

Climate Change: Riau Archipelago Pre-service Teachers' Perspective

Metta Liana^{1,*}, *Aulya Ade Rahmi*², *Roma Doni Azmi*¹, and *Dios Sarkity*¹

¹ Faculty of Teacher Training and Education, Universitas Maritim Raja Ali Haji, Jl. Raya Dompok, Tanjungpinang, Indonesia

² Civil Engineering Department, Faculty of Civil Engineering, Plan, and Geo Engineering, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia

Abstract. Climate change (CC) has affected many aspects of life, including social, environmental, political, and economic. As educators in the future, pre-service teachers need to be equipped with the understanding and motivation to be involved in efforts to overcome problems related to facing CC challenges and opportunities. Riau Archipelago is a province in Indonesia that is a coastal area that directly experiences the impacts of CC. This research investigates pre-service teachers' perspectives on CC in coastal areas. The study employed the descriptive survey method using a 5-Likert scale instrument to involve pre-service teachers in the Riau Archipelago. Respondents (n=224) were selected from the undergraduate student population. The research results show that pre-service teachers' perspectives in coastal areas, it is important to know and implement various solutions to CC. However, pre-service teachers have low motivation to overcome CC. However, the low motivation of student teachers needs to be improved because pre-service teachers are part of society and have an important role in understanding students so they can apply and face climate change problems. It is hoped that future research can provide a clearer picture of how efforts can be made to increase pre-service teachers' motivation to participate in overcoming problems in CC in coastal areas.

*Corresponding autor: mettaliana@umrah.ac.id

1 Introduction

In recent years, concurrent significant shifts related to Climate Change (CC) have been observed globally, including escalating global temperatures, diminishing ice volumes, elevating sea levels, and alterations in worldwide precipitation patterns [1]. These shifts lead to ecosystem loss and degradation, such as tropical coral reefs, diminished water and food security, augmented infrastructure damage, increased death and morbidity rates, human migration and displacement, impaired livelihoods, heightened mental health issues, and amplified inequality. The 2022 annual report from the Intergovernmental Panel on Climate Change (IPCC) highlights that Greenhouse Gas (GHG) emissions have prompted a rise in the earth's average temperature by approximately 1.5⁰ Celsius [1]. This is pivotal as the certainty of global warming could unleash catastrophic climate-related disasters.

In Indonesia, disasters linked to climate change have become a common occurrence [2]. Instances encompass prolonged inundation in Kalimantan due to intense precipitation, extensive forest and terrestrial fires in Sumatra owing to heightened temperatures, and an ascent in sea level along the northern coast of Java. Beyond natural disasters, CC also jeopardizes food crops and can lead to a surge in disease-transmitting vectors like mosquitoes and flies [2].

The global community agreed to the Paris Agreement 2015 to mitigate worldwide GHG emissions. Each country, Indonesia included, established its target for reducing GHG emissions, documented in its Nationally Determined Contribution (NDC). The climate ambition was intensified in the Updated NDC by bolstering the commitment, which was executed through various programs, strategies, and actions in the facets of mitigation, adaptation, transparency framework, and additional supportive implementation frameworks [2].

Climate change is anticipated to affect small islands significantly, threatening the very existence of some due to their susceptibility to escalating sea levels, augmented flooding, shoreline erosion, and shifting habitats [1]. Inhabitants of such islands are particularly at risk of losing livelihoods, experiencing involuntary relocation, and encountering food scarcity due to climate change [1]. So, there is a need to pay special attention to the impacts of CC on coastal areas [3].

Societal actions significantly influence adaptation to global climate changes, with continuous discussions addressing persistent local challenges to enhance adaptive capabilities [4]. The dialogue about climate change and societal understanding is crucial, with individuals, regardless of their role in society, being key players in initiating and supporting necessary greenhouse gas emission reductions. Acknowledging these roles doesn't dismiss the larger contexts in which individuals operate nor impose undue responsibilities. The ongoing balance between structure and agency is recognized, focusing on individuals' mental and emotional commitment to responding to climate change, influencing, and being influenced by behavioral, civic, and political activities [4].

In addressing climate change (CC) challenges, the significance of universities and other higher educational institutions in readying upcoming generations cannot be overstated by amplifying their consciousness and comprehension of the matter [4–6]. The involvement of the youth, particularly university students, is vital in formulating and implementing climate change adaptation approaches, demanding a robust educational foundation on the issue. As the imminent policymakers, these students will be confronted with intricate decision-making about CC mitigation, making it essential to thoroughly understand their knowledge base, apprehensions, and viewpoints on CC. Such insights will aid educators in establishing efficacious teaching methodologies, subsequently enhancing climate change literacy and promoting proactive guardianship of the environment [4].

Several studies have discussed the younger generation's and society's perceptions of CC. Students' knowledge of climate change is diversified in peri-urban, urban-rural, and rural-urban zones [7]. In general, students do not know the causes and consequences of climate change due to a lack of knowledge, so students' adaptation and mitigation were not good enough [7,8]. When students are taught about climate change, their opinion of knowledge increases. Thus, students have identified climate change as a notably critical and pressing issue, acknowledging the necessity for both personal and communal responsibility in initiating actions to tackle this challenge [8,9].

Numerous studies have explored the younger generation's and society's perceptions regarding CC. Students' understanding of climate change varies across peri-urban, urban-rural, and rural-urban areas [7]. Generally, students lack sufficient knowledge about the causes and impacts of climate change, resulting in suboptimal adaptation and mitigation efforts [7,8]. When educated about climate change, students' perceived knowledge is enhanced. Consequently, they view climate change as a critical and severe issue, acknowledging both personal and collective responsibilities to participate in initiatives to tackle this challenge [8,9].

College students have identified human accountability for Climate Change (CC) as a notably important and grave challenge, recognizing the necessity for both individual and collective responsibility in undertaking efforts to confront this issue [9–12]. Directly, education regarding CC knowledge influences the deepening of knowledge and changes in attitudes and behaviors and increases students' and college students' awareness of CC [4,6,10–12].

Most community members on Providence Island who were interviewed for this study recognized environmental changes and could recognize climate change elements [13–16]. Climate change (CC) risk perceptions frequently hinge on an individual's beliefs, principles, and encounters [5]. Personal experiences and first-hand observations of the immediate effects of climate change have been identified to influence perceptions of climate risk, leading to diverse and multifaceted comprehensions of climate change that can differ not only between countries but also within individual communities [15,17].

Respondents in studies of Chinese perspectives on climate change typically demonstrate a high level of awareness regarding climate change, its origins, and its consequences on various scales [14]. The populace believes that addressing climate change (CC) is a collective responsibility and has begun to express genuine concern about its tangible impacts, recognizing that mitigating climate change demands more than mere rhetoric—it necessitates tangible actions and all involvement [14,15].

The importance of knowledge in dealing with CC for pupils and students is hoped that education and knowledge about CC is needed. One of them is understanding prospective pre-service teachers in responding to these matters by preparing competencies in the field of CC and applying them in learning and teaching activities. This study aimed to investigate pre-service teachers' perceptions of CC and to provide information to the stakeholders on the effective design of instruments that allow better adaptation and mitigation by society based on the younger generations' perceptions of and ideas about CC. This research employs a qualitative analytical design, utilizing a survey questionnaire to ascertain pre-service teachers' perspectives regarding climate change (CC) in the Riau Archipelago. Taking into account the previously mentioned elements and the significance of comprehending students' viewpoints on climate change in a nation that is highly susceptible to climate change due to its geographical characteristics, this paper poses two research questions:

1. How pre-service teachers' perspective of climate change in coastal areas (Riau Archipelago)
2. How pre-service teachers' personal-sphere will and way in the context of CC

2 Conceptual Background

2.1 Climate Change

Given its intricate nature, climate change encompasses a multifaceted phenomenon that necessitates an understanding of various disciplines—such as science, economics, society, politics, and ethics. Fundamental understanding of the climate can be segmented into several broad and occasionally intersecting categories: comprehension of the functionality of the climate system and specialized knowledge regarding the origins, repercussions, and potential remedies for global warming. Contextual understanding situates anthropogenic global warming within a historical and geographical framework, while practical knowledge facilitates actions at both individual and collective levels [14].

2.2 Public Perspective of Climate Change

Over the last thirty years, disciplines such as anthropology, sociology, cultural psychology, and behavioral decision research have frequently indicated a relationship between human perception and the influence of individual, social, and cultural forces. [14]. There are two concepts of personal-sphere will and way, namely “willpower” and “way power”. These are applied personally in the context of CC [18].

Willpower refers to a person's belief or motivation that they can achieve a goal or desired outcome related to climate change. This includes the desire to make positive changes or to achieve positive outcomes in the face of climate change. Way power (Ability to Find Solutions), refers to a person's confidence or ability to find a path or strategy to achieve a goal or desired outcome related to climate change. This includes seeking and implementing solutions to problems or challenges faced by climate change [18].

Thus, “Personal sphere will and way (PW)” includes an individual's beliefs and abilities to seek and implement solutions to the problem of climate change at a personal level. This includes the belief that individuals can make a difference and have the ability or strategy to do so [18].

3 Research Methodology

3.1. Participants

This research was conducted from 04 July 2023 to 11 July 2023 to Pre-service teachers in the fourth semester of 2021 who came from 5 Study Programs, namely: Mathematics Education (ME), Biology Education (BE), Chemistry Education (CE), Indonesian Language and Literature Education (ILLE), and English Language Education (ELE) at the Teaching Faculty and Science Education at Raja Ali Haji Maritime University. In Table 1 below, the characteristics of the respondents are shown.

Table 1. Respondent characteristic.

Characteristics	ME	BE	CE	ELE	ILLE	Total
Gender						
Man	12	6	4	14	7	43
Woman	43	33	21	38	46	181
Total	55	39	25	52	53	224

Origin of						
Regency/City						
Anambas Regency	0	3	2	5	4	14
Lingga Regency	5	4	5	6	6	26
Karimun Regency	6	6	1	7	12	32
Bintan Regency	7	6	4	7	4	28
Natuna Regency	7	2	1	4	5	19
Batam City	10	8	5	9	6	38
Tanjungpinang City	20	10	7	14	16	67
Total	55	39	25	52	53	224
Age						
19 years old	16	7	10	17	17	67
20 years	35	28	10	27	27	127
21 years	4	4	5	8	9	30
Total	55	39	25	52	53	224

3.2. Design and Data Source

This research is included in quantitative descriptive research. Descriptive research aims to describe the characteristics of a phenomenon or event of a group [19] at a time or changes over time but does not explore causal relationships (Gall et al., 2010). This research is a questionnaire with closed questions with numerical scores with details in Table 2.

Table 2. Questionnaire answer score scale.

Perception of Respondents	Score
Strongly disagree (SDA)	1
Don't agree (DNA)	2
Disagree (DA)	3
Agree (A)	4
Strongly agree (SA)	5

The questionnaire was distributed via Google Form, where the Google Form link was given to lecturers who taught classes in each study program. Before filling out the Google form, students are given articles/readings related to climate change issues. This research captures empirical facts related to the perspective of student teachers on the issue of climate change that occurs, especially in island/coastal areas. A total of 224 prospective teacher students filled out the questionnaire voluntarily. The data was then analysed descriptively based on 3 groups of factors that influence the climate change perspective, namely: Personal-sphere willpower and way power (PW), Collective-sphere willpower and way power (CW), Lack of willpower and way power (PW).

The research began with the preparation of instruments to collect information regarding student teachers' views in the Riau Islands region regarding ongoing climate change. The

questionnaire used was adapted from C. Li and M. C. Monroe [20] contain 15 items related to views on climate change.

4 Result and Discussion

4.1 Result

This research utilizes a questionnaire adapted from the "Climate Change Hope Scale" [18], which includes 15 items grouped into three main factors to measure pre-service teachers' perspectives regarding CC. These factors are (1) Personal-sphere willpower and way power (involves belief in personal ability to find and implement solutions to the problem of climate change); (2) Collective-sphere willpower and way power (involves belief in the collective or group's ability to find and implement solutions to the problem of climate change); and (3) Lack of willpower and way power (involving a lack of confidence or ability, at either a personal or collective level, to address the issue of climate change). The results of filling out the questionnaire by prospective teacher students in the Riau Islands region are presented in the following table.

Table 3. Pre-service teachers' responses to climate change are based on personal-sphere willpower and way power (PW)

Factor	Items	Statement	Percentage				
			SA	A	DA	DNA	SDA
Personal-sphere will and way (PW)	7	I am prepared to engage in actions to assist in addressing issues arising from climate change	26,95	63,81	8,25	0,88	0,11
	9	Currently, I am actively exploring methods to address issues induced by climate change	14,20	63,91	19,88	1,89	0,12
	10	I am aware that there are measures I can undertake to assist in resolving issues attributed to climate change	21,25	68,46	9,40	0,67	0,22
	11	I possess knowledge regarding the actions to be taken to assist in mitigating issues	12,15	61,73	22,60	3,40	0,12

resulting from climate change						
Average	18,64	64,47	15,03	1,71	0,14	

Table 3 presents data on the “Personal-sphere Will and Way” (PW) factor, which involves two key concepts, “willpower” and “way power,” in the context of climate change at the individual level. On average, 83.11% of respondents showed a positive attitude, reflecting the belief that they, as individuals, can find and implement solutions to the problem of climate change at a personal level. Positive responses to items 7 and 10 indicate the respondent’s commitment to proactively participate in initiatives or actions to address problems arising from climate change, such as reducing carbon emissions and supporting environmentally friendly policies or encouraging change through sustainable policies/practices.

Furthermore, positive responses to items 9 and 11 indicate that respondents are not only aware of the problem of climate change but also understand the strategies that can be taken to overcome it, either through contributions to climate change mitigation efforts or advocacy for policies that can address CC. Thus, the data in Table 3 reflects that most prospective student teachers in the Riau Islands region have good confidence and ability to find and implement solutions related to climate change problems.

Table 4. Pre-service teachers’ responses to climate change are based on collective-sphere willpower and way power (PW)

Factor	Items	Statement	Percentage				
			SA	A	DA	DNA	SDA
Collective sphere will and way (CW)	1	I hold the conviction that individuals will possess the capability to resolve issues engendered by climate change	13,13	67,78	15,04	3,82	0,24
	2	I maintain the belief that scientists will ascertain methods to address complications induced by climate change.	31,04	58,98	7,98	1,55	0,44
	3	Even in instances where certain individuals relinquish their efforts, I am confident that there will be others who persist in	35,83	57,33	4,56	1,95	0,33

	endeavouring to resolve issues precipitated by climate change					
4	Owing to the capacity of individuals to derive insights from their errors, they will ultimately mitigate and adapt to climate change	28,11	61,30	9,59	0,88	0,11
5	Daily, an increasing number of individuals commence to express concern regarding issues induced by climate change	26,01	54,57	17,69	1,16	0,58
6	Should collective action be undertaken by all, we possess the capability to resolve issues stemming from climate change	56,40	40,24	2,44	0,61	0,30
8	I am of the belief that an increasing number of individuals are prepared to engage in actions to assist in addressing issues resulting from climate change	26,70	62,29	9,68	1,11	0,22
Average		31,03	57,50	9,57	1,58	0,32

The data presented in Table 4 regarding the responses of prospective teacher students towards collective beliefs and beliefs—as a group or community—to find strategies (way power) and show determination (willpower) in overcoming the problem of climate change, recorded a positive response of 88.53% (which answered "agree" and "strongly agree"). Respondents believe collective action can create significant change and have an effective strategy for dealing with climate change issues.

Positive responses to items 2 and 6 indicate the respondent's belief that problems can be overcome through collaboration and joint initiatives in the form of a community. Respondents' answers reflect optimism regarding community readiness and participation in facing and contributing to solutions related to climate change. Further support is seen from positive responses to items 3 and 8, which reflect the belief that although some individuals may give up

or stop trying, others will always continue to fight and seek solutions to the problems caused by climate change.

Furthermore, positive responses to items 4 and 5 reflect the belief that humans can learn from mistakes or failures and, as a result, will find ways to mitigate and adapt to the challenges presented by climate change. This shows optimism about humanity's ability to develop strategies and solutions to overcome climate change problems in the future based on experience and knowledge gained from the past. In conclusion, prospective teacher students believe climate change's impacts can be overcome collectively.

Table 5. Pre-service teachers’ responses to climate change are based on a lack of willpower and way power (PW)

Factor	Items	Statement	Percentage				
			SA	A	DA	DNA	SDA
Lack of will and way (LW)	12	I am unable to conceive of actions I might undertake to assist in resolving issues related to climate change	2,42	40,58	30,92	21,90	4,19
	13	Climate change is outside of my purview; therefore, I shall refrain from attempting to address problems induced by it	2,65	40,35	27,08	19,82	10,09
	14	The complexity of climate change is such that we may be unable to resolve the issues it precipitates	0,84	40,54	33,45	17,57	8,41
	15	The measures within my capacity are too diminutive to significantly contribute to resolving issues engendered by climate change	2,52	34,96	33,78	23,19	5,55
Average			2,11	39,11	31,31	20,62	6,86

Based on the data presented in Table 6, around 27.48% of respondents stated "disagree" and "strongly disagree" regarding their lack of motivation and ability to find and implement solutions to environmental change problems. Furthermore, 41.22% of respondents indicated a lack of motivation and ability to deal with environmental problems. These findings reveal that

there are still prospective teacher students who do not have the motivation to overcome problems related to climate change.

Most respondents seemed to feel that their efforts to address climate change issues would not have a significant impact, so they chose not to act. This reflects feelings of helplessness and scepticism towards global issues around them, which is caused by the low motivation to create change. Even though respondents have the ability and confidence to implement solutions to the problem of climate change, without strong motivation to overcome this problem, the issue of climate change will remain an unresolved global problem.

4.2 Discussion

Several studies also show that people in coastal or island areas are generally more aware of climate change than urban communities [21]. People in coastal/island areas realize that they are more vulnerable to socio-economic problems caused by climate change, such as climate variability, extreme climate, coastal erosion, and scarcity of freshwater [22]. Perspective pre-service teachers' have the confidence to seek and implement solutions to climate change problems individually and in groups. However, these prospective pre-service teachers have low motivation to overcome climate change. For this reason, efforts are needed to increase the motivation and awareness of pre-service teachers' candidates.

One effort that can be done is by increasing understanding of the impacts of climate change can be conveyed through campaigns and outreach to student teachers [23], as an effort to increase awareness and knowledge regarding the real impacts of climate change and the importance of contributing to mitigation and adaptation. Therefore, student teachers need to be strengthened to be motivated to solve climate change problems, such as by including climate change in the university curriculum [24] and developing engaging and interactive learning materials [25]. For example, by emphasizing problem-based learning, behavior change, nature-based learning, and experiential learning [25,26]. In addition, it is important to equip student teachers with the ability to design lessons that cover the topic of climate change and provide teaching materials that focus on climate change issues [27].

5 Conclusion

The results of this study are that pre-service teachers' perspectives in coastal areas know that it is important to know and implement various solutions to deal with climate change. However, the low motivation of student teachers needs to be improved because pre-service teachers are part of society and have an important role in understanding students so they can apply and face climate change problems. This can be done in several ways, such as implementing a sustainability-based curriculum, providing knowledge through classes explaining climate change, etc. This research is limited to the perspective of prospective teacher students in the Riau Archipelago. It is hoped that future research can provide a clearer picture of how efforts can be made to increase pre-service teachers' motivation to participate in overcoming problems in climate change in coastal areas.

References

- [1] Intergovernmental Panel on Climate Change (IPCC) 2023 *Climate Change 2022 – Impacts, Adaptation and Vulnerability* (Cambridge University Press)
- [2] Ministry of Environment and Forestry of the Republic of Indonesia 2023 *Folu Net Sink: Ministry of Environment and Forestry Indonesia’s Climate Actions Towards 2030* (Jakarta)
- [3] Filho W L, Krishnapillai M, Sidsaph H, Nagy G J, Luetz J M, Dyer J, Ha’Apio M O, Havea P H, Raj K, Singh P, Rogers T, Li C, Boodhan M K, Wolf F, Ayal D Y and Azadi H 2021 Climate change adaptation on small island states: An assessment of limits and constraints *J Mar Sci Eng* **9**
- [4] Alves F, Nicolau L B, Lima D, Azeiteiro U M and Nicolau P B 2018 University Student’s Perceptions About Climate Change: The Case of Interior Design and Architecture Students of a Brazilian University *Climate Change Management* (Springer) pp 183–203
- [5] Prasad R R and Mkumbachi R L 2021 University students’ perceptions of climate change: the case study of the University of the South Pacific-Fiji Islands *Int J Clim Chang Strateg Manag* **13** 416–34
- [6] Barreda A B 2018 Assessing the level of awareness on climate change and sustainable development among students of Partido State University, Camarines Sur, Philippines *Journal of Sustainability Education* **17**
- [7] Dewi R P and Khoirunisa N 2018 Middle school student’s perception of climate change at Boyolali District, Indonesia *IOP Conference Series: Earth and Environmental Science* vol 200 (Institute of Physics Publishing)
- [8] Littrell M K, Okochi C, Gold A U, Leckey E, Tayne K, Lynds S, Williams V and Wise S 2020 Exploring students’ engagement with place-based environmental challenges through filmmaking: A case study from the Lens on Climate Change program *Journal of Geoscience Education* **68** 80–93
- [9] Littrell M K, Tayne K, Okochi C, Leckey E, Gold A U and Lynds S 2020 Student perspectives on climate change through place-based filmmaking *Environ Educ Res* **26** 594–610
- [10] Morgado F, Bacelar-Nicolau P, Rendon von Osten J, Santos P, Bacelar-Nicolau L, Farooq H, Alves F, Soares A M V M and Azeiteiro U M 2017 Assessing university student perceptions and comprehension of climate change (Portugal, Mexico and Mozambique) *Int J Clim Chang Strateg Manag* **9** 316–36
- [11] Santos P T, Bacelar-Nicolau P, Pardal M A, Bacelar-Nicolau L and Azeiteiro U M 2016 Assessing student perceptions and comprehension of climate change in Portuguese higher education institutions *Climate Change Management* (Springer) pp 221–36
- [12] Corner A, Roberts O, Chiari S, Völler S, Mayrhuber E S, Mandl S and Monson K 2015 How do young people engage with climate change? The role of

- knowledge, values, message framing, and trusted communicators *Wiley Interdiscip Rev Clim Change* **6** 523–34
- [13] Altschuler B and Brownlee M 2015 Perceptions of climate change on the island of Providencia *Local Environ* **21** 615–35
- [14] Wang B and Zhou Q 2020 Climate change in the Chinese mind: An overview of public perceptions at macro and micro levels *Wiley Interdiscip Rev Clim Change* **11**
- [15] Tapsuwan S and Rongrongmuang W 2015 Climate change perception of the dive tourism industry in Koh Tao island, Thailand *Journal of Outdoor Recreation and Tourism* **11** 58–63
- [16] Smith W J, Liu Z, Safi A S and Chief K 2014 Climate change perception, observation and policy support in rural Nevada: A comparative analysis of Native Americans, non-native ranchers and farmers and mainstream America *Environ Sci Policy* **42** 101–22
- [17] van der Linden S 2015 The social-psychological determinants of climate change risk perceptions: Towards a comprehensive model *J Environ Psychol* **41** 112–24
- [18] Li C and Monroe M C 2018 Development and Validation of the Climate Change Hope Scale for High School Students *Environ Behav* **50** 454–79
- [19] Creswell J W and Creswell J D 2018 *Research Design: Qualitative, Quantitative, and Mixed Method* (Singapore: SAGE Publications)
- [20] Li C and Monroe M C 2018 Development and Validation of the Climate Change Hope Scale for High School Students *Environ Behav* **50** 454–79
- [21] Ifegbesan A P, Azeez R O and Mabekoje S 2021 Do Socio-Demographic Factors and Sources of Information Relate to Climate Change Awareness? Evidence From Afrobarometer Round 7 Data *JOURNAL OF ENVIRONMENTAL SCIENCE AND SUSTAINABLE DEVELOPMENT* **4**
- [22] Hidayat N, Arifin H S and Putri E I K 2021 The Socio-economic Vulnerability and Villages Community Sustainability Within Tourism Development of Kepulauan Anambas Regency *Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan (Journal of Natural Resources and Environmental Management)* **11** 285–97
- [23] Meilinda M, Rustaman N Y and Tjasyono B 2017 The Perceptions of Pre-Service Science Teachers and Science Teachers about Climate Change *Jurnal Pendidikan IPA Indonesia* **6** 292
- [24] Competente R J T 2019 Pre-service teachers' inclusion of climate change education *International Journal of Evaluation and Research in Education (IJERE)* **8** 119
- [25] Leal Filho W, Sima M, Sharifi A, Luetz J M, Salvia A L, Mifsud M, Olooto F M, Djekic I, Anholon R, Rampasso I, Kwabena Donkor F, Dinis M A P, Klavins M, Finnveden G, Chari M M, Molthan-Hill P, Mifsud A, Sen S K and Lokupitiya E

- 2021 Handling climate change education at universities: an overview *Environ Sci Eur* **33** 109
- [26] Eilam E 2022 Climate change education: the problem with walking away from disciplines *Stud Sci Educ* **58** 231–64
- [27] Herawati* D and Istiana R 2021 Socioscientific Issues-based Textbook on the Topic of Sustainable Development Goals to Develop Prospective Teachers' 21st Century Thinking Skills *Jurnal Pendidikan Sains Indonesia* **9** 256–65