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# Exploring Teachers' Perceptions and Practices in Education for Sustainable Development (ESD) in Public Schools of Karachi

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**ABSTRACT**

The research focuses on the key role of teachers in incorporating SDGs into the curriculum and teaching students to deal with global challenges such as climate change, poverty, and sustainable living. Utilizing a quantitative approach, data were collected from a sample of 100 teachers using a survey method. This research focused on the integration of ESD, the challenges faced by the teachers, and the effect of professional development programs (PDPs) to make the teachers capable of working towards sustainability. The data analysis was done by performing one-sample T-tests to find out the teachers' beliefs and attitudes towards the integration of ESD and Chi-square tests to explore the relationship of the perceived barriers or facilitators and the ESD integration. Correlation analysis showed strong associations between age and ESD understanding being among the key findings. The results showed that teachers have a good grasp of the core ESD concepts and, moreover, they expressed the assurance in the integration of sustainability principles into their teachings. The study demonstrates the key role that teachers play in dynamic the growth of a sustainable development and emphasizes the point that teachers should be given access to the necessary knowledge, skills, and resources so as to create a more sustainable future for the learners and community. Recommendations include ESD to be integrated into the curriculum, professional development programs for teachers, funding provision to facilitate ESD initiatives, encouraging the community to be involved in the process, and advocating for supportive policies from the government. Future research might focus on the long term impact of ESD integration on student achievements, and develop innovative strategies for overcoming the obstacles to the successful implementation of sustainable development programs in public schools.



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## 1. Introduction

The transformative educational landscape highlights the essential role of Education for Sustainable Development. ESD is to educate and provide learners with the required information and competence to address environmental, economic, and social sustainability concerns. The position of teachers is vital in this regard, as they are the ones who play a significant role in the implementation of education for sustainable development (ESD) principles in the curriculum. On the other hand, not a lot of studies have been done on PDPs in providing teachers, especially those in public schools of Karachi, with the skills to apply these principles. The landscape of global education is changing and has made us realize the

significance of Education for Sustainable Development (ESD) which mainly encompasses environmental, economic, and social sustainability issues (Buriro, Mirjat, Pathan, Chandio, Lashari, & Gul, 2023; Bushra, Lashari, Khan, & Pervaiz, 2024; Mooman, Ali, & Lashari, 2023). The purpose of this research is to investigate the role of educators in incorporating ESD in schools located in Karachi, particularly to examine the effect of Professional Development Programs (PDPs). Teachers are essential in this process, as they do not just provide a traditional type of teaching but create a sustainable learning environment that will produce tomorrow's reliable citizens (Buriro et al., 2023). The recognition of the importance of this, professional development programs (PDPs) has been earmarked as the main approach of training educators with the skills, knowledge, and attitudes for the effective integration of ESD into their teaching practices (Bushra et al., 2024). Baroudi (2023), underlines the shift towards modernizing PDPs to include practical, hands-on opportunities that enable educators to reflect upon and apply their acquired knowledge, fostering a classroom and learning environment conducive to sustainability (Salman, Rahat, Niazi, & Lashari, 2023). However, the transition from potential to actual impact on teaching practices Sand, subsequently, student learning outcomes, particularly within the milieu of public schools (Baroudi, 2023; Liu & Phelps, 2020). By challenges such as the ephemeral nature of program effects on teacher knowledge, a lack of supportive government policies, a scarcity of qualified personnel and training opportunities Dahri, Vighio, Al-Rahmi, and Alismaiel (2022), and the pressing need for sustainable, continuous professional development approaches, especially in the digital era catalyzed by the COVID-19 pandemic (Dahri et al., 2022; Lashari, Abbasi, Kurd, Mirjat, Mehmood, & Ahmad, 2023). Despite the acknowledged importance of empowering teachers through PDPs in ESD, a notable research gap persists in measuring the direct impact of these programs on teachers' abilities to act as change agents for sustainable development within public schools (Suhag, Lashari, Malik, & Memon, 2017). Teachers have a sense of responsibility, critical thinking, and global citizenship among students, thereby contributing to a more sustainable and equitable society.

The variability in program effectiveness related to characteristics such as duration, content, and delivery method, alongside the sustained application of learned practices in classroom settings, necessitates further exploration (Baroudi, 2023; Dahri et al., 2022; Liu & Phelps, 2020). Compounding this issue is the overarching challenge within the educational sector in Karachi and across Pakistan, the integration of sustainability principles into educational policies, curricula, and teacher training programs remains limited (Bushra et al., 2024).In addition, the work of Kalsoom, Qureshi, and Khanam (2019) on teacher education documents in Pakistan has shown that ESD is only partially focused on, and only 5% of the B.Ed. the program deals with it. Curriculum focusing on sustainability. This lack of ESD in teacher education not only highlights an urgent need for mainstreaming but also emphasizes the importance of training new teachers in order to give them the tools to promote sustainability-oriented thinking among the students. Furthermore, the works by Qadri and Pasha (2021) focused on self-directed learning skills at the university level and Yousafzai et al. (2020) who investigated the use of predictive analytics for student performance using machine learning and data mining exposed a technological and methodological gap in the education practice. Each of these studies contributes to the awareness of the necessity of addressing the problem of integrating sustainability in education and the adaptation of modern educational technologies and methods to make the process of aligning the educational system of Pakistan with the global sustainability goals more effective (Bushra et al., 2024; Salman et al., 2023; Siming, Asad, & Lashari, 2015). The research is aimed at identifying the differences between the anticipated benefits and the actual outcomes regarding PDPs in transforming teaching methods and students' achievements in one of the most complicated education systems in Karachi. Despite the well-known fact that meaningful and effective PDPs are essential, there is a lack of empirical data showing their direct impact on outcomes, especially in cases where resources are limited, and where there is no adequate policy support. To complete this gap in the research, this study will critically investigate the impact of PDPs on the power of teachers to be change agents for sustainable development. The study seeks to fill the gaps in our knowledge by harmonizing on the investigation which would help in understanding the practical hurdles and opportunities that govern the efficacy of PDPs in creating a learning atmosphere that is encouraging to sustainability.

### 1.1. Research Objectives

1. To assess the knowledge and insights of teachers about the educational Sustainable Development (ESD) principles.
2. To evaluate teachers' attitudes and perspectives towards ESD in the curriculum and a teacher's position in its implementation.
3. To identify perceived barriers and facilitators to integrating ESD into teaching practices among teachers in public schools.

### 1.2. Research Questions

1. What is the current level of knowledge and understanding among teachers in public schools regarding ESD principles?
2. What are the attitudes and perceptions of teachers in public schools towards the importance of ESD in the curriculum and their role in its delivery?
3. What are the perceived barriers and facilitators to integrating ESD into teaching practices as identified by teachers in public schools?

### 1.3. Research Hypotheses

Ho1: Teachers in public schools do not possess a significant level of knowledge and understanding regarding ESD principles.
Ho2: There is no significant positive attitude or perception among teachers in public schools towards the importance of ESD in the curriculum and their role in its delivery.
Ho3: There are no significant perceived barriers or facilitators identified by teachers in public schools that impact the integration of ESD into their teaching practices.

## 2. Literature Review

Empowering teachers in public schools as change agents through professional development programs for bridging sustainable development is crucial. The literature presents a variety of strategies and approaches, emphasizing the significance of comprehensive professional development in enhancing teachers' capabilities to act as facilitators of sustainable development. The lack of practices and knowledge of Education for Sustainable Development (ESD) among public school teachers in Karachi can be attributed to various factors such as teachers in government primary schools perceive themselves as professionals despite educational reforms, indicating a potential misalignment between self-perception and the requirements for integrating ESD effectively (Fayyaz, Lashari, Channar, Chang, Bano, & Buriro, 2023). Such self-concept may possibly hinder the adoption of new teaching methods and topics such as ESD (Fayyaz, Lashari, Rafiq, & Jabeen, 2023; Rizvi & Elliot, 2005). These self-images could prevent the integration of new teaching approaches, concepts, and ESD (Fayyaz, Lashari, Nandwani, & Chang, 2023; Rizvi & Elliot, 2005). The efficacy of teacher training interventions shows, however, that teachers' knowledge and self-efficacy can be improved through structured professional development programs. Nevertheless, this area is not enough researched in Pakistan which emphasizes a void in the training of teachers on ESD (Imran, Rahman, Chaudhry, & Asif, 2018). Studies showed that student teachers had inadequate environmental knowledge, which was believed to be one of the reasons they did not behave in a pro-environmental way (Buriro et al., 2023). This educational deficit of future teachers in environmental knowledge can lead to the inappropriate application and integration of ESD into their teaching methods (Buriro et al., 2023; Esa, 2010). Anand (2015) examines the Quebec regional initiative in Canada for the incorporation of sustainable development in higher education. The study reveals that training of teachers and pedagogical techniques play a key role in knowledge transfer for sustainability.Imara (2021) give a summary of incorporating ESD competencies into teacher education, which shows the success and the issues in the latter's mainstreaming. It highlights a gap in the development of a unified framework for ESD competencies in teacher education. They list down the fundamental competencies and evaluation tools that can be used to reorient teacher education to sustainability. This research points to the necessity for a single model of ESD competencies as a requirement in teacher training. Brandt, Barth, Hale, and Merritt (2022) highlighted the importance of equipping teachers with the competencies to lead societal transformation towards sustainability. Sustainable development is highly relevant in today's world, and education plays a critical role in promoting sustainability. Exploring how teachers can be empowered to facilitate sustainable development aligns with global efforts to address environmental, social, and economic challenges (Salman et al., 2023). Understanding effective

strategies for empowering teachers as change agents can inform the development of professional development programs and policies aimed at enhancing sustainability education in public schools (Bushra et al., 2024).

The research focuses on the specific context of public schools in Karachi and examining the effectiveness of professional development programs in empowering teachers for sustainable development. Their study on ESD-specific professional action competence in teacher education programs shows the critical role of personal, professional, social, and structural connections in achieving intended learning outcomes (Brandt et al., 2022). Jollands, Stupans, and O'Connell (2022) propose a conceptual framework for sustainable change in teaching and learning, emphasizing collaboration between change managers and stakeholders, systematic consideration of variables, and the selection of effective change strategies (Fayyaz, Lashari, Channar, et al., 2023). Baroudi (2023) explores the impact of sustainable PDs on teachers' assessment practices, professional growth, and leadership skills, demonstrating the potential of hands-on opportunities in modernizing PDs for sustainable education reform. Raman (2022) Preparing pre-service teachers for integration of education for sustainable development in school. They explores global trends and various strategies for integrating ESD into teacher education across different countries. Flores (2023) investigates the awareness and practices related to ESD integration in teacher education, emphasizing the importance of faculty development and student engagement. Admirado et al. (2019) present interventions to support teacher professional development, emphasizing a common school vision, professional learning opportunities, collaborative work, and learning leadership. The authors, Duong et al., (2019) investigate the effect of the professional development program on the EMR approach which results in the significant improvement of student-teacher relationships and student behavior due to the short training and ongoing implementation supports. Nusheen et al. (2020) have examined the influence of ESD course on pre service teachers' attitudes towards sustainable development and their promotion of the inclusion of ESD in academic programs, particularly in teacher education programs in Pakistan. These studies altogether, one can say that empowering teachers as change agents in public schools requires multidimensional actions such as developing ESD-specific competencies, creating supportive professional learning communities, implementing long lasting PD programs, and promoting positive attitudes towards sustainable development (Fayyaz, Lashari, Channar, et al., 2023). Verhulst and Lambrechts (2015) take an approach to the implementation of sustainability in higher education from the management of change perspective by emphasizing human aspects like resistance and empowerment.

They present a conceptual model that explains the connection of these factors with sustainable development integration process; such model is useful for understanding and overcoming barriers. Trilaksono, Purusottama, Misbach, and Prasetya (2019) provide the case of an Eastern Indonesian PLC initiative whose success is based on the leadership change model through PLCs. Such a strategy serves to preserve the sustainability of school leadership by aligning the values of school leaders and teachers. Mulyono (2020) focuses on the SPD management for teachers and principals, highlighting the importance of continuous competence development programs for teacher professionalism and, consequently, the students' learning outcomes. Boeve-de Pauw, Gericke, Olsson, and Berglund (2015) undertook an extensive research to determine the effect of ESD on students' sustainability awareness. The research involved a large participant group, which provided the research with richness and diversity of data for analysis. This study has shown that the ESD is a key factor in raising the awareness of students on those issues of sustainability. Finally, the research finds that ESD is a direct pathway that leads to higher amounts of sustainability awareness among students, which is the first step towards a broader goal of building a sustainable future. Cörvers, Wiek, de Kraker, Lang, and Martens (2016) stressed the importance of using problem-based and project-based learning methods that focus on the learner to achieve the innovation in education. These approaches are especially useful in the context of sustainability education, since they endow students with applicable skills and competencies that are necessary to deal with the actual sustainability issues.

Cliona Murphy, Smith, Mallon, and Redman (2020) report on an Irish professional development program that positively influenced teachers' self-efficacy, competence, and pedagogy in teaching sustainability through science education. The program supported teachers in developing transformative pedagogies for sustainability.Manasia, Ianos, and

Chicioreanu (2019) examines before service educators' willingness for nurturing ESD, suggesting the need for professional knowledge, commitment, and management as crucial of teaching willingness. Meesuk, Wongrugsa, and Wangkaewhiran (2021) evaluate a program of PD in the form of a Professional Learning Community finding significant improvements in teaching and learning methods, as well as positive thinking skills among teachers and students. Clíona Murphy, Mallon, Smith, Kelly, Pitsia, and Martinez Sainz (2021) investigates the influence of a sustainability and PD program on primary pupils' understanding of and attitudes towards sustainability, highlighting the program's success in deepening pupils' understanding and developing positive attitudes (Bushra et al., 2024). Karim, Niazi, and Saeed (2023) emphasize the importance of workshops for effective teaching among teachers at the secondary school, highlighting a growing need for effective teaching-learning processes through professional skills and competencies development. Kadji-Beltran, Zachariou, and Stevenson (2013) explore the crucial role of primary school principals in promoting education for sustainable development (ESD) in their institutions. The study highlights the leadership behaviors that effectively support the implementation and maintenance of ESD (Samad & Lashari, 2022). Through the examination of views from principals the research identifies factors that both facilitate and hinder the adoption of ESD. The study acquired participants of a wide range that helped getting a considerable data to empirically validate the theories. The result of this study highlights the vital role ESD plays in improving the sense of students concerning the sustainability issues. Through incorporating ESD in the curriculum, the study shows a direct pathway on how to increase the level of sustainability awareness among students, thus, leading to a broader goal of building a more sustainable future.

## 3. Data Analysis

The SPSS, the Statistical Package for the Social Sciences, was used for the data analysis, which exhibited the high internal consistency with the Cronbach's alpha coefficient of .832 for the 20- item scale, thus, indicating that the instrument was reliable for the measurement. Table 1 presents the demographic characteristics of the sample, illustrating a diverse representation across gender, age, experience, position, and qualifications. Subsequent tables delve into one-sample T tests (Table 2 and 3) and Chi-square tests (Table 4) to explore teachers' perceptions, attitudes, and perceived barriers/facilitators regarding Education for Sustainable Development (ESD) integration. Table 5 highlights significant correlations, such as age positively correlating with ESD understanding and prioritization, and teachers' qualifications correlating with resource awareness, underscoring the multifaceted nature of teacher perceptions and practices concerning ESD.

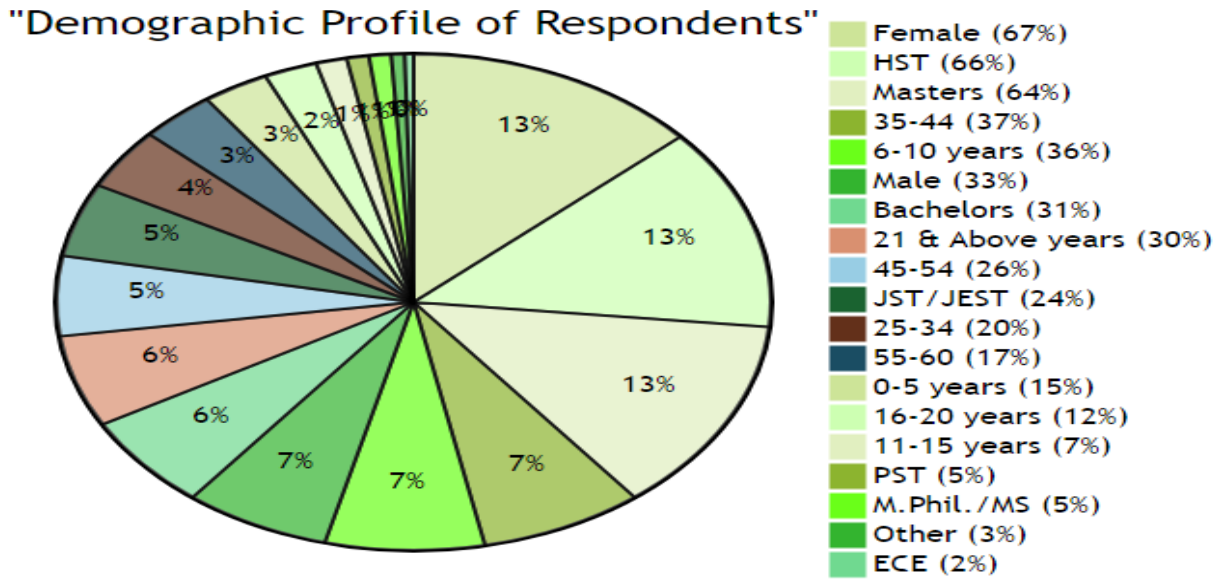
**Table1: Demographic Profile of Respondents, N = 100**

| Demographics | Frequency | Percent |
|---|---|---|
| Gender | | |
| Male | 33 | 33% |
| Female | 67 | 67% |
| Age Group (years) | | |
| 25-34 | 20 | 20% |
| 35-44 | 37 | 37% |
| 45-54 | 26 | 26% |
| 55-60 | 17 | 17% |
| Years of Experience | | |
| 0-5 | 15 | 15% |
| 6-10 | 36 | 36% |
| 11-15 | 7 | 7% |
| 16-20 | 12 | 12% |
| 21 & Above | 30 | 30% |
| Current Position | | |
| PST (Primary School Teacher) | 5 | 5% |
| JST/JEST (Junior School Teacher) | 24 | 24% |
| HST (High School Teacher) | 66 | 66% |
| ECE (Early Childhood Educator) | 2 | 2% |
| Other | 3 | 3% |
| Highest Qualification | | |
| Bachelor's Degree | 31 | 31% |

| | | |
|---|---|---|
| Master's Degree | 64 | 64% |
| M.Phil./MS | 5 | 5% |

Table 1 shows the demographic characteristics the survey respondent consisted of 100 participants, with 33% identifying as male and 67% as female. The majority of respondents are female, highlighting gender diversity among educators in this study. Regarding age distribution, the majority of participants fell within the 35-44 age range (37%), followed by the 45-54 age range (26%). In terms of experience, participants were fairly evenly distributed, with 36% having 6-10 years of experience and 30% having 21 years or more. The most common position held by participants was High School Teacher (66%), followed by Junior School Teacher/Junior Elementary School Teacher (24%). Regarding education achievement, the majority of participants had a Master's degree (64%), followed by a Bachelor's degree (31%). To sum up, the subjects covered a wide spectrum of demographic features which are important in the field of sustainable development. The demographic characteristics which include gender, age, years of experience, current position and highest qualification were purposely selected for analysis because they have the potential to impact the integration and effectiveness of Education for Sustainable Development (ESD) practices in the school. Gender and Age were selected as demographic variables as they may impact perception and implementation of ESD due to different generational experiences or prejudices or gender-specific experiences. Experience of Years is the core, for it shows how much educators know about the standard teaching techniques and the innovative ones, such as education for sustainable development. The Current Position illustrates the extent to which educators have a say in the decision-making process as well as the power to determine whether sustainability is included in curricula. Finally, Highest Qualification acts as a stand-in for the depth of content knowledge and pedagogical skills. Such skills are necessary for teaching the complex ideas of sustainability.

**Figure 1**



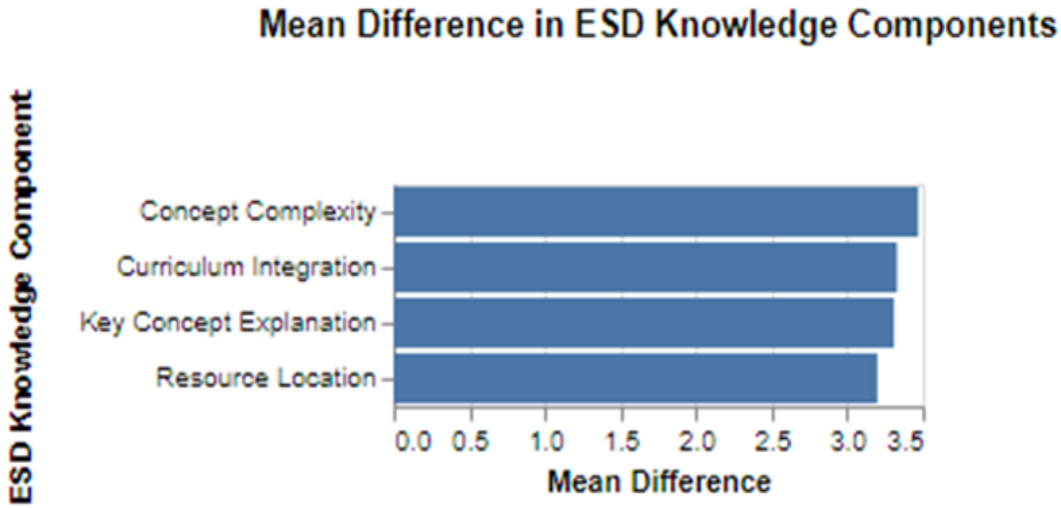

H01: Teachers in public schools do not possess a significant level of knowledge and understanding regarding ESD principles.

**Table 2: Teacher Knowledge on ESD Principles**

| ESD Knowledge Components | T-Statistic | Df | Sig.(p-value) | Mean Diff. | 95% Confi. Int. | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| Key Concept Explanation | 25.157 | 99 | <0.001 | 3.310 | 3.05 | 3.57 |
| Resource Location | 23.732 | 99 | <0.001 | 3.200 | 2.93 | 3.47 |
| Curriculum Integration | 27.043 | 99 | <0.001 | 3.330 | 3.09 | 3.57 |
| Concept Complexity | 31.399 | 99 | <0.001 | 3.470 | 3.25 | 3.69 |

Table 2 presents statistical analysis results of teacher knowledge and understanding of ESD concepts. T-tests show significant knowledge of ESD principles among teachers with all p-values less than 0.001.Teachers have positive perception regarding their ability to explain key ESD concepts to their students (M = 3.31, SD = 25.16, p < .001, 95% CI [3.05, 3.57]). Additionally, teachers expressed confidence in their capacity to locate current and relevant ESD resources aligned with their teaching subjects (M = 3.20, SD = 23.73, p < .001, 95% CI [2.93, 3.47]). Moreover, they demonstrated a strong understanding of integrating ESD principles with the curriculum requirements of their subjects (M = 3.33, SD = 27.04, p < .001, 95% CI [3.09, 3.57]).Furthermore, teachers rejected the notion that ESD concepts are too complex to integrate into elementary or primary school curricula, as indicated by a significantly positive mean response (M = 3.47, SD = 31.40, p < .001, 95% CI [3.25, 3.69]).

**Figure 2**



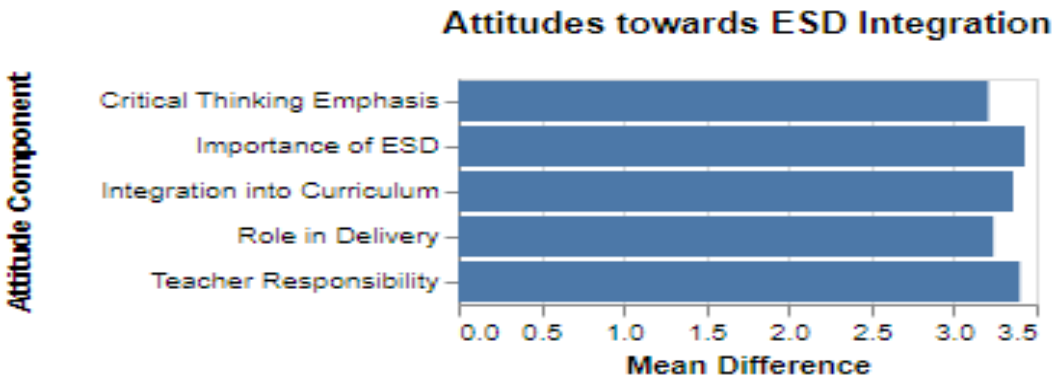

H02: There is no significant positive attitude or perception among teachers in public schools towards the importance of ESD in the curriculum and their role in its delivery.

**Table 3: Attitudes towards ESD Integration**

| Attitude Component | T-Statistic | Degrees of Freedom (Df) | p-value | Mean Difference | 95% Confi. Inter. |
|---|---|---|---|---|---|
| Importance of ESD | 34.740 | 99 | <0.001 | 3.430 | [3.23, 3.63] |
| Role in Delivery | 21.433 | 99 | <0.001 | 3.240 | [2.94, 3.54] |
| Integration into Curriculum | 26.849 | 99 | <0.001 | 3.360 | [3.11, 3.61] |
| Teacher Responsibility | 31.684 | 99 | <0.001 | 3.400 | [3.19, 3.61] |
| Critical Thinking Emphasis | 27.130 | 99 | <0.001 | 3.210 | [2.98, 3.44] |

Table 3 presents the results of one-sample tests conducted to assess teachers' attitudes and perceptions. This table assesses teachers' attitudes toward the importance of integrating ESD into the curriculum. Results indicate a significantly positive attitude among teachers. All p-values were found to be less than .001, indicating strong statistical significance. Consequently, we reject the null hypothesis, suggesting that there is significant evidence to support the alternative hypothesis. This indicates a significant positive attitude or perception among teachers towards the importance of ESD in the curriculum and their role in its delivery. The mean differences and their corresponding 95% confidence intervals (CI) provided further support for this conclusion. For instance, teachers overwhelmingly viewed incorporating ESD in teaching as crucial for developing students' critical thinking on global issues, with a mean difference of 3.43 (95% CI [3.23, 3.63]).

**Figure 3**




H03: There are no significant perceived barriers or facilitators identified by teachers in public schools that impact the integration of ESD into their teaching practices.

**Table 4: Chi-Square Analysis of ESD Teaching Challenges and Barriers**

| ESD Teaching Perspectives | Pearson Chi-Square Value | Degrees of Freedom (df) | Significance (p-value) |
|---|---|---|---|
| Facilitators for ESD Teaching | | | |
| Importance of ESD in critical thinking | 99.587 | 12 | <0.001 |
| Priority of ESD integration curriculum | 107.056 | 12 | <0.001 |
| ESD as essential for a problem-solving mindset | 110.619 | 12 | <0.001 |
| Impact of ESD topics on student engagement | 104.245 | 12 | <0.001 |
| ESD practices as part of teacher identity | 79.163 | 12 | <0.001 |
| Barriers to ESD Integration | | | |
| Critical thinking development challenges | 100.404 | 12 | <0.001 |
| Curriculum constraints on ESD integration | 132.343 | 12 | <0.001 |
| Fostering a future-oriented mindset | 114.895 | 12 | <0.001 |
| Engagement and curiosity in ESD topics | 102.654 | 12 | <0.001 |
| Identity alignment with sustainability practices | 94.814 | 12 | <0.001 |

*Note: All p-values < .001

Table 4 displays the outcomes of Chi-square tests investigating the correlation between perceived barriers or facilitators and the integration of ESD into teaching practices among public school educators in Karachi. Significant correlations suggest impactful relationships between these factors and the successful incorporation of ESD principles. With p-values consistently below .001 across all tests, the null hypothesis unequivocally rejected. This indicates a substantive association between perceived factors and the integration of ESD into teaching practices. As a result, the findings support the alternative hypothesis, emphasizing the substantial impact of perceived barriers or facilitators on the successful incorporation of ESD principles into educational practices within public schools.

**Figure 4**

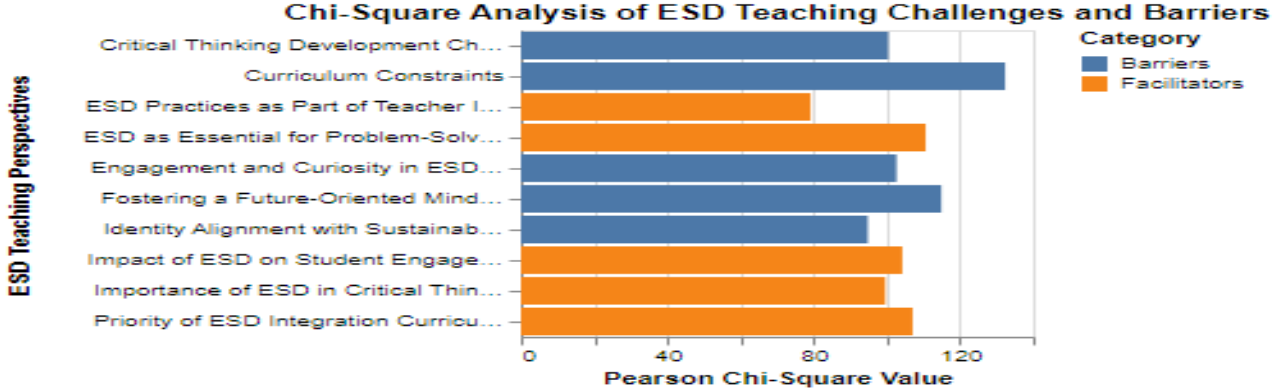
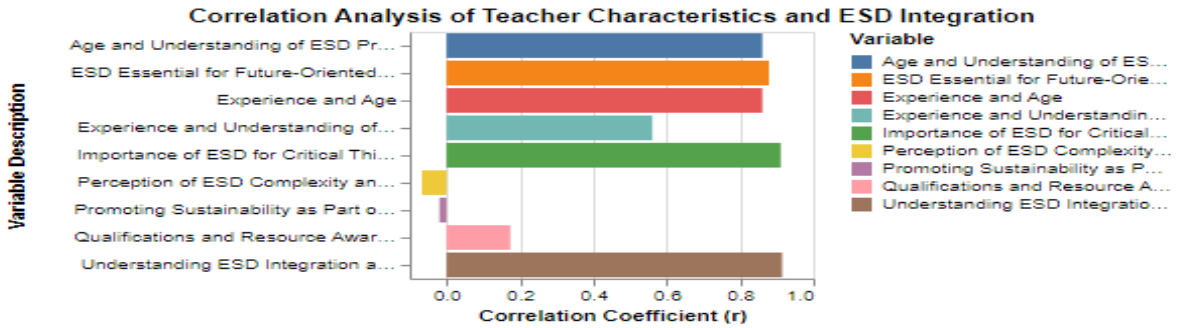


**Table 5: Correlation Analysis of Teacher Characteristics and ESD Integration**

| Variable Description | Correl. Coefi(r) | Sig (p-value) |
|---|---|---|
| Age and understanding of ESD principles | 0.861 | <0.01 |
| Experience and age correlation | 0.861 | <0.01 |
| Experience and understanding of ESD integration | 0.561 | <0.01 |
| Qualifications and resource awareness | 0.174 | <0.05 |
| Importance of ESD for critical thinking | 0.911 | <0.01 |
| ESD as essential for a future-oriented mindset | 0.879 | <0.01 |
| Understanding ESD integration and resource location | 0.915 | <0.01 |
| Perception of ESD complexity and curricular integration | -0.067 | 0.505 |
| Promoting sustainability as part of teacher identity | -0.019 | 0.849 |

Table 5 shows correlation analysis revealed several significant associations. Notably, age showed a strong positive correlation with understanding the integration of ESD principles ($r = 0.861$, $p < 0.01$) and with prioritizing the integration of ESD into teaching practices ($r = 0.204$, $p < 0.05$). Experience also correlated positively with age ($r = 0.861$, $p < 0.01$) and showed a moderate positive correlation with understanding ESD integration ($r = 0.561$, $p < 0.01$). Teachers' qualifications demonstrated a significant positive correlation with knowing where to find ESD resources ($r = 0.174$, $p < 0.05$).Furthermore, significant correlations were observed between teachers' perceptions and practices regarding ESD. For instance, believing in the importance of incorporating ESD into teaching correlated strongly with viewing ESD as essential for fostering critical thinking ($r = 0.911$, $p < 0.01$) and for developing a future-oriented mindset among students ($r = 0.879$, $p < 0.01$). Additionally, understanding ESD integration correlated positively with knowing where to find relevant ESD resources ($r = 0.915$, $p < 0.01$) and with viewing ESD as crucial for developing critical thinking ($r = 0.915$, $p < 0.01$).

**Figure 5**




## 4. Findings

The findings from study on teachers' perceptions and practices regarding Education for Sustainable Development (ESD) within public schools in Karachi offer several key insights. The significant gender disparity in your sample (67% female and 33% male) could be influencing the overall findings. Research indicates that women often demonstrate greater concern for environmental issues and might be more receptive to ESD principles. This may lead to the results being more favorable for ESD. A gender-balanced sample or stratified analysis might reveal how gender is involved in the shaping of the attitudes and the way of life in the context of ESD. The high degree of correlation between age and ESD comprehension, and the moderate degree of correlation with ESD integration, indicates that the older teachers are the more confident they are in ESD. Nevertheless, this correlation could also be attributed to the fact that the generational group was the one that was exposed to ESD concepts during their training or professional development. The younger teachers might have lacked enough exposure that could have a negative effect on their confidence as well as perceived competence. The positive correlation between teachers' qualifications and their understanding of ESD resources indicates that higher levels of education probably improve the ability of a teacher to access and make use of ESD resources. Still, it doesn't automatically mean that

effective teaching techniques are developed. The opportunity to use resources could be seen as a different thing from the ability to integrate them into teaching practices. This issue can be further investigated in future studies. Institutional support for teachers in terms of easy access to ESD materials and training, as well as administrative support, is a critical factor that determines the perception of ESD integration and the importance assigned to it. Schools that offer strong student-support networks could report better results, which could potentially be another confounding variable missed in the study. Cultural outlooks towards sustainability and education can influence how ESD is understood and used. In areas where sustainability is a vision, teachers will probably be more motivated and encouraged to use ESD. In contrast, in regions where it is not so much highlighted, even teachers who are well-educated and resourceful can have difficulties in the comprehensive implementation of the ESD approaches. The overall backdrop of educational policy can either help or hinder the process of embedding ESD.

## 5. Conclusion

The incorporation of Education for Sustainable Development is generally viewed as benefiting for environmental awareness and proactive citizenship, however there are some concerns and alternative views that need attention as well. Critics state that ESD is likely to be a western centered ideological system which may not necessarily be in line with the local cultural values and educational goals in the diverse global regions of the world that includes Karachi. Moreover, the practical implementation of ESD is greatly hampered by the fact that resistance from the traditional educational stakeholders who advocate for the old teaching methodologies, and that the logistics of curriculum redesign are very difficult. Educational finance is another major hurdle, as ensuring a complete ESD program usually involves a lot of money, which may not be the main concern in regions where other educational issues such as literacy rate and basic educational access are more pressing. However, engaging with these criticisms makes us aware of more complicated notions related to ESD's potential impacts and integration into the mainstream education system. At the end, this study contributes to the knowledge of how teachers perceive and practice Education for Sustainable Development (ESD) within public schools of Karachi. The outcomes, therefore, emphasize teachers as an important factor for the promotion of sustainable development and the inclusion of ESD in education. The study showed that the majority of the teachers had a good grasp of the core ESD concepts and that they were favorable towards the use of sustainability principles in teaching. In the face of the unavoidable challenges, such as limited curriculum coverage and scarce resources, teachers demonstrated their dedicated desire to put ESD teaching at the core of their teaching. The research revealed the most prominent barriers and facilitators for ESD integration, noting the need for specific interventions and support mechanisms, which are aimed at overcoming barriers and improving effectiveness of ESD implementation in public schools. The research outcomes highlight the need for integrated professional development initiatives, enabling policies, and curriculum innovations so as to assist teachers and to create a culture of sustainability within the education system. With the empowered teachers, who have the needed knowledge, skills, and resources, we can create a more sustainable future and prepare students to deal with the global problems in an effective manner. Whether teachers are prone to support ESD or not, the inflexibility of the curriculum may be a major obstacle to implementing ESD. Teachers may be highly motivated, but if they are unable to get quality ESD materials and training, this can be a big obstacle. The community and parental support of ESD projects have great influence on teacher motivation and the viability of ESD's integration in schools. The wider framework of the educational policy for ecosystem and sustainability may either help or hinder the integration of ESD depending on the level of attention given to sustainability at the district or national level.

### 5.1. Recommendations

1. In order to make sustainability an inevitable part of the public school curriculum at all levels, it is therefore critical to incorporate ESD principles into the curriculum such that sustainability concepts are integrated into subjects and learning experiences.
2. Conduct comprehensive teacher training courses which are based on ESD so that teachers will be endowed with the necessary knowledge, skills and resources to use sustainability in their teaching.
3. Make sure that all the necessary resources, including teaching materials, technology, and infrastructure, are provided for ESD initiative implementation. This is about

providing new teaching materials, technological tools and environmentally friendly facilities, which are meant to create conducive learning environment.

4. Stimulate the community to be the stakeholders and partners in the promotion of sustainability issues and involve them in the ESD programs. Public schools and other local stakeholders can also team up to promote sustainable actions and community members' involvement in environmental conservation as one of the sustainable actions.
5. Make the government to come up with key supportive policies and initiatives that champion ESD integration in public school system. The policy change is a key part of this process, and it should be applied at local and national levels. Teachers should embed sustainability principles in policies, curricula, and teacher training programs to ensure long-term commitment and support for ESD initiatives.
6. The following strategies for implementing for policymakers and educators:
    - Design and implement a systematic plan to gradually infuse the ESD principles in all the subjects and levels.
    - Make interdisciplinary ESD modules about core subjects through links. Create a feedback loop between the users and the producers.
    - Design and implement formal training programs for curriculum developers to learn ESD integration methodologies.
    - Set a regular professional development plan that comprises ESD-focused training and online workshops.
    - Work together with sustainability practitioners and relevant institutions in order to source for resources and knowledge.
    - Establish a learning environment for teachers to share practices and learn together.
    - Make an annual budget for the ESD resources to include sustainable technology and materials.
    - Allocate funds to implement sustainable infrastructure improvement projects in school facilities.
    - Give the schools that have demonstrated the effective implementation of the ESD the financial rewards.
    - Coordinate ESD workshops which will involve parents.

7. In sum, this analysis examined how the Education for Sustainable Development (ESD) transforms the educational system of the public schools of Karachi. The research findings have been obtained by the thorough analyzing of the existing issues and current implementation landscape. It has been shown that now is the time to take actions that are well thought out and knowledgeable in order to integrate ESD efficiently. The study highlights the crucial role of teachers as the agents of change, providing with the educational system that not only gives knowledge but also develops it into the people who will create a sustainable and strong world understanding. The study provide recommendations to incorporate ESD into education systems by: empowering teachers, enriching the curriculum with sustainability principles, engaging the community in environmental initiatives, and awareness raising for comprehensive supportive policies, which are the core of our approach. These steps are the main pillars of shaping aware, confident and pro-environment members of the society who will lead the transformative activities towards a sustainable and rational world. The outcome of our research can be observed as a roadmap showing how different performers at different levels can induce educational reforms. Moreover, it will demonstrate the significance of ESD in the educational and the social well- being of the community. Being on this development to sustainability, let us keep on with the mission of improving these citizens to be the ones who are knowledgeable, empowered, and eco-conscious, becoming the future leaders of a sustainable and equitable world.

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