertheless, a participant noted the two sides of social media, and she opined that social media "feed me information on how to be eco-friendly but at the same time give me plenty of temptations to live the opposite. However, social media, in the end, do affect my decisions in consumption, that is why people say PR and commercials are so important as they attract one into a world that tempts them to do whatever."

Discussion

Using social media as a channel to disseminate environmental and green messages

It is quite evident that our participants employ social media as their primary information source, including ideas and news related to environmentalism. With mobile devices such as smartphones, as mentioned, utilizing social media have become a mainstream channel of communication and occupied a significant proportion of urbanites' social lives (Ellison and Boyd, 2013). Users see social media as bridges to connect themselves to other netizens (whether they know each other in real life or not), platforms for social intercourse intrinsically (Ellison and Boyd, 2013; Leiner *et al.*, 2018), and even "necessities" in their daily lives. Moreover, some participants considered themselves merely onlookers on social media, while others were more active users, corresponding to the argument of Hassan *et al.* (2018) that there are different kinds of roles among social media users.

We believe that user-generated contents constitute social media where value co-creation is being proceeded (Morra *et al.*, 2018; Sorensen *et al.*, 2017). According to our participants, multimedia materials such as short videos and documentaries are attractive

genres to display environmental educational content. The number of likes of a post act on people's interest in it, but some people do not care about these figures. The influence of the number of likes that prior studies (e.g., Hassan *et al.*, 2018) see as an essential parameter should be further explored in the environmental protection context. Although the respondents claimed that they were rational on social media, some of them would be affected by the comments of the posts.

Although some participants did share environmentally friendly information on social media occasionally, the actual practices they did to proceed value co-creation in the context of environmental education and environmentalism were obscured in general. Our participants were seldom involved in related experiences or interacted with environmental-related posts directly on social media: they would instead take note of this kind of posts alone. It is worth understanding why people interact with this type of posts less. Pham *et al.* (2019) argued that not all types of posts would be favourable. The argument that whether environmental contents on social media are less "lovable" than other sorts of posts leads to the scarcity of interactions is ambiguous so far.

The above discussions do not rule out students using traditional mass media to gain information. Yet, the total frequency and length they spend on traditional media are much less than social media indeed. Students access environmental information and knowledge by skimming through handbills and placards posted in public spaces, and by watching television programs online or through physical televisions, especially documentary films proffered by authoritative media or television channels.

Influence of social media on practising environmentally lifestyle

The practices that our participants adopted for living environmentally lifestyles included performing the 3Rs, reuse, reduce, and recycle (Dijkers, 2019), conserving energy and natural resources, diminishing disposable products, and so forth. Our participants also

showed interest in diverse fields of environmental education and environmentalism. They valued waste management as essential customs as this helped preserve and improve the surroundings and the environments. Even though they were willing to do recycling, imperfect waste policies and recycling systems in different places led to inconvenience. These findings are supporting to the previous research (Ünal *et al.*, 2018) that a person's biospheric values would directly or indirectly advance the performance of pro-environmental behaviours.

Our participants did care about the posts related to environmental education and environmentalism, and they can see this kind of posts from environmental organisations or social media friends once in a while. Although they did not have many interactions with these posts frequently, "peer pressure" could be a passive motivation to engage students in pro-environmental behaviours (Hynes & Wilson, 2016; Tsarenko *et al.*, 2013), especially when they kept seeing pro-environmental contents regularly. According to our participants, when they were close to an environmentalist, they would possibly obtain more ideas about environmental education shared on social media. These findings further demonstrate that people who are in the same social circle influence one another easily, and thus can form a multi-puddle effect (Rogers, 2003).

Further, our participants would be happily and supportively to embrace pro-environmental habits after seeing those posts online out of the sense of fulfilment from protecting the environments. At the same time, in the context of environmentalism, they tend to be onlookers or message receivers to observe related information. Moreover, the lack of understanding of concrete measures may lead to students' bafflement about what practices they can do to be more eco-friendly (Binder and Blankenberg, 2017), even though it is believed that social media contents can raise people's awareness and thus advance their realization of green living.

Concluding remarks

In this study, we firstly define traditional media and social media, and further interpret the concepts in the fields of social media, social networks, environmental education, and environmental communication. The results of our qualitative interviews indicate that:

- Compared with traditional media, students utilise social media very often. Social media platforms are the primary platforms where students learn and obtain information and knowledge. Environmentalism is a popular theme of social media content.

- Social media are suitable platforms for practitioners and educators to propagandize and teach students and to raise their awareness and consciousness of the importance of environmentally friendly lifestyles and behaviours since environmental information can be spread widely through social networks.

- Even though not everyone would actively publish or share posts related to eco-friendly lifestyles on social media, most students regard living eco-friendly is a vital goal in their life, and they are willing to devote themselves to being environmentally friendly.

Therefore, because students might often be passive message receivers on related topics, we make the following suggestions.

- Besides university courses, seminars, and guidelines, educators, and environmentalists could make efforts to promote the significance of environmental protection and education by proffering adequate, attractive, and practical hints, instructions, materials, events, or competitions with and on social media to the public.

- Within university courses and massive open online course (MOOC) courses, curriculum developers and instructors could explore the use of social media to augment classroom activities and coursework.

- Environmental stakeholders, environmentalists, educators, and social media developers could build up more congenial environments or atmosphere on social media for people to apply user-generated content pleasantly and heartily without feeling embarrassed, and therefore value co-creation is being carried out more often.

- Social media users could be more active in taking actions to share environmental information and customs through online social networks, as well as other, more conventional interactions with family members and friends.

It is unavoidable that we have limitations in this study. Firstly, we do not have enough male subjects, and the qualitative results can merely represent the opinions of ten students. Therefore, we would suggest that a qualitative studies with more participants/interviewees should be conducted as one of the possible future research. Besides, there are no distinguishing characteristics between undergraduate and postgraduate students. As a consequence, we suggest that for future studies in the same vein, more diversified participants could be recruited, and researchers can analyse the data based on different demographic variables. Finally, we suggest that future research can focus on evaluating what kind of strategy can increase online discussions over environmentalism most efficiently.

References

Alves, H., C. Fernandes, and M. Raposo. 2016. "Value co-creation: Concept and Contexts of Application and Study." *Journal of Business Research* 69(5): 1626–1633.

Andersson, E., and J. Öhman. 2017. "Young People's Conversations about Environmental and Sustainability Issues in Social Media." *Environmental Education Research* 23(4): 465–485.

Ardoin, N.M., C. Clark, and E. Kelsey. 2013. "An Exploration of Future Trends in Environmental Education Research." *Environmental Education Research* 19(4): 499–520.

Binder, M., and A.-K. Blankenberg. 2017. "Green Lifestyles and Subjective Well-being: More about Self-image than Actual Behavior?" *Journal of Economic Behavior and Organization* 137: 304–323.

Carlson, J., J. Wyllie, M.M. Rahman, and R. Voola. 2019. "Enhancing Brand Relationship Performance through Customer Participation and Value Creation in Social Media Brand Communities." *Journal of Retailing and Consumer Services* 50: 333–341.

Carpenter, C.J., and C.S. Amaravadi. 2019. "A Big Data Approach to Assessing the Impact of Social Norms: Reporting One's Exercise to a Social Media Audience." *Communication Research* 46(2): 236–249.

Carr, C., and R. Hayes. 2015. "Social Media: Defining, Developing, and Divining." *Atlantic Journal of Communication* 23(1): 46–65.

Choudhary, S., R. Nayak, S. Kumari, and H. Choudhury. 2019. "Analysing Acculturation to Sustainable Food Consumption Behaviour in the Social Media through the Lens of Information Diffusion." *Technological Forecasting & Social Change* 145: 481–492.

Costanza, F. 2017. "Social Media Marketing and Value Co-creation." In *Handbook of Research on Strategic Alliances and Value Co-Creation in the Service Industry*.

Craig, G. 2019. *Media, Sustainability and Everyday Life*. London, UK: Palgrave Macmillan.

Dacin, M., K. Munir, and P. Tracey. 2010. "Formal Dining at Cambridge Colleges: Linking Ritual Performance and Institutional Maintenance." *Academy of Management Journal* 53(6): 1393–1418.

Defra. 2008. *A Framework for Pro-Environmental Behaviours, A Report by The Department for Environment, Food and Rural Affairs (Defra)*, UK.

Dijkers, M. 2019. "Reduce, Reuse, Recycle: Good Stewardship of Research Data." *Spinal Cord* 57(3): 165–166.

Dmochowski, J.E., D. Garofalo, S. Fisher, A. Greene, and D. Gambogi. 2016. "Integrating Sustainability Across the University Curriculum." *International Journal of Sustainability in Higher Education* 17(5): 652–670.

Dolan, R., Y. Seo, and J. Kemper. 2019. "Complaining Practices on Social Media in Tourism: A Value Co-creation and Co-destruction perspective." *Tourism Management* 73: 35–45.

Ellison, N.B., and D.M. Boyd. 2013. "Sociality Through Social Network Sites." In *The Oxford Handbook of Internet Studies*, edited by W.H. Dutton, Oxford: Oxford University Press.

Godfrey, D.M., and P. Feng. 2017. "Communicating Sustainability: Student Perceptions of a Behavior Change Campaign." *International Journal of Sustainability in Higher Education* 18(1): 2–22.

Hamid, S., M.T. Ijab, H. Sulaiman, H., R. Md. Anwar, and A.A. Norman. 2017. "Social Media for Environmental Sustainability Awareness in Higher Education." *International Journal of Sustainability in Higher Education* 18(4): 474–491.

Han, H., L.T. Hsu, and C. Sheu. 2010. "Application of the Theory of Planned Behavior to green hotel choice: Testing the effect of environmental friendly activities." *Tourism Management* 31(3): 325–334.

Hassan, S., N. Shiratuddin, N.L. Hashim, and F. Li. 2018. "Evaluating Social Media: Towards a Practical Model for Measuring Social Media Influence." In *Media Influence: Breakthroughs in Research and Practice*, edited by International Resources Management Association, Hershey, PA: IGI Global.

Ho, K.K.W. and S. So. 2017. "Towards a Smart City through Household Recycling and Waste Management: A Study on the Factors affecting Environmental Friendliness Lifestyle of Guamanian." *International Journal of Sustainable Real Estate and Construction Economics* 1(1): 89–108.

Ho, K.K.W., T. Takagi, S. Ye, C.H. Au, and D.K.W. Chiu. 2019. The Use of Social Media for Engaging People with Environmentally Friendly Lifestyle: A Conceptual Model. In *Proceedings of the 2018 SIGGreen Pre-ICIS Workshop*.

Hogan, B., and A. Quan-Haase. 2010. "Persistence and Change in Social Media." *Bulletin of Science, Technology & Society* 30(5): 309–315.

Hynes, N., and J. Wilson. 2016. "I do It, but don't Tell Anyone! Personal Values, Personal and Social Norms: Can Social Media play a role in Changing Pro-environmental Behaviours?" *Technological Forecasting & Social Change* 111: 349–359.

Jeong, M., H. Zo, C.H. Lee, and Y. Ceran. 2019. "Feeling Displeasure from Online Social Media Postings: A Study using Cognitive Dissonance Theory." *Computers in Human Behavior* 97: 231–240.

Jurin, R.R., D. Roush, and J. Danter. 2010. "Characterising the Mass Media." In *Environmental Communication. Second Edition: Skills and Principles for Natural Resource Managers, Scientists, and Engineers*, Dordrecht Netherland: Springer.

Kaida, N., and K. Kaida. 2016. "Facilitating Pro-environmental Behavior: The Role of Pessimism and Anthropocentric Environmental Values." *Social Indicators Research* 126(3): 1243–1260.

Kaplan, A.M., and M. Haenlein. 2010. "Users of the World, Unite! The Challenges and Opportunities of Social Media." *Business Horizons* 53(1): 59–68.

Leiner, D.J., L. Kobilke, C. Rueß, and H. Brosius. 2018. "Functional Domains of Social Media Platforms: Structuring the Uses of Facebook to Better Understand its Gratifications." *Computers in Human Behavior* 83: 194–203.

Lin, C.-C. 2013. "Convergence of New and Old Media: New Media Representation in Traditional News." *Chinese Journal of Communication* 6(2): 1–19.

Majid, S., C. Lopez, P. Megicks, and W. Lim. 2019. "Developing Effective Social Media Messages: Insights from An Exploratory Study of Industry Experts. *Psychology & Marketing* 36(6): 551–564.

Mancha, R., K. Muniz, and C.Y. Yoder. 2014. "Studying Executives' Green Behaviors: An Environmental Theory of Planned Behavior." In *Proceedings of 20th Americas Conference on Information System.*

Morra, M., F. Ceruti, R. Chierici, and A. Di Gregorio. 2018. "Social vs Traditional Media Communication: Brand Origin Associations Strike a Chord." *Journal of Research in Interactive Marketing* 12(1): 2–21.

Nanggong, A., and Rahmatia. 2019. "Perceived Benefit, Environmental Concern and Sustainable Customer Behavior on Technology Adoption." *The Asian Journal of Technology Management* 12(1): 31–47.

Ng, I.C.L., S.S. Nudurupati, and P. Tasker. 2010. "Value Co-creation in the Delivery of Outcome-based Contracts for Business-to-business Service." In *AIM Research Working Paper Series*. London, UK: Advanced Institute of Management Research.

Nguyen, T.N., A. Lobo, and S. Greenland. 2016. "Pro-environmental Purchase Behaviour: The Role of Consumers' Biospheric Values." *Journal of Retailing and Consumer Services* 33: 98–108.

Nishio, C., and T. Takeuchi. 2005. "Factors of Household Recycling and Waste Reduction Behavior." *AP - Asia Pacific Advances in Consumer Research* 6: 46–51, edited by Y.-U. Ha and Y. Yi, Duluth, MN: Association for Consumer Research.

Oakley, I., M. Chen, and V. Nisi. 2008. "Motivating Sustainable Behavior." In: *Proceedings of Ubiquitous Sustainability: Citizen Science & Activism 2008*.

Paredes, M., R. Barrutia, and J. Echebarria. 2014. Resources for Value Co-creation in e-Commerce: A Review." *Electronic Commerce Research* 14(2): 111–136.

Pham, G.V., M. Shancer, and M.R. Nelson. 2019. "Only Other People Post Food Photos on Facebook: Third-person Perception of Social Media Behavior and Effects." *Computers in Human Behavior* 93: 129–140.

Potter, W.J. 2013. "Synthesizing a Working Definition of 'Mass' Media." *Review of Communication Research* 1(1): 1–30.

Prabawa-Sear, K., and C. Baudains. 2011. "Asking the Participants: Students' Views on Their Environmental Attitudes, Behaviours, Motivators and Barriers." *Australian Journal of Environmental Education* 27(2): 219–228.

Quan-Haase, A., and A. Young. 2010. "Uses and Gratifications of Social Media: A Comparison of Facebook and Instant Messaging." *Bulletin of Science, Technology & Society* 30(5): 350–361.

Ranjan, K., and R. Read. 2016. "Value co-creation: Concept and Measurement." *Journal of the Academy of Marketing Science* 44(3): 290–315.

Rogers, E. 2003. *Diffusion of Innovations,* 5th ed. New York, NY: Free Press.

Rossmann, A., K. Ranjan, and P. Sugathan. 2016. "Drivers of User Engagement in eWoM Communication." *Journal of Services Marketing* 30(5): 541–553.

See-To, E.W.K., and K.K.W. Ho. 2014. "Value co-creation and Purchase Intention in Social Network Sites: The Role of Electronic Word-of-mouth and Trust – A Theoretical Analysis." *Computers in Human Behavior* 31(1): 182–189.

Singaraju, S.P., Q.A. Nguyen, O. Niininen, and G. Sullivan-Mort. 2016. "Social Media and Value Co-creation in Multi-stakeholder Systems: A Resource Integration Approach." *Industrial Marketing Management* 54: 44–55.

Smith, A.N., E. Fischer, and C. Yongjian. 2012. "How does Brand-related User-generated Content differ across YouTube, Facebook, and Twitter?" *Journal of Interactive Marketing* 26(2): 102–113.

Sorensen, A., L. Andrews, and J. Drennan. 2017. "Using Social Media Posts as Resources for Engaging in Value Co-creation." *Journal of Service Theory and Practice* 27(4): 898–922.

Stern, P. 2000. "Toward a Coherent Theory of Environmentally Significant Behavior." *The Journal of Social Issues* 56(3): 407–424.

Strauss, A., and J. Corbin. 1998. *Basics of Qualitative Research Techniques*. Thousand Oaks, CA: Sage.

Taylor, S., and P. Todd. 1995. "An Integrated Model of Waste Management Behavior: A Test of Household Recycling and Composting Intentions." *Environment and Behavior* 27(5): 603–630.

Terry, M. 2009. "Twittering Healthcare: Social Media and Medicine." *Telemedicine and e-Health* 15: 507–510.

Tsarenko, Y., C. Ferraro, S. Sands, and C. Mcleod. 2013. "Environmentally Conscious Consumption: The Role of Retailers and Peers as External Influences. *Journal of Retailing and Consumer Services* 20(3): 302–310.

Ünal, A., L. Steg, and M. Gorsira. 2018. "Values versus Environmental Knowledge as Triggers of a Process of Activation of Personal Norms for Eco-driving." *Environment and Behavior* 50(10): 1092–1118.

van der Werff, E., L. Steg and K. Keizer. 2013. "The Value of Environmental Self-identity: The Relationship between Biospheric Values, Environmental Self-identity and Environmental Preferences, Intentions and Behaviour." *Journal of Environmental Psychology* 34: 55–63.

Warner-Søderholm, G., A. Bertsch, E. Sawe, D. Lee, T. Wolfe, J. Meyer, J. Engel, and U.N. Fatilua. 2018. "Who Trusts Social Media?" *Computers in Human Behavior* 81: 303–315.

Whiting, A., and D. Williams. 2013. "Why People use Social Media: A Uses and Gratifications Approach." *Qualitative Market Research* 16(4): 362–369.

Table 1. Theoretical dimensions and second-order theme developed.

Theoretical dimensions	Second-order themes
Media contact	Traditional media contact (MC)
	Social media contact (SMC)
Value co-creation	Behavioural alignment (BA)
	Empowerment and control (EC)
Behavioural attitude	Rule acceptability (RA)
	Subjective norm (SN)
	Attitude towards waste reduction (ATT)
Motivators and demotivators	Perceived cost (PC)
	Perceived benefit (PB)
	Motivators (MOT)
	Barriers (BAR)
Environmentally friendly behaviour	Environmental involvement (EI)
	Recycling (R)
	Reducing household waste (RHW)
	Green perceived behavioural control (PBC)
	Environmental behavioural beliefs (BB)

Appendix A. Qualitative questionnaire framework.

Theme	Content	References
Traditional media contact (MC) (5 questions)	The habits of how people access to traditional media and involving environmentalism such as television programs, newspaper, books, magazines, and other printed sources.	Nishio and Takeuchi (2005); Ho *et al.* (2018)
Social media contact (SMC) (6 questions)	People's daily usage of social media; the reasons, methods, and customs of people access to social media involving environmentalism.	Ho *et al.* (2018)
Value co-creation - Behavioral alignment (BA) (2 questions)	How people realize the substance of social media.	Ng, Nudurupati and Tasker (2010); Ho *et al.* (2018)
Value co-creation - Empowerment and control (EC) (4 questions)	A person's decision making on social media platforms; whether one would be affected by social media content (e.g. the number of Likes, the content of comments)	Ng, Nudurupati and Tasker (2010); Ho *et al.* (2018)
Environmental involvement (EI) (4 questions)	A person's practices of participation in living an environmentally friendly lifestyle; one's interest in environmental protection; the impact of social media towards the former two dimensions	Nishio and Takeuchi (2005); Ho *et al.* (2018)
Perceived cost (PC) (3 questions)	How people think of the cost of disposal arrangement and the influence of social media on this topic	Nishio and Takeuchi (2005); Ho *et al.* (2018)
Perceived benefit (PB) (3 questions)	How people think about the advantages of waste management and how social media impact on their perceptions	Nishio and Takeuchi (2005); Ho *et al.* (2018)
Rule acceptability (RA) (3 questions)	People's understanding and actual practices of recycling and waste disposal regulations; what related information do social media provide	Nishio and Takeuchi (2005); Ho *et al.* (2018)
Subjective norm (SN) (4 questions)	How a person's family, neighbourhood, acquaintances, and friends deal with their waste; the interactions and effects of environmental posts on social media	Nishio and Takeuchi (2005); Ho *et al.* (2018)

Attitude towards waste reduction (ATT) (5 questions)	A person's contribution to environmental protection; one's practices to advocate environmental education and protection on social media and the reactions from other social media users	Nishio and Takeuchi (2005); Ho *et al.* (2018)
Recycling (R) (2 questions)	A person's perceptions of recycling and how do social media display related information.	Nishio and Takeuchi (2005); Ho *et al.* (2018)
Reducing household waste (RHW) (1 question)	The strategy for diminishing domestic rubbish when go shopping and how social media impact on it.	Nishio and Takeuchi (2005); Ho *et al.* (2018)
Green perceived behavioural control (PBC) (2 questions)	A person's realization and actions of environmentally friendly behaviours; how does one's social network influence other people's green behaviours.	Mancha, Muniz and Yoder (2014); Ho *et al.* (2018)
Environmental behavioural beliefs (BB) (4 questions)	What people think about living eco-friendly.	Han, Hsu and Sheu (2010); Ho *et al.*, (2018)
Motivators (MOT) (1 question)	People's incentives to engage in green living	Defra (2008); Oakley, Chen and Nisi (2008); Ho *et al.*, (2018)
Barriers (BAR) (2 questions)	People's challenges to live environmentally friendly.	Defra (2008); Oakley *et al.* (2008); Ho *et al.*, (2018)