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Educating Adaptation And Mitigation Strategies For Climate Compatible Development: A Governance Approach

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Abstract. The integration of climate change adaptation and mitigation strategiesin curricula at elementary school education to provide pro-environment knowledge, skills and attitude to foster the agenda of climate compatible development (CCD) is one of the challenges for environmental governance. To inculcate ideas of triple-win solution strategies through awareness amongst youth on relevant actions can be instrumental for promoting CCD. The elementary education, particularly in developing countries, has not yet took advantage of its role in coping with the biggest challenge of climate change by inducingpro-environment knowledge, imparting requiredskills and developing affective attitude at early age. In this conceptual framework, this article is an attempt to examine the elementarycurricula in the context of climate change education.The objective is to propose an education model to provideeducation for CCD,by employing Bloom's Taxonomy of education and rationalizing the need for its integration in elementaryeducation as contributory in implementation of environmental governance framework for CCD process. It is deciphered that climate change education, which remains a relatively nascent and under-developed domain, needs to be incorporated in school curriculum all over the world, especially in the developing countries like Pakistan. Although importance and need of integration of climate change aspects in elementary education in Pakistan has been realized, steps have been taken but relevant policies and policymakers seem insensitive of its potential to augment the process that may assist in adapting to and mitigating for climate change. Hence, there is a need to devise policy guidelines for integration of climate change adaptation and mitigation strategies in curricula of elementary education through a coordinated education and environment governance mechanism at federal and provincial levels.

Keywords: Climate compatible development, climate change education, elementary level, behavior change, Bloom's Taxonomy, governance

INTRODUCTION

The stark reality of Climate change is the most serious externalityof 21st century (Iqbal & Khan, 2018) for which mass awareness at gross-root level is necessary towards effective adaptation and mitigation strategies particularly for developing countries, which are more vulnerable due to cascading effects. Climate change education (CCE) curricula at school level along-with improved knowledge and skills of the academia is a major governance challenge to foster the agenda of climate compatible development (CCD) with the concept of triple-win solution strategies through awareness on relevant actions (Gunamantha & Dantes, 2019). Climate knowledge is a matter of major concern particularly in the context of understanding about cause and effects at early age. It is pertinent that the education sector is still untapped particularly in developing countries, which is an opportunity to take advantage for coping the biggest challenge of climate change through influencing knowledge, skills, attitude / behavioral change (Anderson, 2012; Tibola da Rocha et al., 2020) at early age, and more precisely through cognitive, psychomotor and affective domains as described in Bloom's Taxonomy (Bloom, 1956).

Planet Earth has seen several extreme transitions in its climate over the geological periods, all of them being natural in nature(Haraway, 2015). However, the current climatic shift is considered largely anthropogenic in nature(Roe et al., 2017). Various countries have a varying role in contribution towards global warming and overall environmental degradation leading to climate change; but the repercussions aren't equitable as each region or country is affected differently based on its vulnerability(Hussain et al., 2020). Global efforts have been snowballing in order to avoid the current climate variability to reach

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catastrophic levels through adaptation and mitigation-effective implementation of which necessitates an informed populace(Braun et al., 2018; Cordero et al., 2020; Farooqi & Fatimah, 2010).Despite being vulnerable to climate change, the education sector offers an untapped potential to combat climate change(Tibola da Rocha et al., 2020). Understanding its imperative role, UNFCCC declared education as a crucial element to generate adequate response to climate change(UNFCCC, 1992).

Pakistan, being a primarily agrarian economy and a developing country vulnerable to climate change, is sensitive to the unsustainable mass resource consumption patterns(Chaudhry, 2017). Pakistan is currently among top 10 most vulnerable countries (Iqbal & Khan, 2018). Lack of knowledge about climate change and how it is affected by personal habits, along with a blatant disregard of eco-interventions has promoted unsustainable consumption patterns that further increase the country's vulnerability to climate change-related disasters. To counter the issue, CCE at an early stage seems to provide a possibility to enlighten and sensitize the coming generation about the magnitude of their actions and how they can contribute to deal with this looming catastrophe(Whitebread & Bingham, 2013). In this regard, the role of education system for elementary schools in Pakistan is crucial, particularly after the 18th amendment in the country's national constitution after as a result of which both environment and education were devolved at province level. Education policies that encourage an inclusive curriculum, ensuring the erudition of CCE and overall environmental education would play a key role in stimulating and propagating eco and climate conscious behavior in children.

In the context, this paper aimed atexamining the state of knowledge about climate change education, developing the model approach for climate conscious behaviorby employing Bloom's Taxonomy and rationalizing the need for its integration at elementary level in Pakistan in order to support decision making process for improved governance mechanism at federal and provincial levels.

METHODOLOGY

This paper is based on qualitative research. The important aspect of climate change education at school level was identified during the analysis of stakeholders' capacity i.e. of academia, as part of broad PhD study by the first author on the topic of governance analysis for climate compatible development in Pakistan. This aspect was then scrutinized further for its potential contribution towards climate adaptation and mitigation strategies. Thus, this paper was produced by extending the capacity component of the thesis.

An innovative climate change education model was developed on the foundation of Benjamin Bloom's Taxonomy of 1956 (Bloom, 1956), which is a set of three hierarchical models used to classify educational learning objectives into levels of complexity and specificity. Firstly, the most common content analysis technique was employed for scrutinizing the literature (Elo & Kyngäs, 2008; Iqbal & Khan, 2018; Lindgren et al., 2020) through which a range of relevant opinions and analysis were considered. Secondly, Bloom's theory was applied by clubbing with the cause and effect analysis to interpret the outcome viz-a-viz the variables involved (STAKE, 1978; Walsham, 1995) for climate adaptation and mitigation strategies and development of CCE Model. Prior to develop CCE model, an analysis exercise was done in an in house consultation session with the academicians. Findings of the exercise was recorded with the help of flip chartsby exercising the widely practiced Network diagram / Situational Analysis technique (Borgatti et al., 2009; Hovland, 2005; Wellman, 1983). It helped in developing better understanding about climate adaptation and mitigation through cognitive, psychomotor and affective domains as described in Bloom's Taxonomy. Lastly, discussion was generated and conclusion was drawn based on CCE model.

RESULTS AND DISCUSSION

Model Approach for Climate Conscious Behavior

Based on Bloom's Taxonomy clubbed with cause and effect analysis, figure 1 shows a novel CCE model developed as part of this study to help in conceptual understanding about propagating the pro-environment and climate conscious behavior among school children.

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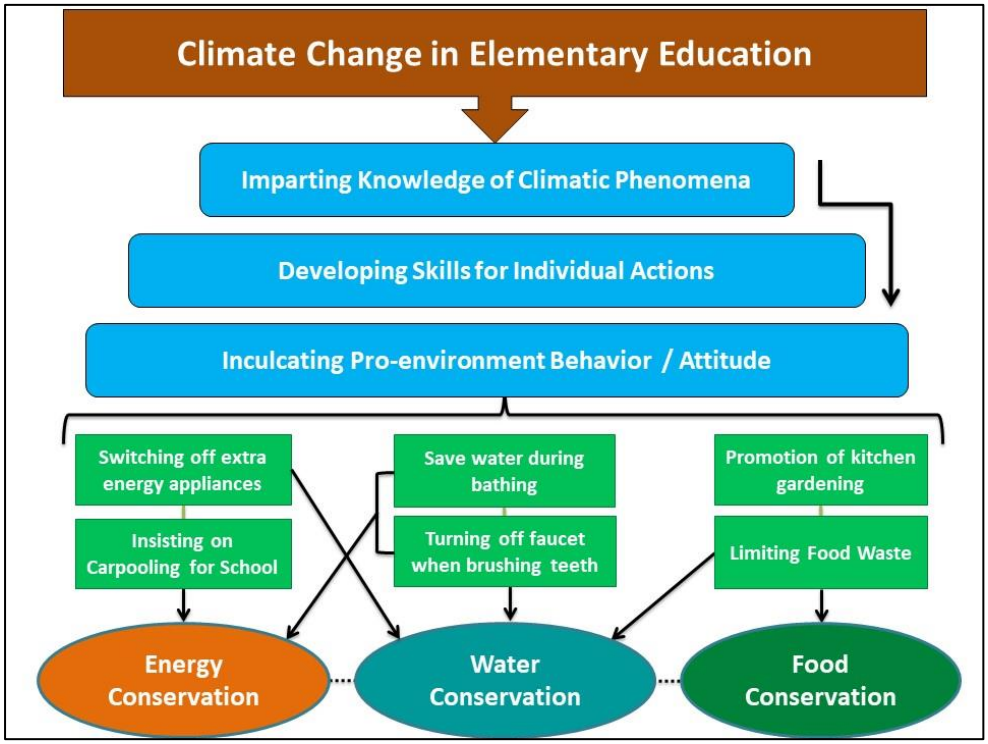

Figure 1: CCE Model for Behavioral Changes at Elementary Level

At core, climate change education (CCE) aims for learning in the face of risk, uncertainty, and rapid adjustments (Stevenson et al., 2017). CCE demands a focus on learning, critical thinking and capacity building that will allow people to inquire, comprehend and critically analyze situations to perform appropriate actions. The Bloom's Taxonomy is fully applicable to adaption and mitigation strategies in order to achieve the goal of climate compatible development (CCD). Social action, along with strategic and technological solutions, has been substantiated to boost the scale of response needed to avoid or delay the worst projected impact of climate change (UNFCCC, 1992). Education and awareness are key sources to instill such pro-environment behavior among the masses. However, behavioral and lifestyle modifications have been deemed challenging at the later stages of human life (van de Ven et al., 2018).

Studies show that education and behaviors imparted to children at an early age are effective in encouraging eco-conscious behaviors that allow them to transform their day-to-day actions (Whitebread & Bingham, 2013). The young age at which children are traditionally enrolled in the primary and secondary schooling is deemed ideal to induce behaviors such as energy, water and food conservation that practically contribute towards climate change adaptation/mitigation as children are most receptive and absorbent of routines and habits that could last a lifetime – promoting the possibility of growing up to become involved in active sustainable and climate-conscious decision making (Bain & Bongiorno, 2020). Understanding and learning such habits at an early age also has another profound impact: promotion of intergenerational learning for best conservation practices with good habits in adults around them (Lawson et al., 2018). While the young generation is destined to become future leaders and expected to deal with the worst climate crises, its current understanding about climatic phenomena, their own impacts, and their ramifications is insufficient to none (Ahmed & Imran, 2020). Therefore, climate change education, which remains a relatively nascent and under-developed domain, needs to be incorporated in school curriculum all over the world, especially in the developing countries including Pakistan.

The water-energy-food nexus is undoubtedly the most vital and complex interconnection of resources and services that is critical for the human security (Hassan et al., 2018, 2019). The delicate linkages between the three are increasingly being disturbed due to the anthropogenic interferences, resulting in tipping the natural balance (Pardoe et al., 2018). Over-exploitation, unsustainable consumption and production patterns are contributing towards climate change, which in turn, is again affecting the availability and quality of these resources (Sidibé et al., 2018). Children can play important

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role in sustainable consumption patterns. An effective climate adaptation and mitigation strategy calls for the sustainable employment and application of these essential assets; improvement in sustainable consumption patterns being one of the important aspects (I. H. Shah et al., 2020). Circling back to the aforementioned narrative, sustainable consumption patterns can be effectively developed when communicated from an early age.

The CCE, in its true essence, supports the building of relevant knowledge base and critical thinking skills, which allows pupils to analyze their behavior and actions that are impacting the climate or environment in general as opposed to indoctrinating certain perceived notions and practices (Stevenson et al., 2017). Figure 1 explicitly shows that an effective CCE model should allow children to assess their own actions utilizing critical analysis tools that have been transferred to them, and then they shall be able to develop practices to correct their actions that are harming the planet. The possible practices in the given case may be tangible deeds which would provide instant gratification such as reducing water consumption while showering or cleaning teeth in the morning, or turning off extra lights or devices (Rousell & Cutter-Mackenzie-Knowles, 2020). Researchers say that any positive participation or contribution towards the cause, regardless of its magnitude, must not be discouraged as the children engaging and experiencing success and appreciation can become empowered for a lifetime of climate-responsible behaviors and decisions (Williamson et al., 2018).

Prospects of Climate Change Education

CCE education models are beginning to emerge worldwide, especially in the countries with a developed education system (Muroi & Bertone, 2019). In several countries where the education policy ensures a uniform education model for every institution, there still seems to be variability in the literacy and understanding of the issue (Potter, 2009). Literature partially attributes this inconsistency to the varying depth of understanding by the teachers, as many of the current educators have not been formally educated on climate change (Hufnagel, 2014). Taking the example of the United States, most of the teachers closely related to the aforesaid domain are biology or earth science teachers, the latter still being a fairly minor area of disciplinary focus (Nagra, 2010). Moreover, the personal biases and blatant disregard for anthropogenic climate change and other ecological deteriorations, coupled with misinformation and the propagation of conspiracy theories through social media platforms are among the factor affecting the consistency of CCE (Berbeco et al., 2019; Sezen-Barrie et al., 2019). Therefore, professional development of teachers to be able to understand the phenomenon and reflect on their actions themselves is fundamental for an effective CCE model (Drewes et al., 2018). Such teachers would be able to effectively impart climate change knowledge while minimizing the likelihood of climate anxiety in children – a distress that develops due to increased concern regarding climate and environmental degradation (Wu et al., 2020). Children are particularly susceptible to this as they are at an age of physical and psychological development, and unregulated stress through education regarding the matter can impact their mental health (Clayton, 2020).

Effective CCE models comprise a variety of approaches to inculcate climate change knowledge at school level. Zoos, despite of the associated controversies, offer an escape to the world of animals which are increasingly being threatened by the anthropogenic climate change driven habitat loss. Regular educational visits to animal sanctuaries not only allow children to connect to nature, but also enhance their understanding of endangered species and animal welfare, inducing a level of environmental concern. Similarly, climate engagement using art and artistic expression has prospect to go beyond scientific communication to help children develop critical thinking (Bentz, 2020). Art forms have been known to have a profound impact on the artist as well as the audience; effective in facilitating dialogue and stimulating behavioral changes in the context of climate change adaptation and mitigation (Hollo, 2018). These approaches are especially convenient for developing countries with limited resources at hand to employ more technically-advanced means. Examples of technology-based CCE are the immersive virtual reality field trips (Markowitz et al., 2018). The argument supporting their use says that interactive media interaction engages cognitive processing in users, impacting the psychological notions. For instance, a virtual tour of a coral reef would allow students to experience the immense biodiversity, along with their degradation due to pollution, ocean drilling etc.(Petersen et al., 2020). Such experiences are effective and enable pupils to experience locations which are difficult for school student to see firsthand. Green infrastructures and schools have also been proven to induce pro-environment behavior and climate consciousness among pupils – a strategy itself contributing towards climate change adaptation and mitigation while teaching the same.

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For CCE, action is the goal(Tibola da Rocha et al., 2020). Effective action would be stimulated when the education equips students with appropriate knowledge and skills to critically analyze situations and plan environmentally sound and sustainable actions themselves with minimum teacher bias(Stevenson et al., 2017). Globally, the potential of CCE at elementary level in climate adaptation and mitigation is largely unexplored(Kagawa & Selby, 2012). Higher education has been a focus of educators and policymakers, with a variety of graduate and doctorate programs in climate change, climate policy and other relevant fields(Monroe et al., 2019). The increasing understanding of the climate change has necessitated the need of academic programs specially designed to understand the phenomenon and provide adaptation and mitigation measures. Such measures are typically technological and strategic in nature, with a budding interest in the potential of awareness and societal change to achieve the goal(UNESCO, 2011). That's where education of children comes into play. Research shows that the current knowledge base of climate change and environmental degradation among school kids is mediocre to none, which is an alarming situation given that children are one of the most affected group from climate change(Gunamantha & Dantes, 2019). Similarly, a study conducted with the students of grade 6 in British Columbia, before and after a two-week instruction program on climate change revealed that the students (and teachers) struggled with the topics of global warming and greenhouse effect(Porter et al., 2012). Such studies reveal the business as usual case of climate education – a product of the traditional learning system, globally. The issue in question needs to be addressed with specialized curriculum and pedagogy that will allow students to understand and comprehend the current crises and their role in solving them(Kagawa & Selby, 2012).

The difficulties in developing an understanding of these conceptsare natural, as climate change and its causes and effects form a multifarious relationship. Apart from being a scientific phenomenon, climate change also has socioeconomic and political roots and implication(Lewis & Maslin, 2015). The very complexity of the issue calls for the need of a holistic understanding of the various spheres of the problem, for which the educators need to familiarize themselves first(Drewes et al., 2018).

The Case of Climate Education in Pakistan

In Pakistan, emphasis on education and literacy pre and post-independence was colossal, which has not been able to move beyond rhetoric and materialize(Ahmad et al., 2014; Rice, 2012). Being a post-colonial nation, the country follows a conventional model for education with little developments to cater for the regional/national requirements(Barber, 2010).The state of CCE or environmental literacy is considered worst among the masses. Although environment and climate related degree programs have been launched on graduate and post-graduate levels, the elementary level education still faces a lack of curriculum to develop an understanding from an early stage, which could last a lifetime(Appraise IJAZ & Sardar Masih, 2015).

Reviewing the existing curriculum of elementary level in Pakistan, it is discovered that the government-issued science or general science subject textbooks contain chapter on basic environmental phenomena(Atta-Ur-Rahman & Shaw, 2015). Upon research, it has been found that chapter with these topicsis given secondary attention by the teachers and are often skipped altogether from the classroom lessons; focus primarily given to physics and chemistry-based theories. This practice provides an insight into the priorities of the educators. A study by (CIES, 2020)reviewed the public school textbooks of Science, Geography and Social Science from 6 to 8th grade. It has been reported that these books lack environmental and climate change related material. They concluded that there is no existing effective framework to update the outdated contents of school books to cater for the pertinent problems of climatic and environmental degradation, let alone provide context and strategies for climatic adaptation and mitigation at their respective level.

Post-18th Amendment, Pakistan's education system was decentralized and power to devise and implement education curriculum was shifted to provinces. Ideally, this was a brilliant opportunity for provinces to customize their regional curricula achieve the goal of providing students an understanding of climate and environmental issues, along with frameworks that promote critical thinking and innovations that develop a climate-positive attitude. For instance, curricula of coastal provinces of Sindh and Balochistan could have encouraged materials and methods to provide understanding about the effects of climate change on the water-scarce provinces, and how coastal and marine ecosystems are facing degradation by the hands of humans and how they can play a part in countering these issues. Similarly, the Northern provinces could have concentrated efforts on developing understanding and consciousness regarding the mighty glaciers, the green cover and the species that are being affected due

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to the climate change implications. Along with that, disaster risk education and skill-based learning in disaster-prone areas of the country is also imperative(Atta-Ur-Rahman & Shaw, 2015). Potential for several such localized as well as holistic climate-context specific CCE models for provinces has existed, and continues to do so, but the current education and environmental policy is flawed at best to tap the immense potential of CCE at school level as a medium to long-term climate adaptation and mitigation strategy(Appraise IJAZ & Sardar Masih, 2015).

National Curriculum Framework of Pakistan, a policy tool for creating, implementing and monitoring educational curricula at school levelstates environment and climate change under the heading of 'emerging trends'(GoP, 2018). For a relatively recent document from the year 2018, it is unfortunate that these issues are considered 'emerging', given thatthe extreme tangible and intangible repercussions of climate change catastrophes are a proven and well researched fact.Framework for Implementation of Climate Change Policy of Pakistan also provides inadequate backing to the various aspects of environmental and climate related education at school level(GoP, 2014). Moreover, the National Climate Change Policy of Pakistan acknowledges the lack of education and curriculum on environmental and climatic studies, and advocates to develop and implement the same for all levels of education, with a focus on higher education(GoP, 2012). An initiative especially targeting the elementary level CCE by the government is the incorporation of conservation and bio-ethics in grades 4 to 5 General Science curriculum under the Single National Curriculum initiative(DAWN, 2020; GoP, 2020).

Apart from the role of government, the NGOs and non-profits have been fairly efficient in promoting CCE through various means(Saeed et al., 2015). They also face difficulties in instilling understanding of climate-related issues in school level students as the current education system of the country has been futile in establishing scientific and socioeconomic bases of students which are imperative for a comprehensive cognition of these issues and to develop conscious behaviors(Huma, 2020; Khanum, 2019; K. Shah et al., 2019). Regardless, a number of non-profits have adapted non-traditional approaches to attain the aforesaid goal. For instance, a non-profit Zindagi Trust, working for bringing educational reforms in the country by mainly targeting elementary girls' schools have initiated a teaching fellowship program, which allows environmental and climate change graduates (or eco-conscious individuals) to teach elementary school girls in remote northern villages of Pakistan(Zindagi Trust, 2019). The purpose is to make these young women- an unfortunately marginalized group- realize the importance of the resources at hand and how they can be conserved through minor lifestyle changes, contributing towards betterment of local environment, as well as overall climate change mitigation. The same organization has started weekly 'Environment Club' at their managed schools to instill climate change adaptation and mitigation understanding and behaviors through activity based learning and increased connection to nature. To achieve the goal of environmental and climate literacy for sustainable behavior changes among young individuals, it is crucial that the role of NGOs is recognized and their endeavors are promoted, and more they are allowed to reform more (public and private) educational institutions, thus supplementing the efforts of government institutions in doing so(UNESCO, 2011).

In 2019, the Federal Ministry of Climate Change in collaboration with WaterAid, under the Clean Green School Program, introduced training and literacy on climate change related issues at the government schools in the federal capital, which is a very good initiative and needs to be integrated in national climate adaptation and mitigation strategies(WaterAid Pakistan, 2019).

Although the importance and urgency of CCE at elementary level in Pakistan has been an established fact, the relevant policies and the policymakers at federal and provincial levels seem not to comprehend its potential to augment conscious behaviors that assist in adapting and mitigating climate change. There is a need that the policy guidelines focusing on establishing climate change education curriculum as a separate subject with holistic theoretical as well as skill-based learning are fully integrated at elementary level and are ensured through a coordinated education and environment governance mechanism at federal and provincial level, which can develop critical thinking of systems and behaviors among students. In this regard, exposure to nature, learning and contemplative expression through arts can prove efficient and cost-effective methods. Additionally, capacity building of teachers to effectively communicate concepts without inducing climate anxiety must be ensured. Considering the diverse nature of climate change consequences in Pakistan, each province should introduce specialized CCE models to target localized climate and environmental issues to work towards their adaptation and mitigation strategies with students. Similarly, disaster risk reduction and preparedness must be incorporated to equip the young generation with the appropriate theoretical and practical apparatuses for the future inevitable.

CONCLUSION

Climate change education (CCE) aims at learning in the face of risk, uncertainty and rapid adjustments. CCE demands a focus on learning, critical thinking and capacity building that allow people to inquire, comprehend and critically analyze situations to perform appropriate actions. The developed CCE model suggests that the Bloom's Taxonomy of education is fully applicable to adaption and mitigation strategies to achieve goals of CCD. Sustainable consumption patterns can effectively be developed if communicated from young age. Understanding and learning such habits at an early age also has potential to promote intergenerational learning for best practices in routine life. While young generation is destined to become future leaders and expected to deal with the worst climate crises, its current understanding about climatic phenomena, their own impacts, and their ramifications is insufficient to none. Therefore, climate change education, which is relatively emerging domain, needs to be incorporated in school curricula all over the world, especially in developing countries including Pakistan. National Curriculumm Framework of Pakistan, a policy tool for creating, implementing and monitoring educational curricula at school level states environment and climate change under the heading of 'emerging trends'. For a relatively recent document from the year 2018, it is unfortunate that these issues are considered 'emerging', given that the extreme tangible and intangible repercussions of climate change catastrophes are a proven and well researched fact. Framework for Implementation of Climate Change Policy of Pakistan also provides inadequate backing to various aspects of environment and climate change related education at school level. Although the importance and urgency of CCE at elementary level in Pakistan has been an established fact, the relevant policies and policymakers at federal and provincial levels seem not to comprehend its potential to augment conscious behaviors that assist in adapting and mitigating climate change. There is a need that policy guidelines focusing on integrating climate change education in the curricula with cognitive, psych-motive and affective components in elementary education and implemented througha coordinated education and environment governance mechanism at federal and provincial level.

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