THE KNOWLEDGE, ATTITUDE, AND MOTIVATION AMONG SECONDARY SCHOOL TEACHERS TOWARDS PRO-ENVIRONMENTAL BEHAVIOUR

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by

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AR6	Sixth Assessment Report
ASEAN	Association of Southeast Asian Nations
AVE	Average Variance Extracted
CCE	Climate Change Education
CO2	Carbon Dioxide
DEfSD	Decade of Education for Sustainable Development
DOE	Department of Environment
EE	Environmental Education
EEP	Environmental Education Programmes
ESD	Education for Sustainable Development
FAO	Food and Agriculture Organization
GHGs	Greenhouse gases
IM	Iskandar Malaysia
IPBES	Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
JICA	Japan International Cooperation Agency
KAB	Knowledge-Attitude-Behaviour
KPA	Kelab Pencinta Alam
KSSM	Secondary School Stand Curriculum
MOE	Ministry of Education
NES	Nature Education School
OECD	Organization for Economic Co-operation and Development
PCB	Pro-Climate Behaviour
PEB	Pro-Environmental Behaviour
PLS-SEM	Partial Least Square-Structural Equation Modelling
SDGs	Sustainable Development Goals
SDT	Self-Determination Theory
SLAAS	Sustainable Schools Program Environmental Award
SPSS	Statistical Package for Social Sciences
TVET	Technical and Vocational Education and Training
UN	United Nations

UNCED	The United Nations Conference on Environment and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund

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PENGETAHUAN, SIKAP, DAN MOTIVASI GURU SEKOLAH MENENGAH TERHADAP TINGKAH LAKU MESRA ALAM

ABSTRAK

Di ambang tempoh cabaran alam sekitar dan kebimbangan terhadap perubahan iklim yang semakin mendesak, tingkah laku manusia telah diiktiraf sebagai salah satu daripada beberapa faktor penyumbang. Tingkah laku mesra alam sekitar telah dilihat sebagai salah satu cara menangani perubahan iklim dan melindungi alam sekitar. Guru sekolah mempunyai peranan penting dalam membentuk tingkah laku mesra alam sekitar kepada generasi yang akan datang. Maka, ia adalah penting untuk menjalankan penyelidikan tambahan untuk memupuk dan menggalakkan tingkah laku mesra alam sekitar di kalangan guru kerana peranan penting mereka sebagai contoh bagi pelajar di sekolah. Kajian ini bertujuan untuk mengkaji hubungan kesan lansung dan tidak lansung faktor-faktor penentu yang berkaitan dengan tingkah laku mesra alam. Faktor-faktor penentu seperti pengetahuan berubahan iklim, sikap pengurangan perubahan iklim, motivasi autonomi, dan motivasi luaran dipercayai memberi kesan kepada tingkah laku mesra alam. Kajian ini juga mencadangkan bahawa sikap pengurangan perubahan iklim, motivasi autonomi, dan motivasi luaran berfungsi sebagai perantara untuk hubungan yang dicadangkan. Rangka kerja penyelidikan telah ditubuhkan dengam menggunakan 383 responden yang merupakan guru di sekolah menengah awam yang terletak di Daerah Selatan Malaysia, khususnya Negeri Sembilan, Melaka dan Johor, dengan menggunakan model “Knowledge-Attitude-Behaviour” dan teori Self-Determination Theory (SDT). Data yang diperolehi dinilai menggunakan program IBM SPSS 23 dan SmartPLS4. Hasil analisa menunjukkan bahawa tingkah laku mesra alam dipengaruhi oleh sikap pengurangan perubahan iklim, motivasi

autonomi, dan motivasi luaran, makakala pengetahuan iklim tidak mempunyai kesan yang signifikan. Kajian ini juga mengesahkan bahawa pengetahuan perubahan iklim, motivasi autonomi, dan motivasi luaran memberi kesan positf terhadap sikap pengurangan perubahan iklim. Selain itu, terhadap hubungan lansung antara pengetahuan perubahan iklim dan motivasi autonomi, tetapi tiada hubungan dengan motivasi luaran. Di samping itu, sikap pengurangan perubahan iklim bertindak sebagai perantara dalam hubungan antara pengetahuan perubahan iklim, motivasi autonomi, dan motivasi luaran dengan tingkah laku mesra alam. Hubungan antara pengetahuan perubahan iklim dan tingkah laku mesra alam sekitar didasarkan kepada motivasi autonomi, tetapi tidak oleh motivasi luaran. Temuan kajian ini mendedahkan faktor-faktor yang mempunyai kesan positif pada tingkah laku mesra alam, serta peranan penting yang dimainkan oleh sikap pengurangan perubahan iklim dan motivasi autonomi sebagai perantara. Penyelidikan ini menyumbang kepada literatur yang sedia ada mengenai tingkah laku mesra alam, khususnya dalam sektor pendidikan, dengan tumpuan khusus kepada guru-guru dalam perkhidmatan.

THE KNOWLEDGE, ATTITUDE, AND MOTIVATION AMONG SECONDARY SCHOOL TEACHERS TOWARDS PRO-ENVIRONMENTAL BEHAVIOUR

ABSTRACT

Amidst a period of increasingly pressing environmental challenges and concerns over climate change, human behaviours have been recognized as one of the several contributing factors. Pro-environmental behaviours have been recognized as a means of addressing climate change and safeguarding the natural environment. Teachers play a crucial role in moulding the pro-environmental behaviour of upcoming generations. Considering this, conducting additional research on fostering teachers' pro-environmental behaviour is imperative, as they serve as exemplars for their students at schools. This study investigates the direct and indirect impacts of determinants associated with pro-environmental behaviour. The determinants such as climate change knowledge, climate change mitigation attitude, autonomous motivation, and external motivation are believed to impact pro-environmental behaviour. This study also suggested that climate change mitigation attitude, autonomous motivation, and external motivation mediate the projected relationships. The research framework was established and examined using 383 respondents who are teachers in public secondary schools located in the Southern Region of Malaysia, specifically Negeri Sembilan, Melaka and Johor, by drawing upon the Knowledge-Attitude-Behaviour (KAB) model and the Self-Determination Theory (SDT). The acquired data were evaluated using IBM SPSS 23 and SmartPLS4. The results indicate that pro-environmental behaviours are influenced by climate change mitigation attitude, autonomous motivation, and external motion, whereas climate change

knowledge does not have a significant impact. The study additionally validated that climate change knowledge, autonomous motivation, and external motivation positively influence climate change mitigation attitudes. Furthermore, there is a direct relationship between climate change knowledge and autonomous motivation but no relationship with external motivation. In addition, climate change mitigation attitude mediates the relationship between climate change knowledge, autonomous motivation, and external motivation with pro-environmental behaviour. The relationship between climate change knowledge and pro-environmental behaviour is mediated by autonomous motivation, not external motivation. The study's findings unveiled the determinants that benefit pro-environmental behaviour and the critical role played by climate change mitigation attitude and autonomous motivation as mediators. This research contributes to the existing body of literature regarding pro-environmental behaviour, specifically within the education sector, focusing on in-service teachers.

CHAPTER 1

INTRODUCTION

1.1 Overview

This research examines pro-environmental behaviour (PEB) among in-service teachers. This chapter focuses on PEB, the importance of behavioural change in individuals through environment-related education, teachers' crucial roles the progress, and the determinants of PEBs. The problem statement in the next section highlighted the challenges of environmental-related education on behavioural change towards PEBs, its effects, and factors that relate to teachers. Next, the research objectives and questions for this study are provided, following the significance and scope of the study. The key terms used throughout this study will be defined, followed by the thesis structure for this study's guidance.

1.2 Research Background

PEB is individuals' efforts to reduce harmful environmental impacts by enhancing and maintaining the environment. It is a behaviour that minimises environmental damage while providing enormous environmental advantages (Stek & Vlek, 2009) and agenda of sustainable development (Ones et al., 2015; Steg et al., 2014). PEB consists of the conservation of water, such as reducing water usage when washing hands or showing; recycling by reusing plastic, containers, glass and papers; reducing electrical usage by switching unused lights off; reusing cups that are disposable; taking public transports, walking or using bicycles; minimise paper usage during printing by printing double-sided; and purchasing or eating green products (Bissing-Olson et al., 2016). There are several terms to describe PEB, such as pro-ecological behaviour (Corral-Verdugo et al., 2013), green consumer behaviour (Stek

& Vlek, 2009), environmentally significant behaviours (Stern, 2000), environmentally responsible behaviours (De Young, 2000), ecological behaviour (Kaiser et al., 1999) and responsible environmental behaviours (Cottrel, 2003). There are also climate change behaviours or climate change-friendly behaviours (Halady & Rao, 2010; Hermans & Korhonen, 2017) and pro-climate behaviours (Wu & Otsuka, 2021). Since the climate is an element of the overall environmental system, pro-climate behaviour (PCB) may be conceptually integrated within PEB (Wu & Otsuka, 2021). Climate-friendly behaviours were presented by Halady and Rao (2010) as embracing climate-friendly activities such as encouraging reduction, reuse and recycling, participating in campaigns to raise awareness about climate change, and using items that are greenhouse gas-free. Hermans and Korhonen (2017) presented climate-friendly behaviours as a willingness to act to mitigate climate change. Climate change behaviours are crucial mitigation behaviours that individuals may adopt and are similar to PEBs such as utilising public transportation, conserving home energy usage, and recycling (Chawla & Cushing, 2007; Chen et al., 2016; Stern, 2000).

Climate change is primarily acknowledged as the greatest challenge to humanity today, presenting significant challenges. It is accepted that human behaviour is the primary driver to climate change (Cook et al., 2016; Grilli & Curtis, 2021), with 97% consensus from climate scientists (Eilam et al., 2020), through overuse of non-renewable resources resulting in deforestation, land degradation, as well as air and ocean pollution (Daigle & Vasseur, 2019; Sanson et al., 2018). Therefore, climate change could be minimised through behavioural change in individuals (IPCC, 2018) because when combined in a significant sample, individual acts and behaviours may significantly impact climate change (Wi, 2019; Williamson et al., 2018). The findings from previous studies showed a behaviour change contributed to the reduction of

greenhouse gasses emissions (McKinsey, 2009; Niamir et al., 2020; Williamson et al., 2018) through several actions such as house heating and food consumption (Faber et al., 2012). This is supported by a study by Williamson et al. (2018), which acknowledged behavioural changes that may reduce global emissions by 20-37% in the coming 30 years. Thus, pro-environmental conduct is vital in addressing environmental problems (Arshad et al., 2021). For a better sustainable future, it is suggested that it is crucial for current behavioural patterns to be changed (Delzendeh et al., 2017). To achieve behavioural change in individual, the emphasis on environment-based education is critical for developing PEB among individuals (Bofferding & Kloser, 2015; Craig & Allen, 2015; De Leeuw & Valois, 2014; Eze, 2020; Gould et al., 2019; Hidayah & Augustin, 2017; Wan Hussain et al., 2021; Meyer, 2015; Nurwidodo et al., 2019; Runhaar et al., 2019).

Education may help develop a more nuanced knowledge of and capacity to cope with climate change (Busch et al., 2019). In addition, incorporating environmental education (EE) into a school's curriculum will undoubtedly result in PEB (Mustam & Daniel, 2018). Therefore, in recent years, efforts to educate people about climate change have been intensified, leading to the establishment of Climate Change Education (CCE) (Ratinen & Uusiautti, 2020). CCE is a specialized area within the broader topic of EE (Meira Cartea, 2020), which itself is constitutes a component more extensive Education for Sustainable Development (ESD) (Nkoana, 2020). According to Nam and Lee (2021), CCE is a constituent component within ESD. CCE strives in developing choices that are consistent with the goals of reducing greenhouse gas emissions and adapting towards the unavoidable impacts resulting from climate change (Meira Cartea, 2020), to encourage continuous global citizenship education via the involvement of different stakeholders, as well as to facilitate the

development of knowledge-based society where local communities implement recommendations (Nam & Lee, 2021), aims to bring about significant, long-term improvements in knowledge, especially among young people, the creation of educational curriculum, the training of trainers and instructors, and the use of appropriate pedagogies (Paas, 2016), and to change or create PEB among pupils (Mohamed Ali Khan et al., 2020). The significance of CCE is vital as early as kindergarten to higher education level, as it is crucial to educate individuals regarding their age and the potential climate change impacts as it affects everyone (Reimers, 2021). In Malaysia, EE is currently included in the curriculum throughout the nation by including different elements related to environment in overall school subjects throughout the country (Mustam & Daniel, 2018; Phang et al., 2016) in response to UNESCO's Chapter 36, Agenda 21 which emphasis education's role in conveying knowledge leading to behavioural changes development (Shamuganathan & Karpudewan, 2015).

Borhan & Ismail (2011) reported that Malaysia has taken action to integrate environmental education into the curriculum, along with many other countries in the region. In the year of 1991, the Education Planning Committee from the Ministry of Education had incorporated and introduced Environmental Education (EE) through the New Primary School Curriculum (NPSC) along with the Integrated Curriculum for Secondary Schools (ICSS) (Nadeson & Rasid, 2005. According to Agenda 21 recommendations, green strategies have been outlined in Malaysia's National Policy that focus on education as well as awareness (Ministry of Science, Technology and the Environment, 2002). Following the widely accepted concept that promotes global peace along with sustainability of the 2030 Agenda, that embeds the Sustainable Development Goals (SDGs), Malaysia incorporated the SDGs into its 11th Malaysian

Plan, with the intention of integrating these objectives towards various sectors such as education, resulting in Secondary School Stand Curriculum (KSSM) integrating global citizenship elements along with sustainability within Geography subjects in secondary schools (Said & Ahmad, 2011). Malaysia also implemented several programmes within the school environment such as Sustainable Schools Programme Environmental Awards (SLAAS) in 2005, and The Iskandar Malaysia (IM) Ecolife Challenge in 2013.

According to Mahat and Idrus (2017), direct education is perhaps the most successful method in the initiative of different stakeholders towards enhancing quality concerning environment. Environmental education, programs, and various initiatives from the environmentally friendly public have all favourably contributed to the increase in environmental awareness and PEB (Minelgaitė & Liobikienė, 2021). In addition, Lutz et al. (2014), Kabir et al. (2015), and Karpudewan et al. (2015) revealed that CCE increases the knowledge of students concerning climate science as well as capabilities in dealing with climate change, climate-friendly behaviour along with awareness on climate change (Deisenrieder et al., 2020). Findings from one case study in Turkey conducted by Yildirim et al. (2021), which implemented various extracurricular activities to promote secondary school students' climate-friendly actions, showed that students openly demonstrated climate-friendly behaviour. Oliver and Adkins (2020) revealed that students from Sweden, the United Kingdom, Ireland, and Portugal are aware of climate change due to school curriculum and educational policy. El Batri et al. (2019) conducted a study in a Moroccan school, and the results indicated a significant improvement in environmental knowledge and intentions to adopt eco-friendly behaviours through the science syllabus in school. Education also plays a crucial role in efforts to reduce CO2 emissions (Sarwar & Alsaggaf, 2021) as a study conducted by Cordero et al. (2020) revealed that 2.86 tons of emissions were

reduced individually by students due to education; Versteijlen et al. (2017) concluded in their study that considerable reduction in emission among students and staff members through online education; Molthan-Hillet et al. (2020) and Zafar et al. (2020) both found that education have a significant influence in reducing CO2 emissions is played by education. Focusing on Malaysia, study conducted by Wan Hussain et al. (2021) which focused on energy-saving behaviour revealed that students aged 11 years old possessed all environmental values and occasionally and often practice energy saving behaviour; Phang et al. (2016) identified awareness was increased among student and teachers from the Iskandar Malaysia Ecolife Challenge initiative; Hanifah et al. (2018) recognized that Low Carbon School programme had shown success in increasing carbon literacy knowledge and values, low carbon attitudes and practices among students who have participated; finding from research conducted by Hanifah et al. (2015) confirmed that the involvement of school in Sustainable Schools Program Environmental Award (SLAAS) transformational impact on their operations, particularly on greening initiatives and also on sustainable behaviour inside the school complex, including increased knowledge in students and teachers who participated in the planned programme; and supported by study conducted by Mahat and Idrus (2017) that revealed participation in ongoing activities by SLASS increased students' and teacher's awareness. Therefore, global evidence indicates that environment-related education (EE, ESD, and CCE) programmes and school initiatives improve the knowledge, awareness, attitude as well as PEB within students in addition to teachers. Research has revealed pro-environmental, or climate change behaviours have increased in significance, particularly among adolescents (Lawson et al., 2019; Palupi & Sawitri, 2018; Pickering et al., 2020; Valdez et al., 2018), and teachers play a crucial role as it is important to instil PEB among adolescents (Cebesoy & Karisan, 2020).

Today's youth will become future decision-makers and stakeholders in a society that will need severe mitigating measures (Hermans, 2016) and the ones who will bear the brunt of climate change's severe consequences (Valdez et al., 2018). In addition, the cultivation of PEB in students has become crucial towards steering the future of built environment closer towards sustainability. Students the exhibit PEB have the potential to lead positive innovations along with changes within the built environment, being the upcoming generations of influential individuals within the industry. It has been highlighted the significance of cultivating environmental consciousness as well as PEB for students as a preparation for their future responsibilities (Yusliza et al., 2020).

Climate Change is a danger to the Earth and all its inhabitants, and it is critical to establish policies and implement measures to combat climate change (Ceyhan & Muğaloğlu, 2020). Educational approaches are critical in reshaping society and establishing a foundation for sustainable growth (Foo, 2013). To achieve this, teachers play an important role in CCE (Karami et al., 2017), are regarded as successful change agents, and greatly influence their pupils via their acts and behaviours (Mahat & Idrus, 2017). The role of teachers is not only limited to educating students on environmental issues (Thompson & Thompson, 2018), fostering environmental awareness among students (Mohamad et al., 2020) but also demonstrating PEBs and attitudes as they serve as role models for their students because most importantly the behaviour of the students is influenced by the teacher's behaviour (Uçar & Canpolat, 2019). This is supported by Dal et al. (2015), which revealed a positive relationship between awareness among teachers together with students, whereby increased awareness concerning climate change among teachers will also increase students' awareness. Furthermore, teachers may be environmental-related education leaders because they

can encourage colleagues, school community members along with administrators to improve methods of learning and teaching with the aim to improve learning and success among students (Sukma et al., 2020; York-Barr & Duke, 2004). For CCE to be effective, teachers must have environmental knowledge (Alagoz & Akman, 2016; Hanifah et al., 2015), positive attitudes and sensitivity concerning the environment, and undergo EE themselves, as they are responsible for imparting the subject (Kim, 2019).

Identifying the most efficient strategies to encourage climate change behaviours is crucial to addressing climate change challenges (Stevenson et al., 2018), especially among teachers who are required to be role models of sustainability (Hanifah et al., 2015) as their behaviour reflects on students (Mahat & Idrus, 2017). Therefore, knowledge of the variables contributing to or preventing PEB is crucial for initiating change and facilitating such behaviour (Huddart Kennedy et al., 2015). Kollmuss & Agyeman (2002) reviewed previous pro-environmental models and proposed that there are three factors which concurrently influence PEB which are internal factors, which consist of knowledge, attitude, motivation, and emotions; external factors are economic, institutional, cultural factors, social, economic, etc.) and demographic factors. Efforts intended to change human behaviour must consider internal and external variables and offer adequate indications for behavioural change (Grili & Curtis, 2021). Modelling teachers' PEB is crucial in influencing the youth (Hermans, 2016). As the success and effectiveness of environmental-related education depends on teachers (Hanifah et al., 2015), to influence behavioural change among students, it is necessary to examine teachers' PEBs in terms of how their actions align with sustainable initiatives. Hence, this study's aim is to ascertain the determinants that impact PEB among teachers from schools located within the Southern Region of

Malaysia. This is accomplished by including climate change knowledge (CCK), climate change mitigation attitude (CCMA), self-determined motivation (SDT), and PEB among teachers. The PEB model developed in this research aims to address the lack of knowledge in PEB research related to environmental-related-education among education, and it is anticipated that this model would be advantageous for the government towards enhancing Malaysia's environmental-related education initiatives.

1.3 Problem Statement

Behavioural change towards pro-environmental has emerged in the environmental domain as a frequently studied subject (Donmez-Turan & Kiliclar, 2021). Education is often seen as a vital instrument for inducing PEB (Ma et al., 2023; Macado & Davim, 2023) and is critical in initiating a behavioural shift that will help to mitigate the harmful effects resulting from climate change towards the environment (Abd Hamid et al., 2021). However, environment-related education, such as EE (Marques & Xavier, 2020), ESD (Zainal Abidin et al., 2023), and CCE, are experiencing challenges (Eze & Nwagu, 2021). Due to this, creating behavioural change to promote sustainability through education has also become a significant challenge (Andrews et al., 2021; Powdthavee, 2021).

Difficulties concerning environmental-related education affect children, including the youth, as it was agreed on education's crucial role in addressing as well as mitigating climate change, particularly in younger generations' education (Rousell & Cutter-Mackenzie-Knowles, 2020). Considering environmental-related education is considered challenging to tackle as a subject, pupils are continually affected by misconceptions (Jarrett & Takacs., 2020) and are unaware of climate change

mitigation measures they may take to assist the environment (Baldwin et al., 2023). However, the most worrying effect on students reported from previous studies is regarding their knowledge and behaviour. It is supported by Kara et al. (2015), who mentioned that environmental knowledge and daily PEB are lacking among the younger generation. Bofferding and Kloser (2015) reported in their study that adolescents have poor knowledge related to responses concerning climate change adaptations. Mitigating climate change topic seems challenging for students, as after learning about the subject, many misunderstandings persisted regarding climate change adaption, resulting in students believing that climate change is unavoidable (Özdem et al., 2014). Studies focusing on students in Malaysia show inconsistent results with knowledge and attitude relating to sustainability being good (Mahat et al., 2019), while environmental literacy is only moderate (Abd Wahab & Mapa, 2020). In addition, according to multiple research studies, environmental awareness and knowledge are also low among citizens in most countries across the globe (Muslih, 2021; Reimers, 2021). Most of the studies reported that the level of environmental literacy is between the range of moderate and moderately high (Abd Rahman & Nasri, 2018; Gavrilakis et al., 2017; Jannah et al., 2013; Liang et al., 2018; Nunez & Clores, 2017; Pratama et al., 2020; Timur et al., 2013). Malaysia has long pushed its people to be more environmentally conscious as a growing nation, yet Malaysians have poor to moderate knowledge of environmental problems (Mustam, 2015). A mere lack of knowledge could be a significant barrier to successful PEB (Pickering et al., 2020). According to Ojala (2013), students' lack of concern by dismissing environmental issues lowers their PEB. However, it is argued in the literature that even with high environmental literacy among students due to environmental education, it seldom impacts their PEB. Several studies showed that even with a heightened awareness of

climate change, PEB remains low (Abdullah & Keshminder, 2020; De Leeuw et al., 2015; Kara et al., 2015; Prinzing, 2020; Sanson, 2018). In Malaysia, students' PEB level is low, even with good environmental awareness (Charlie et al., 2021; Mahat et al., 2019). These inconsistent findings are not promising as an effective CCE or environment-related education that requires behavioural change.

Environment-related education are critical approaches for addressing environmental issues and preserving the environment. Unfortunately, various major obstacles obstruct its adoption (Petkou et al., 2021). The identified factors from the literature are teachers, curriculum, educational policy, pedagogical approach, and stakeholder engagement. Teachers were singled out as a standalone factor because they play a critical role in implementing school environmental-related education initiatives (Daraz et al., 2023). A teacher plays an undeniably crucial role in a successful infusion and effective environment-related education in schools to educate future generations environmentally (Damoah & Adu, 2020). Focusing on CCE, a rising amount of research from earlier times to current years has highlighted the challenges teachers confront while educating on Earth's climate as well as global climate change, from Fortner (2001), Shepardson et al. (2012), Hestness et al. (2014), Plutzer et al. (2016), Kanapathy et al. (2017), Drewes et al. (2018) and Beach (2023). Overcoming obstacles relating to CCE for teachers will improve their confidence in the subject matter (Ennes et al., 2021).

According to Genovese (2022), younger generations have the responsibility for the future of Earth, and it is challenging for educational institutions to cultivate novel values, abilities, and behaviours towards sustainability. This research will focus on the importance of teachers' PEB because studies revealed teachers have a significant impact on shaping students' PEB. According to Liang et al. (2022), when teachers

actively display PEB, it has a substantial impact on students' focus on the environment as well as their willingness to engage in PEB. In addition, Huoponen (2023b) has highlighted that insufficient support from school and absence of authoritative guidance can hinder students from engaging in PEB, and that the school environment must be enhanced to foster more support for environment actions to be embed within students (Huoponen, 2023a). Due to the intricate nature of the human-environment relationship, the fluctuation of PEB may be ascribed to several reasons (Rampedi & Ifegbesan, 2022), and it is highlighted that knowledge, attitude (Zhdanov et al., 2023), and motivation (Canto et al., 2023) are the challenges faced by teachers concerning PEB. Additionally, the effectiveness of environmental-related education at schools depends upon the teachers' fundamental knowledge, attitude, motivation within the subject (Liao et al., 2022).

According to Liao et al. (2022), teachers occupy an essential position in teaching environmental education; therefore, teachers are required to be well-versed in knowledge for students to obtain better learning outcomes. It is also supported by Petkou et al. (2021) that environmental learning for pupils is said to be hindered by teachers' lack of knowledge, which has been cited as a significant obstacle. Much literature has been published about knowledge within teachers on climate change and environment. In-service teachers' knowledge about climate change is lacking, and it was shown in these studies conducted in various countries (Aye et al., 2019; Bhattacharyya et al., 2020; Burmeister et al., 2013; Busch et al., 2019; Falkenberg & Babiuk, 2014; Gkargkavouzi et al., 2018; Guo et al., 2018; Hashemzadeh, 2016; Khalidi & Ramsey, 2021; Ochieng & Koske, 2013; Monroe et al., 2013; Plutzer et al., 2016; Prokopy et al., 2015; Seroussi et al., 2019; Sofiyan et al., 2019). A comparable result was reported in recent studies conducted by Raja Abu Bakar et al. (2021) as well

as Said and Ahmad (2021); in-service teachers' level of knowledge on environmental concern and sustainability is still low, although EE was declared 42 years ago (Abd Wahab & Mapa, 2020). Teachers' environmental knowledge is critical in building their students' environmental competencies (Guven & Sulun, 2017); thus, its absence among in-service teachers is concerning. Many studies suggest that environmental-related education is more successful when teachers are knowledgeable about environmental issues; therefore, it is critical to have agents who can constantly offer facts and knowledge on environmental protection and sustainability (Hanifah et al., 2015).

For environmental-related education to be successful integrated in schools, it is essential to have teachers with the positive attitude towards the subject. Andrea and Petkou (2022) has stated, teachers' attitude on climate change have become crucial, since they play a vital role in guiding pupils' pro-environmental attitudes, which in turn result in students' PEB (Garaika & Sugandini, 2021). In addition, extensive study has consistently emphasized the significance of attitude in fostering individuals' pro-environmental behaviours within schools (Zhdanov et al., 2023)., Focusing on the teachers in Malaysia, previous studies revealed that the level of attitude towards the climate change are positive (Abdullah & Osman, 2024; Karunaneethy & Mahmud, 2022; Nayan et al., 2020). Similar findings were also achieved from other countries, such as India (Mohapatra et al., 2022), Sri Lanka (Rupasinghe & De Silva Weliange, 2023), Indonesia (Sumitro & Rohman, 2023), and Taiwan (Liao et al., 2022). However, moderate level of attitudes was also demonstrated by teachers in Nigeria (Oladipo et al., 2020) and Turkey (Sakçi, 2023). Over time, teachers' attitude towards environment and climate change have been improving. However, the issue resides on the relationship between attitude and PEB, which is known to be weak (Bravo &

Farjam, 2022; Erwinsyah, 2022). This is supported by studies conducted in multiple countries such Malaysia (Fadzil et al. (2021), Indonesia (Tamar et al., 2020), Spain (Fernández et al., 2020) which showed that environmental attitudes do not result in PEB within the educational context. Thus, the above findings indicate the need of further research on the relationship between attitudes and PEB to achieve behavioural change among teachers.

To cultivate PEB among teachers, research should address not just cognitive but affective aspects as well. In line with this, motivational factors are believed to significantly influence PEB within educational context (Baierl et al., 2021; Schönfelder & Bogner, 2020). It is further supported by Yli-Panula et al. (2022), motivation towards PEB has been recognized as a crucial component in the culture of a sustainable school. Additionally, there is a need to enhance students' motivation as it encourages PEB among them (Baeirl & Bogner, 2023). Thus, teachers are not only responsible to impart knowledge and skills onto next generations, but they are also required to instil motivation towards the national goal (Al-Thani et al., 2021; Park et al., 2021). Moreover, teachers' motivation not only influence their own as well as their students' PEB, but also towards the success of environmental-related education. Zguir et al. (2022) as well as Abramovich and Miedijensky (2023) revealed that one of the difficulties and limitation which hinders the implementation of environmental-related education is lack of motivation among teachers. Teachers in Finland evaluated their motivation to teach as comparatively worse than their proficiency in addressing other areas of CCE (Yli-Panula et al., 2022). Therefore, it is crucial to enhance teachers' motivation towards PEB as it could be a viable approach to steer students towards PEB as well (Baierl & Bogner, 2023). In addition, students' motivation has been extensively

studied using Self-Determination Theory (SDT) within educational settings, but less focus was given to teachers' motivation (Barrable & Lakin, 2020).

Teachers' PEB is essential because they have the responsibility to encourage the behaviour of their students, and as stated by Eze and Nwagu (2021), teaching about climate change is only effective if it results in a behavioural change. In addition, teachers are responsible for serving as role models for their students throughout their careers (Sharaai, 2021), and instilling PEB among teachers is crucial because others' actions and behaviour significantly influence individuals' PEB (Yusliza et al., 2020). However, studies on PEB amongst educators uncover a multifaceted depiction locally and globally. Pre-service teachers in Finland were hesitant towards adopting PEB to address climate change (Tolppanen & Kärkkäinen, 2021), educators in US exhibit lack of confidence on in their ability to positively impact the environment through their PEB and primarily focus on individual-level behaviour as opposed to system-level behaviours (Hunter & Jordan, 2020), and teachers in Pakistan exhibit lack of engagement in PEB although aware of climate change awareness (Natalia et al., 2023). In Malaysia, PEB among teachers is worrying, as previous studies by Said et al. (2003), Mahat et al. (2013), and Hanifah et al. (2015) reported that behaviours were low to moderate levels throughout the years. Overall, these results indicate that teachers have difficulties in attaining significant PEB level and further research must be carried out effectively improve their PEB. If the teachers lack certainty in their capabilities and determination to perform PEB towards environmentally friendly future, it may be improbable for them to steer their pupils towards adopting PEB (Ratinen & Linnanen, 2022) and their capacity to serve as PEB influencers could decrease (Rahman, 2020).

To address environmental issues, the global community has initiated attempts to conduct international conferences such as the Tbilisi Conference, the Earth Summit,

and the Belgrade Conference (Abd Rahman & Nasri, 2018). The main objective of these conferences is to create a community with awareness, knowledge, skills, behaviours, and actions in environmental preservation (Suryani et al., 2021). According to the Tbilisi Declaration of 1977, environmental-related education is a critical technique that may help individuals adopt PEBs (Georgiou et al., 2021). Evidence suggests interventions in education have the best results when focusing on actionable as well as solid elements related to environment, climate change, along with sustainable development, particularly related to the behaviour of humans (Anderson, 2012). Undoubtedly, teachers are responsible for developing their students' PEB, especially their knowledge, values, attitudes, actions, and beliefs concerning the environment. It is supported by research conducted by Robina-Ramírez et al. (2020) that teachers must develop environmental competencies to achieve the greening of schools. Therefore, teachers must be environmentally literate to ensure the effectiveness of environmental-related education (Gkargkavouzi et al., 2018). As one of the goals of environmental-related education is to produce environmentally literate students, teachers' knowledge, attitude, and PEB must first be improved tremendously (Dal et al., 2015; Liu et al., 2015; Mogias et al., 2015 Taha et al., 2019). Previous studies, as discussed, had not only shown the worrying conditions of Malaysian teachers and students related to their environmental knowledge and behaviour, but the citizens of Malaysia also demonstrate a low rate of environmental literacy (Shamuganathan & Karpudewan, 2015), low level of PEB (Sharaai, 2021). It was also recommended that even if students have excellent environmental knowledge, attitude, and awareness, their PEB needs to improve (Abd Rahman et al., 2020).

Previous research has shown the significance of understanding PEB's determinants and main drivers (Blankenberg & Alhusen, 2019; El-Deeb et al., 2020).

Several external and internal variables, which vary over time, can impact behaviour (Norkhaidi et al., 2021). According to Manolas (2015), external factors are economic, institutional, cultural, and social; internal factors are knowledge, attitude, awareness, values, motivation, locus of control, priorities, emotions, and responsibilities. According to the assessment of relevant previous literature, evaluating in-service teachers' environmental knowledge and attitudes would offer crucial evidence on the current status of environmental-related education in schools; therefore, more studies are required to highlight the environmental competence of in-service teachers in comparison to demographic factors, to provide better information in designing training programmes tailored to various types of teachers, as well as their requirement in education in environmental-related education classes (Gkargkavouzi et al., 2018). Considering all these factors, it is evident that evaluating in-service teachers' PEB and factors influencing its enhancement are very valuable (Gkargkavouzi et al., 2018). Unfortunately, information about determinants of PEB among in-service teachers is limited in Malaysia, as prior studies concentrated on students and pre-service teachers. The initial literature assessment showed broad environmental knowledge and attitudes among teachers; however, it overlooked aspects that have not been examined before (Gkargkavouzi et al., 2018), such as motivation. This study attempts to address the existing gap within literature by evaluating in-service teachers' climate change knowledge, climate change mitigation attitude, autonomous motivation, external motivation, and pro-environmental behaviour. This study also seeks to fill the gap in in-service teachers' climate change perceptions in Malaysia, as these are inadequate in published literature.

1.4 Research Questions

The research questions below are to address the gaps highlighted by the problems raised in the previous topic:

1. What is the level of climate change knowledge, climate change mitigation attitude, autonomous motivation, external motivation, and pro-environmental behaviour among teachers?
2. Which of the determinants influence the pro-environmental behaviour among teachers?
3. What is the mediating effect of climate change mitigation attitude in the relationship between climate change knowledge, autonomous motivation, and external motivation with pro-environmental with pro-environmental behaviour?
4. How does autonomous and external motivation mediate the relationship between climate change knowledge and pro-environmental behaviour?

1.5 Research Objectives

Several objectives were determined to address the previous research questions. The objectives are as follows: -

1. To determine the level of climate change knowledge, climate change mitigation attitude, autonomous motivation, external motivation, and pro-environmental behaviour of the teachers.
2. To evaluate the influence of climate change knowledge, climate change mitigation attitude, autonomous motivation, and external motivation towards pro-environmental behaviour.

3. To examine the mediating role of climate change mitigation attitude in the relationship between climate change knowledge, autonomous motivation, external motivation, and pro-environmental behaviour.
4. To examine the mediating role of autonomous and external motivation in the relationship between climate change knowledge and pro-environmental behaviour.

1.6 Scope of Research

For this study, the aim is to extrapolate teachers' pro-environmental behaviours by collecting data from in-service teachers within Malaysia. This research specifically focusses on the Head of Science and Mathematics teachers in Southern Malaysia from Johor, Negeri Sembilan and Melaka public secondary schools. These states are chosen based on sustainable efforts relating to education and educational institutions.

In Negeri Sembilan, the State Education Department is planning to develop a STEM Hub with collaboration with external agencies, and one of the many objectives is to cultivate Green Technology elements among teachers and students (Meah, 2023). In addition, Nilai City Council has been organizing 'Go Green' programmes in selected schools to carry out green activities to instil positive behaviour towards the environment among teachers and schools (Jalil, 2019).

The sustainable education effort in Johor is seen through the agreement of Johor Education Department and UDA Holdings Berhad (UDA) to working together towards advocating environmental sustainability, through the implementation of environmental activities within school across the state in line with the education module; Sustainability Education Action Plan (Pelan Tindakan Pendidikan Kelestarian Johor), with the objective of increasing awareness as well as fostering responsibility

among students, schools including local communities in regards with environmental protection and conservation, in addition with natural resources preservation (UDA Inks Deal to Promote Environmental Sustainability in Schools, 2024).

For Melaka, the state has been implementing Eco-Schools Melaka since year 2016 by Melaka Green Technology Corporation (MeGTC) in collaboration with the strategic partner Green Growth Asia Foundation supported by the World Wildlife Fund (WWF) for Nature and Melaka Education Department, which is the implementation of green practices programme and it aims for the programme to be implemented in all schools throughout the state to support Melaka's aim to be a sustainable state by 2035 as well as raising awareness to the public, as stated by the State Education EXCO, Datuk Rais Yasin (Abu Hasan, 2022).

The research is focused on investigating the adoption of PEB among secondary school teachers in the Southern Region of Malaysia. Thus, the study's findings are applicable towards fostering a behavioural change in teachers' behaviour towards the environment. Moreover, the empirical outcomes of this research will be appropriate for substantiating conclusions within educational context. Consequently, this research will enhance the understanding of in-service teachers' PEB.

1.7 Significance of Study

This research will make significant contributions to both theoretical along with practical aspects and will be elaborated further below.

1.7.1 Theoretical Contributions

This study will identify the CCK, CCMA, AM, EM and PEB among teachers in Southern Malaysia. Regarding theoretical contribution, most previous local or international studies in environmental-related education or environmental behaviour

studies mainly focused on students or pre-service and rarely on in-service teachers. This study will focus on in-service teachers responsible for teaching the younger generation about climate change issues and instilling positive PEB in them.

Secondly, this study will contribute findings regarding current CCK, CCMA, motivation and PEB among teachers from the Southern Region of Malaysia. The determinants identified were adapted from the Knowledge-Attitude-Behaviour (KAB) Model and Self-Determination Theory (SDT). Numerous studies have focused on determinants of PEB; however, the integration between the KAB model and SDT theory in this study has not yet been investigated.

In addition, previous studies focusing on environmental behaviour are often too complex to be understood. This study will investigate a simple linear behaviour model by identifying the relationship between the determinants and behaviour. Previous literature states that a straightforward linear model is limited in environmental behaviour studies.

1.7.2 Practical Contributions

For practical contributions, this study's outcome can contribute to current data on the teachers' CCK, CCMA, and self-determined motivation in terms of environmental-related education, focusing more on the topic of climate change. As CCE being implemented worldwide, and in Malaysia soon enough, the findings from this study will contribute as this study focuses more on climate change topics. With these findings, the government can identify whether the teachers received sufficient training to increase their knowledge and attitude. In turn, the government can prepare more initiatives to assist these teachers in fulfilling the objectives of environmental education, strengthening its infusion in the curriculum, and determining whether the teachers require motivation to be engaged in PEB. In addition, these findings will

identify whether there is an issue regarding PEB among teachers, raising teachers' awareness of the need to engage in PEBs. Lastly, the education sector will benefit from this study as the model will reveal which determinants should be focused more on to increase PEB among teachers in Malaysia.

1.8 Definition of Key Terms

The key terms will be clarified as well as elucidated to enhance comprehension of the terminology and ideas utilized for this research.

Environmental Knowledge: Understanding the natural environment along with primary ecosystems facts, relationships and concepts (Fryxell & Lo, 2003).

Climate Change Knowledge: The understanding concerning climate science, causes, together with consequences on climate change (Hestness et al., 2014).

Attitude: An attitude is a set of perceptions focused on a specific object, whether physical or social, tangible or abstract, or a circumstance, which tends to lead one to respond in a particular manner (Grube et al., 1994).

Climate Change Mitigation Attitude: A perspective on climate change mitigation effects that encompasses either a positive or negative sentiment.

Motivation: It is described as a cause for individuals to engage in a particular behaviour, with motivation acting as a significant stimulant to engage in specific behaviour in a particular circumstance (Moisander, 2007).

Autonomous Motivation: It is derived from individuals' genuine interest and affection for the environments, which influence them to engage in PEB (Kim & Lee, 2022).

External Motivation: The influence of green-focused legislation and policies set by the organisation, external incentives, and avoidance of punishment on individuals' PEB (Kim & Lee, 2022).

Pro-Environmental Behaviour: A collection of behaviours aimed at mitigating the harmful effect resulting from an individual's activities towards natural along with built environment (Kollmuss & Agyeman, 2002).

1.9 Organization of Thesis

The structure of this research will be according to the following organization:-

Chapter 1: The first chapter starts by presenting the contextual information on PEB, environment-related education, and teachers' role in environment-related education. Next, the issues statement is introduced, drawing upon the research gap identified in prior studies. Subsequently, the gap is shown in the research inquiries. Additionally, the objectives for this study are presented. Ultimately, the research is extended, and its importance is subsequently introduced. Finally, this chapter summarises the research conducted in this thesis.

Chapter 2: An overview concerning environmental issues, holistic review of environmental-related education worldwide and in Malaysia. This is followed by PEB and its determinants, that are going to be employed for the investigation. The review will focus on the theory along with the model used to foster PEB. The theoretical framework is presented based on the hypothesis developed for this research. The research will include a detailed specification and discussion of the related constructs involved, including their hypothesized links.

Chapter 3: This chapter intends to present as well as discuss the methodological design. It comprises of examination on various measurement techniques, development

of primary instrument, which is questionnaire, unit analysis determination, deciding on samples, collecting data, observational research, assessing including testing pilot study, as well as data analysis methodology.

Chapter 4: The findings gained are described in this chapter. The survey conducted for the research specifically targeted teachers' CCK, CCMA, AM, EM, and PEB being basis towards analysing the acquired data. The respondents' rate of response, their profile, and the initial analysis will be discussed in the first part of chapter four. The measurement model's validity, along with consistency, is also evaluated. Finally, for the concluding section of this chapter, the author concentrates on appraising and analysing the outcomes derived through the study's structural model as well as the hypothesis.

Chapter 5: This chapter provides a concise overview of the topic being examined for this study. An extensive discussion is provided to determine if the results align with previous research. The justification for the outcomes is extensively analysed.

Chapter 6: Subsequently, the chapter provides a concise overview of the study's contributions in terms of theoretical, practical, and methodological. The research also addresses the contributions of academics, policymakers, practitioners, and the government. Ultimately, this chapter underscores the limitations as well as suggestions for further investigation in the future.

1.10 Summary

The chapter elaborates on scope and topic concerning the research. In order to substantiate the necessity of analysing the research area, a thorough assessment of the research background is conducted. Subsequently, the research objectives, as well as