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Understanding, Readiness and Motivation of Science Teachers on the Climate Change Education in Negeri Sembilan

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Abstract

Based on the 13th Sustainable Development Goals (SDGs), education is the most effective channel in educating the new generation to learn the ways to avoid the adverse effects of climate change. Therefore, this research was conducted to examine the level of understanding, readiness, and motivation of Science Teachers in Climate Change Education (CCE) as well as to identify the relationship between the level of understanding, the readiness, and the motivation of teachers in implementing CCE in schools. A quantitative approach using surveys has been conducted to 41 Science Teachers in secondary schools around Negeri Sembilan. The mean scores for all the variables were high. Spearman's Correlation Test has been computed and there was no correlation between the level of understanding and the level of readiness, $r(39) = .04, p = .783$. There was also no correlation between the level of understanding and the level of motivation, $r(39) = -.13, p = .403$. However, there was a weak positive correlation between the level of readiness and the level of motivation, $r(39) = .31, p = .047$. This study will help Science teachers in implementing better quality of CCE, as well as guiding teachers and the Ministry of Education Malaysia in planning CCE intervention modules in Teaching and Learning.

Keywords: Climate Change Education, Climate Change Understanding, Climate Change Knowledge, Climate Change Readiness, Climate Change Motivation

Introduction

Education is the important medium that needs to be used in educating the new generation on ways to reduce the impacts of climate change. Science is the best discipline to incorporate the knowledge of climate change (Verlie, 2017). The awareness towards climate change should be instilled from the early years. CCE will make people realise the need for the mitigation against climate change, the adaptation against hot climate, reduction on climate impact, and the warning system of climate change (The United Nations Educational, Scientific and Cultural Organization [UNESCO], 2021).

The study by Meilinda et al (2017) has claimed that the teachers do not have the preparation to teach about the environment and climate change. Teachers are aware that global warming does impact the Earth and natural disasters keep happening nowadays.

However, many of them only teach about climate change to fulfil the syllabus without connecting to the knowledge and awareness of CCE. This could not be enough to raise the awareness of the students on the impact of climate change. The facts have been supported by the study of Tolppanen et al (2021) in which they found that the teachers' understanding about CCE is very low.

Therefore, this study is carried out to find out the level of understanding, the level of readiness, and the level of motivation of Science Teachers at the Secondary Schools around Seremban, Negeri Sembilan. This study is also being done to identify the relationship between the level of teachers' understanding, the level of teachers' readiness, and the level of teachers' motivation towards CCE at the Secondary School level in Malaysia.

Climate Change Education

United Nations Framework Convention on Climate Change (UNFCCC) 1992 has defined climate change as the global changes in the atmosphere's composition due to the long-term effects of human actions directly or indirectly (Ogunbode et al., 2019). This phenomenon happened due to world economic development and industrialization which led to the release of greenhouse gases to the atmosphere (Haines & Patz, 2004; Ogunbode et al., 2019). The Global Climate Report by the Intergovernmental Panel on Climate Change (IPCC, 2018) has shown that the temperature has risen above the expected temperature increment, and it is projected to be increased to 5.4°C in 2100 (Hsiang & Kopp, 2018).

The upsurge of the global temperature has led to the tremendous effect on certain areas such as in Greenland and Antarctica. The glacier has been drastically melted due to the increase in the global temperature (Hassan, 2020). Besides that, there is also an increase in the sea level which is also predicted to keep on rising in 2100 (Hsiang & Kopp, 2018). Imbalance of the season in the four-season countries (Hassan, 2020) and imbalance of the rainfall in some countries (IPCC, 2021) are also the effects of the rising on the temperature. This phenomenon also has caused the drought in the subtropic area, and this also led to more desertification (Hsiang & Kopp, 2018). Moreover, the water resource and the food resource has become scarce. Increases in the temperature also lead to the outbreak of diseases (Dhimal et al., 2021). Malaysia is also one of the countries which is affected by climate change. We have experienced very high temperatures, imbalanced rainfall, and drought in certain areas (Tan et al., 2021).

CCE is defined as the knowledge to understand and to learn on the way to mitigate the impact of Climate Change (UNESCO, 2014). The CCE discipline relies on the Environmental Education (EE) and Education for Sustainable Development (ESD) (Rocha et al., 2019). Figure 2.5 (Rocha et al., 2019) shows the relationship between the different stated disciplines.



Figure 1: Relationship between EE, ESD dan CCE (Rocha et al., 2020; Hesselink 2000; UNESCO 1997, 2005, 2014)

Throughout the global studies, Winter et al (2022) have carried out the research towards the students' perception and the pre-service teacher's perception. The studies have shown that there are many challenges encountered by them to apply CCE in Austria. The results also showed that only 40% of the respondents claimed the importance of having knowledge about climate change. In Brazil, the case study done by Rocha et al (2020) have found that teachers that joined the Training Course focusing on CCE, having problems in understanding, and applying climate change knowledge in the classroom.

Apart from that, the studies by Tolppanen et al (2020) towards pre-service teachers in Finland have found that the understanding level related to climate change is very low. Moreover, there is no significant relationship between the knowledge of climate change, the methods to reduce the impact of climate change, and the readiness to act. This research has been supported by Ahmed et al (2022) which also found that there is no significant relationship between the teaching experience and the participation in the Environmental Training towards the teachers' perception on climate change. The results from the studies of Winter and Moller (2022) have also shown that the readiness level of teachers in applying CCE is very low.

Qualitative studies by Armstrong and Krasny (2020) at five Professional Development Centres have found that the awareness of teachers towards the CCE is on a high level. The results claimed that their perceptions have been changed from only focusing on the impact of climate change to the ways of mitigating the impacts of climate change. Besides, the studies by Competente (2019) also claimed that the first-year teachers have shown their readiness towards application of the CCE at schools.

In Malaysia, there is no specific subject to teach CCE to the students. Furthermore, no formal learning focusing on climate change and there is no inclusion of climate change issues in the school syllabus in Malaysia (Ying & Osman, 2021). However, the ESD has been introduced in the higher education level as an initiative to reduce the impact of Climate Change in Malaysia (Ying & Osman, 2021). The Curriculum Development Division of Malaysia (2019) has applied this element in the Curriculum and Assessment Standard Document (DSKP) of the Secondary School Science Curriculum (KSSM) Science Form 4 in Topic 4 which is Green

Technology in Preserving Nature. Overall, there is little application of climate change elements into the curriculum in Malaysia.

In conclusion, most of the results of previous studies found that the level of understanding of teachers in CCE is at high level. Therefore, courses need to be held for in-service teachers as well as pre-service teachers to strengthen their understanding in the field of CCE. A more specific course on CCE also needs to be created for the pre-service teachers as in teaching and learning Climate Change in schools.

Methodology

The studies are limited to 41 Secondary Science Teachers in Seremban district, Negeri Sembilan only. This is because the application of CCE is studied in Science subjects including General Science, Physics, Chemistry and Biology only. The method is also limited to the questionnaire method only. A total of 41 questionnaires on the level of understanding, readiness and motivation were distributed among Science Teachers in 16 different Secondary Schools in Negeri Sembilan. The Spearman's Correlation Test was carried out to identify the correlation between the level of teachers' understanding, the level of teachers' readiness, and the level of teachers' motivation towards CCE at the Secondary School level.

The study population is High School Science teachers in Seremban district, Negeri Sembilan. A random sampling of 41 high school Science teachers in Seremban, Negeri Sembilan was conducted. The questionnaire was adapted from the study of (Hung, 2014; Karami and Shobeiri, 2017). The questionnaire has been modified according to the objectives of this study. This instrument contains 4 sections consisting of 36 items. Part I is a questionnaire about teachers' background, followed by Part II about teachers' understanding. Part III is the questions regarding teachers' readiness and Part IV on teachers' motivation in the application of Climate Change in schools. The items in the questionnaire are in the form of a 4-Likert scale (*Strongly Disagree, Disagree, Agree, and Strongly Agree*). This four-point Likert scale is used in this study because it has a high reliability value (Konting, 2004). The Likert scale also helps study participants to make accurate choices based on their own level of acceptance (Ying and Osman, 2021).

The data was analysed using descriptive analysis and inferential analysis, namely Spearman's Rho Correlation Test using IBM SPSS Statistics 26 Software. Descriptive analysis was carried out to answer the 3 objectives of the study, as below

- a) To identify the level of understanding of Science teachers in CCE
- b) To identify the level of preparedness of Science teachers in CCE
- c) To identify the level of motivation of Science teachers in CCE

As the data is not normally distributed, the Spearman's Rho Correlation Test was conducted to answer the objectives of the study, which is to identify the relationship between the level of teachers' understanding, the level of teachers' readiness and the level of teachers' motivation in applying CCE.

Results

A total of 41 questionnaires on the level of understanding, readiness and motivation were distributed among Science Teachers in 16 different Secondary Schools in Negeri Sembilan. Table 1 shows that the most respondents are Science teachers aged between 31 and 40 years. Next are Science teachers aged 41 to 50. Other than that, Science teachers aged 21 to 30 years and Science teachers in the range of 51 to 60 years.

Table 1
Respondents' Ages

Ages	Frequency	Percent	Valid Percent	Cumulative Percent
21 to 30	6	14.6	14.6	14.6
31 to 40	15	36.6	36.6	51.2
41 to 50	14	34.1	34.1	85.4
51 to 60	6	14.6	14.6	100.0
Total	41	100.0	100.0	

In Table 2, the number of female Science teachers who answered the questionnaire is also more than the male Science teachers.

Table 2
Respondents' Gender

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	16	39.0	39.0	39.0
Female	25	61.0	61.0	100.0
Total	41	100.0	100.0	

For Table 3, a total of 36 Science teachers with a bachelor's degree have answered the questions, followed by 5 Science teachers with a master's degree.

Table 3
Education Level of Respondents

Education Level	Frequency	Percent	Valid Percent	Cumulative Percent
Bachelor's Degree	36	87.8	87.8	87.8
Master's Degree	5	12.2	12.2	100.0
Total	41	100.0	100.0	

In Table 4, the respondents were found to consist of new teachers, which is the highest number of Science teachers with 1 to 5 years of experience totalling 16 people, followed by 12 teachers with 11 to 15 years of experience. Next, followed by Science teachers who have experience for 6 to 10 years and 16 years and above.

Table 4

Teaching Experience of Respondents

Teaching Experience	Frequency	Percent	Valid Percent	Cumulative Percent
1 to 5	16	39.0	39.0	39.0
6 to 10	11	26.8	26.8	65.9
11 to 15	12	29.3	29.3	95.1
16 years above	2	4.9	4.9	100.0
Total	41	100.0	100.0	

The analysis for the level of understanding, readiness and motivation of the respondents was evaluated based on mean scores in Table 5 (Landell, 1977). Based on Table 6, Table 7 and Table 8, the mean scores for all the variables were high at 3.69 to 3.88. The level of understanding of Science Teachers was the highest which is 3.9250. The second highest was the Level of Teachers' Motivation with 3.9193, followed by the third highest mean scores which was the Level of Teachers' Readiness with 3.7398. This means that the Science Teachers in Negeri Sembilan were well equipped with the knowledge of CCE and highly motivated with high readiness towards applying the CCE in lessons.

Table 5

Mean Score Interpretation

Total Mean Score	Level
1.00 – 2.33	Low
2.34 – 3.67	Moderate
3.68 – 5.00	High

Source: Landell (1977)

Table 6

Mean for Level of Teachers' Understanding

	n	Minimum	Maximum	Mean	Std. Deviation
Mean of Understanding Level	41	3.38	4.00	3.9250	.13919
n	41				

Table 7

Mean for Level of Teachers' Readiness

	n	Minimum	Maximum	Mean	Std. Deviation
Mean of Readiness Level	41	3.33	4.00	3.7398	.22376
n	41				

Table 8

Mean for Level of Teachers' Motivation

	n	Minimum	Maximum	Mean	Std. Deviation
Mean of 41 Motivation Level	41	3.54	4.00	3.9193	.14074

As the data was not normally distributed with $p < 0.05$, the Spearman's Correlation test was computed to assess the relationship between the variables. Based on Table 9, the findings shows that there was no correlation between the level of understanding and the level of readiness, $r(39) = .04$, $p = .783$. There was also no correlation between the level of understanding and the level of motivation, $r(39) = -.13$, $p = .403$. As the value of p is larger than 0.05, then there was no significant relationship between the level of understanding of teachers with the level of readiness and the level of motivation of Science teachers. However, there was a weak positive correlation between the level of readiness and the level of motivation, $r(39) = .31$, $p = .047$.

Table 9

Spearman's Correlation Test

		Level of Understanding	of Level of Readiness	of Level of Motivation
Level of Understanding	Correlation Coefficient	1.000	.044	-.134
	Sig. (2-tailed)	.	.783	.403
	n	41	41	41
Level of Readiness	Correlation Coefficient	.044	1.000	.312*
	Sig. (2-tailed)	.783	.	.047
	n	41	41	41
Level of Motivation	Correlation Coefficient	-.134	.312*	1.000
	Sig. (2-tailed)	.403	.047	.
	n	41	41	41

*. Correlation is significant at the 0.05 level (2-tailed).

Discussion and Conclusion

Based on the data that has been analysed, it can be concluded that the results of the study have successfully answered the objectives and the questions of the study. The findings of the study show that the level of understanding of Science teachers in Negeri Sembilan is at a high level. The level of motivation of Science teachers in Negeri Sembilan is also at a high level. The results of this study show that Science teachers in Negeri Sembilan have extensive knowledge on CCE. The Science teachers in Negeri Sembilan also have a high motivation towards application of CCE in teaching and learning. The results of this study also found that the level of readiness of Science teachers in Negeri Sembilan is at a high level which means the Science teachers in Negeri Sembilan are well equipped and well prepared to apply CCE in teaching and learning.

The result has been supported by the study done by Karami and Shobeiri (2017) on the readiness to take mitigation actions against Climate Change found that more than 75% of respondents were ready to apply CCE. Boon (2016) stated that teachers need to be provided with a high level of knowledge about Climate Change to help students solve environmental issues that are faced today. When teachers discuss the issue of Climate Change in teaching and learning either directly or indirectly, everything becomes part of the pedagogy for students. This shows that teachers who are highly knowledgeable in Climate Change play an important role in shaping student behaviour towards the environment (Strong, 1998).

The results of the Spearman's Correlation Test show that there is no significant relationship between the level of understanding and the level of readiness. There is also no correlation found between the level of understanding and the level of motivation of Science teachers in the application of CCE. Nevertheless, there is a significant relationship between the level of readiness of science teachers and the level of motivation of Science teachers in Negeri Sembilan. The relationship between these variables shows a weak positive correlation ($r=.312$, $p<.05$). This is supported by the study of Zsoka et al (2013) which found that knowledge and behaviour towards the environment are related to each other. A study by Kollmuss and Agyeman (2002) also supports this study as the study conducted also found that the increase in knowledge of climate change does not help in the increase in positive behaviour towards the environment.

Balmford et al (2017) believe that knowledge about environmental issues is very important in creating high motivation on environment. Without knowledge, positive behaviour towards the environment may not be realised. In this study, there is no significant relationship between the level of knowledge and the level of motivation of Science teachers in Negeri Sembilan. This gap between knowledge and behaviour may be due to the limited learning objectives related to CCE in the classroom. When knowledge about climate change is applied in learning, positive actions towards the climate change will be inculcated. Cantell et al (2019) stated that knowledge is an important factor in understanding Climate Change and solving environmental issues.

Among the suggestions for improvement in this study is that the scope of the study needs to be extended to the whole of Negeri Sembilan. This is because researchers are limited to doing research within the Seremban district only. There are strict procedures that need to be followed if the study is to be conducted in other districts in Negeri Sembilan. In addition, appropriate frequency analysis can be performed to provide more accurate and abundant information. Further research can be conducted by increasing the number of respondents to a larger number to obtain more accurate data. This study can also be conducted in developed areas such as Kuala Lumpur to see the difference in the level of knowledge about Climate Change in different states.

In conclusion, this study clearly shows that a correct and in-depth knowledge of the current climate change situation is important in ensuring the success of global climate change recovery efforts. This is because educators are the best medium to convey the issue of climate change as well as to get thoughtful ideas on how to reduce climate change from continuing to threaten the environment, flora, and fauna. Appropriate pedagogy in the delivery of knowledge about climate change also needs to be provided to educators so that they are more prepared to deliver Climate Change knowledge clearly and easily understood by students. Students also need to be exposed to the knowledge of climate change since they started school. Teachers are important medium in imparting climate change knowledge

towards improving the behaviour of the new generation towards environmental sustainability.

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