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Malaysia's EOC Strategy in Strengthening the Science Knowledge, Awareness and National Interest Towards the Polar Regions

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ABSTRACT

This study aims to examine Malaysia's involvement in the Polar Regions, in the context of education, outreach, and communication (EOC), and consequently, to determine the effectiveness of these initiatives. Using qualitative and quantitative research analyses, this study found that Malaysia's experiences in EOC can be used to increase public knowledge and awareness towards the Polar Regions. In 2015, an exploratory study was conducted to survey the general knowledge, understanding and opinions of young Malaysians with regard to environmental citizenship on polar-related issues. Moving from there, Malaysia became actively engaged in EOC programmes to increase awareness among its young citizens and to develop national interest on the Polar Regions. Hence, knowledge and concerns of Malaysia's young citizens about Polar Regions have been well developed, especially on issues related to climate change. The survey conducted was important for evaluating the effectiveness of Malaysia's initiatives on the Polar Regions in the context of EOC. Consequently, these initiatives have made it possible for Malaysia to establish the scenario of the nation's agenda on Polar Regions, with the support of the Malaysian public. Following that, Malaysia took the initiatives to map out the future landscape of Malaysia's involvement in the Polar Regions. To develop future strategies for the national polar governance, information on Malaysia's activities in the polar regions is important in coordinating stakeholder's initiatives with the available funds for EOC initiatives during the Year of Polar Prediction (YOPP.

KEYWORDS
Environmental education (EE), environmental education and communication, outreach, Antarctic, arctic

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Introduction

The Polar (Antarctic and Arctic) Regions have become increasingly prominent issues among the global community. These issues are related to global climate change, ice melting, rising of sea levels, and human or ecological impacts of environmental changes. Ricci and Egerton (2010) highlighted that the two regions can provide insights into the fundamental earth system processes that are of crucial importance to the environment and climate of the earth as a whole. In fact, they are the locations where the important earth processes originated. Thus, information regarding them can provide an early warning about climatic changes.

Notably, Malaysia is one of the countries from the tropical region that has been actively involved in polar science research, particularly in the Antarctic region. Malaysia initiated its involvement in polar science by setting up the Malaysian Antarctic Research Programme (MARP) in the year 1997 and year 2006. Since then, MARP has extended its research interest to the Arctic region. To date, MARP is making great progress and has attained many achievements in international membership, publications, local and international collaborations and in the production of human capital (Abu Samah et al., 2013). Besides focusing on research activities in the Polar Regions, the national action plan of the Malaysia's polar governance is to create national campaigns to increase awareness on polar issues through Education, Outreach and Communication (EOC), and targeting audiences, especially the young citizens.

This study aims to examine Malaysia's EOC initiatives in increasing awareness and understanding regarding the role of the polar regions and consequently, determine the effectiveness of these initiatives through a public survey. Two specific objectives have been set in order to achieve the main goal of the study, namely (i) To explore Malaysia's initiatives in improving public participation in its national agenda on the polar regions through education, outreach and communication, and (ii) To identify the status of Malaysia's public knowledge, understanding and opinion about polar regions and their connection with climate change and global warming. The present study will serve as a reference for Malaysia's polar governance in designing an adequate communication strategy in the context of education, communication and outreach (ECO) to strengthen public participation in this global issue.

Background

EOC efforts on polar regions must be given an equal standing to research and an important role within polar scientific programmes to ensure that key audiences, especially educators (school teacher and lecturer), students (school and university) and the media have the resources and networks to access relevant and current science information. Harrison et al. (2009) highlighted that there is a great and growing need to improve links between scientists and society because of the important role science plays on people's lives and the significant (and increasing) impact of humans on the environment. Barbour et al. (2008) focal pointed that beyond the growing desire for more contact with relevant science projects, there is also an increasing recognition that science literacy is a critical component in promoting public awareness of science advancements and current events, such as climate change, and in enabling the public to make decisions based on scientific findings Hereby, EOC initiatives serves as a medium to develop

awareness and understanding about the Polar Regions and to deliver information and publicity about the national agenda in the Polar Regions.

In the context of awareness, a wide range of public surveys have been conducted by researchers from countries involved in polar regions, especially the Antarctic region. A study by Hamilton (2008) addressed this issue by exploring data from the General Social Survey (GSS), which in 2006 questioned a representative sample of more than 1800 U.S. adults about their knowledge and opinions concerning polar regions. Then, Tin et al. (2011) studied knowledge about Antarctic wilderness among the Dutch population. They found that respondents clearly supported protecting the Antarctica as a wilderness, acknowledged Antarctica's importance as part of the global climate system and as a science laboratory for the benefit of mankind. In another study, Salazar (2013) provided an initial understanding of the core values and perceptions of a representative sample of the Chilean public about the Antarctic region. Del Acebo Ibánez and Costa (2010) conducted a study on attitudes and behaviours among Argentinian youths (aged 15 to 25 years old) towards environmental problems in Antarctica. At the national level, Shabudin (2015) conducted a survey between late 2013 and mid-2014 to identify the perceptions among young Malaysians with respect to their values about Antarctica and Malaysia's involvement in Antarctica. The current study is different from the previous studies in terms of location of respondents and the structure of questions that focused on both the polar regions (Arctic and Antarctic regions) and climate change related issues.

Methodology

This study utilised qualitative and quantitative research to examine the landscape of Malaysia's involvement in the Polar Regions in the context of education, outreach and communication (EOC). Then, the study will determine the effectiveness of these initiatives by measuring the level of public awareness about the Polar Regions. Its approach to theory construction is guided by case study methodology, involving a multi-strategy research design and the standard social science methods. The specific research design for the study is outlined as follows.

Outreach, Education and Communication

For the purpose of this baseline study, a report on the general and specific outreaching activities initiated from 2001 until 2015 is presented. The report focuses on the activities conducted at the school and university levels in Malaysia. Documents such as reports, news and websites related to outreaching activities in the polar regions conducted in Malaysia were summarized and analysed to explore the landscape of Malaysia's initiatives in the outreach of polar regions.

In terms of education, review of documents and interview sessions were held to explore the formal activities conducted at the schools and universities on the Polar Regions; (i) Secondary school and university syllabuses were examined through document analysis, and (ii) School teachers and university lecturers were interviewed through telephone to gather information. With regard to communication, the trend of media coverage of events regarding Malaysia's research expeditions and non-research activities there such as sending of ambassadors and making official visits to the polar regions in 2002 through 2015. Information on Malaysia's involvement in the polar regions from local media

(print and electronic) can be retrieved from the Internet using keywords such as Malaysia, visit, expedition, Antarctica, poles, polar regions, Malaysia Antarctic Research Programme, and so forth, in both languages, English and Malay

General Knowledge, Understanding and Concern

An exploratory survey on general knowledge, understanding and concern about the polar regions was conducted by Centre for Global Sustainability Studies, Universiti Sains Malaysia and Sultan Mizan Antarctic Research Foundation. The survey was conducted on the Malaysian young citizens, namely university and secondary school students in Terengganu, Malaysia. The survey was conducted between May and June 2015. The study involved 1004 form four and form five students aged 16 to 17, from selected secondary schools and students from public universities in Terengganu. The survey was conducted using a three-part questionnaire. Part 1 consisted of demographic questions and the respondents were asked to provide their personal information such as gender, education level, and their institution. In Part 2, the respondents were tested on their general knowledge about the polar regions, using 15 basic questions concerning definitions, geography, biodiversity, ecology and issues related to the polar regions. Most of the questions were structured as comparison questions, asking them to compare the Antarctic region with the Arctic region. The score categories for common knowledge on Antarctic region were as follows: High knowledge (100% to 80%), Intermediate knowledge (79% to 50%), and Low knowledge (49% to 0%). The method used to determine the score for general knowledge was modified from the research conducted by Koske and Ochieng (2013), which measured the level of awareness and perceptions on climate change among primary school teachers in Kisumu Municipality, Kenya. Meanwhile, Part 3 of the questionnaire focused on respondent's understanding and opinions regarding the roles of the polar regions and polar-related issues, especially on climate change and rise of sea level. The responses were measured using a 3-point Likert scale, where 1 = *Disagree*, 2 = *Not Sure*, and 3 = *Agree*. The 3-point Likert scale approach was modified from the research by Farauta et al. (2011), which measured Farmers' perceptions on climate change and adaptation strategies in northern Nigeria. For statistical analysis, data were analysed using descriptive statistics with the aid of the SPSS 22.0 software.

Results and Discussion

Education, Outreach and Communication on Polar Regions in Malaysia

Besides actively working on foreign policy interventions and scientific research in the polar regions, particularly in Antarctica, Malaysia has taken the initiatives to improve the appreciation, knowledge and awareness of its public on the polar regions through education, outreach and communication (EOC). The EOC programme on the polar regions started in 2001, when Malaysia's Antarctic Research Programme (MARP) received a special allocation under the Eighth Malaysian Plan (2001-2005) and Ninth Malaysia Plan (2006-2010). The establishment of National Antarctic Research Centre in 2002 was to act as a medium to coordinate the activities related to education and outreach. Besides, International Polar Year (IPY) 2007-2008 marked the largest-ever international programme of scientific research focusing on the Arctic and Antarctic regions. It has contributed significantly to the global and local initiatives for raising public

awareness on the issues of the polar regions. Consequently, it became a platform for understanding the effects of climate change on the polar regions and its impacts on this part of the world. During these periods, Malaysia's polar governance in collaboration with local researchers and local universities have successfully embarked on numerous of education and outreach programmes to improve public appreciation and understanding towards the roles of the polar regions for peace, science, and sustainable future.

Through the implementation of Education for Sustainability Development (ESD) concept, Malaysia's polar governance has successfully undertaken outreach activities throughout the country to its public, especially to the young citizens (school and university students). According to Grimmette (2014), the effects of environmental education (EE) programmes on youth, include creating environmental awareness, building a connection with the environment, and changing the perceptions youth has on the environment. The outreach programmes such as seminars, public lectures, workshops and exhibitions have been implemented for university students. Public universities have organised a series of public lectures to local lecturers and students involved with local and international researchers. Other than that, The Environmental Law Association at Universiti Teknologi MARA, (UiTM) has organised a forum for Polar Oceans Week called "International Polar Year - I'm involved, are YOU?" Malaysia has also succeeded in organising a seminar on polar research called the Malaysian International Seminar on Antarctica (MISA) in 2002. It is a biennial seminar where established polar scientists and national research programmes science strategists and managers are invited to share their knowledge and experiences on Antarctic research with Malaysian scientists, especially with young researchers.

Meanwhile, for school students, outreach programmes that focused on the "Back to School" concept, consisting of activities such as experience sharing by local researchers, exhibitions, and quizzes. The programme was organised at selected secondary schools in Malacca, Selangor, Kelantan, Sabah, and Kedah. Besides, Malaysia's polar governance programme actively collaborates with National Science Centre through the *Pusat Sains Negara di Desa* programme. Meanwhile, in 2004, Universiti Sains Malaysia organised an essay writing competition for secondary school students in conjunction with the Malaysian International Seminar on Antarctica. Instead of stressing that Malaysians are deeply involved in research explorations in the polar regions, the outreach activities for the school and university students intended to motivate them and increase their consciousness as global citizens. In fact, the International Association of Cryospheric Sciences (IACS) stated that outreach programmes "should be developed and provided that help students acquire new knowledge, skills, and behaviours; encourage positive and realistic self-appraisal; foster personal, academic, and career choices; enhance the ability to relate mutually and meaningfully with others; and increase the capacity to engage in a personally satisfying and effective style of living" (Boyd et al., 2003, p. xxx).

As a way forward, in 2012, the Malaysian government established the Sultan Mizan Antarctic Research Foundation (YPASM) in an effort to strengthen and sustain the national agenda on the polar regions and to strategically encourage young citizens to be interested in polar studies. A part of the main objectives of YPASM is to develop the scientific capacity of Malaysians, especially those of the young scientists, to promote Antarctic science in the education system, and to

disseminate scientific information on the polar regions. Since its establishment, YPASM has conducted a number of educational and outreach activities in collaboration with local universities. The aim was to increase knowledge, awareness, and responsibility of the public towards the crucial role of polar regions, with a focus towards the increased involvement of school and university students in Malaysia. To date, the YPASM has made some progress and these include providing 7 fellowship awards to Malaysian young scientists and 6 grants to new researchers in polar research.

In this section, the paper will discuss the specific outreach activities initiated from 2012 until 2015. Since 2012, the outreach activities on the polar regions conducted for the public and the students were mainly in the form of seminars, workshops, back to school programmes, and national contests. Table 1 highlights the list of education and outreach activities conducted from 2012 until 2015. Traditionally, outreach programmes were conducted with a speaker delivering his or her presentation to students. However, colleges and universities have been developing innovative strategies to reach out to students (Blocher, 2011). Thus, in conjunction with 6th Malaysian International Seminar on Antarctica 2013 (MISA6) that was held in 2013, YPASM and Universiti Sains Malaysia (USM) had jointly organised a national essay and video competition entitled "Sustainable Antarctica" with strong support from the Ministry of Education (MOE) and Ministry of Science, Technology and Innovation (MOSTI). This programme was successful in attracting the participation of secondary school students in Malaysia. Hence, the organizers have agreed to make the competition as an annual event for young Malaysians to participate and to express their opinions on the polar regions, particularly Antarctic. For 2014, the concept of the contest was creative comics. The contest has successfully attracted hundreds of student participation (e.g., essay, 155 entries; video, 144 entries; and comics, 658 entries). As for the results of the video competition, the works of the top 3 winners of the video competition and consolation prize winners were uploaded in social media such as the YouTube, which can be searched using the keywords *Antartika Lestari* and Facebook through YPASM and POLAR@USM website. Meanwhile, for the winners for the comics competition, their works will be displayed in Digital Comics Book Apps for Android and iOS, which will be developed by YPASM and USM. More important, the collaboration between USM and YPASM reflected the initiative to match the knowledge and expertise, facilities and resources available in the university to the needs, aspirations and expectations of the national polar governance and that of the community to achieve mutual benefits.

In the context of education, to date, the formal teaching curriculum on the polar regions in the school syllabus and university courses in Malaysia is still lacking. For example, at the school level, the issues on polar regions have been marginally touched in the science and biology classes in relation to climate change, ice melting and sea level rises. Besides, the geography syllabus focuses on latitude, topography and climate of the polar regions. The history of Malaysia's involvement in the polar regions, especially the nation's foreign policy on Antarctica in the United Nations General Assembly (UNGA) was highlighted in the syllabus under general study (for form 6 students). Meanwhile, currently at the university level, most of the formal education on polar regions is focused on research activities carried out in part by the efforts of researchers and postgraduate students. Concurrently, for undergraduate syllabus, most of the syllabuses on Polar Regions are integrated with the related-course (subject) in

Table 1. Outreach Activities on Polar Regions (2012-2015)

Year	Activities
2012	Workshop on Antarctica in Vistana Hotel Penang - organised by Long-Term Research Grant Scheme (LRGS) Universiti Sains Malaysia Team. Focus group was young scientists and researchers. The outcome – formation of POLAR@USM to coordinate the polar research group in northern region of Malaysia.
2012	Educational exhibition and awareness programme and interactive activities with public in convocation festival (September 2012, 20-23) Universiti Sains Malaysia - Polar Regions and Greenpeace Save the Arctic Campaign (in collaboration with Universiti Sains Malaysia)
2012	Back to School (Talk, Exhibition and Games) – SMK Jitra, Kedah(in collaboration with Universiti Malaya and Universiti Sains Malaysia)
2013	Sustainable Antarctica Contest 2013 – video (in collaboration with Universiti Sains Malaysia, Ministry of Education and Ministry of Science, Technology and Innovation)
2013	Back to School (Talk, Exhibition and Games) - SMK Bukit Jambul, Penang (in collaboration with Universiti Sains Malaysia)
2013	MRSM (MARA Junior Science College) Debate Contest - Antarctic Issues as a part of debate topic (in collaboration with MARA Junior College and USM)
2013	Back to School (Talk, Exhibition and Games) (in collaboration with USM and MARA Junior College)
2013	Sustainable Antarctica Contest 2013 – essay (in collaboration with Universiti Sains Malaysia, Ministry of Education and Ministry of Science, Technology and Innovation)
2013	Antarctica Day Flag 2013
2013	Antarctica Day - Virtual Peace Balloon 2013
2013	Science Festival – Polar exhibition and talk (in collaboration with National Science Centre)
2013	6th Malaysian International Seminar on Antarctica (in collaboration with USM and UM)
2014	Science Festival – Polar exhibition and talk (in collaboration with National Science Centre)
2014	Mural Painting in Conjunction with Antarctica Day Celebration 2014 – SMK Agama Johor Bahru
2014	Antarctica Day Flags Activity 2014 - Contest
2014	Public outreach (Flag drawing, games and exhibition) - National Science Centre (Kedah – branch)
2014	Sustainable Antarctica Contest 2014 – Comic Creative (in collaboration with Universiti Sains Malaysia, Ministry of Education and Ministry of Science, Technology and Innovation)
2014	Workshop On Strategic Direction For Malaysian Polar (Antarctica And Arctic) Research
2014	Road Tour to Universiti Teknologi Malaysia and Workshop on Polar Research Grant
2014	MARP Road Tour to Universiti Teknologi MARA
2015	Polar Science Camp – Student on Ice Project (for teachers and students)
2015	Student on Ice – Arctic
2015	Sustainable Antarctica Contest 2015 – Comic Strip(in collaboration with Universiti Sains Malaysia, Ministry of Education and Ministry of Science, Technology and Innovation)

some university programmes such as marine science, atmospheric science, climate change, foreign policy and law. However, the integration of polar region syllabus in teaching activities at the university level depends on the "culture" and "interest" of the lecturer. To date, no specific undergraduate programme on polar

regions has been offered in Malaysian universities, either public or private. During the International Polar Year, in 2008, Universiti Sains Malaysia in collaboration with International Antarctic Institute (IAI) have organised a short course on polar studies for formal education to undergraduate and postgraduate students, involving educators from University of Tasmania, Australia. Notably, the formal education on polar regions for university and school students may serve as a platform for Malaysia to build a pool of talents that can generate a tremendous forward momentum for Malaysia's future involvement in polar research and consequently, for the development of its human capital.

Malaysia is a non-consultative party in the Antarctic Treaty since 2011. Therefore, to achieve its status in the Antarctic Treaty Consultative Party (ATCP), it is the right time and with a good reason for the Malaysian government and education institutions to take the initiative to develop a pedagogical framework with holistic insights to promote the roles of polar regions. These initiatives will ensure global sustainability through the national education curriculum for its young citizens. In addition, McFadyen (2011) highlighted that the Antarctic continent has the potentials that can trigger an assortment of learning activities for students, which can foster awareness of the world around them. In addition, they can drive local action in the form of sustainability, citizenship, enterprise and globalisation. This will benefit the wider parts of the world, including Antarctica, for the future (the same goes for the Arctic region). The formal education may lead to the progression of Malaysian citizens with scientific knowledge make them able to think and be concerned about global and socio-scientific issues. Additionally, formal education can develop a community of scholars with leadership capabilities in polar regions. Consequently, this will contribute to shaping of a K-economy and a polar regions education-led Malaysian society. Intangibly, the formal education will contribute to Malaysia's role in implementing the international agreements and protocols relating to the global environment through Education for Sustainability (ESD) such as the Montreal protocol, the Kyoto Protocol, the Madrid Protocol, and so forth. This will consequently strengthen Malaysia's public policy on the polar regions.

In terms of communication, media plays a crucial role in shaping public perception, awareness and opinion about Polar Regions and consequently, influences their action. Nelkin (2001) mentioned that the "media serves as brokers between science and the public, framing the social reality for their readers and shaping the public consciousness about science related events." According to McCombs (2002), the pictures in people's minds about the outside world are significantly influenced by the mass media, both what those pictures are about and what those pictures are. Media also has the ability to influence public opinion and change public consciousness, making it a powerful tool that can persuade the public into taking actions (Azmi et al., 2015). Atkinson (2014) highlighted that the amount of media coverage that different issues receive can affect public knowledge and opinion on those issues, which in turn can influence policy makers and legislators, in setting an agenda and influencing its direction. Thus, media need to play a more prominent role in educating the public and in increasing their awareness regarding sustainability issues and Malaysia's involvement in the polar regions and expeditions by local scientists there to ensure that the national policy can be successfully implemented.

Results from media reviews show that most of media in Malaysia have highlighted Malaysian activities in exploring the polar regions through research expeditions, official visits and ambassador programmes. The media coverage of certain issues may be influenced by certain trends and patterns to secure public attention (Newig, 2004). Therefore, it is not surprising that media coverage on the polar regions in Malaysia increased drastically when there are major events such as official visits, ambassador programmes, and scientific expeditions, and decreased when there are no major occasions occurring in the polar regions. In fact, a common factor about media coverage is that whatever media covers must be newsworthy and that it must be of interest to many people (Lugalambi et al., 2011). Therefore, events such as polar exploration activities capture more attention and coverage by local media. Since 2002, representatives of the Malaysian government made three official visits to Antarctica, which have received wide coverage from the local media; (i) In early 2002, Dr. Mahathir (the then prime minister) and his wife, Dr. Siti Hasmah Mohd Ali, accompanied by three Cabinet Ministers (one of them Mohammad Najib Abdul Razak, the current prime minister) and a delegation, visited Antarctica via Argentina, (ii) In 2011, the King of Malaysia, the 13th His Majesty Tuanku Mizan Zainal Abidin, accompanied by the Minister of Science, Technology and Innovation visited Antarctica, and (iii) In 2014, Terengganu Chief Minister, Datuk Seri Ahmad Said, and a Malaysian delegation made a 15-day visit to Antarctica, organised by the Science, Technology and Innovation Ministry through the initiative of Sultan Mizan Antarctic Research Foundation. These official visits contributed significantly in developing the perception and the increased awareness about the importance of the polar regions and Malaysia's role in the polar regions.

The ambassador programme started in 1998, when a Proton Wira (the national car) landed at the North Pole accompanied by a team of Malaysian skydivers. In 2004, Sharifah Mazlina became the first Malaysian, and the first Asian woman to complete a 1100 km journey alone in the Antarctic and her expedition has set a new world record as she traversed the terrain in only 22 days. Additionally, in March 2014, Faisal Ariff, Paul Koh Zhu Kwang, and Helena Erin Dodge-Wan became the winners of the pru4antarctica search when they represented Malaysia at the International Antarctica Expedition (IAE) 2014, led by Robert Swan, an environmentalist and the first person to have walked to the north and south poles. Later, in June 2014, eight Malaysian youths successfully completed an expedition across Greenland in 27 days under KE7B Malaysia Greenland Expedition 2014, organised by the 7 Continents Exploration Club (KE7B). Finally, in 2015, a Malaysian became the first person to attempt skiing 1,000 km to the Antarctica.

Historically, in early 2015, YPASM and the Ministry of Education organised The Polar Science Camp to select the first batch of Malaysian school students and teachers to be sent to high Arctic in July 2015. It was an exciting learning journey about the polar regions and climate change under the programme called "Students on Ice" Arctic Education Expedition. Student on Ice programme prides itself on the successes of its alumni and hopes to increase the alumni to over 2200 members by 2015. These agents of change will help inspire and motivate people to become environmentally conscious as well as to implement global strategies and programmes that can affect planetary changes positively (Maher, 2010). The hope is that this first batch of school students from Malaysia, with their experience in the polar region expedition will become future polar regions champions when they

return. With their experience they could help inspire and motivate local communities to increase awareness on the polar regions and related issues such as climate change and rise of sea level. Most recently, the Malaysian Seven Continents Exploration Club (KE7B) organised the South Pole All The Way Expedition 2015. The expedition was undertaken by the national triathlete, Shahrom Abdullah, who started the expedition on November 17, 2015 from Messner in Antarctica, scheduled to reach the pole within 50 to 60 days.

In fact, what Malaysia seeks to gain from its polar ambassador programmes is to inspire the spirit of patriotism and global citizen consciousness among Malaysians. Meanwhile, polar regions exploration by Malaysian scientists also gets wide coverage by local media. Most of media coverage on polar regions expeditions highlighted recent and significant advances in research and development in the field of polar sciences, especially in climate change issues. Notably, instead of stressing that the Malaysians are exploring the polar regions, the media in Malaysia have emphasised on Malaysia's strong commitment and role in preserving the polar regions and finding solutions to global climate change through its scientific research in the region, as a responsible and mature nation.

Malaysia has made Education, outreach and communication (EOC) initiatives as a priority during the International Polar Year (IPY) International Programme Office (established in 2005) by playing a prominent role in promoting and fostering hundreds of global EOC efforts on the conservation of the polar regions (Salmon et al. 2011). While IPY EOC encouraged those within the scientific community to actively plan for science EOC, it also engaged experts in education and communication to develop polar activities and become involved in the larger IPY momentum in Malaysia.

The educational, outreach and communication (EOC) efforts will encourage changes in community behaviour, which will help create a more sustainable future for the polar regions in terms of environmental integrity, economic viability, and a just society for the present and future generations. Engaging the public in environmental protection activities on polar regions not only creates direct impact on changing their behaviours and attitudes, but also can influence those of people in their surrounding. Additionally, improved public understanding and perceptions about the roles of polar regions in global change can contribute to better scientific and policy discussions of the connection between the polar regions, global change and sustainability issues at the national and international levels. Consequently, it will promote competencies such as critical thinking, thinking about future scenarios and making decisions in a collaborative way.

General Knowledge, Understanding and Opinion on Polar Regions

In the study, demographic information was obtained from 1,004 samples. With regard to education levels, 50.3% of respondents were bachelor degree holders. This was followed by 45.0% respondents who studied in day schools and 4.7% respondents studied boarding schools. In terms of gender, 61.8% of the respondents were females and 38.4% were males. The results from this study provided a partial view of a small cross section of the Malaysia's young and educated population. Thus, the respondents' views could be considered as relevant information that represents the voice of young citizens in Malaysia about the polar regions and related global environmental issues such as climate change and global warming. It was stipulated in UNESCO Operational Strategy on Youth (2014-

2021) that today's young people are crucial for the shaping of the future. Therefore, the organization's objective is to help empower young people and ensure that their contributions are taken into account. To move forward, future surveys need to study Malaysia's young population from different cultural, age and geographical backgrounds to verify the universality of the results from this exploratory study about their perceptions on the polar regions.

In the context of general knowledge, Table 2 provides the finding for the total scores on the general knowledge of the respondents on the polar regions. The score was based on their responses to 15 questions related to the differentiation between Antarctic and Arctic. The correct answers were then converted into percentage points, and classified into three categories; scores ranging from 0% to 49% (Least), 50% to 79% (Intermediate) and 80% to 100% (High). Results show that the majority of the respondents (69.62%) were classified as having the intermediate category of knowledge about polar region and climate change. Meanwhile, 25.1% of the respondents were classified as having high knowledge and 5.28% of them were classified as having least general knowledge about the polar regions. Results from data analysis showed that most of the respondents could not differentiate between the Antarctic and the Arctic regions, especially with regard to their geographical characteristics and biodiversity.

Table 2. Score on the Polar Regions

Range	Interpretation	(%)
0 - 49	Low	5.28
50 - 79	Intermediate	69.62
80 - 100	High	25.10
	Total	100.00

Note. n = 1,004

Similarly, a previous survey conducted by Shabudin et al. (2015) in late 2013 and mid-2014, on Malaysian young citizens about their Antarctic values showed that most of the respondents could not differentiate the Antarctic from the Arctic with regard to their geographical characteristics, biodiversity, and ecology. Shabudin et al. found that the current formal teaching on the polar regions through the curriculum in the school syllabus and university courses in Malaysia are still lacking. For example, very little of the issues on polar regions have been taught in the school science syllabus; even then, the issues are related only to climate change and sea level rises. Meanwhile, at the university level, the focus of the polar region studies is placed mostly on research activities. Therefore, to strengthen and sustain national interest on polar regions, the Malaysian government and its educational institutions need to develop a strategy in pedagogy with holistic insights to promote the roles of polar regions and ensure global sustainability through the national education curriculum among its young citizens.

The polar regions extremities of the earth are crucial for regulating our planet's climate and are particularly vulnerable to the impacts of global warming. Thus, it is important for the public to understand the relation between the polar regions and the socio-scientific issues such as climate change, global warming and sea-level rise for them to appreciate and respect the significant roles of polar regions in ensuring the global sustainability. Furthermore, the analysis in Table

3 shows that respondents understand the role of the polar regions and the issues related to climate change. On the roles of the polar regions, about 60.0% of respondents agreed that the polar regions play a crucial role in the global climate system and polar regions play an integral part in the global ocean system. A new study by Gottschalk et al. (2015) on the relationship between ocean currents and climate change found that they are tightly linked and that changes in the polar regions can affect the ocean and climate on the opposite sides of the world within one to two hundred years, far quicker than previously thought. On the other hand, majority of respondents (47.8%) were not sure of the interconnection between the polar regions and the global wind patterns. Generally, there are three wind belts in the global wind patterns, namely the polar easterlies, the tropical easterlies, and the prevailing westerlies. The global wind system also creates the ocean currents, another significant factor that equalizes the energy imbalance. Van Knowe (2007) highlighted that if the wind trends are the result of global warming, this will change the general wind patterns for the entire regions of the globe. Thus, without winds and their associated ocean currents, the equatorial regions would get hotter and the polar regions would get colder through time.

Table 3. Respondents' Understanding About the Polar Regions and Polar Regions' Roles and Climate Change Related Issues

No.	Statement	Disagree (%)	Not Sure (%)	Agree (%)
1	Polar Regions play a crucial role in the global climate system.	5.4	25.8	68.8
2	Polar Regions are an integral part of the global ocean system.	5.0	31.9	63.1
3	Polar Regions are an integral part of the global wind pattern.	8.9	47.8	43.3
4	Global warming affects excessive ice melting in the Polar Regions.	4.4	15.4	80.2
5	Greenhouse gas emissions are the major causes of global warming in polar regions.	10.5	29.2	60.3
6	Excessive ice melt in Polar Regions gives a negative impact to polar region ecosystem	4.2	19.0	76.8
7	Melting of the polar regions' glacier and ice sheets are factors that contribute to the rising of global sea level.	5.5	26.5	68.0
8	The increase in sea level as a result of ice melt in the polar regions will give impact on the social, environmental and economic in the coastal area.	7.1	22.7	70.2
9	Tidal flooding will become more frequent with sea level rise	7.5	20.8	71.7
10	Climate change in the Polar Regions had ecological and economic impact to the whole earth.	5.9	32.6	61.5

Note. n = 1,004

A higher percentage of respondents (80.2%) understood that global warming affects the excessive ice melts in the polar regions. About 60.0% of them realise that greenhouse gas emissions are the major causes of global warming in the polar regions. Dasgupta et al. (2007) highlighted three main factors that contribute to the rising seas. First is the ocean thermal expansion. Second is the melting of the Greenland, Antarctica glacier, and ice sheets. Third, changes in terrestrial storage, while ocean thermal expansion as the dominant factor. New data on rates of deglaciation in Greenland and Antarctica suggest greater significance for glacial melts, and a possible revision of the upper-bound estimate for sea level rise (SLR) in this century (Awang, & Abd Hamid, 2013). Notably, 76.8% of the respondents know that excessive ice melts in polar regions have a negative impact to polar region ecosystem and 68% of respondents are aware that melting of the polar regions' glacier and ice sheets are factors that contribute to the rising of global sea level. Regarding sea level rise, about 70.0% of respondents understand that the increase in sea level is a result of ice melts in the polar regions and this will affect the social, environmental and economic conditions in the coastal areas.

Furthermore, about 70.0% of the respondents realised that tidal flooding will become more frequent with the sea level rise. Generally, about 60.0% of respondents understood that climate change in the polar regions will affect the ecological and economic conditions of the whole earth system. Notably, ice melting in the polar regions causes changes in global ocean currents and sea level that can trigger a domino effect to coastal and ocean ecosystems. According to the Intergovernmental Panel on Climate Change (IPCC), even the best-case scenarios indicate that a rising sea level would have a wide range of impacts on coastal environments and infrastructure; effects such as coastal erosion, wetland and coastal plain flooding, salinization of aquifers and soils, and a loss of habitats for fish, birds, and other wildlife and plants (Nicholl et al., 2007). The finding on the overall respondents understanding about the roles of the polar regions and climate change related-issues was determined based on a 10-item question. The result shows that most of respondents understood the polar region and climate change related-issues and its consequential effects on the global sea level (mean = 2.6, n = 1004).

Another survey was conducted to seek respondents' opinions on polar-related issues. The results are displayed in Table 4. The result shows that the majority of respondents (about 70.0%) agreed that what happens to the polar regions is important to them. Although the polar regions are remote from residents living in equator latitudes such as Malaysia, these regions have become increasingly prominent in terms of its connectivity with global climate change, melting ice, rising sea levels, and their human or their ecological impacts on the environment. The highlighted issues may become a part of factors that influenced respondents' views about the importance of the polar regions. With respect to climate changes, more than half (55.3%) of the respondents disagreed that addressing the issue of climate change in the polar regions is the sole responsibility of the government and researchers. On the other hand, most of respondents (70.0%) are willing to reduce activities that can contribute to climate change in polar regions. Leiserowitz (2007) studied the public perceptions on climate change and emphasized the importance of exploring public perception as it can create further impact towards the future development of policies relating to the environment. Furthermore, the respondents were also asked about their opinion on Malaysia's polar regions involvement. Majority of them agreed that education related to the

polar regions and climate change should be incorporated in the national education system. Majority of respondents (81.0%) have expressed the willingness to support any national efforts and initiatives in addressing the issue of the polar regions and climate change.

Table 4. Respondent's Concerns Towards Polar Regions

No.	Statement	Disagree (%)	Not Sure (%)	Agree (%)
1.	What is happening to the Polar Regions are important to me.	5.9	27.6	66.5
2.	Addressing the issue of climate change in the Polar Regions are the responsibility of the government and researchers only.	55.3	21.9	22.8
3.	I'm willing to reduce activities that can contribute to climate change in Polar Regions.	5.1	24.9	70.0
4.	Education related to the Polar Regions and climate change should be enhanced in the national's education system	7.2	27.3	65.5
5.	I will support of any national efforts and initiatives in addressing the issue of the Polar Regions and climate change.	4.5	14.5	81.0

Note. n = 1004.

The results of the survey on the opinions of the respondents revealed that the respondents were highly concerned about the preservation and the sustainability of the polar regions. Some of them were also aware of the implications if the environment of the polar regions is not preserved. However, they did not feel the need to participate in preserving and saving the environment of the polar regions. Fujii (2007) highlighted that the environmental concerns can be described as attending to the "consequences" of behaviour, and a motivation which resulted in efforts to reduce any negative consequences. Schmidt (2007) analysed the correlation between the concern for the environment and how it translates into a form of action towards preserving the environment. She conducted a class on environmental issue and discovered that as students are more aware of the environmental issues, they become more willing to participate in environmental activities such as recycling activities. Meanwhile, Dunlap and Jones (2002, p. xxx) stated that environmental concern indicates "the degree to which people are aware of problems regarding the environment and support efforts to solve them and or indicate the willingness to contribute personally to their solution."

Conclusion

Malaysia is one of the "small player" nations on polar regions, and is actively educating its citizens to appreciate the roles of polar regions. This education process is done through the approach called EOC, which started since the establishment of Malaysia Antarctic Research Programme. Notably, the establishment of YPASM provides the important platform to encourage young citizens, especially school students and young researchers from local universities to participate in Malaysia's agenda on polar regions. The survey on conducted on general knowledge, understanding and concern of young citizens about the polar regions, shows that the general knowledge on polar regions are still at an intermediate level. However, their level of understanding and opinions about the

values associated with the roles of the polar regions and issues related to climate change have been well developed. The result from the survey may serve as an indicator in evaluating the effectiveness of Malaysia's initiatives in relation to the dissemination of knowledge about polar regions. Malaysia has to increase public awareness and participation, especially in the global and socio-scientific issues such as polar regions. These are some of the elements necessary for Malaysia to focus on to gain appreciation and interest in science and technology by the global community.

This research is among the pioneer studies on the issue of the perceived awareness and understanding about the polar regions in Malaysia. In general, this study will advance scholarly understanding of the present scenario of Malaysian public policy on the polar regions in terms of education, outreach and communication. From a pragmatic perspective, the findings from this research will assist policy makers to understand better the perceived awareness and the crucial role of the young citizens regarding polar regions region. This will ultimately assist them to institute new initiatives to confront the challenges related to issues such as global warming, climate change, and rise of sea level. It is hoped that this study will serve as a reference for policy makers to establish a new national polar regions policy as well as to design an adequate communication strategy for Malaysia's governance on the polar regions in the context of EOC) to increase and strengthen public participation in this global issue.

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No potential conflict of interest was reported by the authors.

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