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Climate Change Discourse in Philippine Public Primary Textbooks

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ABSTRACT

The Philippines is highly vulnerable to climate change and extreme weather events, having already experienced some of the strongest typhoons and severe droughts, which have particularly affected its citizens, especially farmers. These natural phenomena have severely impacted the livelihoods of ordinary farmers, fisherfolk, and the broader economic sector. Despite these challenges, studies indicate that many Filipinos are not adequately aware of or well-informed about climate change. This paper investigates how Philippine primary textbooks published from 2000 to 2019 have discussed and contextualized climate change within the subjects of Science and Social Studies, focusing on how these address the causes, impact, and potential solutions to climate change. The lack of awareness about climate change can be attributed, in part, to the limited resources and educational content in primary textbooks—materials that are essential for providing Filipinos with a foundational understanding of climate change and related environmental issues. Utilizing conceptual content analysis, the study reveals that environmental education at the primary level is insufficient to raise awareness of the pressing issues related to climate change in the Philippines. This deficiency in educational content may contribute to the broader ignorance among Filipinos about the significance and urgency of climate change.

Keywords: climate change, public primary textbooks, content analysis, science, social studies

Introduction

Climate change is one of the current challenges of human civilization and poses one of the existential threats confronting humanity. Recent reports by the Intergovernmental Panel on Climate Change (IPCC) showed that the adverse impacts of climate change are already noticeable and are soon to intensify its effect on human activities. Climate change has a widespread impact on ecosystems, peoples, settlements, and infrastructures. It made us experience extreme weather events as well as irreversible losses in the marine and terrestrial ecosystem, threatening food and water security and thus hindering sustainable goals. The economic impact of climate change has already affected the sectors of agriculture, fishery, energy, and tourism and even affected people's physical and mental health (see IPCC, 2022).

The Philippines is the third most vulnerable country to climate change (NICCDIES, 2022). Located on the Pacific Ring of Fire, the Philippines is one of the most disaster-prone countries in the world, facing shifting weather patterns, routine volcanic activities, scorching weather, and rising sea levels. Reports also show that the Philippines is becoming increasingly vulnerable to water scarcity and sea-level rise. The agricultural sector is also facing the impact of climate change, damaging the production and even the health and productivity of the labor force (see World Bank, 2022).

The Philippines is vulnerable to climate change; moreover, surveys showed that most Filipinos need to be more informed. This claim was supported by the study conducted by Bollettino et al. (2020), which indicated that 59.9% of Filipino respondents at the national level had neither heard of nor felt well informed about climate change, while 11.7% had listened to a lot or felt exceptionally well informed, and the remaining 28.4% were somehow informed. This result may vary regionally from the 3.3% awareness of the Bangsamoro Autonomous Region of Muslim Mindanao to 9.6% of the Bicol region, 12.2% in the National Capital Region, 19.6% in Northern Mindanao, 21.3% in the Cordillera Administrative Region to 23.8% of Caraga region, which is the highest region percentage of awareness. The study showed that 46.9% of the respondents believed that climate change is caused by both natural and human factors. While 32.4% believed it was due to human activity, 20% of the participants thought climate change was due to natural processes. Interestingly, the study also showed the correlation between previous experiences and education in disaster preparedness since they are both essential factors that can significantly increase the odds of disaster preparedness activities (Bollettino et al., 2020).

Given that Philippine public primary education still uses textbooks provided by the Department of Education, it is still one of the sources of information crucial to people's awareness about specific issues like climate change that is worth examining. This paper presents the main research problem of how the Philippine public primary textbooks published discussed and contextualized climate change in Science and Social Studies. This paper primarily examined the discussion of the causes, impacts, and solutions to climate change. This paper traced and explored the dynamics of the discourse on climate change, considering the transition from the Basic Education to the K-12 curricula, hence the choice of publication dates from 2000 to 2019. Given that there are two subjects to study, this paper identified whether the State treats climate change as a social or scientific issue.

Theoretical Background

Cause, Impact, and Solutions of Climate Change

Climate change is a complex phenomenon that requires intergovernmental action and has far-reaching impacts on economic development, health, poverty, population growth, resource management, and sustainable development (IPCC, 2022). Addressing these challenges necessitates collective policy decisions, adequate financial resources, and the development of new technological frameworks and capacity-building initiatives, particularly in developing countries (Abbass et al., 2022). Over the years, the impacts of climate change and its causes have become increasingly evident. Recent reports indicate that anthropogenic activities and natural causes are primarily responsible for climate change. Natural causes include volcanic activity, solar variability, ocean currents and circulation, natural greenhouse gas emissions, even tectonic and cosmic events (IPCC, 2022).

Human activities such as excessive agricultural operations, burning fossil fuels, deforestation, and both national and domestic transportation, along with the aftermath of the Industrial Revolution, have led to significant consequences. These include rising temperatures, insect disease outbreaks, health-related issues, life-style changes (Abbass et al., 2022), and adverse effects on agricultural systems, especially in developing countries (Praveen & Sharma, 2019). Climate change is also linked with economic disruptions, declines in tourism, socio-agricultural impacts, and psychological well-being (IPCC, 2022).

Wynes and Nicholas (2017) identified mitigation practices that can be categorized into high-impact solutions, such as having one fewer child, living car-free, avoiding transatlantic flights, and adopting a plant-based diet. Moderate-impact solutions include purchasing green energy, buying more efficient cars, and switching from electric cars to living car-free. In contrast, low-impact solutions involve replacing gasoline with hybrid options, washing clothes in cold water, and recycling. Additionally, government actions and programs, such as climate change legislation, commitments, environmental education, and public awareness, play a crucial role in influencing consumer behavior to address the problem (Abbass et al., 2022).

Textbook, Textbook Studies, and Climate Change Education

Textbooks are books specifically written for teaching and learning purposes, playing a crucial role in shaping the perspectives of both teachers and students on school subjects (Okeeffe, 2013). These contribute to achieving and promoting specific educational goals by including discussions and activities that enhance learning and teaching. In continuation, the key roles of textbooks include encouraging students to construct new knowledge, stimulating questions, balancing detail and precision, and providing students with active, creative, and multifaceted information (Okeeffe, 2013). Textbooks can determine a range of classroom activities and procedures and often serve as a syllabus for instruction (Asakereh et al., 2019). Additionally, these are valuable indicators of classroom content, aligning closely with government-mandated and approved curricula (Wynes & Nicholas, 2017).

Environmental education exemplifies a curriculum emphasizing the importance of values and clarifying concepts to develop skills and tools to understand the interrelationship between humans and the environment (Sarmah & Bhuyan, 2015). It addresses major environmental issues from local, national, and international perspectives. Textbooks remain the most common medium for delivering educational content. Esmaeili and Arabmofrad (2015) argued that textbooks are resources for learning and factors that implicitly influence people's perceptions in various matters. Textbooks continue to form the foundation of curricula and serve as vehicles for knowledge transmission (Nery-Cura & De Guzman, 2018). Achieving a high level of knowledge without the use of textbooks is challenging. However, textbooks can also perpetuate misconceptions and convey implicit or explicit biases on particular subjects (Bonilla & Quesada, 2024).

Studies on climate change representation in textbooks are gaining attention, particularly in light of the current global situation. While there have been analyses of textbook content on climate change in various countries, more research concerning the Philippines needs to be done. Bonilla and Quesada (2024) reviewed existing studies and found that textbooks often provide superficial and fragmented coverage of climate change, frequently portraying it as a distant, future, and global issue. For instance, textbooks in countries like the United States, Spain, the Czech Republic, and Germany dedicate only 1-5 pages to discussing climate change. Additionally, these studies reveal that textbooks tend to emphasize individual actions rather than collective and transformative solutions to climate change (Bonilla & Quesada, 2024).

Contrastingly, D'Apice and Bromley (2023) discovered that history and social sciences textbooks in the United States primarily focus on the roles of political leaders and government actors in addressing climate change, which could hinder students' understanding of effective civic action regarding climate solutions. Moreover, Baarova and Hibszer (2022) identified substantial content on climate change in geography textbooks, which supports the rationale for this paper's focus on examining Social Studies textbooks.

Despite including environmental topics in various textbooks within Philippine primary education, there

has yet to be a comprehensive study on how introductory textbooks contextualize climate change issues and raise awareness. Given the 2012 curriculum changes in the Philippines, there is an opportunity to improve textbook content. It is, therefore, essential to investigate whether or not these changes have occurred and if they have effectively mainstreamed climate change issues across subjects.

Methods

This paper employs conceptual content analysis to examine how textbooks address climate change. Content analysis—a widely used research method for analyzing textual data in verbal, print, or electronic form (Hsieh & Shannon, 2005)—allows for a systematic examination of the material. According to Hsieh and Shannon (2005, p. 1278), content analysis involves the "subjective interpretation of text data through a systematic classification process of coding and identifying themes or patterns." Similarly, Bonilla and Quesada (2024) describe conceptual content analysis as a method to "analyze the explicit or implicit presence of certain words, themes, or concepts in textual materials," providing valuable insights into the meanings and representations of specific issues or topics.

This paper's textual content is categorized into three key concepts: causes, impacts, and solutions. The definitions of these concepts are adopted from Bonilla and Quesada (2024). The "causes" of climate change refer to the "factors contributing to global warming and the alteration of climate patterns" (p. 2181). "Impacts" refer to the "effects of these alterations on the environment and society" (Bonilla & Quesada, 2024, p. 2181). Lastly, "solutions" refer to "measures that can be implemented to mitigate greenhouse gas emissions and adapt to new climatic conditions" (Bonilla & Quesada, 2024, p. 2181). To analyze the content related to solutions, this paper uses Wynes and Nicholas's (2017) three categories: high-impact, moderate-impact, and low-impact solutions.

This paper examines Philippine primary school textbooks because their content is not confined to specialized areas such as Biology, Chemistry, and Physics in Science or Philippine History, Asian History, and World History in Social Studies, as is the case in secondary and senior high school subjects. These primary textbooks cover general topics, providing space to discuss available information on climate change. This study contributes to literature by examining Social Studies textbooks, as most existing research has concentrated solely on Science textbooks and subjects.

Textbooks published between 2000 and 2019 were reviewed to assess the changes in the content on climate change, while considering the transition from the Basic Education Curriculum to the Enhanced Basic Education Curriculum, also known as the K-12 Curriculum. It is assumed that textbook content would reflect these curricular changes. By comparing older and newer textbooks under different curricula, this paper aims to provide empirical evidence of whether there have been developments or reductions in the discussion of climate change.

Public elementary students in the Philippines use these textbooks. This study examines textbooks approved by the Department of Education (DepEd) and distributed in public primary schools. The older textbooks, aligned with the previous curriculum, were published between 1997 and 2000, while the newer textbooks, aligned with the K-12 Curriculum, were published from 2011 to the present. These textbooks are being used by students nationwide. The DepEd provided a list of approved textbooks, which the authors used to locate available copies. Some of the textbooks were retrieved from public school libraries.

This study analyzed 21 textbooks: six older Social Studies textbooks, five older Science textbooks, six newer Social Studies textbooks, and four newer Science textbooks. After identifying keywords, texts, and related discussions about climate change in the examined textbooks, the authors categorized the content based on the previously defined concepts of causes, impacts, and solutions. Since the Social Studies textbooks were written in Filipino, the authors translated the relevant sections into English. The findings were summarized by the authors in tables that present the identified texts and keywords. The authors discussed the findings and assessed the content.

Findings

Data reveals that in the old curriculum, discussions of climate change in Social Studies textbooks were sporadic and inconsistent. While there was some emphasis on solutions for younger students, minimal attention was given by the authors of these textbooks to the causes and impacts of climate change across all grade levels. This indicates that understanding the causes of climate change was not a primary focus in the old Social Studies curriculum, limiting younger students' early awareness of the issue.

Table 1

Frequency of Climate Change related issues in Social Studies Textbooks

OLD	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	NEW	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
Cause	1	-	-	-	1	2	Cause	1	-	3	-	-	1
Impact	-	-	-	1	1	2	Impact	1	2	3	-	1	1
Solution	2	2	2	-	-	1	Solution	1	-	1	-	-	3

Table 2

Frequency of Climate Change related issues in Science Textbooks

OLD	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	NEW	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
Cause	No Books	3	1	2	2	2	Cause	No Books	No Books	1	2	2	2
Impact	No Books	1	2	1	3	3	Impact	No Books	No Books	-	-	2	2
Solution	No Books	3	2	1	1	-	Solution	No Books	No Books	-	-	2	2

In contrast, Science textbooks under the old curriculum provided more consistent coverage of the causes and impacts of climate change, beginning in Grade 2. However, discussions on solutions were not sustained into higher grades, resulting in missed opportunities to reinforce practical learning and climate action as students advanced through their education.

Under the new curriculum, Social Studies textbooks show improvement, offering more consistent coverage of climate change impacts across grades. However, discussions of the causes and solutions remain scattered. In Science textbooks under the new curriculum, mentions of climate change-related issues occur with moderate frequency in the upper grades. However, grades 1, 2, and 3 still lack adequate coverage, leaving a gap in foundational climate change education for younger students.

Climate Change in Social Studies Old Curriculum Textbooks

The Social Studies textbooks examined in this paper discussed environmental problems caused by

human activities. Discussing its consequences also led to the calling of collective responsibilities and actions to take care of the environment, which differs significantly from the old curriculum science textbooks that will be discussed in the succeeding part. The grade 1 level textbook mentioned land and water resources, stating that these resources are scarce and limited. The textbook's content calls to ensure that the environment is cared for with activities like planting trees and other plants and vegetables, composting, and recycling non-biodegradable materials. It also called for prohibiting cutting trees, burning down forests, and reducing the use of commercialized fertilizer. In this context, it emphasized everyone's right to have a clean environment since it is the source of critical human needs to live while reiterating everyone's responsibilities to do their shared responsibilities in ensuring and protecting the environment.

Table 3

Climate Change-Related Issues in Old Curriculum Social Science Textbooks

Grade Level	Causes	Impact	Solution
Grade 1	Deforestation	No available information	Reforestation and Proper waste disposal Shared responsibilities in ensuring and protecting the environment
Grade 2	No available information	No available information	Importance of land and water resources for people's daily needs Environmental protection
Grade 3	No available information	No available information	Government programs to protect the environment. Be a responsible citizen.
Grade 4	No available information	Experience hot weather for most of its days	No available information
Grade 5	Technology brought pollution, and chemicals killed marine animals and plants.	Damage to food sources from farm to sea	
Grade 6	Illegal logging and deforestation Overfishing and destructive practices	Extreme floods killed thousands of people. Water-related problems	DENR programs, such as the National Forestation Program (NFP) and Presidential Order No. 1058

In extension, the grade 2 textbook content continues from the content in the grade 1 textbook. It reiterated the importance of land and water resources for people's daily needs. It provided basic activities to ensure environmental protection, like replanting trees after cutting down old trees, proper use of fertilizers, proper disposal of garbage, and helping the community clean the environment. It also emphasized that people should not engage in using dynamite, chemicals, and electricity for fishing, and instead adhere to the proper ways of fishing in the sea.

The content in the grade 3 level textbook recognizes that logging is essential in the country, extending that

environmental resources should and be allowed to be used. Moreover, it emphasized everyone's responsibility and the proper ways to use resources from forests, mountains, seas, and other natural resources. It also calls out the enforcement of laws that addresses land and water, forest, and mining operations and centers on humans' obligation to maintain and uphold laws addressing the protection of the environment. It includes a cursory discussion about a specific law that addresses logging and laws for water and air pollution. It also projected that everyone is responsible for engaging in government programs to protect the environment such as planting trees in backyards, schools, or road-sides. This textbook also encourages everyone to report someone who engages or has engaged in illegal logging and smoke belching to the media and government authorities.

The content of the grade 4 textbook briefly discussed climate change and other environmental issues. It did focus on the different climates and weather in the Philippines. It attributed the weather to the country's geographical location, so there are more hot days. It also matters when discussing the different temperatures of various places and terrains. The content of the grade 5 textbook, on the other hand, only recognized the impact of evolutional changes on technology and how it affected the natural setting. It recognized that technology brought pollution, chemicals killed marine animals and plants, and even chemical fertilizer led to the killing of the natural capacity of the soil to fertilize. Recognizing these problems led to damage to food sources from land to sea.

Lastly, the content of the grade 6 textbook provided space to tackle different government laws and regulations that address significant human activities affecting environmental situations. It did discuss some of the Department of Environment and Natural Resources (DENR) programs, such as the National Forestation Program (NFP) and Presidential Order No. 1058. This discussion was all rooted in recognition of the problems also mentioned in the preceding grade-level textbooks like illegal logging and deforestation. To some extent, it recognized that natural calamities also led to environmental situations. It mentioned that these problems led to extreme floods and killed thousands of people. It also showed that the Philippines is facing water-related issues. This problem is due to dynamite fishing, extreme consumption and fishing, and irresponsible tourism development in the area. Human development and settlement in the countryside are also sources of environmental destruction since infrastructures and housing led to environmental changes.

While there may be some discussions on climate change across different grade levels, more discussion is needed to fully recognize climate change as a critical issue. Although various environmental problems are mentioned, the content generally needs a more focused and integrated approach to climate change. The existing material addresses environmental issues in isolation rather than emphasizing their connection to the broader context of climate change.

Climate Change in Science Old Curriculum Textbooks

Science textbooks in the old curriculum were found to have no direct mentioning of the phrase "climate change". However, it did mention different environmental problems attributed to human activities and their consequences. No reference was found for the content of the grade 1 level textbook. The content of the grade 2 textbook includes an introductory discussion about the activities that change the land and water. The discussion included cutting down trees and burning them down for people's needs, like having land for their crops, and not planting new trees. The textbook also concentrated on water pollution. It illustrated that it was home for fish and other living things. Throwing garbage and human waste into the body of water causes water pollution and leads to water-borne diseases. Both activities damage the earth and the fish living in the marine system. On the other hand, solutions include reforestation, replacement of trees that were cut down, and proper disposal of garbage and use of water. This statement supports the narrative that humans should be concerned with their activities such as ensuring clean land and waters.

The grade 3 level textbook includes a discussion on the use of soil and water. It has the same illustration from the grade 2 textbook on the causes of pollution and damage to water and soil. However, it provides additional specific cases of solutions to these problems, such as not throwing non-biodegradable materials like plastic, cellophane, Styrofoam, broken glasses,

Table 4

Climate Change-Related Issues in Old Curriculum Science Textbooks

Grade Level	Causes	Impact	Solution
Grade 1	No available information	No available information	No available information
Grade 2	Cutting down trees Burning trees Throwing garbage and human waste into streams	This may cause water pollution and also damage marine life	Reforestation Proper water disposal Becoming responsible citizen
Grade 3	Throwing plastics, toxic chemicals, and non-biodegradable materials into the water	Damages to water and soil Destroy marine life and kills living things in the water	Not throwing non-biodegradable materials into the soil Cleaning of canals, rivers, and seas
Grade 4	Cutting down trees, clearing forests, and mining are some of the causes of soil erosion and pollution Air pollution, water pollution, and soil erosion	Pollution causes instability, disorder, harm, or discomfort to the environment or living organism.	Sustainable lifestyle
Grade 5	Water pollution, chemicals from factories, chemical fertilizers, and warm water from power stations Acid rain and air pollution	Thinning of the ozone layer Damaging the air quality Skin diseases and eye problems	Ensuring that the sewage system works properly and is disposed of carefully
Grade 6	Deforestation Improper waste disposal	Ecological imbalances Global warming Flash flood	No available information

and metals into the soil and cleaning canals, rivers, and seas. Throwing plastics, toxic chemicals, and non -biodegradable materials into the water can destroy aquatic life.

The grade 4 textbook discusses the effect of pollution on people, plants, and animals. It states that pollution is the introduction of contaminants into a natural environment and that it causes instability, disorder, harm, or discomfort to the environment and living organisms, referring again to human activities like the cutting down of trees, clearing of forests, and mining as some of the causes of soil erosion and pollution. The textbook also mentioned that it may cause the death of many organisms, including humans. Air pollution can affect the health of humans, leading to asthma, bronchitis, and lung cancer. Polluted water can also cause diseases because it has germs and chemicals and is unsafe for drinking. It can limit people's activities in the water, like swimming, boating, and fishing because it was suggested that people should not do these activities in polluted waters.

Soil erosion, as discussed in this textbook, because of human actions, can lead to flash floods and less fertile soil. In this context, it suggested possible individual

solutions to the problem. Solutions include tree planting, garbage segregation, proper garbage disposal, less use of cars, walking or biking, and preventing burning garbage that can pollute the air. It also mentioned reforestation, replanting of trees, and different methods of preventing soil erosion like terracing and crop rotation.

The grade 5 textbook mentioned some of the more specific sources of pollution. It said chemicals from factories, chemical fertilizers, and warm water from power stations are some of the causes of water pollution. It does mention a broader scope, like what causes the thinning of the ozone layer. The textbook attributed it to the chlorofluorocarbons (CFCs) used in aerosol spray, refrigerators, and air conditioners. It extended the discussion on acid rain and air pollution. It includes smoke from motorized vehicles and factories, which is poisonous, damaging air quality, and can contribute to acid rain and air pollution. The thinning of the ozone layer increases the chances of developing skin cancer and eye cataracts because it allows the ultraviolet rays to reach the earth's surface. Despite the problems mentioned, little attention was paid to the solution for climate change as it only suggested that the sewage system should work properly and human waste is disposed of carefully.

The grade 6 textbook discussed the importance of forests and the forest ecosystem. The forest is an essential source of daily needs for humans and animals. It ensures a clean environment and protection for survival not only for animals but also for humans. The textbook stated that deforestation contributes to global warming and even allocated space to discuss deforestation. It recognized that deforestation directly impacts the world's climate, lessens the supply of forest products, and affects the balance of atmospheric gases. In the Philippine context, it said that deforestation and cutting down trees for timber still happen, and some loggers, in search of fast and significant income, even cut down young trees.

Atmospheric changes can be attributed to natural causes like volcanic eruptions. However, the textbook stated that human activities disrupt the balance between atmospheric gases such as oxygen and carbon dioxide. Activities that harm the atmosphere include *kaingin*, burning fossil fuels, improper waste disposal from farms and factories, indiscriminate use of fertilizer and pesticide, and rapid population growth. These activities lead to heat being trapped in the earth, soil erosion, insufficient irrigation and drinking water sources, and flash floods, which can also translate to the loss of plant and animal habitats.

The textbook is also the first to mention the effect of rapid population growth. This growth increases the demand for necessities, and more waste are generated by humans due to the need to survive, which leads to the further cutting of trees and deforestation for human settlement. These lead to the disruption of the ecological balance.

Climate Change in New Curriculum Social Studies Textbooks

The grade 1 New Curriculum Social Studies textbook discussed the things that damage and destroy the environment. These include improper garbage disposal, disposal of dead animals, burning trash, and people not helping to clean the environment. The textbook also touched on solutions like cleaning one's surroundings, proper waste disposal, watering plants and trees, classroom cleaning, and using biodegradable fertilizers.

The grade 2 textbook, on the other hand, did not directly discuss or mention climate change. It only discussed the diverse types of climates and how climates affect the conditions of a specific community. It discussed how scorching weather can lead to other agricultural and health-related problems like fever, sore eyes, and allergies. At the same time, the rainy season can also result in different problems like casualties, floods, and agricultural losses for the farmers.

The grade 3 textbook included a discussion on calamities. It categorized calamities as natural phenomena and mentioned how human activities and negligence lead to problems such as floods and wildfires. While noting that the National Disaster Risk Reduction and Management Council (NDRRMC) is a leading national government agency, it also pointed out that it is everyone's responsibility to take care of natural resources. The discussion included steps to prepare for calamities and activities to ensure and protect water and land resources. Aside from the usual practices presented in the previous textbooks, it was first mentioned here that informal settlers near water areas contribute to

Table 5

Climate Change-Related Issues in Social Studies New Curriculum Textbooks

Grade Level	Causes	Impact	Solution
Grade 1	Improper waste disposal	Damage and destroy the environment.	Proper waste disposal
Grade 2	No available information	Agricultural and health-related problems like fever, sore eyes, and allergies Causality, floods, and agricultural loss for the farmers	No available information
Grade 3	Human activities and negligence Informal settlers near water areas could contribute to the destruction of the marine area. Urbanization	Floods and wildfires Destruction of the marine area Damaging the land resources	NDRRMC - steps to prepare for calamities and activities to ensure and protect water and land resources
Grade 4	Irresponsible human actions contribute to climate change	No available information	No available information
Grade 5	No available information	The rise of sea temperature affects agricultural production and the marine ecosystem.	No available information
Grade 6	Mining operation	Most of the informal settlers are affected by this phenomenon, given no capacity, preparation, or awareness.	Contemporary actions and Government policy Establishment of the CCC and NDRRMC and the creation of the National Climate Change Action Plan It is the collective responsibility of everyone to do their part and contribute to protecting and saving the environment.

the destruction of the marine area and that the conversion of forests into subdivisions, malls, and golf courses are some of the most destructive practices that damage land resources.

Climate change was first mentioned in the grade 4 textbook. It claimed that humans are the reason behind this phenomenon. However, it needs to be discussed thoroughly, and instead, this textbook focused on the country's different climate and weather conditions. It stated that different temperature and climate conditions can be experienced because of the setting of different areas in the country. It explained that the diverse arrangements of the natural and physical features cause the varying climates and weathers in different regions. Location near the sea can also contribute to its causes. It did attribute that the geographical location of the Philippines primarily affects its weather and climate conditions and how it can explain the country's experience regarding typhoons.

Contemporary issues are also included in the grade 6 textbook. It included a discussion on climate change after disregarding the previous grade-level textbook. As discussed in the textbook, climate change is a phenomenon centered on the extreme climate changes and weather events that occur worldwide. It also showed reports placing the Philippines as one of the top vulnerable countries to climate change, and how it is challenging to address it given the country's

developing status. The textbook asserts that most informal settlers are affected by this phenomenon, given that they have no capacity, preparation, or awareness of climate change. The rise of sea temperature also affects agricultural production and the marine ecosystem. The textbook explained that the Philippines has abundant natural resources and potential in the mining industry. Though mining operations in the country contribute economically, it was recognized by the authors that it also destroys and damages the environment. Lastly, the projection of the textbook was that the country and area near the sea are expected to experience worse conditions from extreme typhoons, storm surges, and rising sea level.

The textbook, however, focused more on contemporary actions and government policies. It included a short discussion on the establishment of the Climate Change Commission (CCC) and the National Disaster Risk Reduction and Management Council (NDRRMC) as well as the creation of the National Climate Change Action Plan, the National Framework Strategy on Climate Change, and the Philippine Strategy on Climate Change Adaptation as some of the urgent actions of the Philippines in the previous years. Lastly, the textbook recognized the collective responsibility of everyone to do their part and contribute to protecting and saving the environment.

Climate Change in New Curriculum Science Textbooks

There is no Science subject for both grade 1 and grade 2 in the new curriculum. This part examined the content of the grade 3 level textbooks to grade 6. One distinct characteristic of the grade 3 textbook is that it was written in Filipino. However, it gives little attention to climate change. This only includes a discussion on the ecosystem and its importance to animals and humans. However, the textbook consisted of different activities and questions on human-animals-plant relations, such as how humans can damage the environment and what benefits they can get from it while giving no distinct details about it.

The grade 4 textbook concentrated on guiding questions and minimal environmental and ecosystem discussion. Its guide questions encompassed the relations and interactions between living things, such as humans, animals, and plants. This includes discussing the interactions and relationships between living things like mutualism, parasitism, and commensalism. Questions and activities were aligned to understand the animals' and plants' natural conditions and experiences in a specific situation. The textbook also discussed the effects of soil erosion, which were attributed to human activities such as deforestation, illegal logging, overgrazing, and quarrying.

The grade 5 textbook included a discussion on the properties of materials that can harm, and damage humans once used. These materials are used in food packaging and are considered beneficial for their purpose. This textbook suggested recycling these materials and stated that it is everyone's responsibility to protect, preserve, and conserve the environment. The textbook recommended ways to protect intertidal zones, such as avoiding synthetic fertilizers and using natural fertilizers that will not be entirely absorbed by the plants and could be washed off into waterways. It can decrease food production, which can harm both humans and animals. Further, the content of this textbook also discussed the weather disturbances and typhoons in the Philippines and their essential characteristics and steps to take before and during the typhoon situation in the country.

Lastly, the grade 6 textbook briefly discussed the Philippines' ecosystem as well as climate and weather. This did not include any direct mention or discussion of climate change conditions in the country. More attention must be given to the forest status and the decreasing number of forests in the Philippines due to deforestation and urbanization. The textbook included the agents of change in the earth's ecosystem, including earthquakes and volcanic eruptions. At the same time, the discussion on weather patterns consists of the two distinct seasons: the dry and wet seasons. Note that the textbook included the effects of weather changes and not climate change on health. Effects include influenza, cold, cough, asthma, heat stroke, and dehydration. Regarding livelihood, the climate affects most crops, products, and tourism services, extending that extreme climatic conditions can affect crop production. The textbook emphasized cooperation and immediate action to decrease forest product consumption and reduce forest destruction. For individual actions, it emphasized the need for proper waste disposal by classifying biodegradable and non-biodegradable.

Table 6

Climate Change-Related Issues in Science New Curriculum Textbooks

Grade Level	Causes	Impact	Solution
Grade 1 and 2	No available information	No available information	No available information
Grade 3	Humans can damage the environment.	No available information	No available information
Grade 4	Harmful materials that can harm and damage humans once used. Soil erosion, Deforestation, Illegal logging, Overgrazing, and Quarrying.	No available information	No available information
Grade 5	Water pollution, chemical from factories, chemical fertilizers, and warm water from power stations. Acid rain and Air pollution	It affects food production, which can harm both humans and animals. Weather disturbances and typhoons in the Philippines.	Practicing recycling those materials and stating that it is everyone's responsibility to protect, preserve, and conserve the environment.
Grade 6	Deforestation and Urbanization.	Decreasing forest in the Philippines. Climate directly affects most of the crops, products, and tourism services.	Cooperation and immediate action to decrease forest product consumption and reduce forest destruction. Proper waste disposal

Discussion

Climate change is not a mainstream issue based on the content of the textbooks that were published under the old and new curriculum. The content of climate change in the latest textbooks is the same as the content of the textbooks under the old curriculum. Climate change was not presented and discussed as an intergovernmental complex challenge to human civilization with various impacts on ecological, environmental, socio-political, and economic disciplines. The textbooks need a more precise and consistent illustration of climate change. There were even discussions in the grade-level textbooks that did not discuss climate change. The content, however, included different climate- and environmental-related issues. The content of these textbooks cannot guarantee that the discussion will be enough to enlighten the students and populations about the current context of climate change.

The curriculum changes only give way to repeatedly recognizing some of the old ways and practices that damage the environment in its new curriculum textbooks. Nothing added to the discussion of climate change. These changes also minimized the detailed discussion of environment-related problems, especially in the new curriculum Science textbooks. Content about climate change might be determined by the existing understanding and data available during the year of crafting the textbooks, especially under the old curriculum. That can explain the lack of discourse in the old curriculum. However, succeeding years also led to the publication of different IPCC reports on climate change. Release dates of IPCC reports are enough for the new curriculum textbooks to use as references for the content. In observation, it failed to materialize and be used in the newly published textbooks since the same discourses can be read in the old and new curriculum textbooks.

There were discussions related to climate and environmental issues but not about climate change. It also focused little on the localized context, problems, and solutions to climate change. Most of the causes

of these problems were attributed by the authors to human activities, although it emphasized that natural causes can also be agents of changes on the earth's surface. For Social Studies, the causes are evolutionary changes in technology, human development, and settlement, and these were ascribed to informal settlers in the sea areas that led to the destruction of marine areas and the conversion of forests into subdivisions, malls, and even golf courses. Science textbooks emphasized deforestation as one of the significant contributors to climate change and global warming.

To extend, these textbooks included burning fossil fuels, improper waste disposal of factories, and rapid population growth. The causes' presentation varied depending on the textbook's grade level. Most basic causes were mentioned in the lower year, and the most complex causes were touched on in the upper-grade level textbooks. However, even though these issues were mentioned, the textbooks needed to give more discussion and details about the causes of climate change. There is a need to mention some of the critical causes of climate change. The role of global human activities in causing climate change were not mentioned. It did not consider the roles and contributions of most industrialized and developed countries in worsening climate change conditions over time. It did right when it mentioned that it was not only the natural causes that led to this situation. It took into account the role of human activities. The roles of humans are increasing in worsening the environmental conditions which failed to materialize in the textbooks' discussion.

The impact of climate change should have been discussed more in the textbooks examined. It repeatedly mentioned the effect of improper waste disposal, which damages marine ecosystems and pollution. Deforestation leads to flash floods and can kill thousands of people. One of the alarming impacts mentioned in both Science and Social Science textbooks is the impact of extreme weather events and rising sea levels on agricultural and food production, which are both harmful to humans and animals. Diseases and sicknesses were mentioned as some of the effects of weather changes, but these were not directly attributed as effects of climate change. Many impacts of climate change were ignored, such as its impact on biodiversity, the economic sector, tourism, livelihood, agricultural and crop production, food security, health, and human psychology.

The textbooks' content regarding the solutions to climate change mainly stated the low-impact actions of Wynes and Nicholas's (2017) distinctions of three levels of actions. This only centered on individual actions like tree plantings, recycling, proper waste management, and proper use of soil fertilizer. The Social Studies textbooks focused on collective actions and calling out everyone's responsibilities compared to Science's individual-initiative actions in addressing environmental issues. Collective actions include engaging in government programs and activities and reporting illegal activities to the media and the government. While the science textbooks called for individual actions aside from the ones mentioned above, these also included reduced car usage, walking, biking and prohibiting the burning of garbage.

The textbook content clearly showed no distinct and detailed presentation of the current and past experiences of the Philippines in climate change. Localized examples are nowhere to be found in the content of the two subjects for both the old and new curriculum. This exposes an area for improvement with regard to textbook content on climate change, challenging the government to discuss and allow people to be familiar with it. It is also crucial since it needs to thoroughly examine the localized impact that makes people unalarmed by this kind of problem and not discuss matters on disaster preparedness and management.

The rationale behind choosing and including this set of solutions centers on its accessibility to individuals. These formative years are essential for students' awareness of climate change. Failing to provide information that seeks to make the government and people collectively accountable might lead to realizing that this issue should be taken and addressed individually, which is somehow contrary to the demand for solutions. Climate change is a problem that needs collective and global cooperation. Though it is essential to know what to do as an individual, it might disregard and minimize making demands from the government to do its part in addressing it and participating in global actions. Structural and cultural norms might intervene; they can, however, determine the suggestive solutions

written by the publishers, though this is a subject for another study.

The limited changes in the content about climate change in Philippine public primary textbooks before and after the implementation of the K-12 curriculum can be attributed to several systemic, practical, and contextual factors. Although the IPCC's reports are globally significant, their findings may not have been integrated into curriculum frameworks due to a lack of localized adaptation or prioritization. Policymakers and curriculum developers may not have fully recognized the urgency of incorporating climate change education or lacked the expertise to do so effectively. This issue is compounded by limited funding for textbook development and updates, resulting in the continued use of older editions that fail to include updated climate change content. Additionally, publishers often face budget constraints and limited incentives to frequently revise educational materials.

The Department of Education (DepEd) has taken steps to strengthen the integration of climate change concepts into the curriculum through the Enhanced Basic Education Act of 2013. Key topics, such as Disaster Risk Reduction and Management (DRRM) and climate change adaptation (CCA), have been incorporated into various subjects, and a dedicated DRRM subject is offered in senior high school alongside other co-curricular activities. However, challenges remain. Many educators may lack sufficient training in climate science or the pedagogical skills required to teach it effectively. This is further complicated by the shortage of updated teaching materials, visual aids, and technology for learning. Moreover, textbooks often lack local examples of climate change impacts and solutions, making the topic appear abstract and less relevant to learners.

It is important to recognize that Philippine public primary textbooks are not alone in their shortcomings when it comes to discussing climate change in a meaningful context. Research indicates that even textbooks in developed countries often lack adequate coverage of climate change. The comparative analysis between Science and Social Studies subjects is particularly intriguing, as it reveals differing approaches to addressing climate change and proposing solutions. This highlights the need for careful examination of Social Studies curricula in future research, as it is equally crucial for these subjects to engage in climate change discussions.

Initiatives to fully integrate climate change education into public primary textbooks must begin with the allocation of sufficient resources—not only for textbook updates and supplemental materials but also for comprehensive teacher training to ensure effective implementation. Strengthening collaboration among educators, publishers, policymakers, and climate experts is equally critical to ensure that textbook content is both age-appropriate and reflective of localized contexts. Future textbooks should present both local and global dimensions of climate change, highlighting local examples of its causes, impacts, and potential solutions alongside global cases with relevance to the local setting. Furthermore, incorporating public discourse, including Indigenous knowledge and youth perspectives, is essential for fostering a holistic and inclusive understanding of climate change.

This paper emphasizes that Social Studies textbooks, in addition to Science textbooks, can play a vital role in climate change education. Science and Social Studies together provide complementary perspectives: Science explains the "how" of climate change, while Social Studies addresses the "who," "why," and "what can be done." Science textbooks primarily focus on the scientific aspects of climate change, such as its causes, effects on ecosystems, and potential technological or ecological solutions. Meanwhile, Social Studies textbooks explore the societal dimensions, helping students understand the social, economic, and political impacts of climate change, including its effects on communities and livelihoods.

By integrating these two disciplines, students gain a well-rounded understanding of climate change, combining scientific knowledge with social awareness to empower informed decision-making and meaningful action. For a country as highly vulnerable to climate change as the Philippines, prioritizing climate change awareness through public primary school textbooks is imperative. However, a review of current materials reveals significant gaps, underscoring the urgent need for comprehensive reforms to achieve this goal.

Conclusion

The Philippines is one of the countries that are vulnerable to climate change, yet the content of select Science and Social Studies textbooks showed that most of its population has a low awareness of it. This might be attributed to how primary education addressed this problem long before the current situation. Findings showed that climate change is not a mainstream issue discussed in the old and new curricula Science and Social Studies textbooks. Even though it showed and discussed different environmental-related problems, it failed to consistently recognize climate change as a pressing issue.

This study utilized textbooks that are still available and easy to access. Textbooks published by different publishers give another view on how climate change was discussed and elaborated. However, the examined textbooks are those distributed widely in public elementary schools. Further, researchers can focus on collecting and examining materials from other publications by different publishers. It is also interesting to examine the author's background, funding, and processes for managing those government-mandated publications to see the dynamic relations between the government authors and publishers in writing the climate change discourse. It still needs encouragement to discuss the issue of climate change in platforms like traditional media and social media in the Philippines and in public textbooks that are easy to access and widely used. Failure to account for the lack of climate change education in public textbooks would not help to collectively address the cause, impact, and solutions to climate change in the Philippines.

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