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Integrating Climate Education for Social Welfare Enhancement in Indonesia

Leonyta Anggun Nugroho
Bakrie University, Jakarta, Indonesia

Muhammad Raafi
Gadjah Mada University, Yogyakarta, Indonesia

Abstract
Indonesia still faces two significant challenges: a climate education system and relatively low social welfare rates. To address these pressing concerns, this study examines the feasibility of utilizing climate education to enhance social welfare. This study proposed a comprehensive framework for climate education in Indonesia. This framework, developed using quantitative and qualitative research methods, was designed to adapt to various contexts, including formal educational settings such as schools and universities while remaining accessible to underprivileged communities. The study's findings highlighted the importance of integrating climate and environmental education into the educational system. This study also analyzed the impact of the climate crisis on social welfare conditions in Indonesia, paying particular attention to vulnerable communities. It then proposed strategies for implementing climate education to enhance social welfare. These strategies emphasized the use of interactive and action-oriented approaches. The framework presented in the paper aims to equip future professionals with the necessary tools and knowledge to drive innovation in sustainable technologies, shape responsible policy decisions, and foster community resilience.

Keywords: climate change, climate education, education, inclusivity, social welfare

Introduction

In the face of mounting scientific evidence and escalating global concerns, it is crucial to recognize the distinction between climate change and climate crisis. Climate change, a term often used interchangeably with climate crisis, refers to the long-term shifts in temperature and weather patterns observed over decades. While climate change is an ongoing phenomenon with far-reaching implications, the term "climate crisis" emphasizes the urgency and severity of the situation. It underscores climate change's unprecedented scale and rapidity, highlighting the growing risks and potential for irreversible damage.

The World Meteorological Organization's (WMO) provisional State of the Global Climate report paints a grim picture of the Earth's warming trajectory. With 2023 poised to become the hottest year on record, the relentless rise in global temperatures underscores the escalating urgency of the climate crisis. The report's findings are a stark reminder that the Earth is rapidly approaching a dangerous tipping point, where irreversible damage to ecosystems and societies becomes

inevitable. The WMO report highlights the persistent upward trend in global temperatures, with the past eight years setting consecutive warmth records.

The WMO report on the current state of the global climate highlights the urgency of the climate crisis and the growing risks and potential for irreversible damage. This damage extends beyond the physical environment, reaching into the social, economic, and cultural spheres, particularly for marginalized communities that are often least equipped to adapt to and cope with the climate crisis impacts. This includes Indonesia, with diverse landscapes and vulnerable populations. In Indonesia, the cascading effects of the climate crisis are felt across the archipelago, from rising sea levels threatening coastal communities to extreme weather events disrupting agricultural livelihoods. These impacts are disproportionately affecting marginalized groups, such as indigenous communities and small-scale farmers, who rely on natural resources for their livelihoods, have limited access to infrastructure, and face difficulties in adapting to changing conditions (Khan et al., 2019).

While the long-term trajectory of the climate crisis is clear, understanding the specific weather patterns and climate trends for the near future, such as in 2024, is essential for building resilience, ensuring sustainable resource management, and decision-making, especially in Indonesia. The WMO has stated a 66% chance of exceeding the 1.5 °C warming threshold for at least one year between 2024 and 2027. A climate scientist, Zeke Hausfather, asserted that 2024 is a strong possibility for breaching the 1.5°C threshold, further emphasizing the heightened risk of crossing this critical line soon (The Climate Brink, 2023). In 2024, we are facing a critical juncture in the fight against the climate crisis. This could be the year that we cross the 1.5°C warming threshold, a critical point beyond which leads to even more significant impacts.

In Indonesia's diverse landscapes and vulnerable populations, integrating climate education into social welfare strategies is essential to focus on mitigating the unequal effects of the climate emergency, particularly on marginalized communities, and fostering resilience in the face of escalating climate risks. However, the climate crisis in Indonesia is a minor focus of science education. It is only taught as a supplement to science subjects, such as biology or geography (Arwan et al., 2022). This limited coverage means that students need to receive a comprehensive understanding of the climate crisis and its implications since they may lack the skills and knowledge necessary to take action to address the crisis.

In light of the information presented, the research questions are as follows: (a) How can climate education be integrated into social welfare strategies to tackle the impacts of the climate crisis? (b) What tailored strategies can be implemented to enhance the accessibility, relevance, and effectiveness of climate education for diverse populations in Indonesia, considering the country's varied cultural and socioeconomic contexts?

Literature Review

Climate Education

Climate education is critical in addressing the challenges of the climate crisis and promoting sustainable practices. This literature review aims to synthesize and integrate research findings on climate education to provide insights into its effectiveness, challenges, and potential future directions.

One study conducted in a middle school classroom implemented climate change education through an integrated social studies and language arts framework. The findings indicated that this method resulted in high levels of climate literacy and improved reading comprehension as well as overall engagement with the topic (Huntington et al., 2019). This finding highlights the importance of integrating climate education into existing curricula to enhance students' understanding of and engagement with climate change.

Primary and secondary schools in England support a cross-curricular approach to climate change education, including global social justice issues. They advocate for an action-based curriculum starting in primary school and prioritize basic literacy as a funding priority (Lemery et al., 2020). This finding suggests the need for a comprehensive and interdisciplinary approach to climate education that addresses social justice issues and starts early in students' education.

While presenting climate change information in an entertaining video may not directly increase cognitive engagement, it can indirectly enhance engagement by increasing perceived entertainment value. In Indonesia, a study by Zukmadini and Rochman (2023) examined climate change mitigation and adaptation education by integrating it through documentary films for junior high school students. This activity concluded that education using documentary films can increase students' knowledge about mitigation of and adaptation to climate change. This finding highlights the importance of incorporating engaging and entertaining elements into climate education materials to capture students' attention and promote active learning.

However, there are several challenges in implementing effective climate change education. In the Dallas-Fort Worth area of Texas, scientific educators and the general public demonstrate awareness of local risks and basic climate science but also hold misconceptions and skepticism about climate change. Teachers face barriers such as lack of training, time, and resources as well as the absence of climate change in the state curriculum (Littrell et al., 2020). This finding emphasizes the need for comprehensive teacher training programs, increased resources, and curriculum integration to overcome these barriers and improve climate education.

Climate change has been recognized as one of the significant challenges to global health in the 21st century, and the issue mentioned affects all human populations. Vulnerable populations, particularly those facing poverty, and weak public health systems are more susceptible to health challenges resulting from climate change (Siegner & Stapert, 2020). This research finding emphasizes the need to incorporate climate change education into the humanities curriculum to raise awareness regarding the health consequences of climate change and promote resilience among vulnerable populations.

Lastly, least-developed countries (LDCs) face significant challenges due to low incomes, low education levels, inadequate infrastructure, and vulnerability to climate change. Causal loop diagrams can help identify critical feedback and leverage points for potential interventions to enhance resilience in these countries (Jamil et al., 2021). This finding suggests the need for tailored climate education programs that address the specific challenges faced by LDCs and promote sustainable practices.

Cultural values influence science educators' support for climate change education, including their intentions to support it and curricula content preferences (Howard-Jones et al., 2021). This finding suggests the importance of considering cultural perspectives and values when designing climate education programs to ensure their relevance and effectiveness. In line with this, teachers' beliefs about climate change instruction can significantly influence their practice. However, controversy and resistance from stakeholders can inhibit teachers from fully incorporating their beliefs into their instruction (Foss & Ko, 2019). This finding highlights the need for supportive environments and policies encouraging teachers to integrate climate change education into their teaching practices.

In conclusion, the research findings on climate education highlight the importance of integrating climate change education into existing curricula, incorporating local context and personal narratives, adopting a cross-curricular and action-based approach, and addressing cultural values and beliefs. Additionally, there is a need for comprehensive teacher training programs, increased resources, supportive environments, and tailored interventions for vulnerable populations and

least-developed countries. It is recommended that future studies prioritize the assessment of prolonged effects resulting from climate education interventions, develop effective strategies to overcome barriers, and explore innovative approaches to engage students and promote sustainable behaviors.

Social Welfare

The climate crisis has significant implications for social welfare. It increasingly affects people's living conditions and is a growing source of social risks. Research has focused on the climate crisis's social and welfare implications and social policy's potential roles in addressing the global climate crisis and transitioning to a low-emissions society (Bjørn et al., 2022). Furthermore, a study initiated by Bagolle et al. (2023) focuses on the issue of protecting vulnerable households from new climate threats in Latin America and the Caribbean. It proposes alternatives to close the existing gaps and adapt social protection systems to the new challenges. It emphasizes the need to strengthen and adapt operating mechanisms, including social information systems, targeting mechanisms, and payment-transfer mechanisms.

Social protection is crucial in mitigating the effects of the climate crisis on employment and livelihoods. Between 2000 and 2015, climate-related dangers resulted in a yearly reduction of 23 million years of productive work, mainly impacting vulnerable populations. Social protection tools such as unemployment protection, social health protection, pensions, cash payments, and public employment programs ensure financial stability, healthcare access, and the potential for work and income generation. One study conducted by Costella et al. (2021) showed that social protection systems cannot only diminish poverty and inequality but also foster resilience, inclusive growth, and environmental sustainability. Strong social safety nets are efficient mechanisms for mitigating life-cycle and climate-induced risks and uncertainties and are crucial for protecting marginalized people. These research findings highlight the urgency of incorporating social protection into policies that address environmental consequences and transition issues, which is crucial for attaining cumulative and transformational outcomes necessary in climate policy. Efficient policy packages encompass inclusive social discussion, connecting labor market policies with social protection, and formulating national just transition strategies.

In Indonesia, the government is now finalizing the Adaptive Social Protection (ASP) Roadmap to bring together the three focus areas: safeguarding against social risks, adapting to the effects of the climate crisis, and reducing the impact of disasters. The International Labor Organization (ILO), through the Adaptive Social Protection Forum (2023), investigates the use of social insurance systems in Indonesia to mitigate the effects of climate risk and reduce the impact of associated shocks. It explains that social insurance schemes have the potential to deal with climate risk and reduce the effects of related shocks in Indonesia. The paper also emphasizes the potential for expanding the current social insurance systems to enhance protection for impacted workers. This may be achieved by temporary modifications in benefits, qualifying requirements, and operating capacity. Social protection may function as a strategic instrument for managing climate risks and addressing the present demands for climate action and enhanced resilience. Last year, almost 2 million individuals were impacted by natural catastrophes, resulting in an average economic loss of 22.8 billion rupiah. Thus, by employing ASP, we can prevent any tragedy from leading to prolonged impoverishment. The ILO study suggests that allocating social insurance money towards investment can significantly facilitate a gradual adjustment and smooth transition toward an ecologically sustainable economy and society. The study can contribute to the ASP Roadmap and the Indonesian National Long-Term Development Plan (RPJPN) 2025-45.

Research Methodology

This study aimed to investigate the relationship between climate education and social welfare in Indonesia using a mixed-methods approach that involves qualitative and quantitative methods. The qualitative aspect of the study involved a systematic literature review that identified existing

research on the state of climate education in Indonesia, the current situation of social welfare, and the potential connections between these two areas within the Indonesian context. Thematic analysis identified key themes and patterns in the reviewed literature to provide a rich and nuanced understanding of the existing research landscape.

The quantitative aspect of the study involved a survey. A structured questionnaire was developed to measure participants' knowledge of the climate crisis, perceptions of its impacts, engagement in climate-related actions, socioeconomic status, access to education, and participation in climate action programs. The survey was administered to a diverse and representative sample of 250 Indonesian citizens through various means, ensuring the gathered data reflects the broader population.

Statistical analysis, including correlation analysis, identified correlations between the measured variables and explored potential relationships between climate education and social welfare.

This combined approach allows for a more comprehensive understanding of the research question. The literature review provided contextual understanding and existing knowledge. At the same time, the survey allowed for gathering new data on the relationship between climate education and social welfare from the perspective of Indonesian citizens.

Results and Discussions

Distinguish Climate and Environmental Education

Climate education and environmental education are two distinct but interconnected fields crucial in addressing the pressing challenges of the climate crisis and sustainability. Climate education educates individuals, communities, and institutions about the causes, impacts, and solutions of climate crises (Mavuso et al., 2022). On the other hand, environmental education encompasses a broader range of topics related to the environment, including conservation, biodiversity, pollution, and sustainable practices. Climate crisis education (CCE) began in Japan with the introduction of global warming and climate crisis as subjects in education following the publication of *Kankyô Kyôiku Shidô Shiryô* (Educational Resources for Environmental Education) by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in 1991, and the implementation of the Act on the Promotion of Global Warming Countermeasures (referred to as the Global Warming Act) in 1998. Essentially, CCE incorporates a sense of immediacy as a strategy for mitigating climate crisis, aiming to increase public consciousness that future actions will decide the success of stabilizing the climate (specifically, meeting the 1.5 °C objective outlined in the Paris Agreement).

Climate and environmental education are essential for enhancing social welfare in several ways. Firstly, climate and environmental education promote awareness and understanding of the interconnectedness between human actions and the environment. They empower individuals to make informed decisions and take actions that contribute to mitigating the adverse effects of the climate crisis. By fostering critical thinking skills, climate education helps individuals understand climate change's complex causes and impacts, enabling them to challenge misinformation and advocate for sustainability policies. Similarly, environmental education encourages participation and action by inspiring individuals and communities to reduce their carbon footprint, support community-based solutions to the climate crisis, and advocate for sustainable practices (Hursh et al., 2015). Moreover, these educational initiatives are integral in fostering a culture of sustainability and nurturing a generation capable of addressing local and global environmental challenges. By integrating climate crisis across subject areas and providing hands-on projects, educational institutions can produce informed students who understand the impact of their actions on the ecosystem. This creates a ripple effect as informed students grow into environmentally conscious adults who contribute to a sustainable society.

To tackle the climate crisis effectively and enhance social welfare, it is crucial to incorporate climate and environmental education into the educational system. Educational institutions must innovate ways to incorporate these topics across disciplines and provide students practical opportunities to engage in sustainability-focused projects. This approach equips students with the necessary knowledge and skills and instills a mindset of environmental responsibility and active participation in addressing the climate crisis. By integrating climate and environmental education, we can comprehensively understand the interconnectedness between human activities and the environment. This integrated approach will empower individuals to make informed decisions and take collective action toward a more sustainable future (Table 1):

Table 1. Distinguishing Climate and Environmental Education

Feature	Climate Education	Environmental Education
Primary Focus	The science, impacts, and solutions related to the climate crisis emphasize human influence on the Earth's climate system.	The interconnectedness of ecosystems, ecological processes, and human interaction with the environment.
Key Issues	Global warming, greenhouse gasses, sea level rise, extreme weather events, climate justice, and mitigation/adaptation strategies.	Biodiversity loss, pollution, resource depletion, deforestation, habitat destruction, and conservation efforts.
Disciplinary Connections	Overlap with science, geography, economics, policy, and social justice.	Encompasses a broader range of disciplines, including science, biology, ecology, geography, sociology, and ethics.
Action Orientation	Emphasizes personal and collective action to address the climate crisis through advocacy, sustainable living practices, and policy interventions.	Promotes responsible environmental stewardship through lifestyle changes, community engagement, and conservation initiatives.
Overall Approach	Systems-oriented, focusing on the complex relationships between human activities, climate systems, and global impacts.	Holistic and interdisciplinary, emphasizing the web of life and the delicate balance within ecosystems.

Source: Authors' analysis (2023)

To create effective climate education, it is essential to have a solid understanding of environmental knowledge. This includes recognizing how human activities such as deforestation and unsustainable use of resources contributes to greenhouse gas emissions and planetary warming. Educational institutions can implement innovative approaches by weaving together environmental knowledge and climate education. One such approach could involve students participating in service learning projects alongside communities most vulnerable to climate impacts. This would allow students to gain firsthand experience while contributing to meaningful environmental action.

Social Welfare in Indonesia

Social Welfare Conditions

As per the definition enshrined in Law No. 11 of 2009 on Social Welfare, Article 1, Paragraph 1, social welfare in Indonesia means fulfilling its citizens' primary material, spiritual, and social needs, thereby allowing them to lead a dignified life and contribute actively to society. The fundamental material needs include access to food, clothing, shelter, healthcare, and education, which form the foundation of individual aspirations. On the other hand, spiritual needs relate to the beliefs, values, and religious practices that provide individuals with a sense of purpose, identity, and connection to a higher power. Social needs focus on human interaction, participation, and belonging, including social engagement, community involvement, and a sense of security and protection. When social needs are satisfied, individuals feel connected to their communities, valued as members of society, and empowered to contribute to the collective well-being. Social welfare is intricately woven into a society's well-being and encompasses various dimensions that shape its overall health, welfare standards, quality of life, and social security. It encompasses policy, economics, and legislation and provides a nuanced understanding of a society's overall health and trajectory.

Indonesia is a developing country with a population of over 270 million, facing significant challenges in income and wealth distribution and access to necessities. Although the poverty rate decreased slightly to 9.36% in 2023, based on the data from Statistics Indonesia (BPS), it is still above the pre-pandemic level of 9.22%. This reduction must reflect the uneven distribution of economic benefits, leaving vulnerable communities susceptible to the impacts of the climate crisis. Inadequate resources, infrastructure, and technology hinder the progress of poor communities, trapping them in a cycle of poverty and vulnerability.

The climate crisis disproportionately affects poor households, who lack the financial resources, infrastructure, and access to technology needed to adapt. This makes it harder for them to adopt drought-resistant crops, build resilient housing, or move to safer areas in the face of rising sea levels. For example, farmers in poverty-stricken regions may require more financial means to invest in irrigation systems or drought-tolerant seeds since they are vulnerable to crop failures and food insecurity. Similarly, communities living in coastal areas may need help to afford the costs of seawall construction or relocation to higher ground, mitigating their exposure to flooding and storm surges.

This study surveyed 252 respondents to assess the Indonesian population's quality of life and access to necessities. The results revealed worrying statistics, with only 9.1% of respondents reporting a good quality of life and 23% saying they were satisfied with their access to food, water, and shelter. This points to significant gaps in social welfare coverage and raises concerns about the well-being of many Indonesians. Lack of access to essential needs can lead to malnutrition, health problems, and a diminished ability to engage in productive activities. Similarly, poor quality of life can negatively impact mental health, social relationships, and overall happiness. This study also showed a lack of awareness and concern among respondents regarding the possible impact of the climate crisis on their welfare. Only 23.4% expressed concern about the climate crisis's impact on their well-being, which may be owing to their limited understanding of the issue, while only 11.5% reported having a solid knowledge of the climate crisis and its potential consequences. This lack of awareness highlights the urgent need for climate education to empower individuals and communities to comprehend, adjust to, and alleviate the effects of the climate crisis.

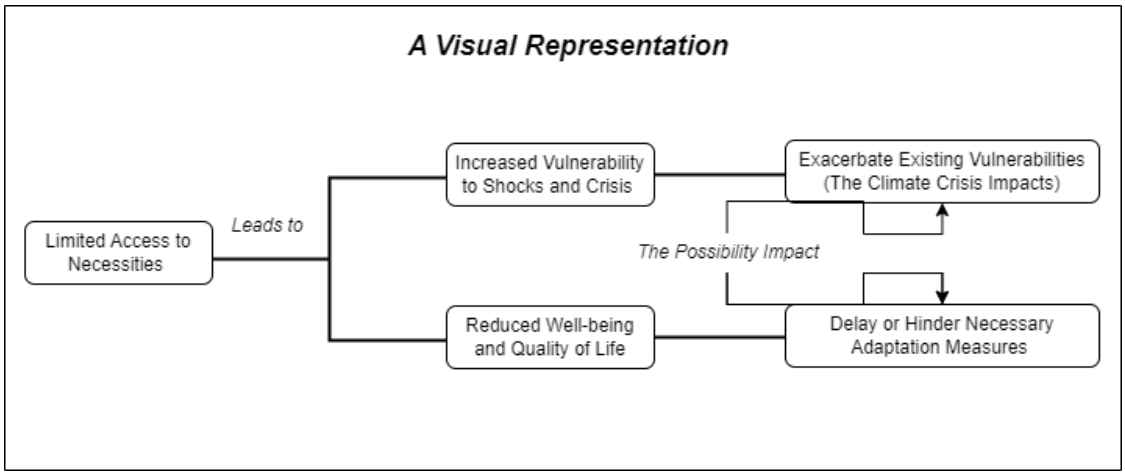

Figure 1. Flow of Social Welfare Conditions and Their Impacts
Source: Authors' analysis (2023)

The depicted flow shows a disturbing cycle of vulnerability and hardship within the social welfare system. The main problem is the limited access to necessities such as food, water, shelter, and healthcare. This lack of essential resources exposes individuals and communities, making them highly vulnerable to external shocks and crises. Natural disasters, economic downturns, and health emergencies can cause severe damage, making it even more difficult for them to cope. The consequences of this vulnerability are significant, and factors resulting in decreased well-being and quality of life can harm individuals. Many suffer from poor physical and mental health, limited opportunities for education and employment, and strained social relationships. This further deepens the cycle of vulnerability, trapping individuals in a seemingly endless struggle. Moreover, the flow chart highlights a vicious feedback loop that exacerbates vulnerabilities. Limited access to necessities disproportionately affects marginalized groups and individuals, amplifying pre-existing inequalities and social injustices. This creates a situation where the most vulnerable are hit the hardest, making it even more difficult for them to break free from the cycle of poverty and hardship. The impact that the adaptation to the climate crisis might face is another primary concern. Individuals struggling to secure necessities may need more resources, knowledge, or capacity to implement essential adaptation measures. This can hinder their ability to build resilience and lessen its effects, creating further challenges for the future.

The findings of this study reveal the potential of climate education as a powerful strategy to enhance social welfare in Indonesia. While the depicted flow chart shows the challenges of limited access to necessities, increased vulnerability, and reduced well-being, it also presents an opportunity for positive change. Equipping people and groups with the necessary knowledge and abilities is crucial. These can help individuals and communities thrive, and we can cause a chain reaction of improvement in various areas of social welfare.

Social Welfare Challenges

The climate crisis affects the fundamental structure of societies. This impact takes the form of various social welfare challenges. This study examines four social welfare concerns that Indonesia will likely face due to the increasing threat of climate-related disasters. It is worth noting that these challenges are only a glimpse into the complex network of social welfare issues intertwined with Indonesia's climate crisis.

First, food security. Indonesia, well-known for its lush rice fields, faces a growing food supply threat. The issue has become even more urgent owing to the worsening climate crisis. While the problem was previously driven by resource management and population growth, rising temperatures, erratic rainfall patterns, and extreme weather events such as floods and droughts are now harming food production and putting the nation's ability to feed its people at risk. The situation is particularly alarming because Indonesia relies heavily on rice. Each year, Indonesians consume 35.6 million tons of grain, which translates to 124 kg of rice per person. This dependence on rice makes the country highly vulnerable to any disruptions in rice production. According to the Central Bureau of Statistics data, El Niño has harmed food production stability. During January-September 2023, only 45.33 million tons of milled dried grain were produced, a 0.11 million ton reduction compared to 2022. This represents a 0.23% drop, primarily due to a reduction of 0.03 million acres in the harvested area. The Indonesian government planned to purchase one million tons of rice from India by the end of 2023 to address these challenges. However, this highlights the urgent need for long-term solutions.

Students who receive climate education can be more informed about how the climate crisis impacts food production. For instance, students can assist farmers in creating adaptation plans that can include water-saving irrigation methods or planting crops resistant to drought. Research by Sisay et al. (2023) has shown that farmers in Ethiopia who received training in climate-smart agriculture techniques experienced a 30-45% increase in crop yields compared to using conventional techniques. Educating students about responsible sourcing, dietary choices, and reducing food waste can help create a more sustainable food system. Studies have shown that reducing food waste at home can improve food security for vulnerable groups and significantly reduce the environmental impact of food production.

Second, economic instability and loss of income. Indonesia's economy relies heavily on tourism, fishing, and agriculture. Unfortunately, these industries are affected by the worsening climate conditions, including extreme weather events and rising sea levels, causing significant revenue losses and economic instability. The impact of the climate crisis on the economy is substantial, and Sri Mulyani Indrawati, Indonesia's Minister of Finance, estimates that by 2030, the country's GDP could be severely impacted by climate-related catastrophes. This could result in an incredible loss of Rp1.380 trillion, highlighting the urgent need to address this issue. Furthermore, these disasters have far-reaching consequences. The loss of jobs, reduced income, and the threat of poverty are just some of the long-term impacts that could result from the climate crisis.

Students who study green technology, sustainable infrastructure development, and renewable energy sources can contribute to creating a more resilient economy that can withstand the effects of the climate crisis. Encouraging students to develop innovative solutions to climate-related problems can lead to growth in employment and economic opportunities in a green economy.

Last, inequalities and social unrest. Indonesia is facing severe consequences due to the worsening climate disaster. The situation affects the country's food production and economy and exacerbates social divides. It may even lead to social unrest. Though the climate crisis impacts everyone, marginalized communities are more vulnerable and bear the brunt of it. This widens the gap between the rich and poor and leads to social unrest. Communities with limited resources and access to adaptation techniques are the worst affected by climate-related disasters and environmental degradation. They become more vulnerable and impoverished when they lose their homes, sources of income, and access to basic needs. Social unrest is not solely a result of the climate crisis but can be exacerbated by it. According to Burke et al. (2015), climatic conditions do not directly cause conflict, but they can alter the circumstances in which social interactions occur, potentially increasing the likelihood of conflict. Their research highlights this point. For example, climate crisis-induced droughts can severely impact crop production in an Indonesian rural village that relies primarily on agriculture, leading to food shortages and financial difficulties. The scarcity

of water resources can further exacerbate tensions between farmers and herders, which may already be high. Additionally, the government's perceived inaction in addressing the issue can fuel social unrest and protests. Although the drought may not directly cause conflict, it can create an environment of vulnerability where existing social and economic grievances can escalate quickly. The climate crisis can potentially exacerbate inequalities and inequities, similar to how wet weather can increase the likelihood of car accidents owing to slick roads and reduced visibility.

Educational initiatives that bring together students from diverse backgrounds to collaborate on climate crisis projects can foster a sense of accountability and teamwork. In Indonesia, community-based climate education initiatives led by local groups and educators enable communities to develop solutions and voice their needs, promoting a sense of agency and reducing social tensions.

Indonesia's wealth and stability are currently under threat from those issues. Although those issues are complex and multifaceted, educating the younger generation about the climate crisis is a crucial first step toward resolving them.

Strategies Implementation to Enhance Social Welfare

Owing to its unique geography and demographics, Indonesia faces severe consequences of the climate crisis. The country's coastal areas are prone to rising sea levels, extreme weather events, and unpredictable rainfall patterns. Agriculture, a primary livelihood source in Indonesia, is also affected by the crisis. Hence, it is essential to integrate climate education into social welfare strategies that empower communities to understand, adapt to, and mitigate the detrimental effects of the crisis. Climate education offers several benefits to communities in Indonesia. Firstly, it helps equip them with the tools needed for disaster preparedness, transforming them from passive victims into proactive agents to build their resilience. Early warning systems become community knowledge, which empowers coastal inhabitants to prepare for tsunamis or farmers to anticipate floods. This knowledge is shared through workshops and village gatherings, strengthening communities and cultivating a culture of preparedness. Secondly, climate education fosters sustainable resource management, teaching communities to live harmoniously with the environment. Farmers can learn about drought-resistant crops and water conservation techniques, coastal communities can develop evacuation plans and early warning systems, and urban dwellers can comprehend the significance of implementing sustainable waste management practices and green infrastructure. Coastal communities can even implement mangrove restoration projects to shield their shores while nurturing fish nurseries and ensuring environmental and economic resilience. This shift towards sustainability strengthens the foundation of well-being, weaving a future where communities thrive within the limits of the ecosystems. Thirdly, climate education empowers communities to diversify their livelihoods, breaking the shackles of traditional practices that leave them vulnerable to climate shocks. These threads of preparedness, sustainability, and diversification, interwoven through climate education, create a tapestry of resilience and profoundly enhance social welfare.

It is essential not to neglect privileged communities in climate education initiatives because the effects are interconnected and ripple through society. Educating them fosters understanding and empathy, leading to solidarity and a shared responsibility to find comprehensive solutions to the crisis's holistic impact. Moreover, many solutions to the climate crisis require innovation and technological advancements, and privileged communities are well-positioned to contribute to this space. Therefore, this study recommends implementing school-based climate education programs to foster early awareness, university-level research initiatives to develop innovative solutions, and community-based resource accessibility programs to empower those with limited access to necessities, ensuring comprehensive and inclusive climate action.

The current climate crisis is a significant challenge that requires collective effort and innovative solutions. While many initiatives are aimed at policy changes and technological advancements, the

foundation for a sustainable future lies in education, especially in empowering young people. Schools play a crucial role as hubs of knowledge and development in equipping students with the necessary understanding, skills, and motivation to combat the climate crisis. However, given the situation's urgency, a more dynamic and action-oriented approach is required. To achieve this, a reimagined model of climate education is proposed in this flowchart that goes beyond theoretical knowledge and fosters tangible action by integrating interactive learning, hands-on projects, and community partnerships. Schools can transform into breeding grounds for climate-conscious learners and empower students to become active participants in building a sustainable future.

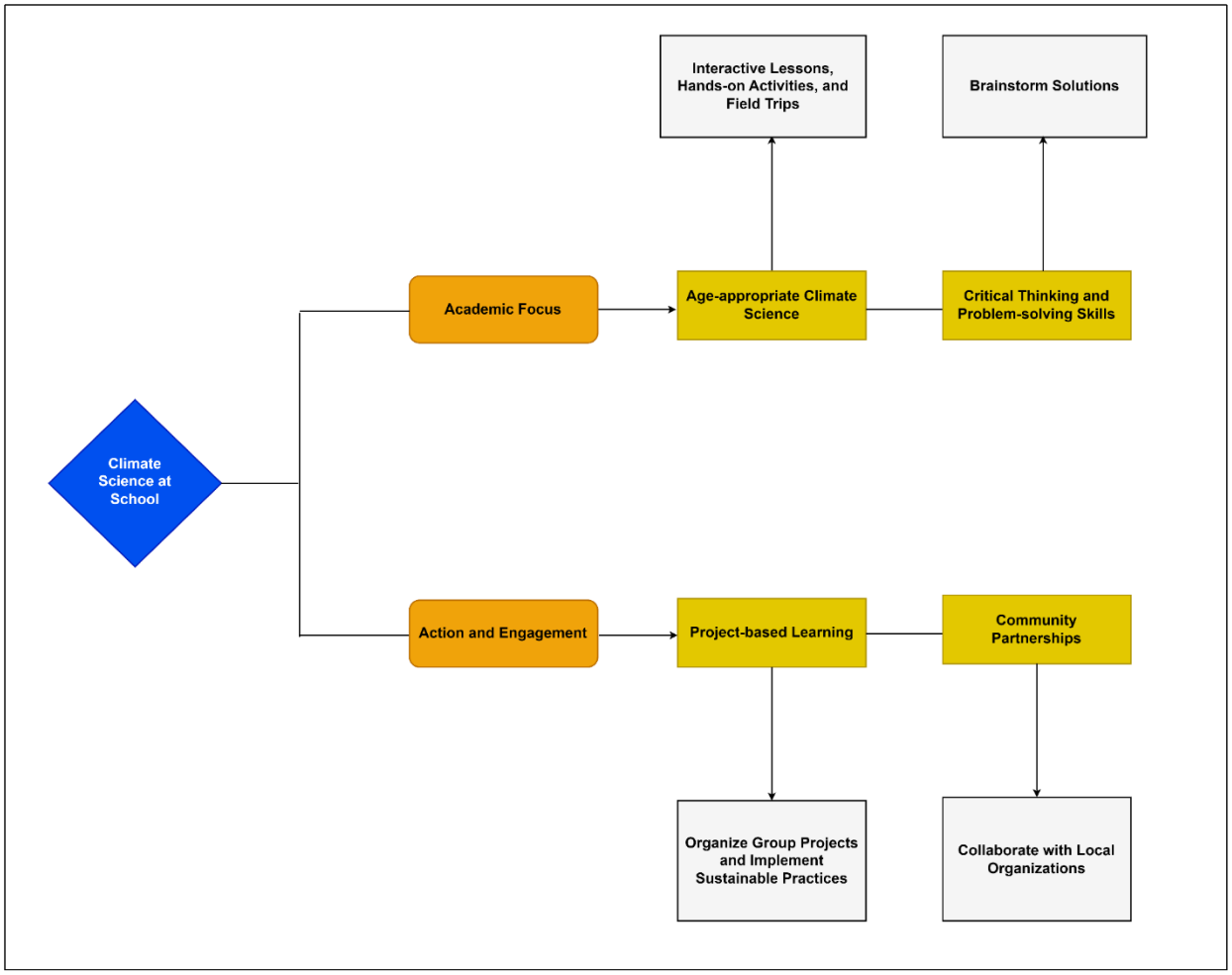

Figure 2. School-based Climate Education
Source: Author's Analysis (2023)

Figure 2 presents a blueprint for such education, a transformative journey where knowledge blossoms into action, culminating in a generation equipped to reshape our planet's future. Interactive lessons become immersive virtual reality journeys to melting glaciers, hands-on laboratories simulating greenhouse gas effects, or captivating field trips to local ecosystems teeming with life. These dynamic approaches cater to diverse learning styles, igniting young and old minds with knowledge and a profound connection to the natural world. As the roots of understanding deepen, students shed the mantle of passive learners and embrace the role of active problem-solvers. Brainstorming sessions crackle with the electricity of diverse perspectives as they chart a course toward a sustainable future, for instance, a classroom echoing with ideas for reducing the school's carbon footprint, from rooftop solar panels to student-led bike-to-school campaigns. Critical thinking and problem-solving skills blossom through this vibrant exchange, transforming knowledge into impactful solutions. As Szczepankiewicz et al. (2021) aptly describe,

critical thinking skills are about honing the ability to dissect arguments and counterarguments, weigh evidence with a discerning eye, and unearth the intricate logical connections that weave the tapestry of climate science. Students learn to identify biases, deconstruct logical fallacies, and discern the weight of various sources, wielding critical thinking as a scalpel to dissect the often murky waters of climate crisis information.

Project-based learning allows climate science to transcend textbook confines and bloom into tangible action. Student groups can design and implement community gardens, conduct energy audits in school buildings, or raise awareness about sustainable practices through engaging skits. Each project becomes a learning experience, a source of pride, and a testament to young minds' agency in shaping a sustainable future. As students grapple with real-world challenges, they hone their critical thinking and problem-solving skills, learn collaborative navigation, and cultivate civic responsibility beyond classroom walls. The final branch of the flowchart signifies a robust expansion beyond the school walls. By collaborating with local organizations, environmental NGOs, and sustainability experts, students amplify the reach and impact of their projects. Student groups can partner with conservation organizations to plant trees in local parks, work with city officials to implement green infrastructure initiatives, or collaborate with farmers to adopt sustainable agricultural practices. These partnerships are testaments to the power of collective action, where young voices inspire communities, and local initiatives ripple outwards, shaping a broader landscape of positive change. As students engage with diverse stakeholders, they gain valuable insights into community dynamics, bridge communication gaps, and cultivate the leadership skills crucial for navigating complex climate challenges.

The blueprint presented in Figure 2 illustrates a vision for the future in which climate education is crucial in empowering young minds to become stewards of a sustainable planet. By fostering genuine understanding, nurturing critical thinking and problem-solving skills, and providing opportunities for action-oriented engagement, schools can help shape a generation of climate-conscious leaders who are well-prepared to confront the challenges of our present times with creativity, resilience, and optimism. As they graduate and move into various fields, they will carry the knowledge and insights gained within these classrooms and share their passion for sustainability with their communities, workplaces, and the wider world.

However, teaching about the climate crisis is a challenging task. The process requires educators to create a safe and accepting environment where students can share their doubts and concerns. As Monroe et al. (2017) astutely observe, climate educators bear the unique challenge of crafting an atmosphere that embraces this multiplicity while gently dismantling deeply ingrained misconceptions. The challenge for an educator is to sensitively address students' misconceptions about the climate crisis, which often originate from social and cultural factors such as family beliefs, community narratives, and media influences. The educators must listen to their students with empathy and respect, encourage open dialogue, and provide evidence-based answers to their questions.

The university campus has always been a hub of knowledge and intellectual discourse. However, with the increasing threat of the climate crisis, it is time for universities to embrace their role as a catalyst for positive change. Universities must transcend the traditional scholarship approach and actively work towards practical solutions. It requires a significant shift in the university landscape, where knowledge can be translated into action, and dialogue leads to positive transformations. To cultivate a dynamic ecosystem, universities must prioritize collaboration, empower students, and embody sustainability in every aspect of their being. Knowledge alone is not enough; universities must create an environment in which collaboration is encouraged, diverse perspectives are valued, and innovation is ignited. For instance, student-faculty committees can co-create solutions to real-world challenges, and peer-to-peer mentoring programs can guide and support upcoming environmental leaders.

The collaborative spirit must expand beyond the university's walls, as strategic partnerships with local communities, NGOs, and government agencies are crucial. Joint research initiatives, community outreach programs, and collaborative infrastructure projects can harness the collective power of diverse stakeholders, ensuring the impact of student-led initiatives is amplified. This framework suggests a multifaceted approach to achieving academic understanding, providing tangible solutions, and promoting engaged student leadership.

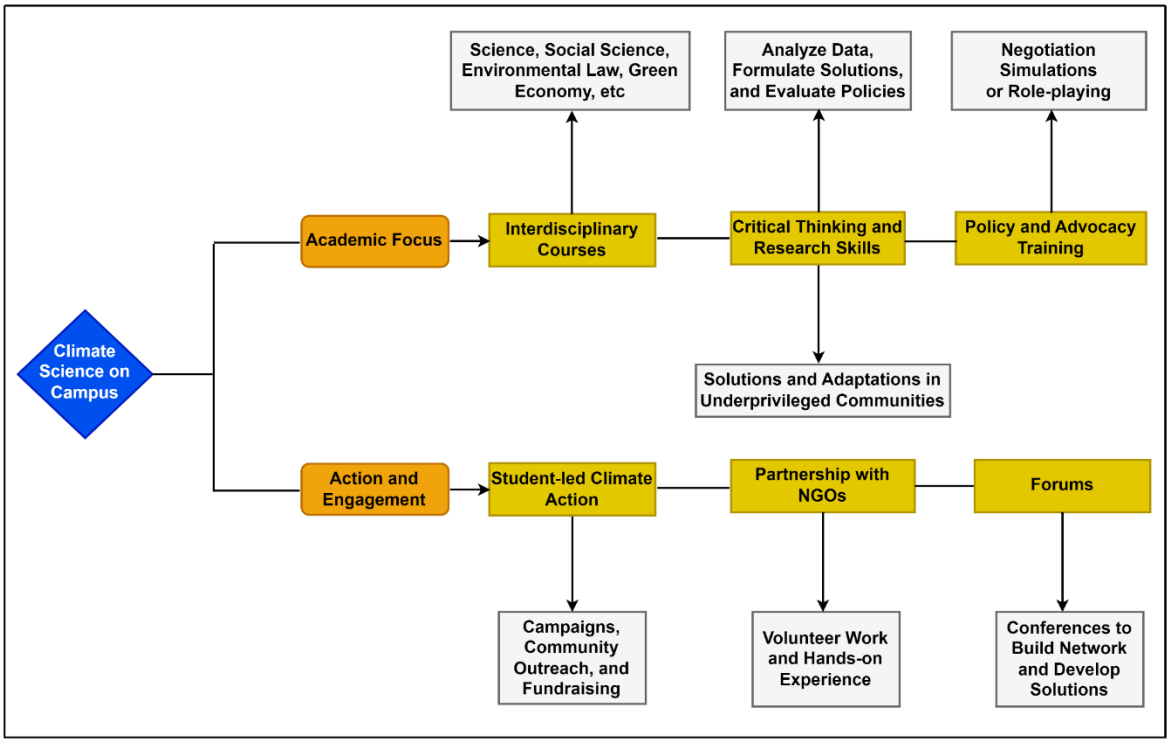

Figure 3. University-level Climate Education
Source: Authors' Analysis (2023)

This framework's foundation breaks down barriers between academic fields by offering innovative courses incorporating science, social science, law, economics, and environmental studies. This interdisciplinary approach helps students comprehensively understand the climate crisis, its effects, and possible solutions. The classrooms come alive with lively discussions on various topics, such as the ethical implications of carbon pricing, legal aspects of environmental regulations, and the economic outcomes of climate-induced migration. The coursework sharpens students' analytical skills, critical thinking abilities, and problem-solving techniques. This can be achieved through rigorous coursework, data analysis workshops, research project collaborations, and mock policy debates. The ultimate goal is to foster a new generation of critical thinkers and problem solvers that require a comprehensive approach.

The framework also empowers students to take action on environmental issues on their campuses and in their communities. Students can become agents of change by participating in initiatives awareness campaigns, community clean-up drives, and fundraising for renewable energy projects. These initiatives help students take ownership of environmental well-being and provide valuable experiential learning opportunities. The framework emphasizes collaboration with established NGOs to maximize these opportunities. It allows students to volunteer with environmental organizations, participate in conservation efforts, and learn from experienced activists. These partnerships ensure that student initiatives are grounded in real-world needs and have a lasting impact. Students need strong communication and negotiation skills to advocate for climate action

effectively. The framework includes workshops on policy analysis, advocacy strategies, and effective communication to help students present their research confidently and advocate for impactful climate action at local, national, and international levels.

Lastly, the framework culminates in a vibrant ecosystem of forums, conferences, and workshops that unite diverse stakeholders such as students, researchers, policymakers, industry experts, and community representatives. These forums serve as platforms for knowledge exchange, cross-cultural dialogue, and collaborative brainstorming, accelerating innovation and generating contextually relevant solutions. Acknowledge the worldwide impact of the climate crisis; the framework fosters partnerships with universities and student organizations worldwide. It allows for international collaboration on innovative solutions, best practices, and a network of committed young leaders working towards a common goal. This international collaboration strengthens the impact of local initiatives and paves the way for collective action across borders (Figure 3).

Molthan-Hill and Blaj-Ward (2022) argue that climate education should be incorporated into various academic fields. They emphasize that fields closely related to the natural world, climate science, or built environments have an advantage since they can easily include climate education to promote a more comprehensive and systemic understanding of the issue. Students can eventually become leaders in this area by connecting their knowledge of climate science with their ability to organize and carry out significant climate action. The study also emphasizes the crucial significance of social science-based fields and those focusing on society, such as business, sociology, psychology, and media. The core issues of these fields readily align with the curriculum for teaching about the climate crisis. Students can learn in these subjects about examining the connections between social concerns and the climate crisis, the impact of communication on the creation of climate narratives, and the psychological factors that influence people's decisions to take action. The vision is for all academic disciplines to recognize their responsibility in preparing students with the knowledge, skills, and perspectives necessary to confront the difficult realities of a rapidly changing world and contribute towards building a sustainable future. This interdisciplinary approach holds great potential for shaping well-rounded individuals capable of tackling the complex challenges of our time.

The importance of higher education in equipping future generations with the necessary tools and knowledge to tackle the challenges of the climate crisis cannot be overstated. Hess and Maki (2019) argue that comprehensive sustainability education should be integrated into university curricula, with climate science at its core. They rightly emphasize the significance of climate science education in sustainability education. Understanding the physical mechanisms, socioeconomic implications, and potential solutions to the climate crisis is a critical pursuit that can help future professionals address this complex issue from various angles. Hess and Maki propose a systemic transformation of universities that integrates sustainability into every aspect of campus life, including energy consumption, waste management, and infrastructure development. This transformation can also involve forging partnerships with local communities and environmental organizations to create living laboratories for sustainability where theoretical knowledge leads to practical action.

The benefits of such a comprehensive approach are extensive. Graduates with a deep understanding of climate science and practical skills to address it will become valuable assets in various sectors. They will drive innovation in sustainable technologies, shape responsible policy decisions, and foster community resilience in the face of climate change. Universities can become beacons of hope and inspiration by committing to sustainability principles. They can showcase the practical application of these values and serve as models for positive transformation.

As universities in Indonesia are taking steps to provide upcoming generations with the essential resources to address the issue of the climate crisis, a significant gap remains. Underprivileged

communities, who are most vulnerable to environmental damage, often lack the education and resources that could empower them to adapt and thrive. Therefore, this study proposes a multi-pronged approach to enhance social welfare through climate education tailored to these vulnerable populations.

Consider a scenario where the spatial limitations of traditional classrooms are overcome, and the boundaries of learning are expanded beyond them. This paradigm shift would entail reaching out to the underprivileged communities, enabling them to access education, and empowering them to lead productive lives. Such a transformative undertaking requires rethinking conventional educational practices and adopting innovative approaches to make learning accessible and inclusive. Through storytelling sessions that draw on the richness of indigenous knowledge and traditional practices, individuals can learn about the climate crisis resilience and vulnerability. Interactive workshops and community forums replace textbooks, providing hands-on learning and practical skills such as sustainable agriculture, climate-resilient infrastructure construction, and green entrepreneurship.

Technology can bridge geographical barriers, allowing climate education to reach even the most remote areas through mobile apps, radio broadcasts, and online platforms. Diverse learning styles are accommodated by this approach, ensuring inclusivity for those who may not feel comfortable in traditional settings. Peer-to-peer learning networks foster a sense of collective ownership and empower local knowledge champions to emerge, leading climate action initiatives within their communities. Community-based climate action groups become incubators for collective action, mobilizing individuals to share best practices, advocate for climate-friendly policies, and hold local authorities accountable. Effective communication and engagement training equips community leaders with the tools to influence decision-making processes and secure vital resources for adaptation initiatives.

Monitoring and evaluation are inherent components of this framework, ensuring transparency and accountability. Data is collected through participatory research methods that incorporate the voices of the community itself, informing continuous adaptation and refinement of the framework. Context-specific indicators track the impact of climate education on social welfare, measuring improvements in poverty reduction, food security, and disaster preparedness. Ensuring that the framework stays relevant and adaptive to the changing demands of disadvantaged communities is made possible through this continuous feedback loop.

Potential Challenges in Implementing the Framework

Although there is much potential for incorporating climate education into curricula at schools and universities, certain challenges must be addressed. These hindrances affect this critical information's effectiveness and widespread acceptance, ranging from resource limitations and deficiencies in school teacher training to faculty expertise concerns and disciplinary isolation in universities. Additionally, this paper examines the unique challenges that climate education curricula in schools and universities face.

Curriculum overload is a major challenge that stands in the way of Indonesia's enormous potential for incorporating climate education into the curriculum. Concerns about current responsibilities are warranted, as primary schools manage nine subjects, junior high schools handle eleven subjects, and senior high schools offer twelve. The existing curricular structure is outlined in the recently issued Minister of Education, Culture, Research, and Technology Regulation Number 262 of 2022 on Amendments to Regulation of the Minister of Education and Culture Number 56 of 2022 on the Guidelines for Curriculum Implementation in the Context of Learning Recovery, emphasizing the already packed schedules. In this situation, it could appear unwise to introduce climate science as a distinct subject, which could exacerbate the overload problem. Nevertheless, neglecting climate education because of this difficulty would mean missing a chance. The core of climate

education is not just the study of climate science but also the development of transferable abilities in critical thinking, problem-solving, and action-oriented skills.

A lack of financing is another major challenge to including climate education in Indonesian schools. The country's historical underinvestment in education is the root of this problem, as evidenced by the 1945 Constitution and the Law on Regional Government (23/2014). According to these rules, education must receive at least 20% of national and regional budgets, which is seldom achieved in practice. Sukasni and Efendy (2017) point out that Indonesia's education budget is not as high as other countries in Southeast Asia, raising questions about the government's commitment to education as a catalyst for national growth. The financing shortfall directly impacts the development of essential components of effective climate education, including curriculum, resources, and technological advances. This underinvestment has a variety of negative effects. Inadequate funding may force schools to prioritize other courses, leaving climate education behind. Students may have a fragmented knowledge of climate concerns, making it more difficult to participate meaningfully in this important discussion.

There is the intrinsic complexity of climate science itself, which presents a barrier even with sufficient resources and curricular integration. Understanding greenhouse gas dynamics and evaluating complicated data and estimates are only a few of the many complex ideas that make up the climate catastrophe. Many teachers lack the expertise and experience needed to handle these intricacies effectively, which might make it more difficult to offer climate education. The subject matter is frequently filled with disagreement and conflicting opinions. It can be difficult for teachers to handle delicate conversations with objectivity or neutrality, adding another difficulty to their teaching duties. This can be especially challenging when there are wide differences in public opinion on the climate catastrophe.

Universities also face critical challenges in incorporating climate education into their courses. Notably, there are particular challenges to consider when implementing the suggested framework for climate education into practice at Indonesian universities.

The proposed framework highlights the value of a multidisciplinary approach to climate education, but there are certain challenges in implementing this idea in Indonesian universities. Veron et al. (2016) rightly pointed out that innovative curricula, professional growth, and institutional support are necessary for effective integration. However, there are several challenges in achieving these objectives, given the state of higher education in Indonesia today. Firstly, there is cause for concern, given Indonesian institutions' scant research capabilities. Regarding the 2019 Times World University Ranking, only two Indonesian universities are included in the top 1,000, and none of the country's universities rank in the top 500 for research. There might also be a lack of financing and infrastructure for research in Indonesia, which could impede the development of strong educational and research initiatives to address climate-related issues. According to data from the centers for development, education, and training, there were 2,439 engineers and 9,669 researchers in Indonesia in 2019. However, statistics from Indonesia's landscape of science and technology indicate that only 13% of those researchers have doctoral degrees, with the majority (45%) holding a master's degrees.

Inadequate research capacity and minimal strategic emphasis on funding for research and development have hampered essential climate-related research and innovation. Insufficient training and experience among researchers further exacerbate the issue. Consequently, there is a pressing need for faculty development, specifically in climate education. However, the challenge lies in providing educators with the knowledge and abilities required across a broad spectrum of subjects without adequate funding and support. This lack of resources also makes it challenging to promote multidisciplinary cooperation, which is essential for comprehensive climate education.

Additionally, navigating the complexity of various academic cultures and departmental structures hinders collaboration, making it difficult to build significant initiatives.

The involvement of students is another potential challenge to consider when it comes to climate education. Students may question the relevance of learning about the climate crisis and how it can benefit their future careers. This lack of understanding can hinder effective learning and engagement. Traditional academic structures often compartmentalize subjects, making it difficult for students to see how the climate problem affects many disciplines. Career counselling may not fully highlight the diverse range of positions and opportunities available in the green economy, which limits students' exposure to the potential uses of climate knowledge.

Policy Recommendations

To address the social welfare concerns caused by the climate crisis in Indonesia effectively, it is essential to implement complete policies along with climate education. A few suggestions for policies to consider encompass the following: (a) Climate education should be included in the curriculum of every educational level, from elementary school to tertiary education, ensuring that the material is comprehensive, age appropriate, and tailored to the local context; (b) Educators must also be provided with extensive training and opportunities for professional growth to acquire the necessary pedagogical skills and understanding to teach about climate change effectively; (c) Collaboration should be encouraged between academic institutions, community associations, and environmental non-governmental organizations to provide interesting and relevant learning opportunities; and (d) Policies should be implemented that mitigate the disproportionate impact of climate change by ensuring equitable access to opportunities, resources, and adaptation measures for disadvantaged groups.

Conclusions and Suggestions

Climate education is crucial for addressing the climate crisis and promoting social welfare. Educators can increase students' knowledge about mitigation and adaptation to the climate crisis by incorporating engaging and entertaining elements into climate education materials. However, challenges such as lack of training, time, resources, and cultural values and beliefs can hinder effective implementation. Vulnerable populations, particularly those facing poverty and weak public health systems, are more susceptible to health challenges resulting from the climate crisis. Moreover, least-developed countries face specific challenges due to low incomes, low education levels, inadequate infrastructure, and vulnerability to climate crisis. Comprehensive teacher training programs, increased resources, supportive environments, and tailored interventions are needed to address these challenges. Social protection systems, such as unemployment protection, social health protection, pensions, cash payments, and public employment programs, are essential for mitigating the effects of the climate crisis on employment and livelihoods. The climate crisis in Indonesia is disproportionately affecting poor households, who lack the financial resources and infrastructure needed to adapt. This lack of access to necessities, such as food, water, shelter, and healthcare, exposes them to external shocks and crises, leading to malnutrition, health problems, and reduced well-being. Climate education is a powerful strategy to enhance social welfare in Indonesia, providing tools for disaster preparedness, sustainable resource management, and diversification of livelihoods. By integrating climate education into social welfare strategy, communities can better understand, adapt to, and mitigate the effects of the crisis, fostering a more resilient society. This approach can help individuals and communities build resilience, reduce vulnerability, and create a tapestry of resilience that can profoundly enhance social welfare.

Future studies in this area could explore the effectiveness of specific active learning techniques in climate education and their impact on students' understanding and commitment to action. Additionally, research could focus on the implementation and outcomes of the proposed comprehensive framework for climate education in Indonesia, examining its influence on social welfare and sustainable development. Lastly, studies could investigate the role of local

communities and organizations in supporting climate education initiatives and their contributions to fostering community resilience.

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