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Environmental Challenges: A Study of the Linguistic Representation of Environmental Issues in Textbooks through the Lens of Transitivity Model by Halliday

Dr. Nazia Suleman[1], Dr Ambreen Shahnaz[2], Mehvish Zulfiqar[3]

[1]Head, Department of Humanities, COMSATS University Islamabad, Vehari Campus
Email: naziasuleman@cuivehari.edu.pk, ORCID: https://orcid.org/0000-0002-8863-5742
[2]Assistant Professor, COMSATS University Islamabad, Wah Campus
Email: ambreen@ciitwah.edu.pk, ORCID: https://orcid.org/0000-0002-3446-7835
[3]MS in English Linguistics, Email: mehwishzulfqar0@gmail.com

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Corresponding Author:
Dr. Nazia Suleman,
Head, Department of Humanities, COMSATS University Islamabad, Vehari Campus
Email: naziasuleman@cuivehari.edu.pk
ORCID: https://orcid.org/0000-0002-8863-5742

ABSTRACT

The representation of climate change themes and text plays a key role in framing the youth perceptions and influencing climate change. The debate about the climate representation in text books concentrated on the narrow use of language, role of pictures and images and ideologies. This study describes climate change and environmental themes in relation to linguistic representation in textbooks from public and private schools in Punjab, Pakistan. It delves into linguistic analyses of textbooks, emphasizing the role of language in conveying environmental actions, actors, and entities. This research employs Halliday's Transitivity SFL Model as a framework to explore language patterns related to environmental issues. Mixed-method research design is used combining qualitative and quantitative approaches. Language structures dealing with actions, participants, and relationships related to climate are being uncovered using Halliday's model to do linguistic analysis. This study involves content analysis, comparing the frequency and mean of ecolinguistic elements in textbooks from public and private schools. Ongoing difference of curriculum between public and private schools, and its impact on students' understanding of climate change is clearly evident. Findings reveal distinct differences between public and private school textbooks, emphasizing that students in schools with more updated curricula, often found in the private sector, have a better understanding of climate change. While the study deals with the Pakistani context, its methodology and outcomes give a framework for similar explorations globally.

1. Introduction:

The gravity of environmental issues calls for a quick and robust action which ultimately may strengthen the strategies pertaining to environmental awareness. A growing awareness of the curriculum and societal attitudes toward climate change has resulted in an increasing interest in the scholarly debates on the curriculum and its interconnection to climate change. In the realm of education, the curriculum serves as a carefully crafted roadmap, directing the sequence of instructional experiences and content within an educational setting. Its significance lies in guiding teachers, fostering student learning, and preparing individuals for the challenges that lie ahead (Posner, 2004). The multifaceted nature of the curriculum, especially concerning environmental challenges, holds deep impacts. It shapes students' knowledge, attitudes, and behaviors, providing essential information about ecological systems, human impacts, and urgent planetary challenges. A thoughtfully designed curriculum encourages critical examination of environmental issues, fostering critical thinking skills essential for addressing complex challenges in the future. Notably, the curriculum plays a pivotal role in developing environmental awareness, equipping students with the knowledge, skills, and attitudes necessary to address contemporary environmental challenges. Environmental challenges need immediate attention in today's world, and their representation in educational materials has same significance. According to Environmental scientists, "Pakistan is one of ten countries most at risk from climate change" (Wallace-Wells, 2022).

Ecolinguistics, an interdisciplinary field exploring the relationship between language and the environment. It has consequently become the subject of study, as stated by Yina Wu, who claims that ecology has developed into "the core issue of the 21st century." (Wu, 2018). The study of Eco linguistics by using the term of language ecology through metaphor study by adapting relationship of living being as organisms and their environment initiated by Norwegian linguist, Einar Haugen (1972), (Luardini & Sujiyani, 2018) . Halliday's Transitivity Model Therefore, ensuring environmental sustainability and taking an ecological perspective is part of the area of eco linguistics (Dash, 2019). This intersection provides a unique perspective on language's role in conveying environmental actions, actors, and affected entities.

The youth needs to be provided with an awareness and skill sets to mitigate the sufferings of climate change. In this scenario, the mandate of the schools is to provide the information about the depleted ecosystem and at the same time the ways and means to overcome the effects of climate change. The human engineering has been found failed by the capricious forces of nature. The COVID-19 Pandemic is an obvious example of massive disruption so we need to educate and aware our children about the climate change. The need for an overhaul in educational systems has been evident since long before the perils of climate change and pandemics ( ) Curriculum having Environmental education serves as a powerful tool for the learning, training and mind making in longer run. Curriculum plays an important role in raising awareness and understanding about climate change education among students at school (Reid and Scott, 2016). The United Nations Conference on Human Environment suggested that environmental topics must be incorporated into the curriculum to establish the framework for future generations for protecting and improving the environment. Long lasting solutions for the environmental problems can be found through Environmental Education (EE), The multinational Conference of Tbilisi in 1977 (Mliless & Larouz, 2018).

Education has long been recognized as a powerful tool for shaping attitudes, values, and behaviors. Incorporating environmental education into the primary and secondary curriculum can create a foundation for sustainable practices and foster a sense of responsibility towards the environment. By raising awareness about environmental issues, such as deforestation,

renewable energy, conservation, and resource depletion, children can develop a deeper understanding of the interconnections between human activities and their ecological impacts.

However, disparities exist in the educational landscape, particularly between public and private schools. Children in schools with more updated and comprehensive curricula, often found in the private sector, tend to have a better understanding of environmental issues, stronger critical thinking skills, and increased engagement with the subject. On the other hand, overall learning experience of the learners can be effected by outdated curricula in public schools. An updated curriculum can help in keeping education updated. Current environmental issues and developmental maintenance must be included into it. Environmental issues can be understood by students in much better way, if described in text books. It means text books have greater influence in shaping students' perceptions (Roth, 1992). This article points out the importance of including environmental topics with greater analytical approach. Therefore, understanding how environmental issues are linguistically represented in these contexts is crucial for assessing the comprehensiveness and accuracy of environmental education. This discrepancy extends to the representation of environmental issues in textbooks, where linguistic analysis becomes a valuable tool to assess comprehensiveness and accuracy.

The environment has become a major international problem in contemporary era. Environmental education is now a part of education around the world. These six objectives for environmental education formulated by The United Nation,(UNESCO–UNEP 1976):

1. Environmental problems' awareness.
2. Environment and understanding of its problems, and the importance of human in relation to the environment.
3. Environmental problems and human concerns.
4. Environmental problems and its overcoming skills.
5. Environmental problems and skills to solve these problems
6. Environmental problems and participation to solving these problems. (Jacobs & Goatly, 2000).

Pakistan is one of the countries highly exposed to climate change. Pakistan as one of the most polluted countries in the world according to ranking of World Air Quality Index (2023). Wallace-Wells (2022) reported in the New York Times that Pakistan had faced water shortage, heat and flood waves that had killed thousands of people and livestock, and destroyed architecture most recently. Wildfire in Koh-e-Sulaiman range in May 2022 destroyed millions of pine trees and eventually provided income for at least five generations. Following the wildfire, Pakistan economy was almost bankrupt and billions of dollars lost to the deluge that destroyed or damaged millions of homes, and killed hundreds and thousands of animals. If the global warming scale remains the same, there is supposition about Pakistan's future environmental catastrophes. Most of the developing countries are highly vulnerable against this threat of climate change and Pakistan is of no exception. According to environmental scientists, Pakistan is one of ten countries most at risk from climate change (Wallace-Wells, 2022). Masses are not educated to protect their country from the catastrophic effects of climate change despite of this higher vulnerability.

The study highlights to comprehend how language, especially through textbooks, shapes the narrative of sustainability in the broader global context. In linguistic analysis Halliday's Transitivity Model designed to find invisible language patterns, recognize biases, and provide consciousness into framing actions and perceptions on environmental challenges among learners. The study not only contributes to understanding language dynamics but also highlighting language's vital role in persuading global efforts toward sustainability within the Sustainable Development Goals (SDGs). This study provides valuable awareness into how

language shapes the narrative of sustainability, finally affecting environmental consciousness, societal engagement by significantly assessing linguistic constructs in textbooks.

2. Literature Review:

The study of ecolinguistics by using the term of language ecology through metaphor study by adapting relationship of living being as organisms and their environment initiated by Norwegian linguist, Einar Haugen (1972), (Luardini & Sujiyani, 2018) . Recognizing environmental issues as one of the most crucial issues of this era influencing the human race globally, it was specifically focused that ecological themes must be given a required place in all type of curricula **(Brown, 1991).** The incorporation of environmental themes into children's textbooks has been identified as valuable for encouraging a generation with an enhancing ecological awareness **(Adugna, 2015).** Environmental issues can be understood by students in much better way, if described in text books. It means text books have greater influence in shaping students' perceptions **(Roth, 1992).**

Yashukwa (2022) conducted a study in Australia about the teachings of climate change its possibilities and challenges. The study was particularistic as the perspective of five teachers were studied qualitatively. The content of the climate change was incorporated into the literacy teaching in an artful way by the experienced teachers. Newsome et al, (2023) discussed about the connections of climate change with teaching and learning and its possible mitigation strategies for the educators. The study has a number of suggestions from the climate scientists about 'how to change how we teach, where we teach, and what we teach to ensure teaching enterprises survive and thrive in the face of a changing climate'. Climate change is an omnipresent factor. Certain 'areas of action' encompassing specific projects to be addressed throughout all the aspects pertaining to operations and culture. One example is "teach climate change in all subject areas'. (Gibbs,2016)

Norton, Hulme (2019) studied that how UK editorial news about climate change are influencing climate policies and in framing public perceptions. In the editorials of UK national newspaper in 2001,2007 and 2015 is studied using Stibbe (2016) framework, ' stories we live by'. Lukewarmer, Ecoactivist, Smart Growth Reformer and Ecomodernist were the four famous newspapers that shaped UK's climate conversation.

Andersson and Wallin (2000) discussed that students' attitude towards environment can be maintained by environmental education in the text books. Kose and Yilmaz (2016) discovered the demonstration of cultural aspects in environmental education textbooks. The study described the environment related content to increase the understanding of the environmental challenges. The main point of concern is the linguistic representation of environmental challenges in textbooks, concerning to reveal the issues, through the Transitivity Model proposed by Halliday. Role of the public and private schools is recognized by their educational curriculum criteria. Public schools cater to a diverse population and are often influenced by government-mandated curricula, whereas private schools may have more autonomy in shaping their educational content. The previous studies have indicated that these differences can lead to variations in textbook content (Smith, 2017).

Yehya et al, (2018) highlighted the differences between public and private schools in integrating technology and environmental awareness in the context of Lebanese education. Although primarily supporting the official curriculum, private schools show more capabilities in adopting technology, Private schools have taken individual capabilities to integrate technology in education, although these efforts primarily support the official curriculum rather than the informal aspects of learning, such as developing students' values or behaviors, (Yehya et al, 2018). Public schools face hurdles because of economic challenges, affecting their association with environmental capability and the integration of technology into curriculums. There is a remarkable lack of governmental support and institutional tools in

environmental education and integrating digital equipment in Lebanon, (Hamzeh et al, 2019). In Lebanon, Public schools face notable difficulties in participating meaningfully due to economic challenges in the digital sector. This has led to a lack deficiency in association with informal environmental capabilities, integrating information and communication technology in civics curriculums, (Ghosn-Chelala, 2019). The study found that private schools are more vulnerable than public schools to integrate technology within their educational policies, attributed to better budgetary preparedness, collaborated by Nakhoul and Perry (2019). Furthermore, low prioritization of environmental issues and the lack of implemented digital use in Lebanese institutions, particularly in the context of environmental education, highlighted a need for further factual research on the ecological values of the Lebanese education.

In a recent study, **Janjua (2022)** explored how literature, specifically Eco poetry, contributes to addressing environmental concerns and building awareness. The analysis focused on the poem "I am Afraid of Muslims" by Waqas Khwaja, a Pakistani English poet, delving into its roles, processes, and central theme expressing environmental values and nature's voice. A significant recent contribution **(Cheng, 2022)** is the introduction of "New Developments of Ecological Discourse Analysis," which serves as a genuine reference for introducing Ecological Discourse Analysis (EDA). Most of the developing countries are highly vulnerable against this threat of climate change and Pakistan is of no exception. According to environmental scientists, Pakistan is one of ten countries most at risk from climate change (Wallace-Wells, 2022). Masses are not educated to protect their country from the catastrophic effects of climate change despite of this higher vulnerability.

A curriculum focuses on the main elements which are used to prepare the learning process and to plan the focus and the main contents of the language learning (Tjendani, Suastra, Mbete, & Malini, 2015) . One of the most critical issues of the time affecting the human race globally as identifying environmental crises, it was especially emphasized that ecological themes should be given a compulsory place in curricula across the country (Zahoor & Janjua, 2019) . The current study is designed to analyze the curriculum of public and private schools with the lens of Halliday's Transitivity Model to explore the environmental themes in syllabus. The point of focus in this regard is to analyze that how much successful Pakistani curriculum is to address the issues regarding the environmental changes. The researchers compared the syllabi of both public and private schools in Punjab in terms of their shared contributions to provide environmental education. Therefore, the present study is not only important in a Pakistani context, but also has applicability for a global readership as well as research scholars around the world interested in this field, which is as still new and underexplored (Zahoor & Janjua, 2019).

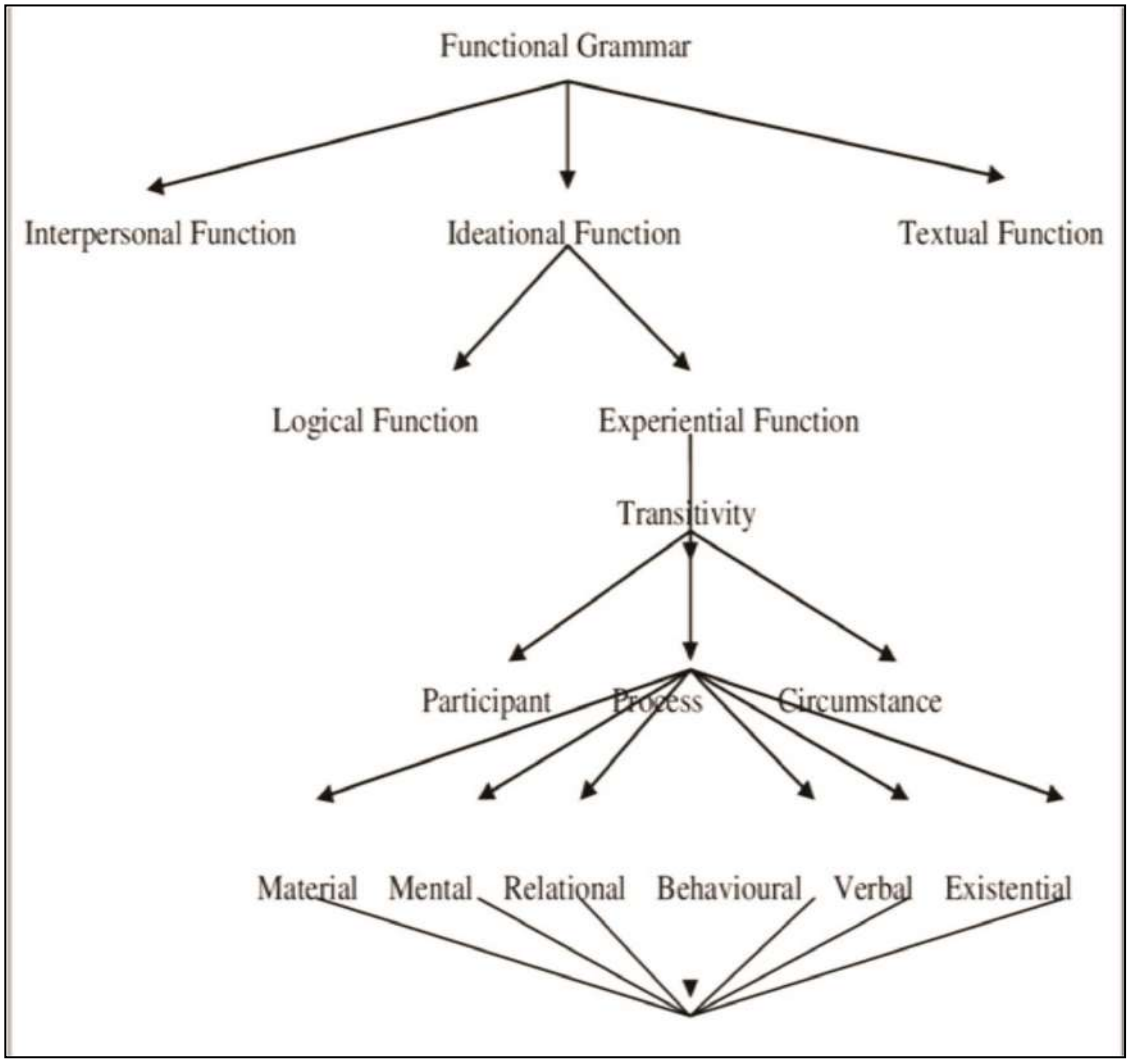
3. Methodology:

The current study is designed to analyze the curriculum of public and private schools with the lens of Halliday's Transitivity Model to explore the environmental themes in books. The point of focus in this regard is to analyze that how much successful Pakistani curriculum is to address the issues regarding environmental changes. The researchers are also keen to compare the syllabi of both public and private schools in Punjab in terms of their share to provide environmental education. The comparative analysis sheds light on differences in Eco linguistic content between public and private schools, with potential implications for environmental education strategies. The research plays a role in the comprehensive discourse on the role of language in shaping environmental consciousness, highlighting the need for comprehensive environmental education across various educational settings.

The study conducted by using mix-method research design, combining both qualitative and quantitative approaches. The qualitative aspect involved a linguistics analysis of

textbooks using Halliday's Transitivity model (SFL) and additionally metafunction to identify Language patterns and biases related to environmental issues.

Furthermore, The Transitivity Model by Michael Halliday is a linguistic theory that classifies the processes into six types: material, mental, relational, behavioural, verbal and existential, analyzes how verbal processes convey meaning in language. It focuses on the way in which participants (typically actors and goals) and circumstances are organized in a clause. The model categorizes verbs into different types based on the participants they involve, such as material processes (actions), mental processes (thoughts, perceptions), and relational processes (states, relationships). In essence, the Transitivity Model helps to understand how curriculum language structures convey information about actions, participants, and the relationships between them within a sentence. The Transitivity Model in Eco linguistics provides a framework for investigating how curriculum language contributes to our perceptions of environmental issues and can influence attitudes and behaviors toward sustainable practices. Since the study has to investigate the ecological worldview generated by the environmental texts, for the linguistic analysis, it concerned to the experiential metafunction of language, precisely the transitivity model proposed by Halliday as part of his systemic functional linguistic (SFL) framework (Halliday, 1994).



The quantitative aspect included quantitative content analysis followed by frequency and rank to compare the both public and private school's textbooks to gather data on students' awareness and understanding towards environmental challenges. The study conducted an

ecolinguistics analysis of the environmental text included in Pakistani English and Science textbooks from Primary level from public and private schools in order to explain their ecopedagogical import. However primary level further split into two developmental levels based on learns' age and intellectual ability, (NCEL, 2006). The first level includes grade 1-5 and focuses on just structural and lexical activities. The second level included grades 6-8 and focuses shift to the function of language and content knowledge appropriate to learners' age and critical understanding of it. Since the present study's focus was the ecological contents included in English and Science textbooks and the function of language in constructing the ecological reality in environmental text in the textbooks, it has been delimited to the textbooks for grades 6-8, because in this level students have the capability of understanding the role of climate change. Besides that, the textbooks selected are English and Science textbooks from public and private schools, published by the Punjab curriculum and textbook board.

SFL focuses on how language is used to communicate meaning in different social contexts. It looks at the relationship between language, social structure, and individual expression. SFL helps us understand how meaning is created and how language functions in society. Data and pictures from the text books have been analyzed in order to know what students are learning about ecosystem and how it may impact their dealing with the environment.

Data analysis:

The study conducted by using mix-method research design, combining both qualitative and quantitative approaches.

The qualitative aspect involved a linguistic analysis of public and private textbooks using Halliday's Transitivity model (SFL) and additionally metafunction to identify the language patterns and biases related to environmental issues. The Transitivity Model by Michael Halliday is a linguistic theory that classifies the processes into six types: material, mental, relational, behavioral, verbal and existential. The Transitivity Model in ecolinguistics provides a framework for investigating how curriculum language contributes to our perceptions of environmental issues and can influence attitudes and behaviors toward sustainable practices. To explore the Linguistic Representation of Environmental Issues in Textbooks, the present study analyzes the language at the ideational level by investigating the six types of processes in our data.

The quantitative aspect included quantitative content analysis followed by frequencies to compare the both public and private school's textbooks to gather data on students' awareness and understanding towards the environmental challenges. The analysis of the environmental texts included in the selected textbooks has been carried out along three dimensions: eco centric, Anthropocentric and eco justice.

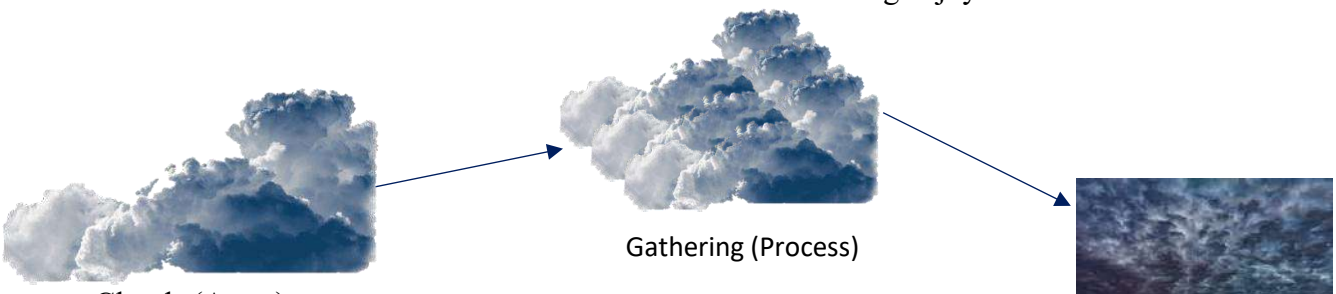
Qualitative analysis: Private schools textbook analysis:

A. Material process: Material process refers to physical experience of human being. Material processes are process of doing and happenings of the real physical world (Halliday 1994). They express the notion that some entity does something which may be done to some other entity. In the material processes, there are two participants, namely: actor and goal. **Actor:** Participant **Goal:** Aim.

Rain: "The clouds **(act)** formed on the surface of the different water bodies **(mat)** do not stay there.

Theystart to move **(pr)** from one place to another **(mat**) in the direction of winds. Winds **(act)** bring **(pr)** the clouds **(act)** from the sea **(pr)** to the land **(mat).** The colder air **(act)** in the upper layers of the atmosphere cools **(gl**) the clouds **(act)**". **(Science Book, Class 6th)**

1. Clouds **(act)** are come together **(pr)** to make cool **(gl)** environment.
   It is an Actor-Process-Goal, in which clouds are actor and cooling is the goal. When clouds come together, they cool the atmosphere and changed the climate accordingly.
   Ecolinguistics is a field that explores the relationship between language and the environment, emphasizing how language can shape our perceptions and interactions with the natural world. In the given sentence, the description of clouds coming together to create a cool environment is an ecological observation. It highlights the interconnectedness of natural elements and their impact on the environment. The sentence indirectly touches on climate-related aspects. The notion of clouds coming together to create a cool environment suggests a mechanism that plays a role in regulating temperature. This can be related to climate change discussions by emphasizing the importance of natural processes, such as cloud formation, in maintaining environmental balance and temperature control.
2. Raindrops **(act)** fall **(mat)** from the sky to nourish **(gl)** the thirsty earth and to change **(gl)** the climate. It can be observed in the above sentence that depicts rain as a vital process for nourishing the earth. From an ecolinguistic perspective, it emphasizes the role of rain in supporting ecosystems and maintaining a balance in the natural environment. The sentence tells us that rain is not just water falling from the sky; it's like nature's way of taking care of the environment, especially when we think about how our climate is changing.
   <u>Eco centric:</u>
   The above process is eco-centric in nature. Eco centrism places ecosystems in the centre and humans
   are seen as interconnected with the environment. Human being enjoys cold weather.



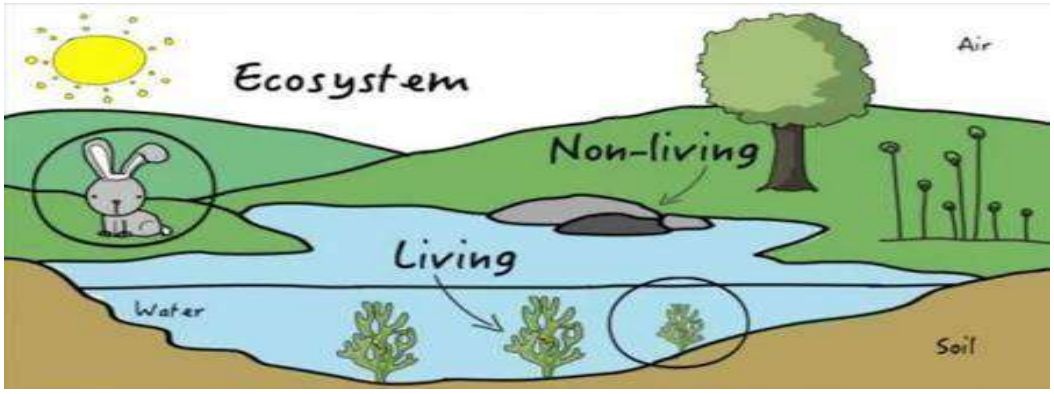
Clouds (Actor)

Cooling (Goal)

3. "When**(cir)** the size of the water drops**(mat)** increases further**(pr),** it**(cir)** becomes(**pr)** difficult**(cir)** for the cloud**(act**) to hold them**(pr),** and**(cir)** water drops**(pr)** begin to fall**(pr).** This is called 'rain **(cir).**'"
   It can be observed in the above sentence that describes the conditions leading to the occurrence of rain. The first process, "becomes difficult," implies that as the size of water drops increases further, it becomes challenging for the cloud to retain or hold them. This suggests a change in the state of the cloud due to the increasing size of water drops. The second process, "begin," indicates the initiation of the action of water drops falling. The implicit actor here is the natural process influenced by the changed conditions mentioned earlier. The goal of this action is the "water drops," and the material specifying the cause of the action is "the size of the water drops." This sentence highlights the dynamic process where the increasing size of water drops makes it difficult for the cloud to hold them, ultimately leading to the initiation of the process of water drops falling, commonly known as "rain." This process is crucial in the water cycle, and changes in climate can impact it. The

language used here helps us understand a natural process. It connects us to the environment by describing how clouds and rain work together. It emphasizes the role of natural systems in sustaining life.

1. **Ecosystem interaction:**
   "All these living things **(act)** react **(pr)** with non-living things of the ecosystem. In the street the non-living parts **(act)** are the glass and concrete walls **(mat)** the tarmac road **(mat)** and the hot air **(act)** containing exhaust gases from all the vehicles moving along in the park, the non-living parts **(act)** are the soil under the grass and the cleaner air with its greater range of temperature **(mat)** due to the weather."
   (Science book 7th page no 65)



1. "In the street, the non-living parts **(act)** are the glass and concrete walls **(mat),** the tarmac road **(mat),** and the hot air **(act)** containing exhaust gases from all the vehicles moving along."
   This sentence describes the non-living components present in a street environment. The goal specifies the various components that make up the non-living parts; including glass and concrete walls, the tarmac road, and the hot air containing exhaust gases from vehicles. The language used in this sentence directs our attention to the components of the street environment, focusing on the distinction between living and non-living elements. It reflects how language influences our perception of the urban landscape and our relationship with the built environment. The mention of "hot air containing exhaust gases" draws attention to the environmental impact of human activities, particularly vehicular emissions. This highlights a potential contribution to climate change due to the release of greenhouse gases. It encourages awareness of sustainable practices, such as using eco-friendly building materials and promoting alternative transportation methods to reduce emissions.
   It is an actor process goal. The actor (All these living things) engages in material processes (reacting) with the goal of the non-living components (glass, concrete, tarmac, exhaust gases, soil, and air) in streets and parks. The goal is to illustrate the interactions and relationships between living and non-living elements in these environments.
2. "In the forest, the trees **(act)** release oxygen **(pr),** and this life-supporting gas **(act)** reacts **(pr)** with the sunlight **(act)** to create a breathable atmosphere **(mat)."**
   This sentence describes the interaction in a forest ecosystem. The trees release oxygen, and this oxygen, in turn, reacts with sunlight to form a breathable atmosphere. This process underscores the interconnected relationships between living and non-living components in an ecosystem. It emphasizes the role of trees in producing oxygen, essential for life on Earth. Deforestation and changes in vegetation patterns can impact oxygen levels, influencing the overall health of the atmosphere. It highlights the interaction between sunlight and oxygen, showcasing the importance of solar energy in ecological processes. Climate change, with factors such as air pollution and greenhouse gas emissions, can influence air quality and impact the composition of the atmosphere. From an ecolinguistic perspective, the sentence

connects language to the environment, fostering an appreciation for the natural processes that sustain ecological well-being.

Anthropocentric:

The above process is anthropocentric in nature. it describe how living things, which are primarily humans, interact with non-living component of urban and natural environments.

B. Existential process:

An existential process is a type of process that denotes the existence or presence of something. It is concerned with stating or presupposing the existence of entities. In an existential process, the verb typically expresses existence or occurrence. Halliday states that "existential process represent thatsomething exists or happens." The object or event which is being said to exist is labeled Existent.

1. **Changes in Weather:**

   All living beings **(ex)** are influenced **(ext)** by atmospheric conditions **(ex)** around them. Temperature, humidity, rainfall **(ex)** and wind speed **(ex)** are the various atmospheric conditions **(ex).** The temperature, humidity,Wind and other atmospheric conditions are called the elementsof the weather **(ex).** A warm sunnyday **(ex)** can be overtaken **(ext)** by a violent store or it may be taken only a minute to vanish **(ext**) the heavy rain and return of sunny weather.

   (Chapter 7, climate changes)

1. All living beings **(ex)** are influenced **(ext)** by atmospheric conditions **(ex)** around them. Temperature, humidity, rainfall **(ex)** and wind speed **(ex)** are the various atmospheric conditions **(ex).**

   This sentence highlights the relationship between living beings and the surrounding atmospheric conditions. Understanding this relationship is crucial in the context of climate change because shifts in atmospheric conditions, such as temperature changes or extreme weather events, can significantly impact living beings. For example, rising temperatures can influence biodiversity, ecosystems and effecting behavior of species. Understanding the effect of atmospheric conditions on living beings emphasizes the importance of environmental sustainability. It motivates a consciousness of the graceful balance that exists in nature and highlights the role of language in conveying this relationship.

   "A warm sunny day **(ex)** can be overtaken **(ext)** by a violent store or it may be taken only a minute to vanish **(ext**) the heavy rain and return of sunny weather."

   The above mention sentence highlights the vital and sometimes uncertain nature of weather events. It considers the increasing intensity and frequency of extreme weather events, such as heavy rainfall and violent storms in the context of climate change. Climate change can influence to more uncertain weather patterns, affecting the typical characteristics of a warm sunny day. The sentence underscores the vulnerability of weather conditions and the potential

for rapid changes. Sustainable practices aim to stabilize weather patterns and promote resilience in the face of environmental changes. The language used here contributes to an ecolinguistic perspective by illustrating the dynamic and interconnected nature of weather phenomena. In the context of climate change and environmental sustainability, the sentence emphasizes the need for climate-resilient practices to address the increasing unpredictability of weather events.

Eco centric:

The above process is eco-centric in science. Eco centrism places ecosystems in the Centre andhumans are seen as interconnected with the environment. The above process shows that how change in weather influence human beings.

C. Relational process:

Relational process construes being and relation among entities through identification, attribution, and possession. It is divided into three parts, those are carrier, attributive (intensive, possessive, and circumstantial), and attribute.

1. **Biodiversity of rainforests:**

"A rainforest**(c)** is an ecosystem in which a community of plants, animals, and microorganisms **(at)** live in a hot, wet environment inside the forest **(id)." (Science books 7th class page no 68).**

1. "A rainforest**(c)** is an ecosystem in which a community of plants, animals, and microorganisms **(at)** live in a hot, wet environment inside the forest **(id)."**

The sentence involves a relational process, which establishes a connection between the rainforest and the community of plants, animals, and microorganisms. In this context, a rainforest is characterized as an entity, and the relational process connects it to the described ecosystem. The sentence, through its relational process, contributes to ecolinguistics by linguistically defining and establishing the relationship between a rainforest and its ecological community. The linguistic expression in the sentence sets the stage for discussing how climate change may influence the hot and wet environment essential for the rainforest ecosystem. The sentence is relevant to environmental sustainability by highlighting the importance of preserving rainforests as ecosystems. Rainforests play a critical role in maintaining biodiversity, regulating climate, and providing various ecosystem services

A rainforest is an ecosystem where a diverse community of plants, animals, and microorganisms thrives within a hot, wet environment inside the forest, emphasizing the close relationship betweenthe rainforest and this rich biodiversity. The "is," "in which," and "live" relational processes establish the essential connections between the rainforest, its ecosystem, and the living organismsthat inhabit it.

Eco-centric:

The process is eco centric in nature as it focuses on describing the rainforest ecosystem and the living community within it, emphasizing the environment's significance without primarily focus on human interests or actions.

2. Climate:

"Climate**(c)** has **(at)** a big effect on the food we eat **(id),** the energy we use, homes we live in,

work we do, and how we travel to work, our culture and heritage and the way we spend our spare time**(id).** It**(c)** can even affect **(at)** our health, from sunburn to allergies to Respiratory illnesses **(id).** For instance, Pakistan**(c)** has **(at)** a tropical, hot and humid Climate in certain areas like Lahore and Karachi **(id),** and this**(c)** affects **(at)** the outdoor activities of people living in these areas **(id).** The hotter **(at)** the climate **(id),** the lesser **(at)** the Outdoor activities**(c)** people would indulge in **(at).”**

1. “Climate**(c)** has **(at)** a big effect on the food we eat **(id),** the energy we use, homes we live in, work we do, and how we travel to work, our culture and heritage and the way we spend our spare time**(id).**
   The main process in this sentence is a relational process, which signifies a state of being or having. In this case, it's the relationship between "Climate" and its impact on various aspects of human life. The things involved in this relational process are "Climate" and its effect on various aspects of human life, such as “the energy we use, homes we live in, the food we eat, work we do, how we travel to work, our culture and legacy, and the way we spend our spare time. The use of language emphasizes the interconnectedness between climate and various aspects of human life, highlighting the significance of understanding this relationship for environmental discourse. The sentence emphasizes the intense effects of climate on various aspects of human existence, from food and energy utilization to spare time activities and cultural practices.
2. Pakistan**(c)** has **(at)** a tropical, hot and humid Climate in certain areas like Lahore and Karachi **(id),** and this**(c)** affects **(at)** theoutdoor activities of people living in these areas **(id).**
   In this sentence, the relational process "has" indicates the relationship between "Pakistan" and "a tropical, hot and humid climate." It expresses that Pakistan possesses or is characterized by the specified climate attributes. Another relational process is "affects," establishing a connection between the climate and its impact on outdoor activities. This sentence establishes a link between the description of Pakistan's climate and its effects on people's outdoor activities. Climate change is a global concern, and this sentence highlights the specific climate characteristics of certain areas in Pakistan. By acknowledging the impact on outdoor activities, it indirectly emphasizes the vulnerability of these regions to climate variations. Environmental sustainability is touched upon by recognizing the potential disruptions caused by the climate to people's activities. The transitivity model, in this context, helps identify the

actors (Pakistan, climate) and the processes (having a climate, affecting outdoor activities), contributing to a comprehensive understanding of the relationships described in the sentence.

D. Verbal process:

Verbal process represents process of saying, or more accurately, of symbolically signaling. It is intermediate between mental and material process: saying something is a physical action which reflects mental operation. Verbal process consists of Sayer, Reporting/quoting/projecting, and Reported/quoted/projected

1. Weather:

When we (**sayr**) think (**ver**) of weather, we think of it as wet or dry, warm or cold. For common people (**sayr**), such terms are enough to know (**ver**) what kind of weather there is on any given day. In simple words, weather is (**ver**) the condition of the atmosphere at a given point in time. The weather experts or meteorologists(**sayr**), in order to assess weather, measure its indicators like temperature, rainfall, pressure, humidity, sunshine and cloudiness, andmake predictions and forecasts**(ver**) about what the weather would be like in the future.

1. "The weather experts (**sayr)**...make predictions and forecasts (**ver**) about what the weather would be like in the future".

The sentence as a whole conveys that the weather experts, as the subject (sayer), are actively engaged in the verbal process of making predictions and forecasts about future weather conditions,with the reported content being what the weather would be like in the future. The sentence demonstrates how weather experts engage in behavioral processes to understand and predict weather patterns. This is relevant to ecolinguistics as it highlights the language used to describe the relationship between human activities (meteorological assessments) and the environment (weather patterns). Climate change and environmental sustainability are inherently connected to weather predictions and assessments. By accurately measuring indicators like temperature, rainfall, pressure, humidity, sunshine, and cloudiness, meteorologists contribute to understanding climate patterns and trends.

E. Behavioral process:

A behavioral process is a type of process that involves actions or behaviors carried out by living beings. It pertains to activities that are purposeful, intentional, or reflective of the volition of the participant.

1. Climate:

"Climate**(c)** has**(at)** a big effect on the food we eat **(id),** the energy we use, homes we live in, work we do, and how we travel to work, our culture and heritage and the way we spend our spare time**(id).** It**(c)** can even affect **(at)** our health, from sunburn to allergies to Respiratory illnesses (**id**).

1. "The way we (**bhvr**) spend (**pr**) our spare time."

In this sentence, "The way we" is the behaver (the entity engaged in the action), "spend" is the process (indicating the action of spending), and "our spare time" is the manner or the way in which this action takes place. It describes how people conduct themselves or behave regarding the spending of their spare time. The behavioral process is depicted through the phrase "the way we spend," emphasizing human actions in shaping cultural practices and leisure activities. This highlights the impact of climate on social and cultural behaviors, including leisure preferences and traditions. Ecolinguistically, it suggests the need to recognize climate influences on cultural practices and heritage preservation, fostering a deeper understanding of environmental sustainability within cultural contexts.

F. Mental processes:

Mental process relates to thought, feeling, and perception. Mental processconsists of Senser, process (cognition, affection, and perception), and phenomenon. This process type tends to be realized through the use of verbs like think, know, feel, smell,hear, see, want, like, hate, please, repel, admire, enjoy, fear. **Senser**: Someone who thinks, feels, and perceives, called Senser.

Process: What a Senser thinks, feels, and perceives namely mental process. **Phenomenon**: The thing is thought, felt, and perceived; it can be said as phenomenon.

1. **Global warming:**

Global warming **(C)** is the current increase in temperature of the Earth's surface (both land and water) as well as its atmosphere **(At).** In the past, when the Earth (**Sensor)** experienced **(Process-Mental)** increases in temperature (**Phenomenon)**, it was the result of natural causes but today it is being caused by the accumulation of greenhouse gases in the atmosphere produced by human activities.

1. When the Earth (**Sensor)** experienced **(Process-Mental)** increases in temperature (**Phenomenon)**, it was the result of natural causes but today it is being caused by the accumulation of greenhouse gases in the atmosphere produced by human activities.

This sentence illustrates the mental process of the Earth experiencing increases in temperature. Ecolinguistics focuses on how language influences environmental discourse, and this sentence highlights the linguistic representation of the Earth's response to environmental changes. The sentence contrasts past natural causes of temperature increases with the current human-induced causes related to greenhouse gas accumulation. By analyzing the mental process of the Earth experiencing temperature changes, we can understand how language is used to describe the historical and contemporary drivers of climate change. The sentence underscores the importance of addressing human activities, such as the accumulation of greenhouse gases, to mitigate the impacts of climate change and promote environmental sustainability.

Public schools textbook analysis:

A. **Material process:**

1. **Forest:**

Forests (**act**) play significant role (**pr)** in the development of any country **(mat**). Forests (**act**) are important natural-resources on which economy of the regions depends. Forests (**act**) helping environment **(mat);** Trees (**act)** provide **(pr**) habitual for wildlife, trees**(act**) shade **(pr**)buildings, reducing the need for air conditioning, trees**(act**) increase property values and improve mental health, trees**(act)** act as a windbreak, trees**(act)** absorb carbon dioxide from the air, trees**(act)** filter(**pr)** pollutants from the air we breathe and release oxygen, and trees**(act)** cool outdoor temperatures and protect us from Ultra Violet rays.

The Geography text book of Grade 6, based on Single National Curriculum 2022, title "Forests of the World" (Chapter No. 4, page no. 53.)

1. "Forests **(act**) help the environment (**mat)**."

This sentence emphasizes the relationship between forests and the broader environment, highlighting the supportive role of forests in maintaining ecological balance. This sentence emphasizes the supportive role of forests in maintaining a healthy environment. By stating that forests help the environment, the sentence implies a relationship of mutual support between forests and the environment. This concept resonates with ecolinguistic principles that emphasize the interconnectedness of all elements within ecosystems. It suggests that forests are integral components of the environment and play a vital role in sustaining its health and functionality.

2. "Trees**(act)** provide**(pr)** habitat for wildlife, shade**(pr)** buildings, reduce the need for air conditioning, increase property values, improve mental health, act as a windbreak, absorb

carbon dioxide from the air, filter**(pr)** pollutants from the air we breathe, release oxygen, cool outdoor temperatures, and protect us from Ultraviolet rays."

This sentence calculates various material processes associated with trees, emphasizing their multifaceted contributions to ecosystems and human well-being. From an ecolinguistic perspective, it illustrates the interconnectedness of ecological functions performed by trees within their habitats. In the context of climate change and environmental sustainability, it underscores the vital role of trees in ecosystem services provision, including carbon sequestration, air purification, and climate regulation.

It is an actor process goal. The actor (Forests and trees) actively engages in a material (environmental) process (absorbing carbon dioxide, filtering pollutants from the air, releasing oxygen) and contributes significantly to the development of any countries. The process involves trees, the primary material, playing various roles. In this environmental symbiosis, trees serve as the material contributors to various processes. They provide essential habisstats for wildlife, acting as an important feature for ecological balance. The goal is to maintain, enhance or restore the well- being and balance of the Environment and the economy of the regions through the positive contributions of the forests.

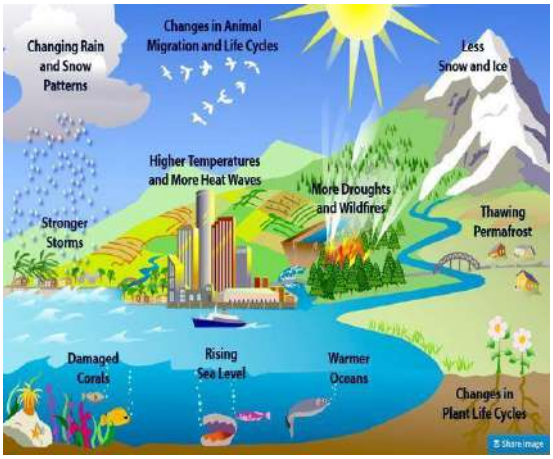
2. **Global warming:**

Global warming is caused by human activities **(act)** and livestock grazing **(act).** These activities release greenhouse gases **(mat)** into the atmosphere, trapping heat **(mat),** methane **(mat),** carbon dioxide **(mat)** and leading to a rise in Earth's temperature **(mat).** We can prevent global warming by using renewable energy **(g),** conserving energy **(g),** and promoting sustainable transportation **(g).**

(The Science text book of Grade 8, based on single National Curriculum 2022, title "Ecosystem", Chapter No.1, Page No.8.

1. "These activities release greenhouse gases **(mat)** into the atmosphere, trapping heat **(mat**)."

The material process "release" describes the action of emitting or discharging greenhouse gases into the atmosphere. This sentence reflects the impact of human activities on the environment, emphasizing the role of language in communicating environmental issues. In this context, the sentence highlights the linguistic representation of human-induced environmental changes, such as the release of greenhouse gases, which contributes to climate change. The sentence directly addresses the mechanism by which human activities contribute to global warming and climate change. By releasing greenhouse gases into the atmosphere, such as methane and carbon dioxide, human activities intensify the greenhouse effect, leading to the trapping of heat and the subsequent rise in Earth's temperature. Sustainable practices, such as transitioning to renewable energy sources, conserving energy, and promoting sustainable transportation, are presented as potential solutions to mitigate the release of greenhouse gases and reduce the rate of global warming.



It is an actor process goal. In this actor are living things and non-living things. These actors engage in process (Burning of fossil fuels, deforestation, industrial processes, melting ice caps, sea level rise, and rising temperature) and produced material like methane, carbon dioxide, temperature, greenhouse gases that can harmful for our ecosystem.

Anthropocentric:

This process is a central aspect of anthropogenic climate change, with significant implications for global climate patterns, sea level rise, extreme weather events, and ecological systems.

A. Existential process:

1. **Burning of Fossil Fuels**:

When fossil fuels **(ex)** are burnt (pr) to run **(pr)** vehicles and industries **(ex),** they **(p**) emit **(pr**) many greenhouse gases **(ex)** like carbon oxide **(ex)** which cause **(pr)** global warming **(ex).** The poisonous and harmful substances **(ex)** which **(p)** make **(pr**) the air **(ex)** unfavorable for life are called **(pr**) air pollutants **(ex).** Exposure **(pr)** to Sulphur dioxide **(ex)** can cause **(pr)** breathing difficulties **(pr),** pneumonia **(ex),** lung cancer (**ex),** etc.

(The General Science text book of grade 8 based on single national curriculum 2022, title 'Ecology" chapter No.1, page No. 9.)

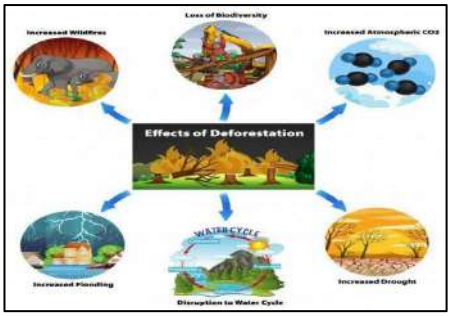
1. When fossil fuels **(ex)** are burnt **(pr)** to run (pr) vehicles and industries **(ex),** they **(p)** emit **(pr)** many greenhouse gases **(ex)** like carbon oxide **(ex)** which cause **(pr)** global warming **(ex).**

This sentence illustrates the relationship between fossil fuel combustion and the emission of greenhouse gases, particularly carbon oxide, which contributes to global warming. The sentence directly addresses the process by which fossil fuels, when burned, emit greenhouse gases, which are known drivers of climate change and global warming. Understanding the environmental impact of fossil fuel combustion is crucial for addressing sustainability challenges. This sentence highlights the need for sustainable alternatives to fossil fuels to mitigate their detrimental effects on the environment.

It is an existential process which shows that how excessive burning of fossil fuels is causing much harmful process and posing a direct threat to the very existence of human beings.

A. Relational process:

1. **Human activities and human disasters:**



Human beings (**car)** are performing different activities on the earth i.e., agriculture, deforestation, urbanization and mining etc. (**at**) all such activities cause natural disasters (**id**) directly or indirectly. (The Geography text book of Grade 6, based on Single National Curriculum 2022, title "Natural Disasters", **Chapter No.5, page No. 67.)**

1. Human beings (**car)** are performing different activities on the earth i.e., agriculture, deforestation, urbanization and mining etc. (**at**) all such activities cause natural disasters (**id**) directly or indirectly.

In this sentence, "cause" is a relational process that establishes a connection between the subject "all such activities" and the object "natural disasters." It highlights the relationship between human activities and their effects on the occurrence of natural disasters. The relational process "cause" highlights the role of human activities in influencing environmental conditions that can contribute to climate-related natural disasters. It emphasizes the need for sustainable practices that minimize environmental degradation and reduce the risk of natural disasters

Carrier is the main subject or object that the statement is about. In this sentence, the carrier is 'human beings' performing different activities on the earth. The attribute provides additional information about the carrier, here the attribute 'agriculture, deforestation, and mining etc.' describes the various activities that humans are engaged in and their impact on causing natural disasters. The identifier is a part of the attribute that uniquely identifies the carrier, here it's the natural disasters caused by the activities of human beings. The "are performing", "on earth", and "cause" relational processes establish the impact of the human activities on natural disasters.

Eco-centric:

The environmental impacts of human activities, suggesting a concern for the Earth's ecosystems and the potential for natural disasters. This perspective aligns with an eco-centric viewpoint, which prioritizes the well-being of the entire ecosystem over individual species or humans. The emphasis on the consequences of activities like agriculture, deforestation, urbanization, and mining implies a broader ecological perspective rather than a purely human-centric or biocentric focus.

2. **Replantation:**

Replantation **(c)** provides opportunities **(pr)** for learning about nature, environment conversation **(at).** Replantation**(c** initiatives, such as reforestation and forestation, provide opportunities for new linguistic patterns to emerge vocabulary and terminology expansion, cultural significance language for conversation, cross cultural communication, language of environmental activism **(at).**

The above picture is extracted from the text book of grade 8, based on single national curriculum 2022.

1. Replantation**(C)** provides opportunities **(pr)** for learning about nature, environment conversation (**At).**

In this sentence, the focus on "Replantation" as the carrier and the relational process of "provides" highlights how replantation activities offer opportunities for learning about nature and engaging in environment conversation. Ecolinguistics would be interested in exploring how language is used to discuss, promote, and understand replantation efforts and their implications for environmental discourse. Replantation, as described in the sentence, plays a role in addressing climate change by restoring ecosystems, mitigating deforestation, and enhancing carbon sequestration. The relational process of "provides opportunities" underscores the potential of replantation initiatives to contribute positively to climate change mitigation and adaptation strategies. The sentence emphasizes how replantation provides opportunities for learning about nature and engaging in environment conversation, indicating a focus on environmental education and awareness. This aligns with the principles of environmental sustainability, which emphasize the need for education, awareness, and action to ensure the long-term health of ecosystems and the planet.

B. Verbal process:

1. Overpopulation:

It was hot summer night; Danish was lying down with his grandfather on the roof of their home. The sky was dusty and cloudy. Humidity had increased and everyone was feeling hot. "Tell me something about your childhood

(reported)", Danish **(say)** asked (**verbal)** his grandfather.

(The English text book of Grade 6, based on Single National Curriculum 2022, title "Overpopulation- a Dilemma", Chapter No.8, page No. 81.)

1. "Tell me something about your childhood", Danish (**Say**) asked (**verbal**) his grandfather.

In this sentence, Danish's request to his grandfather reflects an interest in connecting with his family history and heritage, which can include stories related to the natural environment. By asking about his grandfather's childhood, Danish is engaging in an ecolinguistic act of exploring the environmental experiences and memories of previous generations. Danish's curiosity about his grandfather's past experiences may involve stories about changes in weather patterns, environmental conditions, or natural disasters that could be related to climate change. By sharing these stories, Danish's grandfather could provide valuable insights into how the environment has changed over time, contributing to a better understanding of the impacts of climate change on local communities and ecosystems. Through the act of asking and storytelling, Danish and his grandfather are engaging in a form of environmental sustainability. By sharing memories and experiences related to the natural environment, they are fostering a sense of connection and stewardship towards the environment.

It is a Verbal Process and it consists of three participants; sayer, reporting, and reported. The sentence in which Danish asked his grandfather, Danish has a function as sayer, asked is verbal (reporting), and his grandfather as (reported).

2. Behavioral process:

1. Agricultural Activities:

Agricultural activities of human are highly affecting the climate and causing severe changes to the environment. Human's **(bhvr)** uncontrolled use of pesticides **(pr)** to get high amounts of yield **(cr)** is highly responsible for sudden severe climatic changes.

1. Human's **(bhvr)** uncontrolled use of pesticides **(pr)** to get high amounts of yield **(cir)** is highly responsible for sudden severe climatic changes.

This sentence highlights the human behavior of using pesticides excessively to achieve higher yields in agriculture. The sentence links the uncontrolled use of pesticides by humans to sudden severe climatic changes. Excessive pesticide use can lead to environmental degradation, soil erosion, and disruption of ecosystems, all of which contribute to climate change. The sentence underscores the importance of sustainable agricultural practices to mitigate environmental damage caused by the uncontrolled use of pesticides. Sustainable farming methods focus on reducing pesticide use, promoting biodiversity, and conserving natural resources to ensure long-term environmental sustainability.

The use of pesticides by human to kill the crop destroying pests is killing the pests that are actually environment friendly and cause many benefits for human. The emission of gases from those pesticides and the burning of waste within the agricultural land is basing the climatic changes severely.

3. Mental process:

1. The process of sensing:

It was hot summer night; Danish was lying down with his grandfather on the roof of their home. The sky was dusty and cloudy. Humidity had increased and everyone (**Senser**) was feeling **(mental**) hot (**phe**). "Tell me something about your childhood", Danish asked his grandfather. His grandfather said, they **(sen**) had lived in a different but

peaceful time. They**(sen)** loved **(mental)** to swim in the river (**ph**) but it was now polluted by human waste.

(The English text book of Grade 6, based on Single National Curriculum 2022, title "Overpopulation- a Dilemma", Chapter No.8, page No. 81.)

1. "Humidity had increased and everyone **(Senser**) was feeling (**mental**) hot **(phenomenon**)".
   This mental process describes the cognitive and emotional state of individuals as they perceive and experience the sensation of heat. It highlights the subjective experience of warmth due to increased humidity, emphasizing the sensory and affective aspects of the phenomenon. The sentence underscores the linguistic representation of climate-related phenomena, such as increased humidity and heat, and their effects on individuals' well-being. The sentence raises global temperatures lead to higher levels of atmospheric moisture. This phenomenon contributes to heat stress and discomfort, affecting human health and productivity. The sentence underscores the importance of addressing climate-related factors, such as increased humidity and heat, to mitigate adverse impacts on human populations and ecosystems.
2. "They **(Sen)** loved **(Men**) to swim in the river **(Ph**) but it was now polluted by human waste."
   The above mentioned sentence is related to mental process that describes the positive feelings and emotional attachment towards swimming in the river. It emphasizes their feelings for this activity, recognizing appreciation for the natural environment. The sentence highlights the connection to nature and the enjoyment derived from engaging with natural spaces. The pollution of the river by human waste signifies the anthropogenic impacts on water quality and ecosystem health, which can be influenced by climate-related factors such as extreme weather events and changes in precipitation patterns. The contrast between the subjects' love for swimming in the river and its current polluted state highlights the disconnection between human appreciation for nature and the adverse impacts of human activities on environmental quality.
   It is a mental process phenomenon. The mental process (the emotion and feelings, love) involves the Senser (everyone, they (humans) and Phenomenon (hot, in the river). In the first line the phenomenon (hot) is mentally felt (feeling) by the 'Senser'(Humans). In the second line the phenomenon is the act of swimming in the river, which encompasses the physical experience of being in the water and the overall event itself.

- **Comparison between public and private schools textbook analysis:**

Qualitative analysis:

The study employed a mixed-method research design, combining qualitative and quantitative approaches. Linguistic analysis using Halliday's Transitivity SFL Model was conducted on English and Science textbooks from public and private schools in Punjab, Pakistan, focusing on grades 6-8.

The Transitivity SFL Model was used to highlight and classified linguistic processes in the textbooks. The model classifies processes into six types: material, mental, relational, behavioral, verbal, and existential. By analyzing these processes, the study focuses to highlight the hidden language patterns in environmental issues.

Findings from Private School Textbooks:

In contrast, private school textbooks, signifying a more balanced circulation in all process types. There was a focused on material processes, pointing a greater attention to material aspects related to environmental sustainability. Material processes were contributed by a higher level of mental processes, pointing a more focused examination of mental aspects.

Mental process emphasizes a greater attention to cognitive and critical thinking regarding environmental challenges. Relational processes were stronger, pointing towards a entire understanding of ecological systems (Jones et al., 2019). In private school textbook existential, verbal and behavioral processes were limited but well explained connected to climate change and environmental sustainability.

There are some processes used in textbooks analysis based on SFL model:

Findings from Public School Textbooks:

Public school textbooks focus on material processes, highlighting actions and physical elements of environmental issues. Relational processes were limited, providing a less logical inspection of the relationships within ecological systems. Mental processes were comparatively limited, pointing a possible space in addressing mental elements. Relational processes were common, advising a focused; exploration of ecological relationships (Smith, 2017).Verbal process was also focused and emphasizes ecolinguistics elements, environmental sustainability and climate change. Existential process was also discussed in public school textbooks and focused on ecolinguistic elements. Behavioral process was also limited and addressing a behavioral element connected to ecolinguistics.

Material Processes:

In contrast, private school textbooks, signifying a more balanced circulation in all process types. There was a focused on material processes, pointing a greater attention to material aspects related to environmental sustainability. Material processes were contributed by a higher level of mental processes, pointing a more focused examination of mental aspects. Metafunction reveals a focus on encouraging proactive engagement and responsibility.

Public school textbooks showed a higher frequency of material processes, indicating a focus on concrete actions. Limited emphasis on material processes, often presenting environmental actions in a passive tone. Metafunction suggests a need for a more active and participatory approach to environmental issues. Public school textbooks highlighted a focus on material processes, stressing actions and physical elements of environmental issues.

Mental Processes

Private school textbooks consisted of mental processes, suggesting a more focused examination of mental elements related to climate change, high on mental processes, cultivating ecological awareness and critical thinking. Metafunction highlights a focus on shaping students' perceptions and attitudes towards climate change, (Brown & Green, 2020).

Public school textbooks lagged in this regard. Limited focus on mental processes, resulting in less emphasis on fostering environmental consciousness. Metafunction reveals a need for an increased focus on framing attitudes and perceptions.

Relational Processes:

Private school textbooks highlighted a lower number of relational processes, indicating a less interacted understanding of environmental problem, comprehensive focused of relational processes, emphasizing the interaction of environmental problem.

Public school textbooks exhibited a higher frequency in this category. Relational processes are more prominent, leading to a more comprehensive understanding of ecosystem dynamics. Metafunction indicates a need for a more holistic approach to depicting environmental relationships, (Johnson, 2018).

The metafunction analysis highlights the big educational goals existing in the textbooks. Private school textbooks signifying a more balanced circulation in all processes seem to align better with the holistic objectives of environmental education. There was a focused on material processes, pointing a greater attention to material aspects related to environmental sustainability. Material processes were contributed by a higher level of mental processes, pointing a more focused examination of mental aspects. Mental process emphasizes a greater attention to cognitive and critical thinking regarding environmental challenges. Relational

processes were stronger, pointing towards a entire understanding of ecological systems (Jones et al., 2019). In private school textbook existential, verbal and behavioral processes were limited but well explained connected to climate change and environmental sustainability.

Public school textbooks highlighted a focus on material processes, stressing actions and physical elements of environmental issues. In contrast, private school textbooks, signifying a more balanced circulation in all process types. There was a focused on mental processes, pointing a greater attention to cognitive aspects and critical thinking regarding environmental challenges. Material processes were contributed by a higher level of mental processes, pointing a more focused examination of mental aspectsThere was a focused on mental processes, pointing a greater attention to cognitive aspects and critical thinking regarding environmental challenges. Material processes were contributed by a higher level of mental processes, pointing a more focused examination of mental aspects. Relational processes were more strong, pointing towards a entire understanding of ecological systems (Wang & Zhang, 2021).

This comprehensive comparative analysis provides differences in the linguistic analysis of ecolinguistics and environmental change in public and private school textbooks. The study provides obtainable to improve public school curriculum, promoting a more authentic and comprehensive perceptions understanding of environmental challenges among students

Quantitative Analysis:

Private schools textbook analysis:

A. Material process:

1. Rain:

Frequency table 1

Participants	Words	Frequencies of Words
Actor	The clouds, Winds, Colder air	3
Material	Water bodies, Another place,Water Vapors, Land	4
Process	Movement, Clouds Gather, Become Laden, Bring fromsea to land	4
Goal	Cools the atmosphere	1

Description: Frequency table 1 shows that there are 4 main participants in the material process, actor, material, process and goal. 3 actors make the 4 processes on 4 materials and achieve only one goal. This shows that number of goals is independent of number of participants.

2. Ecosystem Interaction:

Frequency Table 2

Participants	Words	Frequencies of Words
Actor	Living things Non-living parts	2
Material	Glass Concrete walls,Soil, Grass The tarmac road,Temperature	6
Process	React	1
Goal	Relationship between livingthings and non-living things	1

Description: Frequency table 2 shows that there are 4 main participants in the material process, actor, material, process and goal. 2 actors make 1 process on 6 materials and achieve only one goal. Thisshows that number of goals is independent of number of participants.

B. Existential process:

1. Change in weather:

Frequency Table.1

Participants	Words	Frequencies of Words
Process	Influence, Make, Changes, Overtaken, Vanish, Describes ,occur	7
Existent	Living beings Atmospheric, conditions Temperature, Humidity, Rainfall Wind Speed Conditions Sunny day	8

Description: Frequency table 1 shows that there are 2 main participants in the existential process, existent and existential. 8 existents cause 7 existential processes. This shows that number of existential processes is independent of number of existents.

2. Relational process:

1. Biodiversity of Rainforests

Frequency Table.1

Participants	Words	Frequencies of Words
Carrier	A rainforest	1
Attribute	Plant, Animals Microorganism	3
Identifier	Environment forests	2

Description: Frequency table 1 shows that there are 3 main participants in the relational process, carrier attribute and possession/identifier. 1 carrier rainforest has 3 attributes (plants, animals and microorganisms) which are identified by 2 identifiers (environment and forest). This shows that acarrier can possess many attributes at a time and number of attributes is not fixed.

2. Climate

Frequency Table 2

Participants	Words	Frequencies of Words
Carrier	Pakistan	1
Attribute	tropicalhot humid climate	3
Possession	Has	

Description: Frequency table 2 shows that there are 3 main participants in the relational process, carrier attribute and possession identifier. 1 carrier Pakistan possesses 3 attributes for climate (hot, humid and tropical) at same time. This shows that a carrier can possess many attributes at a time and number of attributes is not fixed.

3. Verbal process:

1. Weather:

Frequency Table.1

Participants	Words	Frequencies of Words
Sayer	Weather experts	1
Verbal	Make prediction	1
Reported	weather	1

Description: The frequency table shows that there are three participants; Sayer 34%, Verbal 33% and reported 33%. It is evident that 1 sayer with 1 verbal process reported 1 information.

4. **Behavioral process:**

1. **Climate:**

Frequency Tabl.1

Participants	Names	Ratio
Behaver	We	1
Process	Spend	1
Circumstantial	Our spare time	1

Description: Above table depicts the ratio of the participants in a percentile manner showing behaver (33%), process (33%), circumstantial (34%).

5. **Mental Process:**

1. **Global Warning:**

Frequency Table.1

Participants	Words	Frequencies of Words
Senser	Earth	1
Mental Process	Experienced	1
Phenomenon	Temperature	1

Description: Frequency Table 1 shows that there are three participants in the mental process; Senser, Mental process, Phenomenon. As shown in the table the Senser is 34%, Mental Process is 33% and the phenomenon is 33%. In this process 1Sensors is going through 1 process and 1 phenomenon.

Public schools textbook analysis:

A. **Material process:**

1. **Forest:**

Frequency Table.1

Participants	Words	Frequencies of Words
Actor	Forests, Trees	2
Material	Development of any country, Environment, Natural- resources,	3
Process	Provide habitat for wildlife, Act as a windbreak, Increase property values and improve mental health, Cool outdoor temperature, Protect us from UV rays, Shade buildings, Reduce the need for air conditioning, Filter pollutants from the air, Release oxygen	9

Description: There are four participants in the material process, actor, material, process, goal. The actor is 13%, material is 20%, process is 59%, and goal is 8%. 2 actors make 9 processes on 3 materials and achieve 3 goals. This shows that number of goals is independent of number of participants.

2. **Global Warming:**

Frequency table 2

Participants	Words	Frequencies of words
Actor	Living things and non-living things, Human activities	3
Material	Greenhouse gases, temperature, methane, carbon dioxide.	4
Process	Burning of fossil fuels, deforestation, industrial processes, melting ice caps, sea level rise, and rising temperature	6
Goal	Promoting sustainable transportation, using renewable energy, biodiversity, protect habitat.	4

Description: There are four participants in the material process, actor, material, process, goal. The actor is 18%, material is 23%, process is 34%, and goal is 24%. Process and material depend upon actor. The goal is independent, depend upon material.

A. **Existential process:**

1. **Burning of Fossil Fuels:**

Frequency table 2

Participants	Words	Frequency	
Pronoun	They ,Which, It	3	
Process: Existential	Burnt, to run, Emit, Cause ,Burning Releases, Make, Called, Is, Affects, Dissolve, Breathing difficulties	12	
Existent	Fossil fuels ,Vehicles and industries , Greenhouse gases, Carbon oxide, Global warming Poisonous substances, Air, Air pollutants Carbon mono oxide, Human organ system, Sulphur and Nitrogen oxides Rain water		16

Description: Frequency table depicts that there are three (03) main participants in the existential process i.e., pronoun, process and existent which 10%, 39% and 51% respectively. It shows that number of existents is significantly greater that all other participants hence proving it independent.

B. Relational process:

1. Human Activities and Natural Disasters:

Frequency Table.1

Participants	Words	Frequencies of words
Carrier	Human beings	1
Attribute	Agriculture, Deforestation, urbanization and mining	4
Identifier	Natural disasters directly or indirectly	1

Description: The frequency table shows that there are 3 main participants in the relational process, carrier, attribute and possession/identifier. 1 carrier human beings have 4 attributes (agriculture, deforestation, urbanization and mining) which are identified by 1 identifier (natural disasters). This shows that a carrier can possess many attributes at a time and number of attributes is not fixed.

2. Replantation:

Frequency table.1

Participant	Words		Frequency of word
Carrier	Replantation		1
Attribute	Nature, conversation.	environment	2

Description: There are two participants in the rational process, carrier is 33%, and attribute is 67%. Carrier is independent to attribute.

C. Verbal process:

1. Overpopulation:

Frequency Table.1

Participants	Words	Frequencies of Words
Sayer	Danish	1
Verbal	Asked	1
Reported	His grandfather	1

Description: The frequency table shows that there are three participants; Sayer 34%, Verbal 33% and reported 33%. It is evident that 1 sayer with 1 verbal process reported 1 information.

D. Behavioral process:

1. Agricultural Activities:

Frequency Tabl.1

Participants	Names	Ratio
Behaver	Farmer	1
Process	Use of pesticides, Use of fertilizers, Burning of agricultural waste	3
Circumstantial	Destruction of ozone layer, Killing of environment friendly pests, Poisonous air index	3

Description: Above table depicts the ratio of the participants in a percentile manner showing behaver (14%), process (43%), circumstantial (43%).

E. Mental Process:

1. Process of sensing:

Frequency Table.1

Participants	Words	Frequencies of Words
Senser	Everyone, they (humans)	2
Mental Process	Feelings loved	2
Phenomenon	Hot, river	2

Description: Frequency Table 1 shows that there are three participants in the mental process; Senser, Mental process, Phenomenon. As shown in the pie diagram the Senser is 34%, Mental Process is 33% and the phenomenon is 33%. In this process 2 Sensors are going through 2 processes and feeling 2 phenomena

➢ **Comparison between public and private schools textbook analysis:**

Quantitative analysis:

1. Private Schools:

Name of process	Frequency	Rank
Material	10	1
Existential	08	2
Verbal	01	3
Mental	01	4
Behavioral	01	5
Relational	06	6

Description:

There is a private school table that shows 6 processes of SFL model by Halliday that have found by analyzing in private schools textbooks followed by frequencies and ranks of these processes. First process is material process based on 10 frequencies and 1 rank. Second process is existential process based on 8 frequencies and 2 ranks. Third process is verbal process based on 1 frequency and 3 ranks. Forth process is mental process based on 1 frequency and 4 ranks. Fifth process is behavioral process based on 1 frequency and 5 ranks. Six and final process is relational process based on 06 frequencies and 6 rank. There was a focused on material processes, pointing a greater attention to material aspects related to environmental sustainability. Material processes were contributed by a higher level of mental processes, pointing a more focused examination of mental aspects. Metafunction reveals a focus on encouraging proactive engagement and responsibility.

2. Public Schools:

Name of process	Frequency	Rank
Material	07	1
Relational	06	2
Verbal	01	3
Mental	01	4
Behavioral	01	5
Existential	03	6

Description:

There is a private school table that shows 6 processes of SFL model by Halliday that have found by analyzing in private schools textbooks followed by frequencies and ranks of these processes. First process is material process based on 07 frequencies and 1 rank. Second process is relational process based on 06 frequencies and 2 ranks. Third process is verbal process based on 1 frequency and 3 ranks. Forth process is mental process based on 1

frequency and 4 ranks. Fifth process is behavioral process based on 1 frequency and 5 ranks. Six and final process is existential process based on 03 frequencies and 6 rank. Public school have less frequency in contrast to private school textbook analysis in all processes.

5.Discussion:

Climate change is a major concern of today's world. Notably, the curriculum plays a pivotal role in developing environmental awareness, equipping students with the knowledge, skills, and attitudes necessary to address contemporary environmental challenges. Environmental challenges need immediate attention in today's world, and their representation in educational materials has same significance. According to Environmental scientists, "Pakistan is one of ten countries most at risk from climate change**"** (Wallace-Wells, 2022). The United Nations Conference on Human Environment suggested that environmental topics must be incorporated into the curriculum to establish the framework for future generations for protecting and improving the environment held in June 1972. Long lasting solutions for the environmental problems can be found through Environmental Education (EE) The multinational Conference of Tbilisi in 1977 (Mliless & Larouz, 2018). Significance of Education (EE) and ecolinguistic is evident from these conferences.

This study presents an important aspect of education and its influence on shaping youth perceptions of climate change. By examining the textbooks from public and private schools in Punjab, the linguistic representation of climate change in the research enlighten on how language can affect awareness and understanding of environmental issues among students. Climate change education is a critical concern worldwide, and understanding how it is represented in educational materials is pivotal for designing effective curriculum and promoting environmental literacy among youth.

The employment of Halliday's Transitivity Systemic Functional Linguistics (SFL) Model as a framework for linguistic analysis is specifically significant. This model allows for a systematic analysis of language patterns connected to environmental issues, focusing on actions, participants, and relationships. By utilizing a mixed-method research design integrating qualitative and quantitative approaches, the study assure an extensive understanding of the textual representation of climate change in the analyzed textbooks.

The findings of this study highlight the linguistic representation, curriculum differences and critical aspects of environmental education in Pakistani schools. It presents significant differences between public and private school textbooks emphasize the role of curriculum in forming students' understanding of climate change. Findings emphasizing that private school students have more updated curriculum, have a better understanding of environmental change, highlights differences between public and private school textbooks. The study expands its analysis to the Lebanese educational context, examining challenges faced by public schools in integrating technology and environmental awareness. The differences between public and private schools in terms of curriculum content and technological integration are noteworthy. Private schools, with more independent, tend to offer a more updated and appealing curriculum, encouraging a better understanding of environmental challenges among students. Public schools restricted by economic troubles, potentially obstructing students' exposure to current environmental issues, face challenges in keeping step with advancements in education. This needs for crucial notice to fill these gaps through focused policies, increased funding, and association between educational contributors. This finding is consistent with broader discussions about differences in education quality between public and private institutions, which can have suggestions for responses to climate change.

The identification of these linguistic constructs provides a foundation for enhancing the effectiveness of environmental education. It highlights the importance of selecting words and structures that promote a more critical and reflective engagement with environmental topics.

Incorporating ecolinguistic considerations into curriculum design can contribute to shaping a more ecologically conscious worldview among youth.

This finding aligns with previous research on the role of education in shaping attitudes and perceptions towards the environment. The study conducted by Mehwish Zahoor and Fauzia Janjua(2020) focused on the incorporation of content based on raising the environmental awareness as a global issue. Using Halliday's transitivity analysis and Gaard's eco-pedagogical framework from the UCP Journal of Languages & Literature 51, the study examined the environmental texts in English language textbooks used in Pakistani primary schools. Their findings revealed a most important distribution of an anthropocentric worldview in the construction of nature and the human-nature relationship within these textbooks, thereby lacking significant ecopedagogical import (Zahoor & Janjua, 2020). This lack of ecopedagogical emphasis in English language textbooks used in Pakistani primary schools highlights a potential difference between public and private schools in the country. While both public and private schools may use similar textbooks, the approach to teaching and the emphasis on critical global issues such as environmental crises may vary. Private schools, which often have more resources and independance, might have the capacity to incorporate a more comprehensive and ecologically conscious curriculum compared to public schools, where resources and curriculum development might be more restricted. The findings suggested a need for revising the content to shift from being more human-centered (anthropocentric) to focusing on eco-pedagogy, aligning with current environmental concerns.

Leiserowitz et al. (2018) conducted research in the United States focusing on the impact of formal education on climate change awareness and engagement among youth. Their findings highlighted the pivotal role of education, particularly environmental education in shaping students' attitudes and behaviors towards climate change. The study emphasized that exposure to environmental education programs not only increased students' knowledge about climate change but also introduced a sense of responsibility and motivation to take action. This emphasizes the importance of integrating climate change education into school curricula to empower future generations to address environmental challenges effectively.

Guo, Q & Jacobs, G. M. (2023), explored his study on Analyzing Children's Films about Integrating Ecolinguistics into Education. The findings of the study on integrating ecolinguistics into education, particularly through the analysis of children's films, have significant suggestion for the private sector curriculum. By incorporating ecolinguistic concepts into educational practices, such as analyzing media texts, educators can provide students with authentic views and perspectives on environmental issues. Private sector curriculum often aims to develop well-rounded citizens who are trained to understand and address societal challenges, including environmental concerns. Integrating ecolinguistics into the curriculum allows students to engage critically with media content, such as children's films, and develop a deeper understanding of environmental change. Through the analysis of films like "The Lorax" and "Back to the Outback," students can explore complex environmental themes, such as sustainability, conservation, and the interconnectedness of ecosystems. By encouraging students to examine these themes through an ecolinguistic lens, the curriculum can encourage environmental literacy and allow students to become active participants in environmental management. Furthermore, incorporating ecolinguistics into the curriculum promotes interdisciplinary learning, as students draw connections between language, culture, and the environment. Integrating ecolinguistics into the private sector curriculum provides students with authentic views on environmental issues and provides them with the critical thinking skills necessary to direct complex environmental challenges in their communities.

Overall, these studies collectively highlight the global importance of environmental education in addressing environmental challenges, including climate change. They emphasize the need

for comprehensive and integrated approaches within educational systems to provide students with the knowledge, skills, and attitudes necessary to direct and respond to complex environmental issues effectively. The findings and themes discussed in the study on Pakistani schools vibrate with broader discussions on the role of education in shaping environmental awareness and encouraging sustainability.

6. Conclusion and recommendation:

To conclude, this research has provided a comprehensive examination of the complicated interaction among ecolinguistics, environmental education and curriculum differences with a specific focus on the linguistic depiction of climate change in Pakistani schools using Halliday's Transitivity SFL Model. The study underscored the pivotal role of the curriculum in shaping students' awareness, attitudes, and behaviors towards environmental issues. The research highlighted updates to the curriculum, especially in public schools, to make sure that students are furnished with the skills and knowledge necessary to address current environmental issues. The study's mixed-method research, qualitative ecolinguistic analysis with quantitative content analysis, offered a fine understanding of the difference between public and private school textbooks. The findings revealed the need for, institutional support, collective efforts and budgetary readiness to fill the gap in technological integration between public and private schools. While the study emphasizing the universal importance of addressing environmental education differences and linguistic representation in curricula in Pakistani context. The study recommended for a more comprehensive, updated, and technology-integrated curriculum, particularly in public schools, to make sure a comprehensive and accurate understanding of environmental challenges among the next generation. Finally, this study not only holds practical implications for shaping a more informed and dynamic approach to environmental management worldwide but also provides the academic discourse on climate change. In the same vein, findings reveal distinct differences between public and private school textbooks, emphasizing that students in schools with more updated curricula, often found in the private sector, have a better understanding of climate change. Zahoor and Janjua **(2020)** recently highlighted the importance of including content aimed at raising the environmental awareness as a global issue. The research concluded that needs revision to focus on the later perspective as per the current environmental concerns hence the content is more anthropocentric than eco-pedagogic.

Recommendations:

Curriculum Updates

This includes recommendations to update the public school curriculum to investigate current challenges the latest scientific developments, technological advancements, and global environmental concerns into the educational framework. Historically, it has been commonplace for schools to adopt a new curriculum every few years (Curriculum Adoption Process Takes a Village, plus Months of Planning and Testing - Battle Ground Public Schools, 2019; Partelow & Shapiro, 2018). Educational boards and Governments must be organizing the advancement and execution of active curriculum that promote a logical understanding of climate change and sustainability.

Inclusive Environmental Education

Environmental education is comprehensive and accessible to all students and efforts should be made to fill the gap between public and private schools. This could provide the development of authentic guidelines for environmental curriculum, to guarantee a consistent and up-to-date learning experience for all students. This includes the provision of updated textbooks, teacher training programs, and collective capabilities with environmental institutions to increase the overall quality of environmental education in public schools.

Teacher Training

Training teachers with the valuable knowledge and skills to successfully conveying environmental education is important. Teacher training programs should be designed to train teachers to provide particular skills and knowledge to successfully educate environmental education. Professional advancement should focus on integrating technological tools into the classroom, promoting critical thinking skills among students, employing updated curricula, regarding environmental challenges.

Global Collaboration

Environmental challenges, based on global nature collaboration with educational institutions, international organizations, and researchers can provide motivations to enhance environmental education programs. Sharing best practices and learning from successful initiatives globally can enrich the local educational landscape.

Sharing best practices and learning from successful capabilities globally can enrich the local educational context, and addressing curriculum differences, containing ecolinguistic considerations, fostering collective efforts are key to development environmental education in Pakistani schools. By executing these recommendations can provide to shape environmentally conscious individuals equipped to address the urgent challenges of climate change and sustainability.

Overall, this study emphasizing the global significance of incorporating current environmental issues into curricula, contributes to the growing body of literature on environmental education and linguistics. By critically examining linguistic constructs in textbooks, the research promotes a more informed and motivated approach to environmental management among the next generation, not only in Pakistan but also in the broader international context. The study suggested the urgency of fostering a comprehensive, updated, and technology-integrated curriculum to effectively address the environmental challenges and promote sustainable practices in education.

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Appendix:

Key to transitivity labels:

Participants label	Abbreviation
material	Mat
Actor	Act
Process	Pr
Goal	Gl
DemonstrativePronoun	Dp, P
Process	Pr
Existent	Ex
Carrier	C
Attribute	At
Identifier	Id
Behaver	Bhvr
Process	Pr
sayer	Sayr
verbal	Ver
Sensor	Sen
Mental Affection	Men
Phenomenon	Ph