What are stopping university students from acting against climate change?

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ABSTRACT: Climate Change Education (CCE) is a branch of Education for Sustainable Development (ESD) that addresses the pressing issue of climate change. Like ESD, it seems to be constrained in bringing about attitudinal and behavioral changes. This review aims to examine the barriers of attitudinal and behavioral changes among students of higher learning institutions towards climate actions. It examines specific peer-reviewed literature on CCE, particularly on its effectiveness, to deduce these barriers and formulate the relevant recommendations. From this review, six barriers were identified. The first is the complexity and multi-dimensionality of CCE can be hard to grasp, thus causing students to lose sight of the associated climate actions. The second is their preconceptions and misconceptions, which could weaken their willingness to take climate action, and this is complicated by biases, which form the third barrier. The fourth and fifth barriers are their perception that some of these changes are difficult and that they may not result in significant outcomes. Lastly, their habitual behaviors could subconsciously lead them to contradict climate actions. To address these barriers, a series of CCE courses with the inclusion of a practical course is useful to let students identify their habits and difficult changes, unlearn the habits and strategize to overcome the difficulties, and assess the significance of their behavioral changes through an evidence-based approach. A dedicated foundational CCE course is crucial to equip students with the fundamentals before integration of CCE into other courses in their respective majors in the process of mainstreaming CCE. Knowing these barriers and how to deal with them is advantageous to break the bottleneck of attitudinal and behavioral changes associated with CCE.

KEYWORDS: Climate change education; sustainable development; attitude; behavior; biases; evidence-based

1. Introduction

Climate change has increasingly become a topic of daily conversations as the impacts of climate change are increasingly felt in our daily lives. The latest Sixth Assessment Report (AR6), published by the Intergovernmental Panel on Climate Change, a scientific body under the United Nations dedicated to assessing and advancing information related to anthropogenic climate change, has identified with very high confidence the impacts of climate change on the global marine, terrestrial, and freshwater ecosystems, and these impacts have significant

socioeconomic implications [1]. AR6 has also predicted extreme weather events that are beyond the previous global warming projections, resulting in abrupt and irreversible changes to ecosystems. Besides, these events have manifested in all regions inhabited by humans, where multiple hazards are present simultaneously [1]. These are portrayed in AR6 as highly confident to adversely affect mental health and psychological wellbeing, causing aggression and other psychological complications [1,2]. Global mean temperature is expected to exceed 1.5°C or 2°C by the middle of this century and this implies intensifying loss of glacier, loss of coral reefs and heat-related socioeconomic impacts [3-5]. A rise of global mean sea level by 0.15 m from the current level is projected to cause an increase of approximately 20% of 100-year flood at coastal areas [1].

In view of the negative and far-reaching consequences of climate change, Climate Change Education (CCE) has been introduced as a subset of Education for Sustainable Development (ESD) [6]. Climate change is a direct threat to many of the Sustainable Development Goals (SDGs) set by the United Nations. For instance, climate change is foreseen to aggravate poverty of the vulnerable populations particularly those residing in the low-lying coastal areas [7]. In Africa, the number of people affected by sea-level rise will double in 2030 from the 54 million in 2000 [1]. Climate change also threatens the quest for zero hunger by hitting the food system, thus raising risks of undernourishment and starvation [8,9]. The counteracting effects of climate change on sustainable development complicate ESD, which aims to achieve sustainable development through the impartation of the relevant values and knowledge which subsequently shape attitudes and behaviors [10]. ESD encompasses elements such as ethics, citizenship, gender equality, human rights, governance, and natural resource management [11]. ESD was initially promoted through the United Nations Decade of Education for Sustainable Development, 2005-2014, (DESD) through the engagement of multiple stakeholders such as governments, non-governmental organizations, private institutions, and the general public [11, 12]. However, ESD does not seem to be complete without addressing the impacts of climate change on sustainable development, which create greater challenges for the attainment of the SDGs. In fact, promoting attitudinal and behavioral changes that counter climate change is beneficial to sustainable development, and these two domains are complementary rather than contradictory. Reducing carbon emissions at all levels of a society in the fight against climate change could encourage responsible consumption and production as well as the conservation of natural resources and biodiversity [13]. In fact, climate action itself is an SDG [14].

As such, with the catalysis of the Action for Climate Empowerment (ACE) serving as a call-out to various sectors to formulate policies and promote actions in relation to climate change and the experience of ESD, UNESCO has matter-of-factly taken on the role of embedding climate change elements into ESD and advocating CCE [11]. In its new ESD for 2030, which serves as an international framework for execution of ESD, a special address to the current climate emergency has been made [15]. ESD for 2030 is a sequel to the Global Action Programme (GAP), which served as a follow-up to DESD to step up ESD. ESD for 2030 will propel initiatives at various levels that eventually lead to the mainstreaming of ESD [15]. Most studies in this domain probed the development and implementation of ESD [16-19]. There are also numerous studies examining the effectiveness of ESD [20–23]. These studies generally revealed that ESD might be more effective in imparting knowledge than in effecting attitudinal and behavioral changes. While studies are relatively few in the specific domain of

CCE, similar challenges in changing the attitudes of learners towards climate actions have been reported [24,25]. Most of the research related to ESD and CCE was conducted among students of higher learning institutions [24,26,27]. In view of the importance of knowing the barriers of attitudinal and behavioral changes for climate actions, in order that specific strategies can be drawn to remove the bottleneck of CCE in bringing out positive attitudes and behaviors among learners towards climate action, this review primarily aims to systematically present the barriers of attitudinal and behavioral changes among students in higher learning institutions in relation to climate actions. Secondarily, it aims to synthesize the recommendations to address, if not overcome, the barriers. This review contributes substantially to the formulation of CCE, which targets the attitudes and behaviors of the learners so as to more effectively combat the pressing climate issues.

2. Materials and Methods

This article is fundamentally a literature review. It involved literature searching with journal databases consisting of Scopus, Web of Science, ScienceDirect, and ProQuest [28]. The main keywords used in the literature search were effectiveness, climate change education, attitude, behavior, attitudinal change, and behavioral change. The keywords were either entered individually or jointly into the search engines. The keywords were entered jointly when a more specific search was intended to retrieve articles that matched the objectives stated. Figure 1 shows the flowchart of literature selection. The selection process yielded 30 articles to be included in the review presented mostly in Section 3.

The search criteria are: 1) The articles should ideally be published in the last 15 years (2007-2022) since ESD has only received much attention with the initiation of DESD in 2005 and CCE is even more recent; 2) The articles must be written in English; 3) The articles must be of scholarly nature which were peer-reviewed; journal articles were given priority over conference papers in this review as they generally undergo more stringent review processes; theses and dissertations were excluded from the review; 4) The articles must center on CCE, particularly its effectiveness; and 5) The articles must address the aspect of attitude in CCE.
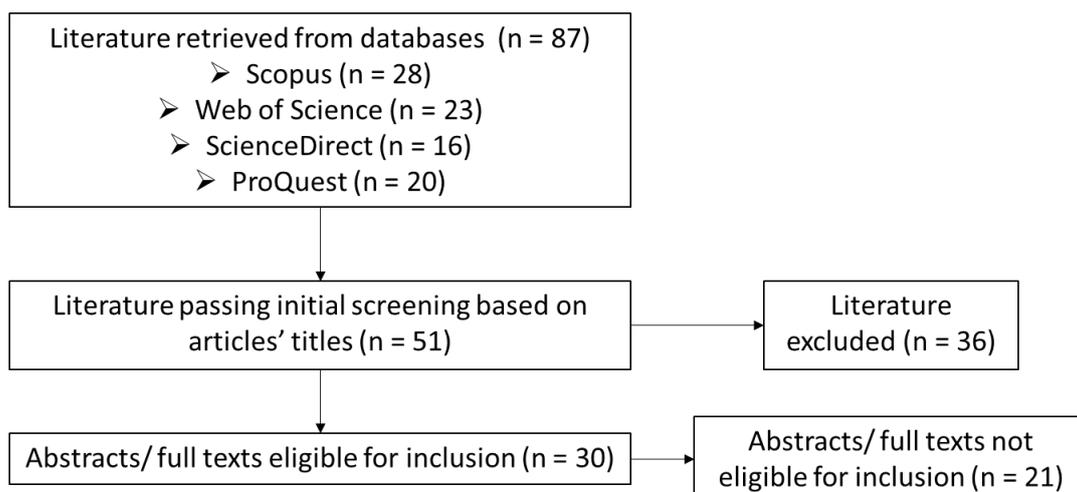
Figure 1. Flowchart of literature selection for review.

3. Results and Discussion

3.1. The Concepts of Attitude and Behavior

Attitudes can be divided into inner tendencies and evaluative responses. In terms of evaluative responses, an attitude is regarded as the opinions, judgements, or beliefs a person holds towards someone or something [29]. It covers virtually anything that a person evaluates, and these objects of evaluation are termed attitude objects. They serve as stimuli that produce evaluative responses [29]. To produce a response, a person needs to first perceive an attitude towards an object, conciously or unconsciously, or encounter the object. This first encounter could predispose the person to a particular response subsequently, either positive or negative, thus constituting an attitude-influencing factor called residue of past experience [30]. This past experience could form a certain tendency to produce a positive or negative response towards an attitude object, hence the inner tendency facet of attitude [31].

Tendency is distinguished from disposition in the sense that it is not time-bound like a lasting disposition. Besides, a tendency may not be obvious to the conscious mind and represents the mental residue, whether favorable or unfavorable, that could influence evaluation of an attitude object [29]. A challenge in defining attitude is that the definition could change with the emergence of new theoretical models, particularly for inner tendency. In some theoretical models, for instance, the theory of planned behavior, attitude is linked to behavioral intention and, subsequently, behavior [32]. Here, attitude takes on the stance of evaluative responses, and it is a person's positive or negative evaluation of an attitude object that yields the intention to perform a particular behavior in response to the object [32].

In relation to CCE, a learner needs to be exposed to CCE before he or she can form an evaluative response to the subject matter. This evaluative response could also be influenced by the learner's inner tendency, which developed from residues of previous exposure to CCE or other climate change-related matters (Figure 2) [33]. Once an attitude towards CCE has developed, it would serve as a determinant of the learner's intention to behave for or against climate change, according to the theory of planned behavior (Figure 2). However, currently, CCE tends to have limited effectiveness in forming positive attitudes towards climate actions, and this could downplay the purpose and significance of CCE to yield meaningful adaptation to and mitigation of climate change at various levels [25,31,34]. The barriers to positive attitudinal and behavioral changes among students of higher learning institutions are illustrated in the following sections.
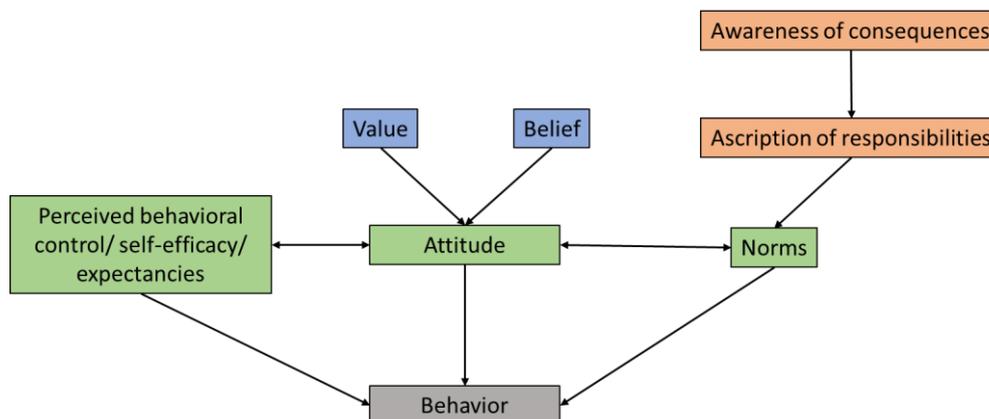

Figure 2. Compilation of the determinants of attitude and behavior (note: double arrow indicates mutual effect).

Though attitude is an important prerequisite of a behavior, attitudinal change may not always lead to a behavior. This is promulgated in the theory of planned behavior. A behavior is essentially an action or activity carried out by a person in response to external or internal stimuli [35]. While attitude acts as an internal stimulus of a behavior, behavior could also be affected by perceptions of whether an activity is easy to conduct, the outcomes of the activity, norms etc. which are elicited in theoretical frameworks such as the self-efficacy theory, norm activation model and value-belief-norm theory (Figure 2) [36].

3.2. Barriers to Attitudinal and Behavioral Changes

3.2.1. Complexity of CCE

CCE is interdisciplinary, covering natural science, social science, and even economics. It has been reported as being conceptually challenging [37]. Students frequently hold certain misconceptions about climate change, and they have difficulty understanding the nature of the issue. For instance, they could be confused by the natural and anthropogenic causes of climate change and perceive the current climate change as part of the ever-changing Earth's climate throughout the geological timeframe [38]. The inability to distinguish modern climate change from historical climate change could make the grasping of the anthropogenic nature of climate change difficult. A common statement that university students often make is that carbon dioxide, the major culprit of climate change, is only present in a small amount in the atmosphere and has relatively low global warming potential in comparison to other greenhouse gases [25].

Furthermore, appreciating CCE requires systems thinking, particularly the interaction between various components of the Earth's climate system, such as the biosphere, lithosphere, cryosphere, atmosphere, and hydrosphere, as well as the feedback mechanisms between these components [39]. This is challenging for students, and linking these complex concepts to how their attitudinal change could help with climate change is even more challenging. In addition, the social aspects of climate change, such as the concept of vulnerability and resilience in relation to adaptation to climate change, present challenges to students [40]. Students might not fully comprehend the idea that the impacts of climate change on individuals, societies, and nations are not equal and are related to the resilience of the entities which are, in turn, affected by multiple factors [41].

3.2.2. Preconception and misconception

Many students also come to CCE with misconceptions, for instance of temperature fluctuations over a short span as a manifestation of climate. Students could mistake weather for climate by quoting an obvious change in a weather pattern in comparison to 5 to 10 years ago. However, misconceptions such as this could be readily rectified [42]. A danger of misconception or inaccurate preconception is that it could create resistance to change when new concepts are introduced through CCE, a typical manifestation of an inner tendency affected by the past experience of a person towards an attitude object [43]. Learners could reject new ideas or modify new ideas to fit their preconceptions. How strongly a person holds on to a preconception is determined by the socio-cultural contexts shaping the preconception. Preconceptions are often interconnected with other concepts, especially those related to one's cultural and social norms, which are linked to the political system and governance [44]. A common example is the governance of carbon emissions. Students may find carbon emission limits imposed on

developing countries in the pretext of climate change unfair and a friction to their economic growths [42]. They might have the opinion that developed countries were the major contributors of greenhouse gases at certain points of their development, during which climate change had not received as much attention as it is today [45]. This could open up more issues related to climate ethics and justice, which would add another layer of complexity to CCE. Another possibility is that their exposure to these issues in CCE would trigger evaluative responses which shape their attitudes towards climate change, and these attitudes might not be all positive.

3.2.3. Biases

With reference to the description of what attitude is, students might have developed an inner tendency towards climate change due to their residues of past experience, and the inner tendency constitutes confirmation bias, where students of CCE tend to focus on information which matches with their past experience or preconceptions. In this manner, students either filter out information incongruent with their preconceptions or distort the new information to preserve the initial beliefs [43]. It is also likely that students could hold on to their initial beliefs or preconceptions that they deem defensive and authoritative (Figure 2) [46].

Affect is another source of bias in CCE, where students feel emotionally drawn to a particular attitude object in CCE after an evaluative response [47]. Such emotions could hamper reasonable judgement, and this bias is unlikely to change with the presence of new evidence [48]. For instance, students from an island nation could develop strong emotions when learning about climate injustice befalling the Pacific islands, which suffer disproportionately higher impacts of climate change relative to the greenhouse gases they emit [49]. The emotion could be negative as they perceive the major emitters of greenhouse gases to be the culprits behind the climate change impacts received by these islands.

3.2.4. Perceived difficulty in making changes

While past experience could alter one's tendency towards an attitude object and their evaluative responses could possibly favor an attitudinal change, it is likely that students could perceive certain changes to be difficult to implement. This relates to the self-efficacy theory, which centers on how a person perceives whether he or she is capable of engaging in the behaviors that yield the desirable outcome (Figure 2) [50]. Self-efficacy is similar to expected values in the expectancy-value theory as well as the perceived behavioral control of the theory of planned behavior, which more closely describes this barrier (Figure 2) [51]. Perceived behavioral control is essentially the perception of whether a particular behavior is easy or hard to perform [52]. In addition to the support of theoretical frameworks, this barrier has been reported by a study among students of higher learning institutions in the US and UK, where the majority of them felt climate change is a concern and a subject of importance, but few were willing to make crucial changes, such as a switch to a plant-based diet, due to their preferences for meat and meat protein. Besides, only a few respondents were willing to stop flying because of the lack of other comparable low-carbon alternatives and their love for travel [53].

This perceived difficulty is also influenced by external factors, such as the availability of cleaner transport alternatives in an area. In areas where public transport is less developed, let alone low-carbon transport, driving less would be hard to achieve. In a society where the recycling rate is low and recycling facilities are scarce, it would be difficult for a student to

engage in the segregation and recycling of waste to reduce resource consumption in the combat against climate change [54]. Perceived difficulty, therefore, often goes beyond individual factors. It requires coordinated responses at institutional, national, and even international levels to eliminate these challenges, which stem from infrastructural development and governance.

3.2.5. Perception of the significance of the outcomes

Outcome expectancy states that the propensity to achieve a specific outcome influences the likelihood of a behavior, and it is unaffected by self-efficacy (Figure 2). In view of the complexity of climate actions and the need for the involvement of multiple stakeholders at different levels to combat climate change, it is natural for learners to think whether what they do individually would make much difference, especially in the mitigation of climate change [55]. Currently, CCE aims to build learners' competency in the subject of climate change, from knowledge to action. However, the complexity of climate change is often portrayed in CCE as requiring multi-faceted approaches through international collaboration, law and policy making, technology development, governance, and the deployment of market-based instruments [6]. These approaches target specific sectors such as power generation, manufacturing, construction, agriculture and transportation. The emergence of industrial ecology and circular economy adds to the complexity of mitigating climate change [56]. Nonetheless, these approaches lead students of higher learning institutions to downplay the significance of their individual efforts. It has commonly been reported that some students do not perceive lifestyle changes such as reducing flying and consumption as making a significant difference in the multidimensional mitigation of climate change [53]. It is likely for them to think that their carbon footprints are negligible in comparison to those of industries.

3.2.6. Habitual behavior

Habitual behaviors are the specific responses produced by a person to a specific stimulus on any given occasion. Habitual behaviors might form from strong attitudes developed previously, are usually deeply ingrained and are often performed unconciously [10]. Some university students have admitted the habits of driving as the main means of transportation, having meat in their diets, overbuying food, which causes wastage, and taking long showers [53]. Since habits are deeply ingrained, typical intervention through attitudinal change could be challenging. It may require a deeper understanding of attitude-habit interactions to learn the mechanisms of consolidation of a behavior into a habit [57]. Unlike the inner tendency of an attitude, habitual behaviors are often learned and may require little thought. They are repeated due to reinforcement and may need specific interventions [57].

3.3. Recommendations for Attitudinal and Behavioral Changes

Many studies have been devoted to the development of pedagogies for CCE and each has its own merit. Strategies such as deliverative discussion among learners to develop their critical thinking of the concepts of CCE and reflect on their knowledge of climate change have been proposed [58]. Addressing misconceptions is also one of the strategies, and this is parallel to the finding that preconceptions and misconceptions are barriers to attitudinal change. In relation to the barriers identified above and the pedagogies proposed previously, the following recommendations are made:

1. In view of the complexity of CCE, it can be delivered in a series of courses starting with the science aspect, followed by the socioeconomic aspect, and practical approaches to adapt to and mitigate climate change. There are numerous studies which can be referred to in relation to the pedagogies for these courses [43–58].

2. In mainstreaming CCE as aspired by ESD for 2030, it is beneficial to dedicate a fundamental CCE course covering the crucial aspects of climate change to set the foundation for all university students before they are exposed to the CCE components embedded in their respective majors. This could help them cope with the complexity of climate change.

3. Addressing preconceptions and misconceptions is not new to the pedagogies of CCE, and this should be incorporated into dedicated CCE courses or embedded CCE components. Similarly, like preconceptions, biases could impede the uptake of new information related to climate change, and biases related to climate ethics and injustice could be carefully addressed through reviewing the current efforts that have been made to address the injustice and imparting the idea that climate actions are collective, collaborative, and complementary.

4. The difficulty of making changes can be addressed in the practical approaches of CCE where learners could be asked to explore the actions they can take to adapt and mitigate climate change; classify the actions into levels of difficulty to execute; focus on the harder actions; and think of ways to break the actions down into simpler steps or replace them with the ones in which they are willing to engage. Learners could also be prompted to make commitments to difficult changes or reduce the frequency of their current practices that are not favoring climate action. These activities could be tracked over the duration of the practical course to gauge if changes have taken place. At the end of the course, learners could reflect on this process of making changes and think of ways to further improve.

5. In terms of the significance of outcomes stemming from the changes made, learners could be engaged in an evidence-based practice to monitor the carbon emissions they could reduce and the positive impacts of their changes. They could also participate in or initiate community projects, another strategy commonly mentioned in the literature to foster collaborative and inquiry-based learning [43]. It is advantageous for learners to also develop the competence to evaluate the impacts, whether positive or negative, of climate change mitigation and adaptation.

Habitual behaviors are sometimes hard to identify as they might elude the conscious mind. Learners need to be engaged in the deliberate identification of habitual behaviors that could counter climate actions. Learners can also be assigned partners to help spot such behaviors. They will then be guided through the process of reducing the frequency or unlearning the habits.

4. Conclusions

With the upstepping of ESD to address the implications of climate change, CCE has come into the limelight. As with ESD, while many frameworks, strategies, and pedagogies have been proposed to improve the effectiveness of CCE, CCE seems to have limited effectiveness in effecting attitudinal and behavioral changes among students of higher learning institutions in comparison to imparting knowledge and skills. Through a literature review, this paper is crucial

in drawing out and highlighting the major barriers to attitudinal and behavioral changes among students of higher learning institutions. These students are often perplexed by the multi-dimensionality of climate change and have little idea of how they could contribute individually and collectively towards climate action. They could also come with preconceptions, misconceptions, and biases that affect their assimilation of new knowledge and willingness to take action. They might perceive certain changes as difficult to make and could interfere with their daily activities or preferences. Besides, there is a tendency to think that the outcomes of making certain changes are insignificant, which deters the intention to make changes. Habitual behaviors, often performed unconsciously, add challenges to behavioral changes among these students. Knowing these barriers enables improvement of CCE to more effectively bring about attitudinal and behavioral changes, which are crucial in promoting climate action. Improvement can be achieved, for instance, through the offering of courses on the practical aspect of CCE, which facilitates identification of habits and difficult changes; formulation of measures to overcome these habits and difficult changes; deployment of an evidence-based method to assess the impacts of breaking the habits and making the changes; and reflection of the process for continuous improvement. This review hopes to minimize, if not remove, these shortcomings of CCE in the attitudinal and behavioral domains.

Acknowledgments

Competing Interest

The authors declare that there is no competing interest.

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