Integrating environmental justice and education:
A comprehensive review

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Abstract

Environmental justice is a critical and evolving concept that addresses the inequities in environmental exposures and their impacts on marginalized communities. This review examines the intersection of environmental justice and education, emphasizing the role of educational institutions in mitigating environmental injustices. By analyzing current literature and case studies, this study highlights how pollutants disproportionately affect children in socioeconomically disadvantaged and racially marginalized communities. Schools and educational policies can play a pivotal role in addressing these disparities by fostering community engagement, promoting awareness, and advocating for policy changes. This review also explores the concept of environmental racism and its implications for health and educational outcomes among students. It underscores the importance of a socioecological approach, involving collective action from individuals, schools, and communities to achieve sustainable and equitable environmental conditions. This study aims to provide a comprehensive understanding of the critical role education plays in promoting environmental justice and offers actionable recommendations for stakeholders committed to creating healthier and more inclusive environments for future generations.

Keywords: Environmental justice, environmental racism, socioecological approach, participatory pedagogy, sustainable development.

Introduction

Environmental justice is an interdisciplinary field that addresses the disproportionate environmental burdens borne by marginalized communities, particularly those of lower socioeconomic status and racial minorities (Bullard, 1993). This concept has gained significant attention as evidence mounts regarding the unequal distribution of environmental hazards and their profound impacts on health, quality of life, and educational outcomes (Mohai & Saha, 2015). Environmental justice encompasses the equitable distribution of environmental benefits and burdens and emphasizes the need for inclusive and participatory decision-making processes (Heaney et al., 2011).

The relationship between environmental justice and education is particularly crucial, as educational institutions are uniquely positioned to influence and mitigate the effects of environmental inequities (Gordon & Glaser, 2020). Schools serve as central hubs in communities, offering opportunities to educate, engage, and empower students and their families about environmental issues. However, children, especially those from disadvantaged backgrounds, are often the most vulnerable to environmental pollutants. These pollutants, which include industrial emissions, agricultural pesticides, and contaminated water sources, pose significant risks to their health and development (Brumberg et al., 2021).

Research indicates that exposure to environmental toxins is linked to a range of adverse health outcomes, including respiratory conditions, developmental disorders, and learning disabilities (Rogge & Combs-Orme, 2003). These health issues can significantly affect students' academic performance and overall well-being, perpetuating a cycle of disadvantage (Claudio et al., 1999). Moreover, the concept of "environmental racism" highlights how racial and ethnic minorities are disproportionately affected by environmental hazards, further exacerbating existing social inequities (Thomas, 2022).

Purpose and Significance of the Study

This review aims to explore the intersection of environmental justice and education, focusing on how educational institutions can address and mitigate these disparities. By examining current literature and case studies, this study seeks to provide a comprehensive understanding of the role that schools and educational policies can play in promoting environmental justice. The integration of environmental justice into educational practices and policies is essential for fostering a more equitable and sustainable future. Through community engagement, advocacy, and innovative pedagogical approaches, schools can become pivotal agents of change in the fight for environmental justice.

This study is significant because it highlights the critical role of education in addressing environmental inequities and underscores the importance of incorporating environmental justice principles into educational curricula and school policies. By doing so, educational institutions can help break the cycle of disadvantage and contribute to the creation of healthier and more equitable communities.

Background

The background section provides a comprehensive overview of the foundational concepts and context necessary to understand the intersection of environmental justice and education. This section explores the definition and scope of environmental justice, the implications of environmental racism, current environmental challenges and pollutants, socioeconomic and racial disparities in environmental exposures, and the critical role of education in addressing these issues. Through an examination of case studies and examples, this section aims to establish a clear understanding of the complexities and significance of integrating environmental justice into educational practices.

Definition and Scope of Environmental Justice

Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income concerning the development, implementation, and enforcement of environmental laws, regulations, and policies (Bullard, 1993). This concept emerged in the early 1980s as a response to the growing recognition that environmental hazards disproportionately impact marginalized communities, particularly those of lower socioeconomic status and racial minorities (Mohai & Saha, 2015).

The scope of environmental justice extends beyond the equitable distribution of environmental benefits and burdens. It encompasses the need for inclusive and participatory decision-making processes that involve affected communities in addressing environmental issues (Heaney et al., 2011). Environmental justice advocates argue that marginalized communities often lack the political power and resources to influence environmental policies, resulting in disproportionate exposure to environmental hazards such as air and water pollution, hazardous waste sites, and industrial facilities (Cole & Foster, 2001).

Environmental racism, a subset of environmental justice, specifically addresses the racial disparities in environmental exposures. This term highlights how environmental policies and practices often systematically disadvantage racial and ethnic minorities (Pulido, 2000). Studies have shown that communities of color are more likely to live near sources of pollution and experience higher levels of environmental health risks compared to white communities (Bullard, 2001). These disparities are not

only a result of current environmental policies but also reflect historical patterns of segregation and discriminatory land use practices (Taylor, 2014).

Addressing environmental justice requires a multifaceted approach that includes legal, social, and economic strategies to ensure that all communities have access to a healthy environment. This involves enforcing existing environmental regulations, creating new policies that specifically address environmental inequities, and fostering community engagement and advocacy (Brulle & Pellow, 2006). The integration of environmental justice into educational curricula and school policies is essential for raising awareness and empowering students and communities to take action towards achieving environmental equity.

Environmental Racism and Its Implications

Environmental racism refers to the institutional policies and practices that differentially impact the health and environment of racial and ethnic minorities (Bullard, 2001). This concept underscores the reality that minority communities are more likely to be exposed to environmental hazards and less likely to benefit from environmental protections. The term was first popularized in the 1980s when studies began to reveal the unequal burden of pollution on African American, Latino, Native American, and Asian communities (Pulido, 2000).

The implications of environmental racism are far-reaching and multifaceted. Communities of color are often situated near industrial facilities, waste disposal sites, and other sources of pollution (Mohai & Saha, 2015). This proximity to environmental hazards results in higher rates of health problems such as asthma, cancer, and other chronic diseases (Brumberg et al., 2021). For example, a study found that air pollution levels in predominantly African American and Latino neighborhoods were significantly higher than in predominantly white neighborhoods, leading to increased rates of respiratory and cardiovascular diseases (Jbaily et al., 2022).

Moreover, environmental racism exacerbates social and economic inequalities. Health problems resulting from environmental exposures can limit individuals' ability to work and contribute to economic hardship. Additionally, educational outcomes are negatively impacted as children in polluted environments are more likely to suffer from health issues that lead to absenteeism and decreased academic performance (Claudio et al., 1999). This creates a vicious cycle where marginalized communities are continuously disadvantaged.

Environmental racism also has significant psychological and social implications. The stress and anxiety caused by living in polluted environments can lead to mental health issues, including depression and anxiety disorders (Gee & Payne-Sturges, 2004). Furthermore, the lack of political power and representation among affected communities means that their voices are often excluded from environmental decision-making processes, perpetuating feelings of disenfranchisement and injustice (Schlosberg, 2007).

Addressing environmental racism requires a concerted effort to create and enforce policies that protect vulnerable communities. This includes stricter regulations on industrial emissions, better waste management practices, and comprehensive health and safety assessments for proposed developments. It also necessitates active community engagement and empowerment, ensuring that affected populations have a say in the policies that impact their environments (Cole & Foster, 2001). Education plays a critical role in this process by raising awareness, promoting advocacy, and fostering a new generation of leaders committed to environmental justice.

Current Environmental Challenges and Pollutants

The current environmental landscape is marked by numerous challenges that pose significant risks to public health and the environment. Among the most pressing issues are air pollution, water contamination, and soil degradation, all of which disproportionately impact marginalized communities.

Air Pollution Air pollution remains one of the most critical environmental challenges, with industrial emissions being a primary contributor. Factories, power plants, and vehicles release a plethora of harmful pollutants, including particulate matter (PM), nitrogen oxides (NOx), sulfur dioxide (SO2), and volatile organic compounds (VOCs) (Friis, 2019). These pollutants can penetrate deep into the lungs and bloodstream, causing respiratory and cardiovascular diseases, and are linked to premature deaths (World Health Organization [WHO], 2018). For instance, studies have shown that children living in urban areas with high levels of air pollution are more likely to develop asthma and other respiratory conditions (Delfino et al., 2003).

Water Contamination Water contamination is another significant environmental challenge, often resulting from industrial discharges, agricultural runoff, and inadequate waste management. Chemicals such as per- and polyfluoroalkyl substances (PFAS), heavy metals, and pesticides find their way into drinking water supplies, posing severe health risks (Centers for Disease Control and Prevention [CDC], n.d.). PFAS, commonly known as "forever chemicals," are particularly concerning due to their persistence in the environment and association with various health issues, including cancer, liver damage, and reproductive problems (Andrews & Naidenko, 2020).

Soil Degradation Soil degradation, caused by industrial activities, deforestation, and unsustainable agricultural practices, results in the loss of fertile land and the contamination of soil with hazardous chemicals. This not only affects food security but also leads to the bioaccumulation of toxins in the food chain, posing long-term health risks (FAO, 2017). Pesticide use in agriculture is a major source of soil contamination, and exposure to these chemicals is linked to developmental and neurological disorders in children (Gunier et al., 2017).

Industrial and Agricultural Pollutants Industrial and agricultural pollutants continue to pose significant threats to environmental health. Industrial facilities often release toxic substances into the air, water, and soil, impacting nearby communities. Agricultural practices contribute to pollution through the use of pesticides and fertilizers, which can leach into water supplies and affect both human health and ecosystems (Dereumeaux et al., 2020). Communities living near industrial and agricultural sites are particularly vulnerable, facing higher risks of exposure and subsequent health problems.

Climate Change Climate change exacerbates existing environmental challenges, contributing to more frequent and severe weather events, rising sea levels, and shifts in ecosystems. These changes disproportionately affect low-income and minority communities, who often lack the resources to adapt and recover from environmental stresses (Intergovernmental Panel on Climate Change [IPCC], 2018). The increased frequency of natural disasters, such as hurricanes and floods, further exposes these communities to environmental hazards and disrupts their livelihoods (IPCC, 2018).

Health Impacts The health impacts of these environmental challenges are profound, particularly for vulnerable populations. Exposure to pollutants can lead to chronic diseases, developmental disorders, and mental health issues (Brumberg et al., 2021). Children, the elderly, and individuals with preexisting health conditions are at higher risk. The cumulative burden of these exposures exacerbates health disparities and highlights the urgent need for effective environmental policies and interventions (Corlin, 2021).

Socioeconomic and Racial Disparities in Environmental Exposures

Socioeconomic and racial disparities significantly influence the extent and severity of environmental exposures, contributing to broader health inequities. These disparities manifest in various forms, from the siting of hazardous facilities to differential access to resources for mitigation and adaptation.

Disproportionate Siting of Hazardous Facilities Research consistently shows that hazardous waste facilities, industrial plants, and other sources of pollution are disproportionately located in low-income and minority communities (Mohai & Saha, 2015). This phenomenon, often referred to as "environmental injustice," means that these communities are more likely to experience higher levels of pollutants.

Studies have demonstrated that neighborhoods with higher percentages of racial minorities and lower-income residents are more likely to be situated near sources of air and water pollution (Bullard, 2001; Pulido, 2000). This unequal distribution of environmental hazards is a significant driver of health disparities.

Health Impacts of Environmental Exposures The health impacts of these environmental exposures are profound. For instance, children in low-income and minority communities are at a higher risk of developing respiratory conditions, such as asthma, due to their proximity to pollution sources (Claudio et al., 1999). Airborne pollutants, including particulate matter and volatile organic compounds, are linked to increased rates of respiratory and cardiovascular diseases (Jbaily et al., 2022). Furthermore, exposure to contaminated water and soil can lead to various health issues, including developmental disorders and cancer (CDC, n.d.).

Access to Mitigation Resources Socioeconomic disparities also affect communities' ability to mitigate and adapt to environmental hazards. Wealthier communities have greater access to resources that can help reduce exposure to pollutants, such as advanced filtration systems, healthcare, and cleaner environments (Brulle & Pellow, 2006). In contrast, low-income and minority communities often lack these resources, exacerbating their vulnerability to environmental hazards. This lack of resources extends to political influence, where marginalized communities may have less capacity to advocate for environmental protections and improvements (Heaney et al., 2011).

Historical Context and Systemic Inequities The roots of these disparities are deeply embedded in historical and systemic inequities. Segregation policies, discriminatory zoning laws, and economic disenfranchisement have historically placed minority communities in less desirable and more polluted areas (Taylor, 2014). These systemic inequities are perpetuated by ongoing policies and practices that continue to marginalize these communities. For example, the practice of "redlining" in the mid-20th century systematically denied minority communities access to mortgages and insurance, relegating them to less desirable areas with higher environmental risks (Pulido, 2000).

Educational Impacts The educational impacts of environmental exposures are also significant. Students in polluted environments often suffer from health issues that lead to increased absenteeism and decreased academic performance (Rogge & Combs-Orme, 2003). Chronic health problems, such as asthma, can result in frequent school absences, limiting students' ability to keep up with their studies and perform well academically (Claudio et al., 1999). This educational disadvantage further entrenches socioeconomic disparities, creating a cycle of disadvantage.

Community Responses and Advocacy Addressing these disparities requires robust community engagement and advocacy. Community-based organizations play a crucial role in raising awareness, advocating for policy changes, and providing support to affected residents (Cole & Foster, 2001). Effective advocacy involves building coalitions across different sectors and empowering community members to participate in decision-making processes that affect their environment and health. This participatory approach is essential for achieving lasting environmental justice and health equity (Schlosberg, 2007).

The Role of Education in Addressing Environmental Justice
Education is a powerful tool for addressing environmental justice, as it fosters awareness, encourages critical thinking, and empowers individuals and communities to advocate for equitable environmental policies. Schools and educational institutions play a critical role in mitigating environmental injustices by integrating environmental education into their curricula, promoting community engagement, and supporting advocacy efforts.

Environmental Education in Curricula Integrating environmental justice into educational curricula is essential for raising awareness and fostering a deeper understanding of environmental issues among students. Environmental education should include topics such as the sources and impacts of pollution,

the concept of environmental racism, and the socio-economic factors contributing to environmental disparities (Heaney et al., 2011). By educating students about these issues, schools can equip them with the knowledge and skills needed to recognize and address environmental injustices in their communities.

Promoting Critical Thinking and Advocacy Education plays a crucial role in developing critical thinking skills, which are necessary for understanding complex environmental issues and advocating for change. Through project-based learning and participatory pedagogies, students can engage in hands-on activities that explore the real-world implications of environmental justice (Garrett, 2022). These approaches encourage students to think critically about the root causes of environmental disparities and to develop innovative solutions to address them.

Community Engagement and Empowerment Schools serve as community hubs, making them ideal platforms for promoting environmental justice initiatives. By fostering partnerships with local organizations, government agencies, and community groups, schools can facilitate collaborative efforts to address environmental issues (Fook & Askeland, 2007). Community engagement activities, such as environmental clean-ups, public forums, and participatory research projects, empower students and community members to take collective action towards environmental justice (Healy, 2022).

Supporting Policy Advocacy Educational institutions can also play a significant role in policy advocacy by raising awareness of environmental justice issues and advocating for policies that protect vulnerable communities. Schools can leverage their established relationships with district and city officials to advocate for safer environmental standards and regulations (Perdue et al., 2003). By educating students and community members about their rights and how to effectively advocate for change, schools can help build a stronger, more informed, and active citizenry.

Participatory Pedagogies and Creative Arts Participatory pedagogies and creative arts offer innovative approaches to teaching and learning about environmental justice. Methods such as participatory action research, photography, and creative writing allow students to explore and document their experiences with environmental issues (Scicluna, 2020). These activities not only enhance students' understanding of environmental justice but also provide a platform for them to voice their concerns and share their stories with a broader audience. By incorporating these methods into the curriculum, schools can create more inclusive and engaging learning environments that promote social awareness and advocacy.

Developing Socioemotional Skills Education that addresses environmental justice also contributes to the development of socioemotional skills, such as empathy, resilience, and social responsibility (Garrett, 2022). These skills are essential for students to effectively engage with and address complex social and environmental issues. By fostering a sense of empathy and social responsibility, schools can inspire students to become active participants in their communities and to work towards creating a more just and equitable society.

Education is a vital component in the fight for environmental justice. By integrating environmental justice into educational practices and policies, schools can play a significant role in raising awareness, promoting critical thinking, and empowering communities to advocate for equitable environmental policies. Through community engagement, policy advocacy, and participatory pedagogies, educational institutions can help address the root causes of environmental disparities and foster a more sustainable and just future for all.

Case Studies and Examples
Examining case studies and real-world examples provides valuable insights into the practical application of environmental justice principles and the role of education in addressing these issues. This section highlights several key case studies that illustrate the intersection of environmental justice, education, and community engagement.

Case Study 1: The West End Revitalization Association (WERA) The West End Revitalization Association (WERA) in Mebane, North Carolina, is a prominent example of community-driven environmental justice advocacy. WERA was established in response to the disproportionate environmental burdens faced by African American communities in the region (Heaney et al., 2011). The organization employs a community-owned and -managed research model to address issues such as inadequate infrastructure, water contamination, and industrial pollution. Through partnerships with local schools, WERA has integrated environmental justice education into the curriculum, empowering students to participate in community-based research and advocacy efforts. This collaborative approach has led to significant improvements in local environmental conditions and increased community awareness and engagement.

Case Study 2: The Detroit Hispanic Development Corporation (DHDC) In Detroit, Michigan, the Detroit Hispanic Development Corporation (DHDC) has been instrumental in addressing environmental justice issues affecting Latino communities. DHDC focuses on reducing exposure to industrial pollutants and improving air quality in heavily industrialized areas (Taylor, 2014). The organization works closely with local schools to educate students about environmental health risks and to involve them in advocacy efforts. DHDC's initiatives include environmental health workshops, community clean-up events, and campaigns to pressure policymakers for stricter environmental regulations. These efforts have not only raised awareness but also empowered students and community members to advocate for their right to a healthy environment.

Case Study 3: The Duwamish River Cleanup Coalition (DRCC) The Duwamish River Cleanup Coalition (DRCC) in Seattle, Washington, is dedicated to addressing the pollution and environmental degradation of the Duwamish River, which runs through several low-income and minority communities. DRCC collaborates with local schools to integrate environmental justice into science and social studies curricula (Fry, 2020). Students participate in hands-on learning activities, such as water quality testing and habitat restoration projects, which enhance their understanding of local environmental issues. The coalition also organizes community forums and workshops to engage residents in the cleanup process and advocate for comprehensive remediation efforts. Through these initiatives, DRCC has successfully mobilized community support and secured funding for large-scale environmental restoration projects.

Case Study 4: The Children's Environmental Health Initiative (CEHI) The Children's Environmental Health Initiative (CEHI) based at the University of Michigan focuses on addressing environmental health disparities affecting children in vulnerable communities. CEHI works with schools and community organizations to provide educational programs that teach students about environmental health risks and empower them to take action (Brumberg et al., 2021). One of CEHI's notable projects involves using geographic information systems (GIS) to map environmental hazards and their impacts on children's health. This data-driven approach helps communities identify high-risk areas and advocate for targeted interventions. CEHI's collaboration with schools ensures that environmental education is grounded in local context and directly relevant to students' lives.

Lessons Learned from Case Studies These case studies underscore the importance of community engagement, education, and advocacy in addressing environmental justice issues. Key lessons learned include:

- **Community Ownership:** Successful environmental justice initiatives often involve strong community ownership and participation. Engaging residents in research, decision-making, and advocacy fosters a sense of empowerment and accountability.
- **Education Integration:** Integrating environmental justice education into school curricula enhances students' understanding of local issues and prepares them to be informed advocates.

Hands-on learning activities and real-world applications make education more relevant and impactful.

- **Collaborative Partnerships:** Partnerships between schools, community organizations, and government agencies are crucial for addressing complex environmental challenges. These collaborations leverage diverse resources and expertise to achieve common goals.
- **Data-Driven Advocacy:** Using data to identify environmental hazards and their impacts helps communities make informed decisions and advocate for effective interventions. Tools like GIS provide valuable insights into spatial patterns of pollution and health outcomes.

Environmental justice is an imperative that transcends the boundaries of race, socioeconomic status, and geography, demanding a comprehensive and inclusive approach to ensure equitable environmental health outcomes for all communities. The intersection of environmental justice and education highlights the critical role that educational institutions play in raising awareness, fostering critical thinking, and empowering communities to advocate for their rights.

This review has underscored the profound impacts of environmental racism and socioeconomic disparities on marginalized communities, emphasizing the urgent need for targeted interventions. Through the examination of case studies, it is evident that community engagement, participatory pedagogies, and policy advocacy are essential components of effective environmental justice initiatives. Schools, as central hubs within communities, are uniquely positioned to lead these efforts, leveraging their resources and relationships to drive meaningful change.

The integration of environmental justice into educational curricula not only equips students with the knowledge and skills to understand and address environmental issues but also instills a sense of social responsibility and civic engagement. By fostering partnerships with local organizations, government agencies, and community groups, schools can amplify their impact, creating a collaborative framework for sustainable and equitable environmental health outcomes.

Recommendations

1. **Integrate Environmental Justice into Educational Curricula**
   - Educational institutions should incorporate environmental justice topics into science, social studies, and health curricula, emphasizing the links between environmental health and social equity. This integration will raise awareness among students and empower them to become informed advocates for their communities.
2. **Promote Community Engagement and Participatory Pedagogies**
   - Schools should adopt participatory pedagogies that involve students in hands-on learning activities related to environmental justice. Community-based projects, such as water quality testing and habitat restoration, provide practical experiences that enhance students' understanding and engagement.
3. **Foster Collaborative Partnerships**
   - Educational institutions should build and strengthen partnerships with local organizations, government agencies, and community groups. These collaborations can facilitate the sharing of resources, expertise, and strategies, creating a unified approach to addressing environmental justice issues.
4. **Advocate for Policy Changes**
   - Schools and educational leaders should actively advocate for policies that protect vulnerable communities from environmental hazards. This includes pushing for stricter

regulations on industrial emissions, better waste management practices, and comprehensive health and safety assessments for new developments.

5. **Utilize Data-Driven Approaches**
   - Implementing data-driven approaches, such as geographic information systems (GIS), can help identify high-risk areas and target interventions more effectively. Schools can partner with academic and research institutions to collect and analyze data, providing a strong evidence base for advocacy efforts.

6. **Support Professional Development for Educators**
   - Providing professional development opportunities for educators on environmental justice topics can enhance their ability to teach these subjects effectively. Training programs should focus on building educators' knowledge and skills to integrate environmental justice into their teaching practices.

7. **Engage Students in Advocacy and Civic Engagement**
   - Encouraging students to participate in advocacy and civic engagement activities related to environmental justice can help build a new generation of leaders committed to social and environmental equity. Schools can facilitate student involvement in local government meetings, environmental campaigns, and community organizing efforts.

By implementing these recommendations, educational institutions can play a pivotal role in advancing environmental justice and creating healthier, more equitable communities. The collective efforts of educators, students, and community members are essential for addressing the complex and interrelated challenges of environmental health disparities and achieving sustainable change.

Turkey-Specific Recommendations
1. **Incorporate Environmental Justice into National Education Standards**
   - The Ministry of National Education (MEB) should incorporate environmental justice topics into national education standards, ensuring that all students receive education on environmental health, sustainability, and social equity.

2. **Promote Local Community Engagement**
   - Schools should work with local municipalities, environmental organizations, and community groups to engage in local environmental projects. This can include initiatives such as cleaning up local parks, monitoring air and water quality, and advocating for cleaner industrial practices.

3. **Develop Green School Programs**
   - Establishing green school programs that focus on sustainable practices, such as energy efficiency, waste reduction, and the use of renewable resources, can serve as practical examples for students and communities. These programs can also include educational components that teach students about the importance of environmental stewardship.

4. **Support Research and Data Collection**
   - Universities and research institutions should be encouraged to conduct research on environmental justice issues specific to Turkey. This research can inform policy decisions and help target interventions to areas most in need.

5. **Enhance Public Awareness Campaigns**
   - National and local governments should run public awareness campaigns to educate citizens about environmental justice issues and the importance of environmental protection. These campaigns can leverage media, social media, and community events to reach a broad audience.

6. **Strengthen Legal Frameworks and Enforcement**
   o Strengthening environmental laws and ensuring their enforcement is crucial. This includes stricter regulations on industrial emissions, improved waste management systems, and rigorous environmental impact assessments for new developments.
7. **Empower Vulnerable Communities**
   o Special attention should be given to empowering vulnerable communities through education, access to resources, and participation in decision-making processes. This can involve providing grants and support for community-led environmental projects and initiatives.

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