

# Engineering Education and Indian Students' Perception on Environment and Sustainable Development: A Comprehensive Study and Analysis

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**Abstract**—Environmental issues and sustainable development are becoming increasingly vital topics in today's global context, necessitating a thorough understanding of public perceptions and attitudes towards these critical concerns. This conference paper presents a comprehensive survey report and analysis that investigates students' perceptions of environmental issues and sustainable development. The study aimed to assess the awareness, knowledge, and attitudes of students, who are pivotal stakeholders in fostering sustainable practices and shaping the future. To accomplish this, a structured questionnaire was designed and distributed among a diverse sample of students from multi-disciplinary engineering students hailing from urban localities across Tamil Nadu state in India. The survey for data collection comprised a range of questions covering multiple dimensions, including environmental awareness, knowledge of sustainable development principles and personal behaviors. It was an online poll (n=36) including NEP (New Ecological Paradigm) scales as well as self-reported behavior assessments. The results of the survey revealed valuable insights into student views on environmental and sustainability concerns. The findings indicated a moderate to high level of awareness among the surveyed students, with varying degrees of knowledge and attitudes toward sustainable practices. Moreover, the analysis shed light on the factors influencing the perspectives of students, including educational background, environmental education and awareness, personal experiences, locus of control and environmental responsibility and exposure to environmental initiatives. By fostering a deeper understanding of the viewpoint of students, this study aims to contribute to the broader goal of creating environmentally conscious and responsible citizens, capable of addressing the complex challenges facing our planet.

**Keywords**—sustainability, awareness, environment, perception, education,

## I. INTRODUCTION

Recent years have seen a rise in the importance of sustainable development as a worldwide issue, making it imperative to comprehend how pupils view this important subject in order to create a sustainable future. Students' perceptions of sustainable development take into account their knowledge, attitudes, and behaviors related to environmental, social, and economic challenges. Students are essential to bringing about change and building a sustainable future because they are the next generation. This paper

investigates the many viewpoints held by students toward sustainable development and emphasizes the significance of creating a thorough comprehension of its guiding principles.

One aspect impacting how students view sustainable development is their level of awareness. The compelling need to address social inequality, climate change, and environmental deterioration is becoming increasingly apparent to today's youth. They are exposed to knowledge through a range of mediums, including social media, educational institutions, and activist movements. This raised consciousness motivates students to research solutions and participate in initiatives that advance sustainability. They have different views on sustainable development. While few demonstrate some degree of neglect, others completely embrace the concept of sustainability. Positive attitudes towards sustainability are largely rooted in an understanding of how social, economic, and environmental challenges are interconnected and the importance of balancing them for long-term well-being.

Students' understanding of sustainable development extends beyond just their academic understanding to include their activities and behaviors. Many students participate actively in sustainability-related community projects like recycling programmes, neighborhood initiatives, and advocacy campaigns. They are aware that little, individual activities add up to greater, beneficial effects over time. Students show their dedication to fostering a better world for themselves and future generations by making strides toward sustainability.

The way that students view sustainable development has a significant impact on how policies, educational programmes and social norms are developed. Their voices and deeds have the power to alter cultural perceptions of sustainability and bring about the adjustments that are required. Through the inclusion of pertinent themes in their curricula, the provision of chances for experiential learning, and the encouragement of critical thinking, educational institutions play a crucial role in fostering students' perceptions of sustainable development. We can raise a generation that embraces and lead the shift toward a sustainable future by providing students with the information and skills necessary for sustainable living.

The Agenda for Sustainable Development, also known as the Sustainable Development Goals (SDGs), is a comprehensive and universal plan of action adopted by the United Nations in 2015. The agenda consists of 17 interlinked goals and 169 targets aimed at addressing global challenges and achieving sustainable development by the year 2030. The SDGs cover a wide range of areas, including poverty eradication, quality education, gender equality, clean energy, sustainable cities, climate action, and more. In response to growing worries about the negative effects of economic expansion on the environment and society, the idea of sustainable development first came into being in the late 20th century. After the United Nations World Commission on Environment and Development's 1987 Brundtland Report, commonly known as "Our Common Future," was released. According to the paper, sustainable development is defined as addressing current demands without sacrificing the capacity of future generations to address their own needs.

The history of sustainable development also includes several international agreements, including the Convention on Biological Diversity, the Paris Agreement, and the Kyoto Protocol on climate change, among others. These accords serve as a reminder of the value of group efforts and international collaboration in resolving environmental and social problems. Hart and Nolan (1999) concluded about the vitality of future environmental education research must systematically examine the myths that underlie our thought and practice in education systems [1]. They specifically contend that environmental education research needs to start addressing important issues, that is forming relationships with Institutions and communities. The long-term viability of environmental policy depends on environmental education and training since they are the only ways to mobilize an informed and responsible populace and secure the personnel required for practical action [2].

In this study, university students in India, a developing nation, were asked about their current environmental perception trends. Although there have been many studies on how people perceive the environment on a worldwide scale, relatively few have been conducted in developing nations like India, and even fewer specifically in Tamil Nādu. Tamil Nādu, the sixth most populous state in India and the most urbanized state in India (49%) according to the 2011 census, offers a suitable setting for understanding sustainability trends among an urbanized population. The findings from this study can be used to analyze other metropolitan areas. Students from 358 different schools took part in the poll.

The remaining sections of the paper are structured as follows. The theoretical foundation of the experimental setup is covered in Section 2. The survey technique is included in Section 3 along with a detailed account of the participants and the precise way by which the experiment was carried out. The results and analysis of the information gathered via the questionnaire are presented in Section 4. In section 5, conclusions are taken and the potential for additional research in this area is outlined.

## II. LITERATURE REVIEW

Bandar Alkhayyal et al. [3] conducted a study on sustainability implementation at a specific university in Saudi

Arabia. This study aims to assess the degree of awareness among university students in Saudi Arabia's Eastern Province. The majority of studies were only done on the campuses of the universities; Despite being done across 7 universities and in two languages (Arabic and English), only 500 respondents' data were analyzed. It is recommended that institutions should adopt a suitable strategy, such as creating a sustainability purpose at the institutional or departmental level, to raise awareness and facilitate the integration of sustainability concepts across multiple universities. The shortfall of this study is only four of the questionnaire's questions were chosen to be quantitative and the rest were qualitative. The multidisciplinary questionnaire approach touching upon all aspects was not covered in the survey. Above all, the study concentrated on how education may improve students' sustainability literacy and have an impact on their sustainable behaviors. Though Other factors such as social media, society and others might as well have an effect on the wisdom and conduct of students. According to Chawla and Cushing, [4] the statement made by Hungerford and Volk (1990) that environmental educators often believe that imparting knowledge alone leads to responsible action was contradicted by their research. Their article is a summary of studies that explains the many intricate elements that affect and motivate young people to take pro-environmental action. It implies that encouraging environmental action requires more than just knowledge and that other factors are crucial.

Dalia Khalil et al., conducted a study at Heliopolis University with 26 freshman students from several faculties [5]. There was little prior awareness of sustainable development (SD) among students at the start. Students' opinions of SD were good after the first semester, with an emphasis on its significance for the future and its integration with other facets of life. Students understood the value of SD despite their initial lack of comprehension, and they spread the idea to others even though some encountered opposition. And a few additional well-known works and publications elaborated on the concept of comprehending the thoughts of the students on SD to advance in achieving its objectives. The exploratory nature of this study's methodology is a drawback, although it may be improved if a definitive design based on hypothesis were used to hone the findings. And the database of Heliopolis University for Sustainable Development served as the sample frame for this study, which included just 26 freshman students divided among four departments—the faculties of engineering, business and economics, and pharmacy, which each included ten, four, and twelve students, respectively. The sample size was too small for a precise qualitative study because it only represented 26% of the overall HU population.

Existing studies revealed the environmental attitudes and behaviors that have been the subject of research for many years. The study of our research comprehends and elucidates the knowledge, comprehension, and concern of the students about the issues affecting the environment today. The study's novelty is shown by the fact that this is one of the few works to have been produced in the Tamil Nadu geographical area with a considerably large sample of 736. The questionnaire was set taking into account several aspects other than education, affecting perception on Sustainable development, A multidisciplinary approach was followed comprising of

equal portions of quantitative and qualitative questions. Besides, data was collected from universities located at several different localities within Tamil Nadu to take into account the effect a locality has on their perception of Sustainable development Foundations, knowledge, personal assets, and integrative assets should be the primary objective of sustainability in higher education [6]. A study dated 2019 examines the ideologies and awareness amongst university faculties in sustainable development in Tamil Nadu. Another study to investigate the level of awareness among secondary school students in the Papumpare district of Arunachal Pradesh [7] concluded that Only 4.5% of respondents had an excellent understanding of the SDGs, and only 55.84% of respondents were aware of the SDGs at all. This study examines the current generation of students' knowledge and integrative skills, including constructivism and holistic thinking.

### III. METHODOLOGY

The methodology adopted to study the perception of the environment and sustainable development among Indian Engineering students is discussed briefly in this section.

#### A. Participants

As mentioned earlier the study was carried out among the students of various engineering colleges across various localities of Tamil Nadu State, India. Several attempts to address the issues of sustainability were made in various institutions across the state. For example, regular campus clean-ups were arranged by the volunteers on campus heading towards a clean and green campus, The Engineering Syllabus Regulation 2021 by Tamil Nadu state curriculum contains one required non-credit course on environmental science and one elective course in chemical engineering on sustainability goals. All courses in all programmes are examined for their coverage of the Sustainable Development Goals and stated in the curriculum, even though there is only one distinct elective course on sustainability as recommended by Academic Council experts.

Respondents of the current study comprised a total of 736 students. Among them, 386 of the participants were first-year students, 221 were second year, 102 were third year and 27 were fourth-year students. The following departments of engineering participated in the study- Computer Science Engineering, Information Technology, Electronics and Communication Engineering, Electrical and Electronics Engineering, Chemical Engineering, Biomedical Engineering and Mechanical Engineering.

#### B. Instrument and evaluation procedure

- The questionnaire had been altered by considering a number of factors, including the demographical region, existing policies and environmental activities. Experts in the field of environmental engineering reviewed the customized version of the questionnaire to determine its reliability and validity and awarded an item objective congruence score of 0.7. Everyone was questioned on whether the items related to the questionnaire's objective. They provided feedback, and changes were made in response.

- Through departmental visits, the study was completed over the 2022–2023 academic year. The participants were asked to complete the questionnaire after a brief explanation of the study's objectives. They were told to carefully consider each question and select the one that, in their opinion, best answered the question. It took the pupils roughly 25 minutes to complete the questionnaire. Similarly, the questionnaire was shared to fellow engineering students and other engineering institutions in the cities of Tamil Nadu via email, and their responses were recorded.

### IV. RESULTS AND DISCUSSION

The result analysis was resolved into three domains i.e., understanding of current environmental challenges, awareness of sustainable development goals, and behavioral patterns in accordance with nature.

#### A. Understanding of Current Environment Challenges

The first set of questions was constructed such that it was possible to determine the student's knowledge of and opinions about contemporary environmental problems. It contains questions (n=10) that are meant to assist in determining students' baseline level of environmental alertness. The first inquiry examined the level of concern among children regarding their surroundings, and the findings indicate that out of the respondents, only 36.6% expressed an extreme level of concern, indicating a deep sense of care for the environment. However, the majority, comprising 56.5%, reported a moderate level of concern. This suggests that a significant portion of children surveyed did not exhibit high levels of concern for their immediate environment. The study also explored the environmental issues that were most concerning to the students. Global warming and climate change emerged as the top concern, followed by deforestation and habitat loss. This highlights the students' understanding of the pressing challenges facing the planet and their recognition of the need for immediate action to address these issues.

Despite their awareness of environmental problems, the report revealed that only 22.4% of respondents felt optimistic about the future of the globe. This sentiment may stem from the overwhelming scale of the challenges and the urgency required to address them effectively. It also indicates that there is a need for initiatives that instill hope and empower young individuals to actively contribute to positive change. Furthermore, the findings indicated a lack of awareness among the students about environmental rules and regulations. While they may have heard about some policies, a majority of respondents admitted uncertainty about their operation and structure. This highlights a gap in environmental education and the need for enhanced efforts to educate students about environmental policies and their implementation. The findings also emphasized the need to improve environmental education and awareness regarding environmental rules and regulations. By addressing these gaps, it is possible to empower children to become active participants in creating a sustainable future. Fig. 1 show comparability of survey responses between male and female students across disciplines. Based on the study, it can be concluded that females' students (94.66%) possessed a slightly higher environmental awareness in comparison to

males (92.83%) by a meagre 1.83%, the results are in agreement with a study that states that women were more likely than men to engage in sustainable behaviors and showcased better environmental attitudes as a result of personality differences in conscientiousness. Also, students pursuing Chemical Engineering showed greater concern for environmental issues and sustainability activities, which is as expected due to their syllabus integrity with the environment. Following it, departments of computer science engineering and mechanical engineering were found to be more acquainted than the other departments based on a review of the diverse departments' understanding patterns from Fig. 2.

Another conclusion that can be drawn from Fig.3 is that students pursuing final year of undergraduate studies have a greater awareness and understanding of Sustainability and the vitality of implementing this strategy in the current scenario despite the fact that not many came forward to register their responses. Though they have a greater degree of understanding about this concept, they lacked enthusiasm to even fill out the responses.

*B. Awareness on sustainable development goals*

Sustainable development is to achieve a balance between social advancement, economic expansion, and environmental preservation for both current and future generations. The term "sustainability" is significant in several ways. Whole ecosystems are in danger because of the frightening rate at which species are becoming extinct. The extent to which we can acknowledge its limitations as an organizing notion, however, will determine how useful it continues to be from an educational standpoint. A sustainability-focused agenda might run into at least two possible force fields [8-10].

The second part of our survey aimed at assessing the extent to which the crowd understood the sustainability objectives. The majority of those polled (80.4%) knew what sustainable development was in general terms. The research revealed that the participants had a firm knowledge of sustainability's foundational ideas. According to 22.7% of people, sustainable development is a utopian goal that will never be completely implemented. But a significant portion of the people think it's a realizable objective that demands cooperation and dedication. According to Alshuwaikhat et al., colleges are possibly comparable to small cities that have

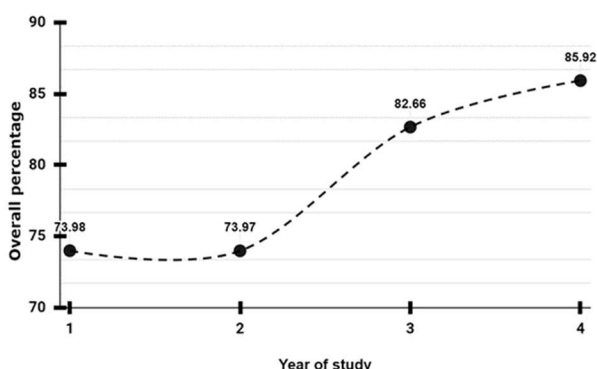


Fig. 3. Environmental awareness among I, II, III & IV years of UG Study

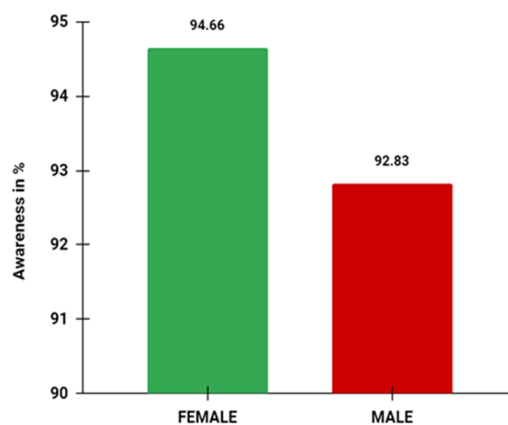


Fig. 1. Environmental awareness among male and female respondents.

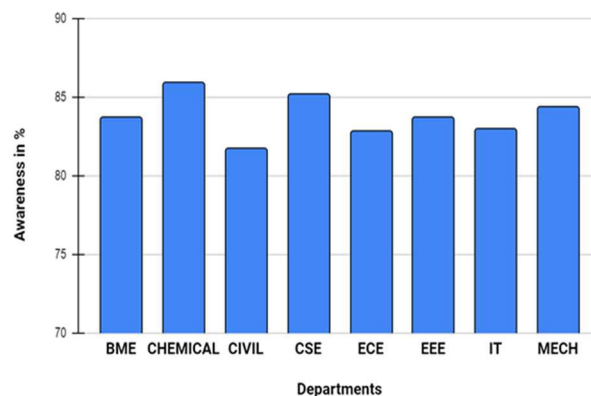


Fig. 2. Degree of expertise in each disciplinary unit

an effect on their surrounding either directly or indirectly because of their operation, population, and services they provide to the local community [11]. In a business setting, guaranteeing fair and ethical labor practices is necessary, according to the students' progressive responses (29.8%), while others say they contribute by taking part in social and community development activities (11.9%) rather than by ensuring fair and ethical labour practices (9.4%). However, the majority of those polled (48.9%) said they were determined to use all three in their company's operations.

From Fig. 4 it is inferred that students perceive that society's main obstacle in achieving sustainable goals is the prevalence of short-term thinking and a focus on immediate gains (39.6%). This mindset neglects the long-term consequences of actions, hindering efforts to address sustainability challenges like climate change and resource depletion. Prioritizing short-term goals leads to the exploitation of resources, environmental degradation, and neglect of future generations. To overcome this obstacle, a shift is needed towards sustainable practices that consider long-term consequences. This requires awareness, education, and promoting a culture that values future well-being. By embracing sustainability and long-term planning, society can work towards a resilient and equitable future.

*C. Behavioral patterns in accordance with nature*

To assess a person's connection to nature and their locus of control, we utilized two measures: the aggregate New

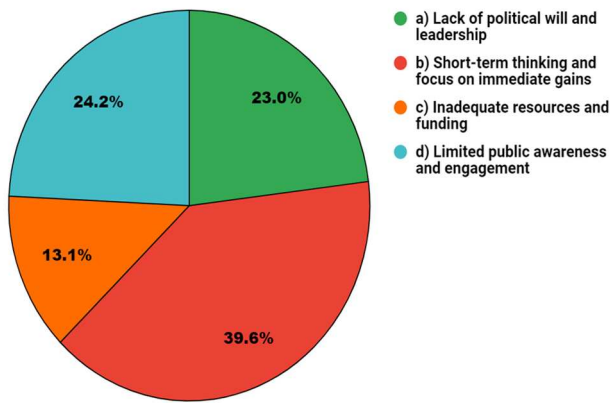


Fig. 4. Obstacles in achieving Sustainable Development

Ecological Paradigm (NEP) scores and the Hierarchy with Nature (HWN) scale. The NEP scores provide an overall measure of a person's ecological worldview, indicating their beliefs and attitudes towards the environment. The HWN scale specifically measures the extent to which individuals incorporate nature into their self-concept or cognitive representation of themselves [12]. This scale helps determine the level of importance individuals place on nature in their lives and their sense of identity.

Additionally, the locus of control refers to the perceived control individuals believe they have over events and outcomes in their lives [13]. This section is a set of 10 questions to determine the locus of control for the student population and its connection to nature. These questions likely assessed factors such as personal responsibility, belief in external forces, or the influence of social and environmental factors on their lives. Each option was awarded points. The degree to which the responses corresponded to natural traits determined how many points they received. The population graph shown in Fig. 5 demonstrates students' current ties to nature.

The centrality of nature and the self was evaluated using the HWN scale. The responses are then examined to ascertain the degree of attachment people have to the natural world. Fig. 6, depicts the percentage distribution of the scale values. This pie chart shows that students generally have an equal

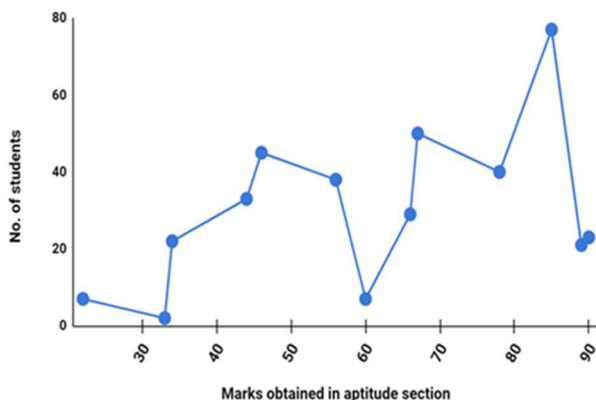


Fig. 5. Students' cognitive processes regarding coexistence with nature

perspective towards nature, meaning they take into account both their personal interests and the welfare of the environment. However, 13% of respondents continue to be more concerned with themselves than with the effects their activities would have on the environment. When individuals prioritize their personal interests over the environment, it can lead to unsustainable practices, ecological damage, and hinder progress towards sustainability goals. Promoting awareness, education, and a shift in mindset is crucial to mitigate these consequences. To overcome individuals prioritizing personal interests over the environment, strategies include environmental education, effective communication, incentives for sustainable behavior, policy enforcement, collaboration, fostering empathy for nature, and promoting long-term thinking and planning.

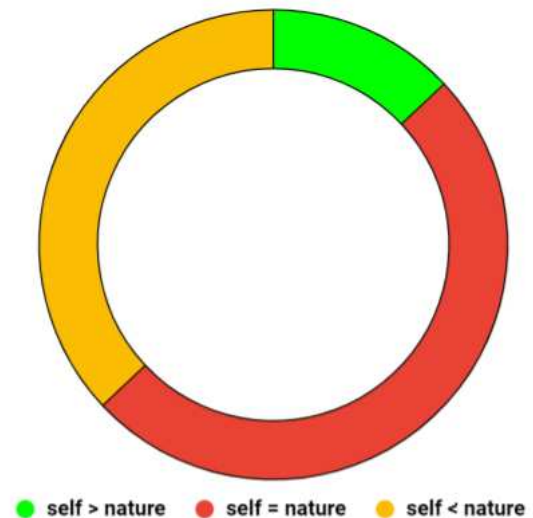


Fig. 5. The HWN scale distribution

## V. CONCLUSION

The results obtained from the questionnaire were analyzed across three major segments including,

1). *Understanding and concern for Environmental issues:* Out of the 736 participants, only 36.6% expressed an extreme level of concern, indicating a deep sense of affinity towards storing out environmental issues. However, the majority, comprising 56.5%, reported a moderate level of concern. This is an indicator of the current mindset, that majority of the undergraduate students fail to take trouble in resolving environmental conflicts. Also, the analysis of the responses indicated a lack of awareness among the students about environmental rules and regulations. A significant proportion of the respondents admitted uncertainty about the operation and harmonization of environmental rules, pacts, declarations, etc.

2). *Awareness of sustainable development goals:* To change the default, adjust the template as follows. The second half of our survey aimed at assessing the extent to which the students comprehend the term sustainability and realized its objectives. The majority of those polled (80.4%) knew what sustainable development was in general terms. The research revealed that the participants had a firm knowledge of

sustainability's foundational ideas however they lacked a depth understanding of sustainability.

3) *Behavioral patterns*: The population was assessed on factors such as personal responsibility, belief in external forces, or the influence of social and environmental factors on their lives, influencing their relatedness to nature. Also, it was concluded that students generally have an equal perspective toward nature, meaning they consider both their personal interests and the welfare of the environment. However, 13% of respondents continue to be more concerned with themselves than with the effects their activities would have on the environment. Prioritizing their self over nature leads to several environmental causes for concern.

Despite the fact that this study is one of its kind, undertaken in Tamil Nadu assessing the perception of undergraduate students on the concept of Sustainability. Our study showed 77 % awareness on SDGs.

### REFLECTIONS

What do the results of this study suggest for future research in India?

It offers means of integrating the concept of sustainable development into universities. Although the students have no prior knowledge of sustainable development issues, they appear to be motivated to protect natural resources. They have changed their lifestyle and realized the importance of individual responsibility to protect natural resources for future generations. This urge to protect the environment should be fueled in the right direction by means of appropriate awareness and sustainable education programmes. The need to act immediately must be realized through education and suitable action must be taken in accordance. Education must inculcate the right sense of environment through well-trained faculty who take the subject seriously. Right understanding in this area is pivotal to fostering innovation in this domain. And engineering graduates especially, having the potential to revolutionize society must take this matter into serious consideration and offer probable solutions.

To sum up, though the common notion is good for the environment, society exists amongst the mindset of youngsters they put themselves first. Their needs, ambitions are put first and attended to even with the environment at stake. Their priority in life is to earn good pay and settle down in life, concern for nature comes only next. Confining education within the four walls of the classroom has led to such a mindset, a practical-oriented study that otherwise would have instilled within them reality, and the need to show

concern. There is a gap in the engineering education curriculum that needs to be bridged to inculcate the habit of conserving the environment for coming generations.

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