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1, Eldams Road, Alwarpet, Chennai - 600018.
Phone: 044-48529990 / 42081758
E.mail: cpreec@gmail.com
Websites: www.cpreec.org / www.journalcpreec.in
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# Comparing Knowledge-Attitude-Practices (KAP) of Waste Management among students of rural and urban Halol, Gujarat

Astha Garg*

**Abstract**

**Purpose:** *This study aims to assess the knowledge, attitudes and practices (KAP) regarding waste management among middle-stage students (6th to 8th grade) in rural and urban schools of Halol, Gujarat and to examine the influence of demographic variables on these domains.*

**Methods:** *A descriptive research design was employed, using a multistage sampling approach to select 678 students from six purposively chosen schools (three urban, three rural). A structured questionnaire validated through pilot testing and expert consultation assessed knowledge (85 statements), attitudes (25 statements) and practices (18 questions) related to solid waste management. Data were analysed using descriptive and inferential statistics with IBM SPSS version 20.*

**Results:** *Urban students demonstrated significantly higher knowledge (M=37.25, SD=11.76) and better practices (M=47.60, SD=11.27) compared to rural students (Knowledge: M=26.89, =* SD*=7.72; Practice: M=41.60, SD=6.46), with large and small effect sizes, respectively. Attitude scores were similar across groups (Urban: M=53.98, SD=5.15; Rural: M=52.03, SD=4.01). Females exhibited more positive attitudes (p=0.006) and better practices (p<0.001) than males. Knowledge and practices improved with age and academic level, but attitudes remained unchanged. Weak positive correlations were found between knowledge and attitude (r=0.103, p=0.007) and between knowledge and practice (r=0.250, p<0.001).*

**Conclusion:** *This study reveals significant urban-rural disparities in knowledge and practices, influenced by gender, age and gender. Targeted educational interventions are needed to bridge these gaps, particularly in rural schools, to foster sustainable waste-management behaviour.*

**Keywords:** *Environmental Education, KAP, middle-stage, rural, urban, waste management.*

* Ph.D. Scholar, The Maharaja Sayajirao University of Barodaa, SD girls hall, Vadodara
Email : garg.astha1022@gmail.com

## Introduction

Environmental education is critical for fostering awareness and shaping students' perspectives toward sustainable development. Schools play a pivotal role in promoting eco-conscious behaviours from an early age, contributing significantly to building a sustainable future. Conservation, resource management and environmental stewardship ideals are instilled when sustainability is incorporated into the school curriculum. Teaching students sustainable living practices that prioritize recycling, resource reuse and waste reduction is a helpful solution.

Schools must set an example of sustainable behaviour by implementing trash reduction plans, renewable energy systems and cycling efforts. In summary, integrating environmental education into the curriculum at the school level prepares students to be responsible citizens. By encouraging environmental awareness, schools can equip the next generation to tackle urgent ecological issues and help create healthier and greener worlds. Students who receive a sustainable education are better equipped to make thoughtful decisions that support the long-term health of the environment (Chopra, 2024).

## Theoretical framework: the knowledge, attitude and practice (KAP) model

The KAP model is based on learning theory (Bandura, 1976) and the diffusion of innovation theory (Rogers, 1995). Rogers asserts that a social system's members gradually embrace innovation through four stages. The stages include knowledge acquisition, persuasion, decision-making and confirmation. Furthermore, (Bandura, 1976) proposed that the social context is the source of individual behaviour learning (Ajzen's, 1991). Theory of planned behaviour offers a framework for comprehending the connection between behavioural intention and attitudes and is another viewpoint used to examine behaviour changes.

The KAP model, developed and widely used as a survey tool in social research, has its roots in family planning and population studies from the 1950s. It can be used to evaluate the relationship between knowledge, attitudes and practices (Ahmad et al., 2015). A structured questionnaire known as the KAP model was used to quantify and analyse what is known (knowledge), believed (attitudes), and done (practices) regarding a topic of interest, a target population (Nguyen et al., 2019; Andrade et al., 2020). Accordingly, KAP model data can be used to identify knowledge gaps and attitudes that hinder understanding and patterns of practice that could help people comprehend and take action on a given issue (World Development Report, 2008). Furthermore, including qualitative methods, such as interviews, can improve KAP surveys, which were first used in population research and family planning in the 1950s. They are now commonly used to examine health-related behaviours and health-seeking activities. They are also referred to as knowledge, attitude and

practice surveys in their paper on the KAP survey, (Andrade et al., 2020).

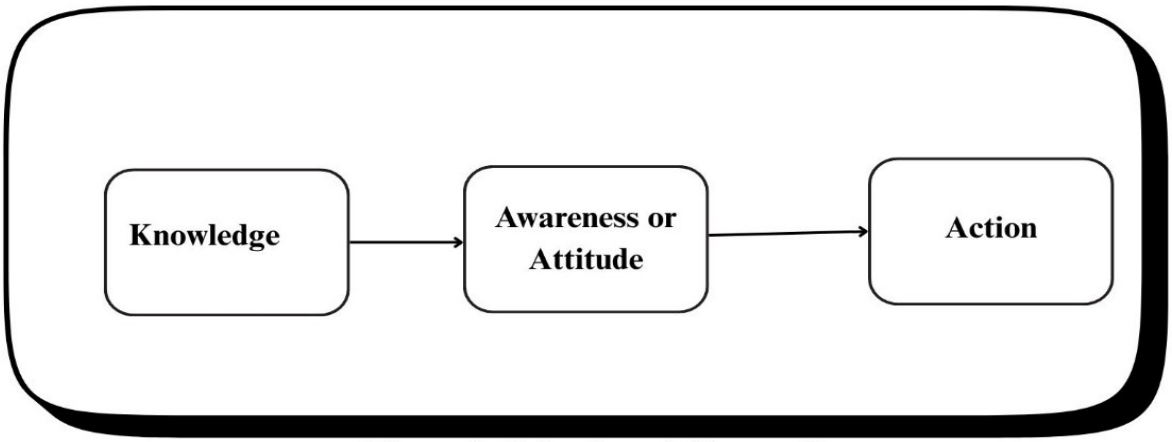



**Figure 1: Behavioural Change System**

A KAP survey should be conducted before an intervention or awareness campaign. The survey results will provide baseline data for future program success evaluations and the inputs required to develop an effective program. After the intervention, the same surveys should be conducted again to assess its effectiveness. If required, interim KAP assessments may also be planned to ascertain whether the program meets expectations and to implement adjustments as needed.

**Objectives**

1. To assess the extent of knowledge, attitudes and practices regarding solid waste management among rural and urban middle school students.
2. To assess the effect size of the independent variables on KAP.

**Hypotheses**

- **H1:** Significant variations in KAP exist among students based on selected independent variables (age, gender and grade).
- **H2:** A correlation exists between knowledge, attitude and practices.

**Methodology**

A descriptive research design was conducted in Halol, Gujarat, to examine the knowledge, attitudes and practices (KAP) regarding solid waste management among middle-stage students ($6^{th}$-$8^{th}$ grade) in rural and urban schools.

A multistage sampling approach was employed, combining purposive and stratified random sampling techniques. Six schools were purposively selected: three urban and three rural schools. Within each selected school, stratified random sampling was used to ensure a proportional representation across all grades ($6^{th}$, $7^{th}$, and $8^{th}$). Approximately 30 students were randomly selected from each grade, targeting 90 students in each school. The sample size was determined using Cochran's formula. A total of 384 students were calculated

with a 95% confidence level and 5% margin of error. However, to ensure adequate representation across all strata (schools and grades), 720 questionnaires were distributed via stratified random sampling. A total of 678 complete responses were obtained (response rate: 94.2%), which exceeded the minimum required sample size and ensured the statistical validity of the findings.

Post-hoc power analysis using G*Power 3.1.9.4 confirmed that this sample provided strong statistical power (>99%) for detecting medium effect sizes (f = 0.25) in planned ANOVA comparisons across grade levels (α= 0.05), well above the conventional threshold of 0.80 (Cohen, 1988).

**Data Collection Tool Sections**

A structured questionnaire was used to assess the students' knowledge, attitudes, and practices. The data collection tool was divided into four sections, and reliability was determined using JAMOVI 2.6.44. software **Figure 2.**

**Statistical Analysis**

Descriptive statistics (means, grade deviations) were calculated for the KAP scores. Inferential statistics were used

**Data Collection Tools Sections**

| Section | Description | Response Type | Score Range | Reliability |
|---|---|---|---|---|
| **Demographic Information** | Captures student names, ages, genders, standards, and areas. | N/A | N/A | N/A |
| **Knowledge of Solid Waste Management** | Assesses knowledge of waste types, disposal, and the 3Rs. | Correct, Incorrect, I do not know | 0 to 85 | α=0.88<br>ω=0.87 |
| **Attitude Toward Solid Waste Management** | Evaluates attitudes toward solid waste management. | Agree, Neutral, Disagree | 25 to 75 | α=0.86<br>ω= 0.76 |
| **Practices Related to Solid Waste Management** | Assesses practices related to solid waste management. | Five-point Likert scale | 18 to 90 | α=0.92<br>ω= 0.91 |



**Figure 2: Data Collection Tool**

to test hypotheses regarding the effects of demographic factors on students' KAP using SPSS software (ANOVA, t-tests, correlation analysis).

**Hypothetical relationship between variables:**

The schematic diagram below shows the hypothetical relationship between selected independent and dependent variables.

**Findings**

The findings were obtained by analyzing the data collected through a questionnaire. The questionnaire was divided into four sections:

**Section 1: Demographic Profile of students**

**Figure 4** shows that (56.34%) of the students were male, followed by (68.14%)

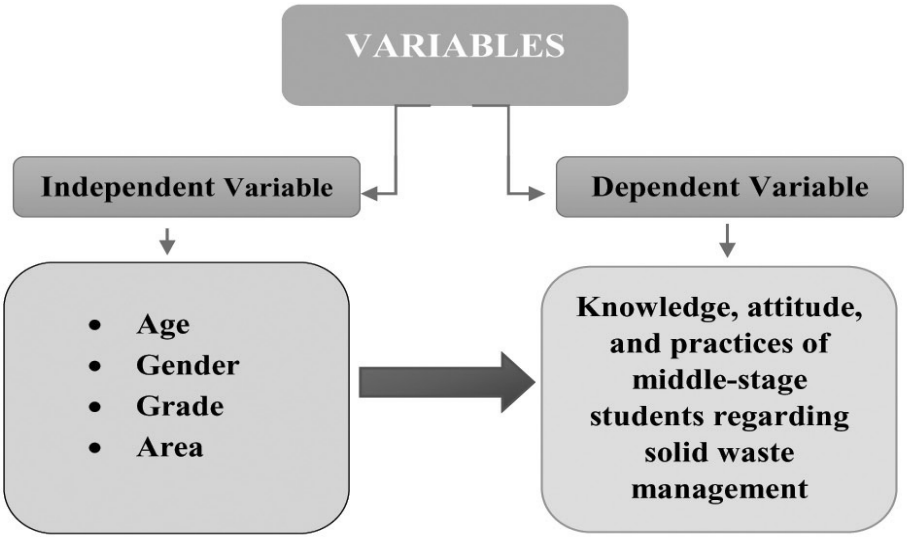
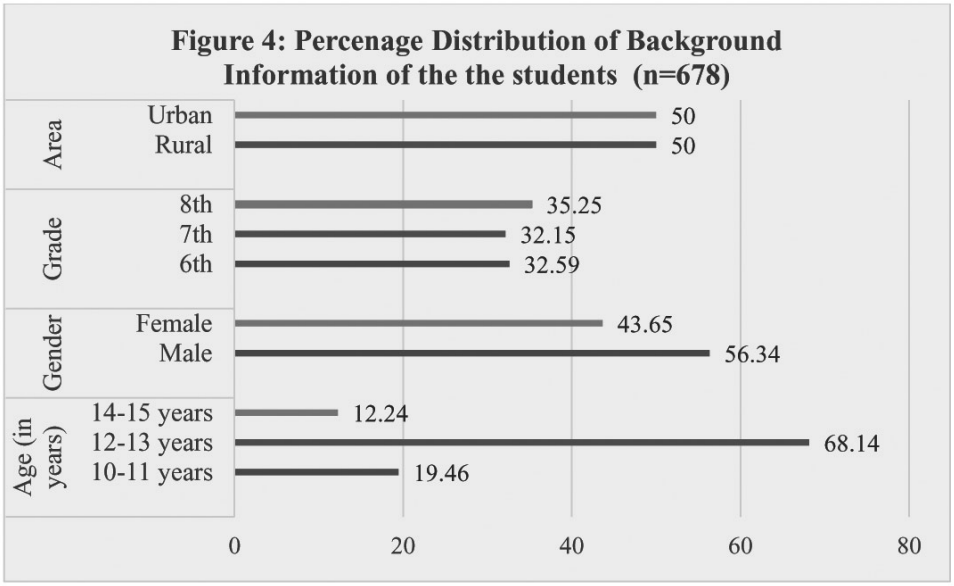



**Figure 3: Schematic Diagram of Conceptual Framework**



aged 12-13. (35.25%) of the students were from grade 8th, one-third from grade 7th, and 50% belonged to urban area schools.

**Section 2: Knowledge of Solid Waste Management**

The solid waste management knowledge assessment comprised 85 statements related to waste types, disposal methods and waste management methods. The data showed disparities between rural and urban school students' performance. Urban students demonstrated significantly superior knowledge levels, with 70.20 per cent of urban students achieving moderate knowledge scores, compared to only 41.00 per cent of rural students. Conversely, 58.99 per cent of rural students exhibited low knowledge levels, as shown in **Table 1.**

The mean knowledge scores further substantiated these disparities, with urban students achieving significantly higher scores (M = 37.25, SD = 11.76) than their rural counterparts (M = 26.89, SD = 7.72). When normalized to a 0-1 scale, urban students achieved 0.42 compared to rural students' 0.33, as shown in **Tables 4 and 5.**

**Section 3: Attitude Toward Solid Waste Management**

Attitude assessment revealed more homogeneous patterns, with most students demonstrating a neutral attitude towards solid waste management. Rural students showed 93.51 per cent neutral attitudes compared to 77.87 per cent among urban students. As shown in Table 2, positive attitudes were more prevalent among urban students.

The mean attitude score was between urban (M = 53.98, SD = 5.15) and rural (M = 52.03, SD = 4.01). On the normalised 0-3 scale, urban students scored 2.15 compared to rural students 2.06, as shown in **Table 4 & 5.**

**Table 1**
**Distribution of Urban and Rural students by extent of Knowledge (n=678)**

| Extent of Knowledge | Range of Score | Rural (339) | | Urban (339) | |
|---|---|---|---|---|---|
| | | *f* | % | *f* | % |
| High | 56-85 | 0 | 00 | 15 | 04.42 |
| Moderate | 29-56 | 139 | 41.00 | 238 | 70.20 |
| Low | 0-28 | 200 | 58.99 | 86 | 25.36 |

**Section 4: Practice related to Solid Waste Management**

Practice assessment demonstrated significant differences among all KAP components. Urban students exhibited better waste management practices, with 53.39 per cent achieving neutral practice and 6.19 per cent showing good practice. In contrast, 70.79 per cent of rural students displayed poor practices,

**Table 2**
**Distribution of Urban and Rural students by extent of Attitude (n=678)**

| Extent of attitude | Range of Score | Rural (339) | | Urban (339) | |
|---|---|---|---|---|---|
| | | *f* | % | *f* | % |
| Positive | 59-75 | 20 | 05.89 | 73 | 21.53 |
| Neutral | 42-58 | 317 | 93.51 | 264 | 77.87 |
| Negative | 25-41 | 02 | 0.58 | 02 | 0.58 |

**Table 3**
**Distribution of Urban and Rural students by extent of Practice (n=678)**

| Extent of Practice | Range of Score | Rural (339) | | Urban (339) | |
|---|---|---|---|---|---|
| | | *f* | % | *f* | % |
| Good | 68-90 | 00 | 00 | 21 | 06.19 |
| Neutral | 43-67 | 99 | 29.20 | 181 | 53.39 |
| Bad | 18-42 | 240 | 70.79 | 137 | 40.41 |

**Table 4**
**Comparison of KAP scores between Urban and Rural**

| KAP | Urban Mean Score | Rural Mean Score |
|---|---|---|
| Knowledge (Out of 1) | 0.42 | 0.33 |
| Attitude (Out of 3) | 2.15 | 2.06 |
| Practice (Out of 5) | 2.68 | 2.33 |
| | **1.75** | **1.57** |

**Table 5**
**Descriptive statistics of the KAP of Urban and Rural**

| | Groups | N | Range | Mean | | S.D. | Variance |
|---|---|---|---|---|---|---|---|
| | | | | Stats | S.E. | | |
| **Knowledge** | Urban | 339 | 54 | 37.25 | 0.41 | 11.76 | 138.52 |
| | Rural | 339 | 37 | 26.89 | 0.63 | 7.72 | 59.62 |
| **Attitude** | Urban | 339 | 29 | 53.98 | 0.27 | 5.15 | 26.55 |
| | Rural | 339 | 20 | 52.03 | 0.21 | 4.01 | 16.10 |
| **Practice** | Urban | 339 | 58 | 47.60 | 0.61 | 11.27 | 127.11 |
| | Rural | 339 | 45 | 41.60 | 0.35 | 6.46 | 41.81 |

**Table 6**
**Descriptive Statistics Test of Normality**

| | N | Skewness | | Kurtosis | |
|---|---|---|---|---|---|
| | | Statistics | S.E. | Statistic | S.E. |
| **Knowledge Score** | 678 | 0.428 | 0.94 | -0.273 | 0.187 |
| **Attitude Score** | 678 | 0.121 | 0.94 | -0.87 | 0.187 |
| **Practice Score** | 678 | 1.863 | 0.94 | 3.520 | 0.187 |

with none of them achieving good practice levels **(Table 3).**

The mean difference between urban (M = 47.60, SD = 11.27) and rural (M = 41.60, SD = 6.46) areas was significant. On the normalised 0-5 scale, urban students achieved 2.68 compared to rural students 2.33, as shown in **Tables 4 and 5.**

**Statistical Significance Testing**
**Normality Assessment and Test Selection**

Normality testing was performed. Skewness and Kurtosis were analysed, revealing highly positive skewness and kurtosis for practice scores **(Table 6)**, which showed that knowledge and attitude scores were normally distributed, and practice scores were not.

**Testing of Research Hypotheses H1:** There exists a variation in the extent of knowledge, attitude and practices regarding solid waste management among the students of selected schools of Halol, Gujarat, due to their selected independent variables.

**Variation in Knowledge, Attitude, and Practices by Independent Variables of Students**

The research hypothesis (H1) demonstrates significant variations in students' knowledge, attitudes and practices regarding solid waste management based on selected independent variables.

**Gender-based differences**

The analysis revealed differential patterns across the three KAP domains by gender. For knowledge scores, males showed slightly higher means, but the difference was not statistically significant (t = 1.68, df = 584.92, p = 0.093, Cohen's d = 0.20). However, significant gender differences emerged in attitude scores, with females demonstrating more positive attitudes toward solid waste management compared to males (t = -2.77, df = 587.93, p = 0.006, Cohen's d = 0.33), representing a medium effect size, as shown in **Table 7.**

Practice scores exhibited a highly significant gender disparity. The Mann-Whitney U test revealed females

| Table 7: t-Test for Knowledge and Attitudes scores by Gender and Area | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Variable** | **Variance Assumption** | **Mean difference** | **t-value** | **df** | **p-value** | **Cohen's d** | **Significant** |
| **Knowledge (Gender)** | | | | | | | |
| Male<br>Female | Equal Variance<br>Not assumed | 1.50 | 1.68 | 584.92 | 0.093 | 0.20 | **Not** |
| **Attitude (Gender)** | | | | | | | |
| Male<br>Female | Equal Variance<br>Not assumed | -1.03 | -2.77 | 587.93 | 0.006 | 0.33 | **Yes** |
| **Knowledge (Area)** | | | | | | | |
| Rural<br>Urban | Equal Variance<br>Not assumed | -10.45 | -13.51 | 591.20 | < 0.001 | 1.30 | **Yes** |
| **Attitude (Area)** | | | | | | | |
| Rural<br>Urban | Equal Variance<br>Not assumed | -0.204 | -0.56 | 676 | 0.575 | 0.04 | **Not** |

significantly outperformed males in waste management practices (U = 37,451.00, Z = -7.90, p < 0.001, Cohen's d = 0.30), with females achieving higher mean ranks (398.53) compared to males (280.47), indicating a medium effect size, as shown in **Table 8.**

**Urban-Rural Disparities**

T-test analysis revealed that urban students had substantially superior knowledge scores compared to rural school students (t = -13.51, df = 591.20, p < 0.001, Cohen's d = 1.30), with a mean difference of 10.45 points, representing a large effect size. However, attitude scores showed no significant variation between urban and rural students (t = -0.56, df = 676, p = 0.575, Cohen's d = 0.04). **Table 7**. Practice scores also revealed a significant difference favouring urban students (U = 50, 109.50, Z = -2.56, p = 0.011, Cohen's d = 0.10), although with a small effect size **(Table 8).**

**Age and Grade Influences**

One-way ANOVA results demonstrated significant age-related variations in both knowledge (F = 3.68, df = 2,675, p = 0.026, $\eta^2$ = 0.011) and attitude (F = 4.49, df = 2, 675, p = 0.012, $\eta^2$ = 0.013) scores. **Table 9**. Post-hoc analyses using Tukey HSD revealed that older students (14-15 years) significantly outperformed younger students (10-11 years) in both knowledge (mean difference = 4.211, p = 0.022) and attitude components (mean difference = 1.922, p = 0.010) (Table 11).

Students in higher grades demonstrated significantly better knowledge scores (F = 27.49, df = 2,675, p < 0.001, $\eta^2$ = 0.075),

| Table 8: Mann-Whitney U test for Practice score by Area and Gender | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Variable** | **N** | **Mean Rank** | **Sum of Ranks** | **U** | **Z** | **p-value** | **Cohen's d** | **Significant** |
| **Practice (Area)** | | | | | | | | |
| Rural | 339 | 280.47 | 95,081.00 | 37451.00 | -7.90 | 0.001 | 0.30 | **Yes** |
| Urban | 339 | 398.53 | 135,100.00 | | | | | |
| **Practice (Gender)** | | | | | | | | |
| Male | 382 | 322.68 | 123,262.50 | 50109.50 | -2.56 | 0.11 | 0.10 | **Yes** |
| Female | 296 | 361.21 | 106,918.50 | | | | | |

with 8th grade students outperforming both 6th (mean difference = 7.214, p < 0.001) and 7th grade students (mean difference = 5.458, p < 0.001) However, attitude scores remained consistent across academic levels (F = 1.092, df = 2,675, p = 0.336) (Table 9).

Practice scores varied significantly by grade ($x^2$ = 26.53, df = 2, p < 0.001), with progressive improvement from 6th grade (mean rank = 285.93) to 8th grade (mean rank = 376.75). However, age did not show significant results ($x^2$ = 0.466, df = 2, p = 0.792).

| **Table 9**<br>**One-way ANOVA Results for differences of Knowledge and Attitudes scores by Grade and Age** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Grade** | | | | | | | | |
| **Variable** | **Source** | **SS** | **df** | **MS** | **F** | **p** | **$\eta^2$** | **Significant** |
| Knowledge Scores | Between Groups | 6562.123 | 2 | 3281.061 | 27.49 | < 0.001 | 0.075 | **Yes** |
| | Within Groups | 80553.854 | 675 | 119.339 | | | | |
| Attitude Scores | Between Groups | 48.552 | 2 | 24.276 | 1.092 | 0.336 | 0.003 | **No** |
| | Within Groups | 15008.376 | 675 | 22.235 | | | | |
| **Age** | | | | | | | | |
| Knowledge Scores | Between Groups | 939.50 | 2 | 469.75 | 3.68 | 0.026 | 0.011 | **Yes** |
| | Within Groups | 86176.47 | 675 | 127.68 | | | | |
| Attitude Scores | Between Groups | 197.47 | 2 | 98.73 | 4.49 | 0.012 | 0.013 | **Yes** |
| | Within Groups | 14859.46 | 675 | 22.014 | | | | |

| Table 10: Kruskal-Wallis H Test for Difference in Practice Scores by Grade and Age | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Grade** | | | | | | | |
| **Variable** | **Group** | **N** | **Mean Rank** | **$X^2$** | **df** | **p** | **Significant** |
| Practice Score | 6th Grade | 221 | 285.93 | 26.53 | 2 | 0.00 | **Yes** |
| | 7th Grade | 218 | 352.97 | | | | |
| | 8th Grade | 239 | 376.75 | | | | |
| **Age** | | | | | | | |
| Practice Score | 10-11 years | 132 | 329.20 | 0.466 | 2 | 0.79 | **Not** |
| | 12-13 years | 463 | 341.70 | | | | |
| | 14-15 years | 83 | 343.60 | | | | |

| Table 11: Tukey HSD Post-Hoc Test for Knowledge Score Across Age Groups | | | |
|---|---|---|---|
| **Group Comparison** | **Mean Diff (I-J)** | **Sig. (p)** | **Significant** |
| 10-11 years vs 14-15 years | -4.211 | 0.022 | **Yes** |
| **Tukey HSD Post-Hoc Test for Knowledge Score Across Grade Groups** | | | |
| 6th vs 8th Grade | -7.214 | 0.000 | **Yes** |
| 7th vs 8th Grade | -5.458 | 0.000 | **Yes** |
| **Tukey HSD Post-Hoc Test for Attitude Score Across Age Groups** | | | |
| 10-11 years vs 14-15 years | -1.922 | 0.010 | **Yes** |
| 12-13 years vs 14-15 years | -1.431 | 0.029 | **Yes** |

**H2:** A correlation exists between knowledge, attitude and practices of dependent variables.

To test H2, Pearson's correlation coefficients were calculated for the KAP scores. The analysis revealed significant but weak positive associations between the knowledge and attitude domains ($r = 0.103$, $p = 0.007$), and a significant correlation emerged between the knowledge and practice domains ($r = 0.250$, $p < 0.001$). However, the attitude and practice domains showed no significant correlation ($r = 0.001$, $p = 0.977$) **(Table 12).**

## Discussion

The findings revealed significant differences in knowledge, attitudes, and practices (KAP) regarding solid waste management among middle-stage students in Halol, Gujarat, particularly between urban and rural schools. (Ramsey et al., 1981) stated that increased

| Table 12: Pearson Correlation Matrix | | | |
|---|---|---|---|
| | **Knowledge** | **Attitude** | **Practice** |
| **Knowledge** | - | 0.103**<br>p = 0.007 | 0.250<br>p = 0.00 |
| **Attitude** | | - | 0.001<br>p = 0.977 |
| **Practice** | | | - |
| **Note *N = 678, p < 0.01 (**) 2-tailed*** | | | |

knowledge leads to favourable attitudes, which in turn lead to actions that promote better environmental quality. Urban students demonstrated superior knowledge and better waste management practices, likely due to greater exposure to environmental education, infrastructure, and awareness programs in urban areas. These results align with previous research, such as (Nguyen and Nguyen, P. N., 2021) who showed in their paper that the mobilization of social resources for educational development in schools was considered important for the cause of education, as it enhances the implementation and efficiency of education.

The large effect size for knowledge differences (Cohen's d=1.30) underscores the need for enhanced environmental education in rural schools to address this gap.

However, attitude scores showed no significant urban-rural variation, with most students displaying neutral attitudes. This homogeneity may reflect limited exposure to initiatives that foster strong positive attitudes toward waste management, as noted by (Ajzen, 1991) where social influences and perceived behavioural control play crucial roles in shaping attitudes. The lack of correlation between attitudes and practices (r=0.001, p=0.977) suggests that positive attitudes alone do not translate into effective practice without sufficient knowledge or resources. This supports (Hungerford and Volk's, 1990) assertion that knowledge and skills serve as prerequisites for behavioural change; more knowledge will motivate humans to act in more responsible ways.

Gender differences were notable, with females exhibiting more positive attitudes and better practices than males did. Age and academic level also influenced outcomes, with older students and those in higher grades demonstrating better knowledge and practices, likely due to cumulative exposure to educational content and cognitive development.

There was a weak positive correlation between knowledge and practice (r=0.250, p<0.001). (Mundo et al., 2009) also showed an insignificant correlation between environmental awareness, knowledge, and perception with solid waste management in their study, which aligns

with (Meijer et al., 2015) who showed that knowledge, attitudes, and perceptions are intrinsic factors; however, extrinsic factors like access to resources, extension services, and supportive social structures are equally important in shaping norms. The non-normal distribution of practice scores ($p<0.001$) indicates variability in behavioural adoption, particularly in rural areas, where poor practices were prevalent. These findings highlight the importance of integrating practical training, such as composting and recycling programs, into school curricula to bridge the knowledge-practice gap. (Hines et al., 1987; Kollmuss & Agyeman, 2002; Bamberg & Moser, 2007), which argues that while knowledge is necessary, external and psychological factors, such as social norms, perceived behaviour, emotional engagement, and other barriers, critically influence behavioural outcomes.

## Conclusion

This study underscores the critical role of environmental education in shaping students' knowledge, attitudes and practices regarding solid waste management in Halol, Gujarat, India. Urban students outperformed their rural counterparts in knowledge and practices, highlighting the need for targeted interventions in rural schools to address these disparities. Gender, age, and grades significantly influenced KAP outcomes, with females and older students demonstrating more favourable behaviours than their counterparts. The weak correlations between knowledge, attitudes and practices emphasize the need for holistic educational strategies that combine theoretical learning with practical applications such as waste segregation and recycling initiatives. Schools should integrate sustainability into curricula and model eco-conscious behaviours through infrastructure, such as waste reduction systems. Future research should explore longitudinal interventions to assess the sustained impact of environmental education on student behaviour, contributing to a greener and more sustainable future.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# Global classrooms in India: the rise of foreign universities

Dr. Kandi Kamala*

**Abstract**

*The landscape of higher education in India is undergoing a transformative shift with the entry of foreign universities, marking the beginning of a globalized classroom environment. This development is closely linked to policy reforms under the National Education Policy (NEP) 2020, which encourages international collaboration, innovation, and academic mobility. The presence of global institutions in India aims to enhance academic quality, diversify learning experiences, and offer globally recognized degrees at relatively lower costs for Indian students. It also provides opportunities for faculty exchange, joint research and skill development aligned with international standards. However, the rise of foreign universities raises critical questions regarding regulatory frameworks, equity in access, affordability and the long-term impact on Indian universities. This paper explores the drivers, opportunities, and challenges associated with the emergence of global classrooms in India, analysing their potential to reshape the higher education system and their implications for India's aspiration to become a global knowledge hub.*

**Keywords:** *NEP 2020 (National Education Policy), Globalization of education, cross-border education, Higher education reforms in India, academic collaboration, student mobility, world-class education, research and innovation, knowledge economy.*

## Introduction

Globalization has reshaped the higher education landscape, leading to increasing academic mobility and international collaboration. In this context, India, one of the world's largest education markets, has emerged as a focal point for global universities seeking to expand their presence. The entry of foreign universities into India signifies not only an educational transformation but also a strategic effort to integrate Indian higher education with global standards.

The National Education Policy (NEP) 2020 has played a crucial role in encouraging the establishment of

* Assistant Professor, Dept. of Political Science, Government Degree College for Women (Autonomous) Begumpet, Hyderabad, Telangana, India 500016.

international campuses and collaborations. By allowing renowned global institutions to set up operations in India, the government aims to enhance quality, provide greater access to world-class education, and reduce the outflow of Indian students seeking education abroad. This initiative is expected to make higher education more competitive, diverse, and innovation-driven, while also fostering international exposure for Indian students without requiring them to leave the country.

At the same time, the rise of foreign universities in India brings new challenges and debates. Questions of regulation, quality assurance, affordability, and the impact on domestic universities are central to this discourse. While some view foreign universities as partners in strengthening India's knowledge economy, others caution against commercialization and unequal access. Thus, the establishment of global classrooms in India represents both opportunity and complexity. It has the potential to redefine the academic ecosystem by blending global best practices with local educational needs, preparing students for a more interconnected and knowledge-driven world.

**History of Global classrooms in India: the rise of foreign universities**

The idea of "global classrooms" in India, facilitated by the entry of foreign universities, has evolved over decades, shaped by policy reforms, globalization, and the growing demand for quality higher education.

1. **Early Phase: Post-Independence (1950s–1980s)**
   - After independence in 1947, India focused on building indigenous institutions such as the IITs, IIMs and central universities.
   - Foreign collaborations existed, but mainly in the form of academic partnerships, faculty exchanges, and development aid (e.g., U.S. assistance in setting up IIT Kanpur, Soviet support for IIT Bombay).
   - Direct foreign campuses were not allowed; education remained a state-regulated public good.

2. **Globalization and Liberalization Era (1991–2000s)**
   - The economic reforms of 1991 opened India to globalization.
   - With the IT and service sector boom, there was an increased demand for globally recognized degrees.
   - Many Indian students started going abroad (mainly U.S., U.K., Australia, Canada), creating a "brain drain."
   - Foreign universities began forming **twinning programs** and **collaborative courses** with Indian institutions, though they still could not establish campuses directly.

3. **Attempts at Policy Reform (2000s–2010s)**
   - The **Foreign Educational Institutions (Regulation of Entry and Operations) Bill, 2010** sought to allow foreign universities to set up in India with regulations, but it lapsed due to political opposition.

- During this period, several foreign universities partnered with private Indian universities (e.g., Amity, Manipal, Symbiosis) to offer joint programs.
- Offshore campuses (like in Dubai, Singapore) attracted Indian students, highlighting India's lag in hosting global institutions.

**4. New Education Policy (NEP) 2020 and Beyond**

- NEP 2020 marked a turning point, explicitly allowing **top global universities** to set up campuses in India.
- It envisioned India as an international education hub, reducing student outflow and fostering research collaboration.
- In 2023–2024, the **UGC released guidelines** for foreign universities to establish campuses in India, with academic and financial autonomy.
- This move coincided with India's aim to become a global knowledge economy and align with the idea of "Study in India."

**5. Current Developments (2023–2025)**

- Prestigious universities such as **Deakin University (Australia)** and **University of Wollongong** announced campuses in Gujarat's GIFT City.
- Talks are ongoing with other institutions from the U.S., U.K. and Europe.
- India's push to integrate global universities with its own education system is expected to increase competition, improve quality and make education globally relevant, while remaining accessible to local students.

Refined year-wise table of the number of Indian students going abroad to study (approximate figures), covering **2015 through 2024**, based on the best available official data: **Table 1**

**Table 1**

| Year | Indian Students Abroad (approx.) |
|---|---|
| **2015** | ~368,625 Education for All in India |
| **2016** | ~382,184 Education for All in India |
| **2017** | ~454,009 Education for All in India |
| **2018** | ~517,998 Education for All in India |
| **2019** | ~586,337 Education for All in IndiaHindustan Times |
| **2020** | ~259,655 / ~260,363 Education for All in India *The Economic Times Business Standard* |
| **2021** | ~445,582 / ~444,553 Education for All in IndiamintNews18 |
| **2022** | ~750,365 / ~750,000 *Hindustan TimesNews18* |
| **2023** | ~894,783 / ~894,000 *Sabrang India The Indian Express*+1 |

- *Going abroad" (outbound in that year)*: ~760,073 students.
- *"Currently studying abroad" (enrolled overseas)*: ~1,335,878 (i.e., 13.36 lakh) students.

**1. Difference in Metrics for 2024**

- ❖ The **~760,073** figure reflects the number of students who went abroad **in 2024** (based on government's Bureau of Immigration data on outbound movement)
- ❖ The **~13.36 lakh** number captures those **already pursuing studies abroad in 2024**, regardless of when they left.

These numbers measure slightly different things—so it is valuable to specify which perspective one is interested in.

**2. Missing Data for 2025**

As of **August 2025**, full-year data for 2025 is not publicly available. However, news reports indicate that in early 2025, about **760,000** students went abroad for higher education—nearly matching the total for 2024. This suggests continuation of recent trends, but the complete annual figure is yet to be confirmed.

**1. How Many Students Go Abroad Each Year?**

- According to **government data**, more than **7.6 lakh** (760,000) Indian students went abroad for higher studies in **2024**, based on Bureau of Immigration figures. This was slightly lower than the peak of 8.95 lakh in 2023.
- Another key figure comes from data presented to Parliament: as of **2024**, **13.35 lakh** Indian students were **pursuing higher education abroad** (i.e., enrolled across multiple years), compared to 13.19 lakhs in 2023 and 9.07 lakhs in 2022.
- In **2025**, estimates suggest this number has grown significantly, reaching approximately **1.8 million** (i.e., 18 lakh) Indian students studying overseas.

**Foreign universities arriving in India: a new chapter in Higher Education**

**1. Landmark: University of Southampton Opens in Gurugram**

The **University of Southampton** (UK) has become the **first foreign university** to establish a full-fledged campus in India under the **UGC's 2023 regulations**. Named "Southampton Delhi," the campus in Gurugram's International Tech Park will launch in **August 2025**, offering four undergraduate and two postgraduate

**At-a-Glance Comparison Table 2**

| Metric | Approximate Value |
|---|---|
| Indian students departing in 2024 | 7.6 lakh (new annual departures) |
| Indian students enrolled abroad in 2024 | 13.35 lakh (total enrolled) |
| Indian students abroad in 2025 | ~18 lakh (total enrolled) |
| Total spending by Indian students (2025) | US $70 billion (estimated) |

courses in fields like computer science, business management, accounting & finance, economics, and finance/ international management. These programs mirror the UK campus in quality, and students may spend up to a year at Southampton's UK or Malaysia campuses. Notably, TOEFL/IELTS scores are not required.

**2. Five More Universities to Join by 2026–27**

Between **2026 and 2027**, five additional global institutions have received **Letters of Intent (LoIs)** from the UGC to set up autonomous campuses in India:

- Illinois Institute of Technology (USA)
- University of Liverpool (UK)
- Victoria University (Australia)
- Western Sydney University (Australia)
- Istituto Europeo di Design (Italy)

These campuses will allow students to earn international degrees locally, drastically reducing the costs and logistical challenges of overseas study.

**3. Mumbai EduCity: A New Hub for Global Education**

As part of the visionary **Mumbai EduCity** initiative near Navi Mumbai, the following five institutions have also received LoIs:

- Illinois Tech (USA)
- University of Aberdeen (UK)
- University of York (UK)
- University of Western Australia (Australia)
- Istituto Europeo di Design (Italy)

This development seeks to position Mumbai as a global knowledge capital, fostering innovation, research and entrepreneurship.

**4. Already Operational: Deakin University & University of Wollongong**
Australian universities have already made headway:

- **Deakin University** and **University of Wollongong** have established campuses at **GIFT City**, Gujarat, supported by special regulatory and financial frameworks.
- Wollongong has also reportedly started offering short-term postgraduate programs (around Rs 8–9 lakh) even before full-scale operations began.

**5. UGC Regulations Enabling the Wave**
The **UGC's 2023 regulations** pave the way for **top-500 global universities** (by overall or subject rankings, or reputational standing) to set up **autonomous campuses in India**. These universities can decide their own curricula, admissions, fee structures and faculty hires, while maintaining parity with their home institutions.

**6. Why It Matters for India**

- **Local access to global quality education**: Students can pursue world-class degrees without going abroad, saving significantly on cost and time.

- **Stem-focused offerings**: Many programs emphasize STEM, business, design, and research—areas crucial to India's development.
- **Boost to research & retention**: Enhances domestic research capacity and helps retain talent that would otherwise study overseas.
- **Global academic ecosystem**: Creates vibrant, multicultural campuses and underscores India's emergence as a **global education hub**.

**Table.3 Foreign Universities Arriving in India (as of 2025–27)**

| University / Institution | Country | Location (India) | Status / Expected Operations Start | Programs / Notes |
|---|---|---|---|---|
| **Deakin University** | Australia | GIFT City, Gujarat | Announced 2023; operations started 2024 | Offering Business Analytics, Cyber security; first foreign campus under UGC rules |
| **University of Wollongong (UOW)** | Australia | GIFT City, Gujarat | Commenced November 2024 | Postgrad courses in Computing (Data Analytics, FinTech), modern infrastructure |
| **University of Southampton** | UK | Gurugram (Gurgaon), Haryana | Classes starting ~August 2025 | UG & PG in CS, Business, Economics, Law, Engineering; investment £30 m |
| **University of York** | UK | Navi Mumbai (Mumbai region) | LoI issued; enrolling by late 2026–27 | To offer UG/PG in Comp Sci, Business, Economics, Creative Industries |
| **University of Aberdeen** | UK | Navi Mumbai or Mumbai region | LoI issued; start ~by 2026 | Full autonomy, programs pending; part of 5 LoI group |
| **University of Western Australia (UWA)** | Australia | Navi Mumbai / Chennai (planned) | LOI; launch by ~2026–27 | STEM & Business programs; campuses in Mumbai and Chennai envisaged |
| **Illinois Institute of Technology (IIT)** | USA | Navi Mumbai (likely) | LoI; start operations by ~2026–27 | First U.S. university in India under UGC rules |

| University / Institution | Country | Location (India) | Status / Expected Operations Start | Programs / Notes |
|---|---|---|---|---|
| **Istituto Europeo di Design (IED)** | Italy | Navi Mumbai | LOI; expected by ~2026–27 | Offering design, fashion, visual arts, communication programs |
| **University of Liverpool** | UK | Bengaluru | LoI issued; operations from ~Aug 2026 | UG/PG: Business, Finance, CS, Biomedical Sciences, Game Design |
| **Western Sydney University** | Australia | Greater Noida (UP) | LoI; classes in Aug–Sept 2026 | BBA, IT; first phase infrastructure under development |
| **Victoria University** | Australia | Noida (planned) | LoI; expected by ~2026–27 | Career-oriented courses in Business, IT, Hospitality |
| **Queen's University Belfast** | UK | GIFT City, Gujarat | Plans for early 2026 launch | Postgrad Business Analytics, Finance, Project Management; future AI focus |
| **University of Surrey** | UK | GIFT City, Gujarat | Expected ~2026–27 | Offering Business, Finance, CS, AI, Cybersecurity |
| **Coventry University** | UK | GIFT City, Gujarat | Expected ~2026 | UG in International Business, Business & Finance |
| **Lincoln University College (Malaysia)** | Malaysia | Telangana (planned) | Proposed 2025 – pending approval | Programs in Medicine, Engineering, Business, AI |

**Source: UGC**

India's bold steps—starting with Southampton and expanding rapidly through LoIs and policy reform—are reshaping higher education. By blending international reputation with local accessibility, the country is on track to become a premier destination for global learning.

**Challenges for Foreign University Campuses in India**

**1. Affordability & Access**

- **High tuition fees** at foreign branch campuses risk limiting access to only affluent students, contrary to NEP 2020's inclusivity goals.
- **Lack of reservation obligations** and insufficient scholarships may further exclude socio-economically disadvantaged groups, reinforcing inequality.

**2. Regulatory Complexity**

- India's **fragmented regulatory framework**, involving UGC, AICTE and other bodies, challenges foreign campuses offering multidisciplinary programs.
- **State-level differences**, lands, approvals, taxes, and bureaucratic inertia add layers of difficulty.
- Despite the FHEI Regulations (2023) offering a legal foundation, navigating evolving and overlapping rules remains tough.

**3. Financial Sustainability & Commercialization**

- There is a tension between maintaining academic quality and achieving commercially viable operations, especially without preferential treatment.
- Foreign campuses may pivot toward profit-driven models, compromising the educational mission and raising equity concerns.

**4. Brand vs Substance**

- Many early branch campuses are specialized or small, rather than full-scale research universities. This can dilute reputation and raise concerns about academic depth.
- Overreliance on branding without delivering high academic standards risks sceptical student response.

**5. Cultural and Academic disconnection**

- Imported teaching methods may clash with Indian classroom norms, pedagogies and evaluation styles. Adapting while preserving quality is delicate.
- Without integration into local curriculum, faculty and collaboration, campuses risk isolation from India's broader educational ecosystem.

**6. Faculty Recruitment & Immigration**

- Hiring foreign faculty involves complex visa processes and regulatory compliance, including UGC's minimum-stay requirements.
- Recruitment of Indian academics can be sensitive due to compensation inequalities or infrastructure constraints.

**7. Operational Infrastructure & Perception**

- Many campuses begin operations in **rented urban buildings**, lacking the aesthetic and facilities of typical universities—distracting from institutional credibility.

**8. Limited Initial Impact**

- The anticipated scale of branch campuses is modest; their effect on Gross Enrolment Ratio and the overall education landscape will be gradual.
- Excessive hype or poorly prepared roll-outs risk launching distrust in internationalisation efforts.

**9. Sovereignty & National identity**

- Academics caution against foreign institutions overshadowing local educational autonomy or undercutting indigenous curriculum and values.
- Foreign campuses, if seen as instruments of soft power, could raise concerns about academic independence.

**Practical examples & context**

- **University of Southampton** is investing up to **£30 million** to open a full-fledged campus in Gurugram by 2025, targeting 5,500 students annually with

**Table-4 Challenges at a Glance**

| Category | Core Challenges |
|---|---|
| Affordability & Access | High fees; limited scholarships; equity concerns |
| Regulation & Bureaucracy | Multi-layered approvals; state variance; evolving policy complexity |
| Financial Viability | Need for profits versus maintaining quality; long-term sustainability |
| Academic Integrity | Reputation risks; specialized focus; marketing overshadowing substance |
| Cultural Integration | Pedagogy mismatch; insufficient local adaptation |
| Faculty & Immigration | Complex visa/stay rules; talent competition and retention issues |
| Infrastructure & Facilities | Lack of campus identity; temporary setups |
| Scale & Impact | Slow enrolment; risk of premature failures |
| National Identity & Policy | Concerns over sovereignty; soft power dynamics; local institutional displacement |

degrees in computing, business, engineering, economics and law, at about two-thirds the cost of UK fees.

- Similarly, institutions like **Deakin University** and **University of Wollongong** have begun operations in **GIFT City**, while others are pursuing campuses in Mumbai and Delhi—highlighting both opportunity and urgency.
- Indian higher education faces foundational challenges—such as limited international faculty, infrastructure shortfalls, insufficient international collaborations and poor industry engagement—which could affect the ecosystem's readiness for foreign campuses.

**Current Landscape: Foreign Universities in India**

**Notable Developments**

- **University of Southampton, Gurugram**: First foreign university to open under UGC's 2023 regulations, offering UK-equivalent degrees in fields like Computer Science, Business Management, Economics, and more. Classes begin August 2025. Students can spend up to a year abroad at Southampton's UK or Malaysia campuses.
- **University of Wollongong (UOW), GIFT City, Gujarat**: Launched in November 2024, offering postgraduate programs in Data Analytics and FinTech with modern infrastructure and scholarships.
- **Other Authorized Institutions**: The UGC has issued Letters of Intent (LoIs) to five more foreign universities to establish campuses in Mumbai and Navi Mumbai—including the Universities of York, Aberdeen, Western Australia, Illinois Institute of Technology, and IED (Italy). Admissions may begin by late 2026.
- **Policy Enablers**: The NEP 2020 and UGC's 2023 regulations are actively facilitating entry of globally ranked universities, creating new educational ecosystems and reducing outbound student mobility.

**Benefits**

- **Affordable Global Education at Home**: Students can access international curricula without incurring high travel and living costs.
- **Potential for Enhanced Academic Standards**: These partnerships can catalyze improvements in pedagogy, research output, and institutional quality.
- **Economic & Structural Boosts**: Campuses could drive job creation, local development, and help retain intellectual capital.

**Challenges & Criticisms**

- **Accessibility and Equity**: High costs may make these campuses accessible only to the affluent—undermining inclusivity goals.

- **Competitive Pressure on Indian Institutions**: Well-resourced foreign campuses may attract top students and faculty away from local universities.
- **Risk of Transactional Campuses**: Without research engagement or local relevance, campuses could become mere teaching extensions rather than academic hubs.
- **Commercialization and Oversight**: Ensuring academic integrity and financial transparency is critical, or risk education being commodified.

**Strategic Recommendations**

**1. Promote Inclusive Access & Affordability**

- **Mandate Quotas and Scholarships**: Require that ≥25% of seats be reserved for underprivileged students, supported by full or partial scholarships.
- **Flexible Models**: Offer tuition subsidies, need-based fee waivers, or government-backed fellowships to broaden access.

**2. Ensure Quality & Accountability**

- **Tiered Regulations**: Implement differentiated oversight—providing operational ease to top-tier global institutions while maintaining strict quality checks.
- **KPIs and Transparency**: Measure indicators like local faculty hiring, joint research output, community engagement, socio-economic diversity, and publish annual performance reports.

**3. Foster Collaborative Synergies**

- **Joint Initiatives**: Encourage co-built programs, shared research centers, dual degrees, and faculty exchanges between foreign and Indian universities.
- **Leverage Local Strengths**: Encourage models like GITAM's dual degrees with University of Melbourne or RV University's collaborations—blending global and Indian expertise.

**4. Align with Local Context & Culture**

- **Curriculum Indianisation**: Integrate Indian case studies, developmental challenges, and cultural knowledge systems into coursework.
- **Partner with Communities**: Projects and learning tied to local economic and social needs can strengthen relevance and real-world impact.

**5. Safeguard Domestic Institutions**

- **Capacity Building**: Use foreign campuses as nodes of excellence that support multi-university development, rather than as competing entities.
- **Balanced Expansion**: Strengthen Indian universities in parallel through funding, autonomy, and regulatory reform so that they can also evolve globally.

**Conclusion**

The entry of foreign universities into India marks a significant turning point in the country's higher education

landscape. These global classrooms have introduced international standards of teaching, cutting-edge research, and innovative pedagogical practices, thereby enhancing the quality and competitiveness of Indian higher education. They offer students greater exposure to global perspectives, cross-cultural learning, and increased employability in an interconnected world.

However, the rise of foreign institutions also presents challenges, including affordability, accessibility, and the potential overshadowing of domestic universities. Policymakers and educational stakeholders must ensure that these global initiatives complement rather than replace local institutions, fostering collaboration, knowledge exchange, and equitable opportunities for all students. Ultimately, the growth of foreign universities in India is a catalyst for modernization, global integration, and academic excellence, provided it is accompanied by thoughtful regulation, inclusivity, and strategic partnerships with Indian universities.

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# A social learning theory-based learning intervention to promote sustainable Waste Management behaviour among students

Astha Garg*

**Abstract**

*India faces numerous challenges related to waste management, including inadequate disposal systems, a lack of awareness and willingness to segregate waste and insufficient resources. Students are the future of society, and they learn fast. If we inculcate the SWM behaviour in the early ages of their lives, it will help society. This study evaluates the effectiveness of a Social Learning Theory (SLT)-based intervention designed to enhance sustainable waste management practices among middle-stage students. Using a pre-experimental pretest – post test design, the study assessed 339 students (aged 10-15 years) from three rural schools in Halol, Gujarat. Students were evaluated on three SLT constructs: cognitive understanding, outcome expectancies, and behavioural performance—a comprehensive 30-hour intervention was conducted. The findings showed the significant improvement across all three constructs: cognitive understanding increased the most by 123.5% with $p<0.001$, cohen d = 3.24, outcome expectancies improved by 21.7% with $p<0.001$, cohen d =1.92, and behavioural performance showed enhancement by 67.5% with a large effect size of 0.89. Contrary to theoretical expectations, no significant correlations were found among the three SLT constructs, and structural equation modelling (SEM) had an excellent fit to the data: $X^{2(0)}$ = 6.02e-13, CFI = 1.000, RMSEA = 0.000, SRMR = 0.000. However, the model revealed no significant predictive relationships among the constructs. The study suggested that education policymakers use SLT in schools to enhance behaviour towards solid waste management (SWM).*

**Keywords:** *Sustainable, waste management, social learning theory, rural schools, intervention, SEM model*

* Ph.D. Scholar, The Maharaja Sayajirao University of Barodaa, SD girls hall, Vadodara
Email : garg.astha1022@gmail.com

## Introduction

Effective waste management is pivotal for promoting environmental sustainability and fostering responsible behaviour. Preschool is an important phase of life when behaviours are shaped, habits are formed and basic behaviours are acquired (Kotler et al., 2012). However, rural schools often face inadequate waste disposal systems, a lack of awareness, limited resources and poor practices, contributing to environmental degradation. Despite initiatives promoting waste management education, the behavioural impact on students remains limited, as many programs focus only on theoretical knowledge without promoting practical behavioural change.

In rural India, where awareness about waste management is low, interventions must incorporate behavioural theories to drive long-term impact. Social Learning Theory (SLT), introduced by Albert Bandura (1977), posits that individuals learn behaviours through observation, imitation, and reinforcement. Bandra (1986) explained the essential principles of social learning theory and modelling with concepts. By modelling proper waste management practices, providing feedback, and offering hands-on experiences, students are more likely to adopt sustainable behaviours. SLT also emphasises self-efficacy, where individuals gain confidence in their ability to perform specific behaviours through repeated practice and positive reinforcement. Social learning theory argues that human behaviours are shaped by cognitive, behavioural evironmental interactions (Ergun, 2002; Ersan, 2016).

## Theoretical Framework: Social Learning Theory (SLT)

SLT offers a comprehensive framework for understanding how individuals acquire and maintain behaviours through social interaction. The intervention program applied three core SLT principles:

1. **Observational Learning:** Students learned waste management practices by watching teachers model proper behaviour, including waste segregation, recycling and composting.
2. **Reinforcement:** Teachers provided positive feedback and correction during practical sessions, reinforcing correct practices and motivating students.
3. **Self-Efficacy and Practice:** Students participated in hands-on waste management activities, such as waste segregation, composting, and recycling. This enhanced their confidence and ability to perform sustainable practices.

Applying SLT principles, the intervention aimed to promote long-term behavioural change among students, equipping them with the skills and motivation to adopt responsible waste management practices.

## Research Problem

SWM assessment in three rural schools exhibited limited cognitive understanding, low outcome expectancies and poor behavioural performance. This highlighted the need for targeted intervention

programs to address rural school gaps through social learning theory.

**Research Objectives**

The primary objective of this study is to evaluate the effectiveness of an SLT-based intervention program in enhancing waste management behaviour among students in three rural schools in Halol, Gujarat.

- To develop need-based SLT-driven intervention for rural schools, middle stage (6th- 8th) grade students.
- To evaluate the effectiveness of the SLT-based intervention in enhancing cognitive understanding, outcome expectancies, and behavioural performance.
- To assess the influence of independent variables (gender, age, and grade) on the effectiveness of the SLT-based intervention.

**Hypotheses**

- **H1:** There is a significant impact on students' cognitive understanding, outcome expectancies, and behavioural performance after the SLT-based intervention program.
- **H2:** A significant positive relationship exists between students' cognitive understanding, outcome expectancies, and behavioural performance after the SLT-based intervention program.
- **H3:** Post-intervention cognitive understanding significantly predicts students' outcome expectancies, and both cognitive understanding and outcome expectancies significantly predict behavioural performance related to solid waste management through the Structural Equation Model (SEM).

**Methodology**

This study used a pre-experimental one-group pre-test–post-test design to evaluate the effectiveness of a Social Learning Theory (SLT)-based intervention on students' cognitive understanding, outcome expectancies, and behavioural performance regarding solid waste management. All participating students were assessed using a structured questionnaire before and after the intervention to measure changes across the three SLT domains. Three rural schools from Halol Taluka, Gujarat, were selected using purposive sampling, based on accessibility and school willingness to participate. Students from Grades 6, 7, and 8 within each school were selected using a systematic random sampling technique. Specifically, every third student on the class roster was selected, yielding an initial sample of 384 students. Structured questionnaires were distributed to all 384 selected students. Of these, 339 questionnaires were returned fully completed, and only those were considered for analysis.

The **pre-test** was conducted in **January 2024** to assess the baseline levels of students' knowledge, attitudes, and practices related to solid waste management. Based on these results, a **customised intervention program**

was designed and implemented. The **post-test** was administered in **September 2024,** following the completion of the 30-hour intervention.

A structured questionnaire based on the SLT framework was developed for data collection. The tool comprised three key sections:

- **Cognitive Understanding:** This section included 85 items with both positive and negative statements. Each item was scored dichotomously; correct responses were scored 1, while incorrect and "I do not know" responses were scored 0.
- **Outcome Expectancies:** This domain included 25 items, measured on a 3-point Likert scale: agree, neutral, and disagree and ascribed scores were 3,2,1, respectively
- **Behavioural Performance:** This section included 18 items assessing the frequency of sustainable behaviours using a 5-point scale; good practice scored 5, and poor practice scored 1.

**Reliability**

To ensure internal consistency, Cronbach's alpha was computed for the overall instrument and the three SLT constructs. The reliability coefficient for the complete tool was found to be $\alpha = 0.88$, indicating high reliability.

**Data Collection and Analysis**

Quantitative data collected through the structured questionnaire were analysed using IBM SPSS Statistics (Version 20) and Jamovi (Version 2.6.44), with the SEMJ module for structural equation modelling. Data were analysed using IBM SPSS Statistics (Version 20) and Jamovi (with the SEMLj module). Descriptive statistics were used to summarise demographic and baseline variables. The Paired-t test and Wilcoxon signed-rank test assessed pre–post changes in students'. Pearson's correlation examined relationships among post-test scores across the SLT constructs. Finally, structural equation modelling (SEM) tested the hypothesised SLT path model. Model fit was evaluated using indices such as CFI, RMSEA, SRMR, and $x^2$; standardised path coefficients and significance values were reported. The analysis followed a multi-step approach to address the research objectives.

**Findings**

**Development of the SLT-based intervention program**

The intervention program was designed after the pre-test using Bandura's Social Learning Theory (SLT). SLT emphasises that learning occurs through observation, imitation, modelling, and reinforcement in a social context **(Bandura, 1965).** A total of 30 hours of the intervention program was delivered over 1.5 months. The intervention aimed to enhance students' cognitive understanding, outcome expectancies, and behavioural performance related to solid waste management (SWM) by using education techniques rooted in the SLT domains of

attention, retention, reproduction, and motivation. Twelve educational modules were developed and delivered in Hindi for rural students to understand better. The duration of each module was kept at 12-13 minutes with high-quality, real-time videos. Modules corresponded to specific waste categories and SWM practices, incorporating theoretical explanations and hands-on demonstrations. Group-based tasks such as waste audits, composting activities and poster-making supported behaviour modelling and social reinforcement. Prices were distributed to the winning team for each activity to boost the motivation. Each module and material was carefully aligned with the components of SLT: attention, retention, reproduction and motivation.

**Background information**

The study included 339 students from three rural schools in grades 6th to 8th in Halol, Gujarat. As shown in Table 1, most students were aged 12-13 years (65.5 per cent), with a mean age of 11.39 years and an SD of 8.98. Males represented 63.7 per cent of the total students. The distribution across academic grades was relatively balanced, 36.6 per cent from 6th grade, 33.6 per cent from 7th, and 33.6 % from 8th grade.

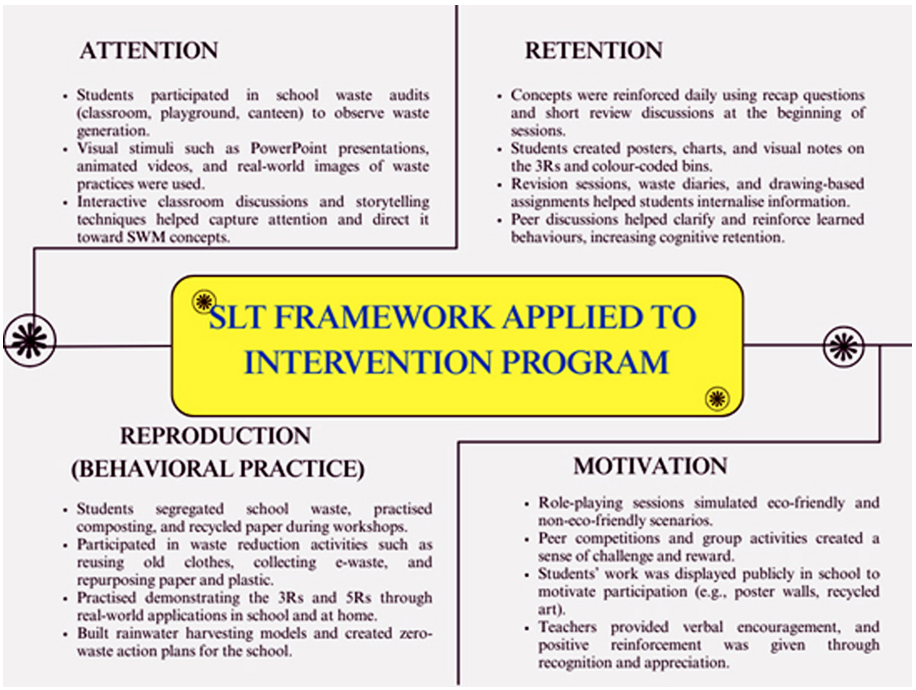
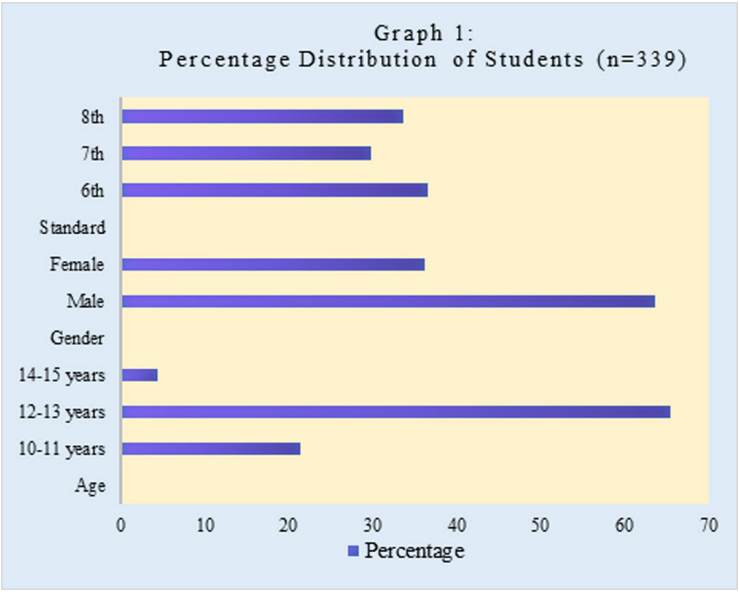



Figure 1 – SLT Framework
*Source: Author*

**Table 1**

Frequency and percentage distribution of the students according to their background information.

| Background Information of the students | Students (n=339) | | |
|---|---|---|---|
| | *f* | % | Mean (SD) |
| **Age (in years)** | | | |
| 10-11 years | 73 | 21.5 | 11.39 (8.98) |
| 12-13 years | 222 | 65.5 | |
| 14-15 years | 44 | 13 | |
| **Gender** | | | |
| Male | 216 | 63.7 | |
| Female | 133 | 36.3 | |
| **Standard** | | | |
| 6th Standard | 124 | 36.6 | |
| 7th Standard | 101 | 29.8 | |
| 8th Standard | 114 | 33.6 | |




**Effectiveness of the SLT-Based Intervention**

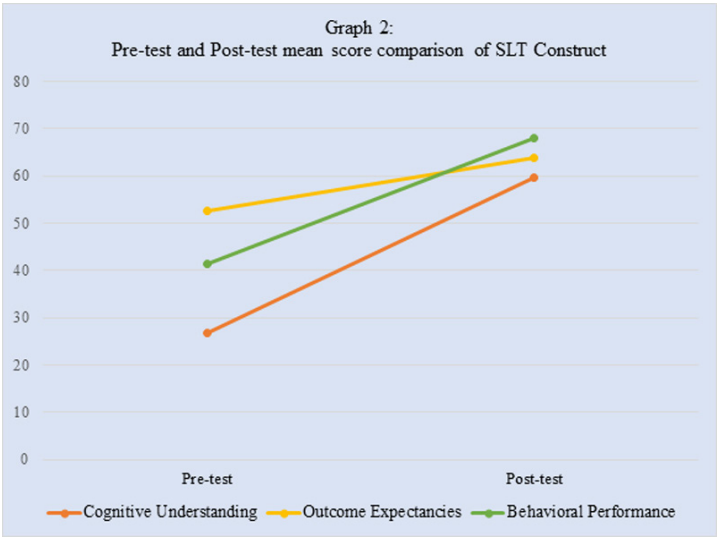
The intervention resulted in substantial improvements across all three Social Learning Theory constructs (Table 2). Cognitive Understanding scored more than doubled from pre-test (M= 26.70, SD = 8.05) to post-test (M= 59.68, SD = 6.78), with skewness and kurtosis lying between -1 and 1, showing normal distribution of the scores. Outcome Expectancies showed moderate improvement from pre-test (M=52.49, SD = 4.17) to post-test (M = 63.90, SD = 3.90) with a standard distribution

curve, followed by the Behavioural Performance demonstrated the most substantial relative improvement, increasing from pre-test (M = 41.25, SD = 6.47) to post-test (M = 69.12, SD = 2.45) with highly skewed data.

As shown in Table 3, the paired t-tests revealed statistically significant improvements in both cognitive understanding (t = -59.55, p < 0.001) and outcome expectancies (t = -35.35, p < 0.001), with large effect sizes

**Table 2**
Descriptive Statistics of SLT Constructs Before and After the Intervention (n =339)

| SLT Construct | Pre-test | | Post-test | | Change in per cent |
|---|---|---|---|---|---|
| | Mean (S.D.) | Skewness (Kurtosis) | Mean S.D. | Skewness Kurtosis | |
| Cognitive Understanding | 26.70 (8.05) | 0.11 (-0.18) | 59.68 (6.78) | 0.23 (-0.69) | 123.5% |
| Outcome Expectancies | 52.49 (4.17) | -0.09 (-0.48) | 63.90 (3.90) | -0.56 (0.07) | 21.7% |
| Behavioral Performance | 41.25 (6.47) | 3.53 (15.74) | 68.12 (2.45) | 2.67 (12.89) | 67.5% |




**Testing of Research Hypotheses**

- **H1:** There is a significant impact on students' cognitive understanding, outcome expectancies, and behavioural performance after the SLT-based intervention program.

(Cohen's d = 3.23 and 1.92, respectively). Table 4 presents the result of the Wilcoxon signed-rank test for behavioural performance. The test revealed a statistically significant improvement (Z = -15.96, p < 0.001) with a considerable effect size (effect size r = 0.89). Hence,

the research hypothesis is accepted. The SLT-based intervention program significantly positively impacted students' cognitive understanding, outcome expectancies, and behavioural performance related to solid waste management.

Outcome Expectancies was negligible; a weak and non-significant relationship was found between behavioural performance and cognitive understanding and Outcome expectancies. Hence, the null hypothesis is accepted. Despite significant improvements, there were

**Table 3**
**Paired-Sample t-Test between pre- and post-test (n=339)**

| Construct | Mean (SD) | t-value | df | p-value | Cohen's d |
|---|---|---|---|---|---|
| Cognitive Understanding | -32.97 (10.19) | -59.55 | 338 | 0.00 | 3.24 |
| Outcome Expectancies | -11.40 (5.94) | -35.35 | 338 | 0.00 | 1.92 |
| *Note.* Negative mean differences indicate improvement from pre-test to post-test | | | | | |

**Table 4**
**Wilcoxon Signed Rank Test to compare pre- and post-test (n=339)**

| Construct | Ranks | Mean Rank | Sum of Ranks | Z | p-value | Effect size |
|---|---|---|---|---|---|---|
| Behavioural Performance | Negative | 12.50 | 37.50 | -15.96 | 0.001 | 0.89 |
| | Positive | 170.91 | 57253.50 | | | |

- **H2:** A significant positive relationship exists between students' cognitive understanding, outcome expectancies, and behavioural performance after the SLT-based intervention program.

To test the H2, Pearson's correlation coefficients were calculated among the post-intervention scores of the three SLT constructs. Table 5 shows that none of the Pearson correlations among the SLT constructs after the intervention were statistically significant. The correlation between cognitive Understanding and no significant relationships among SLT constructs.

- **H3:** Post-intervention cognitive understanding significantly predicts students' outcome expectancies, and both cognitive understanding and outcome expectancies significantly predict behavioural performance through the Structural Equation Model (SEM).

To test H3, structural equation modelling (SEM) was conducted in Jamovi. (SEM) Syntax was used. The relationship was

**Table 5**

**Pearson Correlation Matrix Among SLT Constructs of Post-Test (n=339)**

| Construct | Cognitive Understanding | Outcome Expectancies | Behavioural Performance |
|---|---|---|---|
| Cognitive Understanding | - | - | - |
| Outcome Expectancies | 0.018 | - | - |
| Behavioural Performance | 0.074 | 0.032 | - |
| *Note*. All correlations are Pearson's r. None are statistically significant at $p < .05$. | | | |

entered as "Outcome Expectancies ≅ cognitive understanding" ", Behavioural performance ≅ cognitive understanding + outcome expectancies". The structural equation model demonstrated excellent fit to the data: $X^{2(0)}$ = 6.02e-13, CFI = 1.000, RMSEA = 0.000, SRMR = 0.000. However, as shown in Table 6, none of the structural path coefficients reached statistical significance. The path analysis shows that the cognitive understanding of outcome expectancies was positive but negligible (β = 0.02, p = 0.74). Similarly, outcome expectancies did not significantly predict behavioural performance (β = 0.04, p = 0.54). The direct path from cognitive understanding to behavioural performance was negative and again non-significant (β = -0.08, p = 0.16). The findings revealed that H3 cannot be accepted. Post-intervention cognitive understanding did not significantly predict students' outcome expectancies, and neither cognitive understanding nor outcome expectancies significantly predicted behavioural performance.

**Table 6**
**Standardised Path Coefficient and Significance Levels for the SLT-Based SEM Model (n=339)**

| Predictor → Outcome | β | SE | Z | p | 95% CI (L – U) |
|---|---|---|---|---|---|
| Cognitive Understanding → Outcome Expectancies | 0.02 | 0.03 | 0.33 | 0.74 | -0.05 to 0.07 |
| Outcome Expectancies → Behavioural Performance | 0.04 | 0.02 | 0.60 | 0.54 | -0.03 – 0.05 |
| Cognitive Understanding → Behavioural Performance | -0.08 | 0.01 | -1.38 | 0.16 | -0.04 to 0.01 |
| *Note*. All coefficients are standardised. Model fit indices: $x^2(0)$ = 6.02e–13, CFI = 1.000, RMSEA = 0.000, SRMR = 0.000. | | | | | |

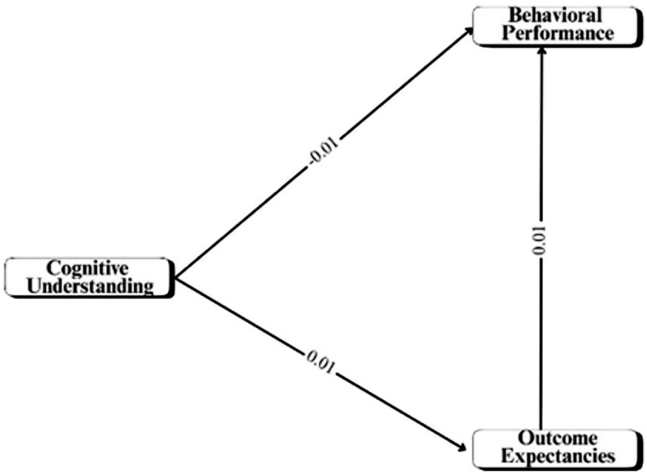



Figure 2: Path Analysis Structural Equation Model

**Discussion**

The findings of this study provide strong evidence for the effectiveness of the SLT-based intervention in improving students' abilities related to solid waste management. The significant improvements across all three domains, cognitive understanding, outcome expectancies, and behavioural performance, showed notable changes in the 30-hour intervention program, successfully addressing its objectives. (Alkan & Cavusoglu, 2024) Their research consisted of 20 sessions over four months based on the stages defined in social learning theory. They found a significant effect on social learning theory in the training process, which is effective in acquiring the desired behaviour through attention, retention, reproduction and motivation.

Despite the significant improvements in all three SLT constructs, the lack of significant correlations and the non-significant path coefficients in the structural equation model present an intriguing paradox. Several factors might explain this disconnect. First, behaviour change is a multifaceted process often requiring time to integrate new knowledge and attitudes into behavioural patterns. The immediate post-test timing may not have captured the delayed effects or the eventual integration of the SLT constructs. (Ersan 2016) mentioned in their study that behaviour feedback (reinforcement) of adults and peers also affects the formation of behaviour**.** (Houthur et al., 2019) indicated a significant gap between knowledge and practice in their research. The study concluded that despite sufficient knowledge regarding sanitation, poor attitudes hindered the conversion of the knowledge into practice. Weak correlations were found in their study.

Second, contextual factors may have moderated the relationships among the SLT constructs. For instance, limited waste management infrastructure in rural areas, family practices, peer

influence, lack of resources and socio-economic condition of the family might have affected the students' abilities to apply their newly acquired cognitive skills and behaviour, regardless of their improvements in these domains. (Ahmad et al., 2015) Also showed no relationship between the three domains regarding sustainable environmental practices. (Paghasian, 2017) showed in their study that the students' awareness of solid waste management did not influence their practices in terms of disposal.

Third, the age of the participants (predominantly 10-13 years) might have influenced the nature of the relationships among knowledge, attitudes and behaviours. Children are still developing environmental values at this developmental stage and may not yet have fully integrated their knowledge and attitudes into consistent behavioural patterns. The study conducted by Mkhonto and Mnguni (2021) showed that a lack of motivation, the imbalance between didactic instructions, ineffective group work and inadequate learner support impacted the effectiveness of the intervention program.

**Theoretical and Practical Implications**

This research has important implications for both the theory and practice points of view. Theoretically, the research suggests that while Social Learning Theory provides a valuable framework for designing educational interventions, the relationships among its key constructs may be more complex and influenced by time. This study's immediate independence of cognitive understanding, outcome expectancies, and behaviours suggests that these constructs may develop at different rates or through different mechanisms, especially in children.

From a practical perspective, the findings highlight the necessity of comprehensive intervention approaches that target each domain separately while providing sufficient time and reinforcement for their integration. Despite their relative independence, the successful improvement across all three domains suggests that multi-component interventions addressing cognitive, belief and behaviours simultaneously may be more effective than sequential approaches that assume automatic evaluation from one domain to another.

Educational intervention should incorporate a well-balanced combination of cognitive, belief, and behavioural components, as implemented in the current study. However, they should also incorporate strategies to strengthen the connections among these SLT constructs.

**Conclusion**

This study demonstrated that a Social Learning Theory-based intervention can substantially enhance students' cognitive understanding, outcome expectancies, and behavioural practices related to

solid waste management in rural schools. While significant improvements were observed in all three domains, the absence of strong inter-construct relationships suggests that behaviour change, especially among students, may require sustained reinforcement, time, and supportive environmental structures. The findings underscore the value of multi-faceted educational interventions grounded in behavioural theory, while also highlighting the need for longitudinal research to capture the evolving interplay between cognitive understanding, beliefs and actions.

**Limitations and future research directions**

When analysing the results of this research, it is important to recognise the study's limitations. The pre-experimental design's lack of a control group limits causal inferences regarding the intervention's effectiveness. Although the pre-post improvements were substantial and statistically significant, other factors might have influenced them. The immediate post-test timing may not have captured delayed effects or the relationships among the SLT constructs over time. Future research would benefit from longitudinal designs that track changes in behaviours multiple times. Such designs would provide valuable insights into the temporal dynamics of behaviour change and the potential delayed emergence of significant relationships among the SLT constructs. Furthermore, children trying to satisfy their teachers may be susceptible to social desirability bias regarding self-reported behavioural measurements. Studies should consider incorporating objective behavioural measures or observational data to complement self-reports.

The study was carried out in a specific cultural and geographical context, rural schools in Halol, Gujarat. The generalizability of the findings to other contexts, such as urban schools or different cultural settings, remains to be established. Future research should explore the efficacy of similar interventions.

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# Environment protection and Conservation – the role of religions and its rituals : an Indian Scenario

Dr. Ganga .G*

**Abstract**

*The present paper shortly reviews how rituals, customs and traditional knowledge beliefs help in the conservation of the environment. The paper highlights how Indian traditions, sacred groves, sacred plants and animals, Indian art and literature have played a role in the conservation of nature and its bio-resources. This paper will discuss community participation and also the manner in which religious means of protection are typically exploited for eco-conservation. This paper conjointly provides parallel insights into how spiritual customers and ceremonies that are historically followed facilitate environmental conservation and protection.*

**Keywords:** *Biodiversity, conservation, environment protection, traditional knowledge, rituals*

## Introduction

Environmental protection and conservation of biodiversity are of utmost importance and need of the hour in today's times. Since the dawn of human civilisation, conservation of the environment and its wealth have been the main concerns. Efficient conservation will be doable by intensive participation which can be made possible by extensive community participation and their understanding its values. One of the essential resources for understanding native societies and promoting character conservation are the ritual beliefs of Indigenous people. (Sodhi and Chandra, 2020).

Mythology has been a part of every faith that exists. It is science that explores myths, fables and legends, based on remote events to the current day. Science and the scientific community investigate evidence-based events or incidents that support common myths; several of those myths have served the aim of environmental conservation and protection. Significance has been given

* Assistant Professor in Microbiology, Sree Ayyappa College, Eramallikara, Chegannur, Allapuzha Distict Kerala Stata, India. Corresponding Author:drgangaimb@gmail.com
ORCID ID :https://orcid.org/0000-0001-8008-1936

in mythology to the worship of Water, Fire and Sun, the five necessary parts of the earth. (Sodhi and Chandra, 2020).

Mountains, hills, rivers and caves are being worshipped as part of rituals of many communities, thence protections are being given considering their holiness, by worshipping specific animal species, birds, reptiles, fishes and plant species. Sacred books such as the Vedas and Upanishads, the Bible, Quran and the Bhagavat-Gita give a clear view on the relations of humans with nature .These books incorporate stories to bring values and a sense of protection and suggest the idea of conservational importance through faith; historically, most faiths support the protection of earth and its environment according to Shah and Patel (2001). Traditionally, almost all religions support the protection of nature by incorporating devotional elements into traditional ritual practices. (Shah and Patel 2001). Worshipping plants and animals was found to be an indirect way to protect them from becoming extinct. Owing to its great benefits as medicine, food, textiles, etc, this has played an important role in the religious culture and customs of Hinduism, Jainism, Buddhism, Sikhism, Jainism etc. All the religious books from India support environmental protection. The *Rigveda* verses 1/90/6, 7,8 say:

"madhu vātāḥ ṛitāyate madhu kṣaranti sindhavaḥ mādvih naḥ santuṣadhi. madhu naktamutusāsu madhumatpārthiva rajah madhu kṣorastu suryah mādhirgābo bhavantu naḥ". (Rajib Sarmah, 2015).

Verses say that rivers have blessed us with pure water. Sun gives us light, air keeps us alive, vegetation gives us food, and mountains and hills protect us. These words evoke divine intervention in the environment to bless and protect the environment and its inhabitants.

According to *Vrksayurvedah*-5,
"dasakūpa sama vāpi dasa vāpi sama hradaḥ dasahrada samah putro dasaputra sama drumaḥ".

Verses say that planting a tree is as beneficial as having ten sons. Rigvedic people exploited nature in a very judicious way; there is a comparison of trees to human beings, Gods, etc. They beseeched Indra (God) to retain trees in forests and sons in their fathers. (*Rig-veda*,8/1/13).

In the Bible, there are many verses to lend religious insights on environmental protection. **Isaiah 43:20-21** says that all living beings on this earth are equal creations by God. The weather, plants and animals are all part of the environment which God created on Earth. The Bible says that they are as much a part of God's creation as mankind itself: **Job 37:14-18 says that,** "Because I provide water in the desert and streams in the wasteland to give drink to my people, my chosen ones, the people I created for me, the owls and jackals adore me and may laud me".

*Quran* the holy book of Islam religion also emphasizes the importance of environmental protection. The wordings of the Quran summarise that the environment is one of the key elements

that needs to be considered and given utmost importance. Natural resources are closely related to the existence of life as a whole and it also believes that all living creatures are the gifts of God and need to be treated equally and to be protected with utmost care. According to the *Quran*, the word environment denotes a condition that describes everything that exists in the Universe. In the *Quran,* - water is considered a key life-providing element; it describes life as being created through water and streams. The rain, rivers, and ocean are considered to the protecters of life. **Quran, 16:65** states that the earth has life because Allah has sent down rain from the heavens. **Quran, 50:9** mentions that, "Grain from the harvest and gardens have grown as a result of the rain that we have brought down from heaven."

Several books cite the necessary medicinal plant species and also mention the price of exploitation of such plant species; such therapeutically important plant species are considered to be the elixir of life. Owing solely to their mythological significance, several sacred plants and animals are being protected and efforts are being made to conserve them through religious beliefs. (Dolon Nath, 2015); (Ambasta, 1986); (Sahu et.al 2013)

The present article provides a window to how Indian traditions, their values, customs and rituals are meant for the eco-conservation and restoration of the environment. The paper describes how literature, beliefs, history and practices mirror the conservation aspects. The paper additionally offers a way to drill conservation responsibility in humans through spirituality and religion.

**Indian traditions, practices and values**

Sustainable development and conservation of natural resources are the major global concerns raised ever since the Stockholm Conference of Environment in 1992 and the United Nations Conference on Human Environment and Development (Earth Summit). However, long-term Indian culture and traditions have already pointed to a harmonious life with nature and its life. The day-to-day lives of Indian citizens are filled with extensive religious rituals, folklore, arts and crafts and cultural practices.

According to Sitakant Mahapatra (1992), ancient communities of India lived in harmony with nature by the tradition of veneration for the elements that are involved in the protection of the ecosystem. Their ethics and values were embedded in safeguarding natural resources with whose help they live. Their tremendous knowledge and understanding of nature and its conservation was commendable.. They have protected it with a sense of responsibility and pride and they believed that the environment cannot be an object of exploitation but is an object of veneration. Hence, they added a spirit of devotion and brought spiritual elements to impose worshipping the Earth Goddess. Hence, worship of the Earth as a deity, became a part of many indigenous cultures, especially

in famine times to get better yield and fruitful benefits. Bondage and intimacy between man and the ecosystem around his habitat were strengthened. Certain tribal communities of India are still fully dependent on their habitat and they live in harmony with nature.

In Hindu mythology, importance was given to birds and animals and they were worshipped as divine forms, thereby making their life secure. There were fourteen *avataras* (births) of god in the forms of animals, reptile and birds such as, Matsya, Kurma, Varaha, Nrisingha etc. It was believed that each species has a specific role to continue the cycle of life. According to the Vedas, killing of nature's scavengers was considered to be sinful and was forbidden.

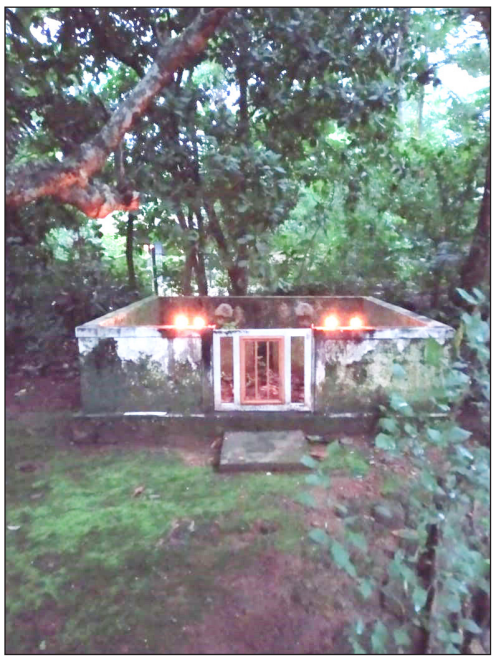
In India, supernatural powers were ascribed to nature as people worship plants, animals wind, sun, moon, water, fire, mountains rivers, birds, fishes, reptiles, etc. Temples and worship places were separately made and natural habitats were made for their deities. Sacred groves and forests were preserved and become part of their worship culture. India being a multi-religious and multi-cultural society, respect for nature is inherent. All practised faiths believe in the principle and teach the worshippers that environment and their nature are the creations of God. All these religions proclaim the obligation of humans to protect nature; India's profound religious practices and their traditional ethics and sound relationship with nature are obvious in conservation. Hence, nature conservation is not a new concept as far as Indian traditions are concerned. Concepts of interrelationship and interdependence were mentioned in Indian scriptures like the *Upanishads and the* epics like *Ramayan* and the *Gita* etc.

**Role of Art and Literature of India in Eco Conservation**

Most of the art forms, Indian sculptures, paintings and architectural ornamentation reflect the love and reverence of nature and wildlife. Hence, most our Indian art forms pay great attention to the conservation aspects also. Protection of nature and conservation of natural resources was an innate feature of the Indian essence and faith, and hence, is reflected in many religious acts, folklore, art and culture, infusing every aspect of routine life. Indian civilization is one of the oldest civilizations in the world. Cave paintings at Bhimbetka in Central India depict the harmony between humans and animals that existed during the era. The coexistence of wildlife and humans is depicted in the arts and sculptures obtained from the reminiscent of Indus valley civilization. Scriptures and paintings that depict their interaction with nature are found indoors and walls of worship, places, art galleries and heritage centres can be considered as a means used to enhance the intrinsic relationship between man and nature.

Indian literature mirrors the deep understanding of nature and its influence on humans. Mahakavi Kalidasa was a great lover of nature of the ancient period and *Meghaduta* and *Ritusamhara*

evoke an interest in nature as a theme for many of his successors. Stories found in the *Panchatantra*, the *Shuka-saptati*, and *Hitopadesha* are the metaphorical representations of various animal species (Nair, 2020a).



**Role of the sacred grove or small forest ecosystem in India for eco-protection**

The concept of the sacred grove was developed to protect small forest patches of the village with valuable medicinal plants indigenous to a specific locality. Sacred groves played a vital role in maintaining folk medicine and traditional plant-based therapies with rare plant species. There are sacred groves that are dedicated to village deities, with the sole aim of protecting them. There are sacred groves in several Indian states. It has been noted that there are many sacred groves in the northern Indian states of Maharashtra and the southern Indian states of Kerala, Karnataka and Tamil Nadu. In states like Kerala, traditionally, every village had about 10-15 sacred groves though the number is tremendously reducing due to urbanization and human encroachments.

According to Madhav Gadgil (1976), sacred groves in India help in maintaining rich biodiversity and hence are considered to be mini Western Ghats. Maintaining and worshipping sacred groves as a part of tradition and ritual practices had not only contributed to forest protection but also helped in protecting several precious flora and fauna that inhabited it. In several regions of India, in addition to sacred forests, many sacred ponds

Sacred groves in Kerala: protected areas as a token of conservation of nature

that are connected to temples are customarily preserved.

Sacred ponds also play a significant role in the protection of certain endangered species of turtles, rare fishes, crocodiles, water animals & fishes, and associated birds and plant species. (Gadgil and Vartak, 1976); (Arora, Ranjit, 1997); (Bain1, 2017; (Nair, 2020b). Sacred groves provide ecosystem services such as conservation of biodiversity, regulation of water cycle, temperature regulation, conservation of air, soil, and water, carbon sequestration, pollination, and food corridor. (Chandran and Hughes ,1997)

**Role of sacred plants and animal in eco-conservation in India**

For mythical, religious and festival purposes, a wide variety of plant and animal species have been utilised. Dolon Nath (Dolon Nath, 2015). Many tree species have traditionally been revered, and peepal trees have been prohibited from being cut down (*Ficus religiosa*). This group includes trees such as the banyan tree (*Ficus 'bengelensis*) and the Khejdi tree (*Prosopis cineraria*). Some plants are regarded sacred by numerous cultures and religious sects in India, and several trees and herbs cultivated on temple grounds are considered sacred and are not allowed to be touched. Tulsi, neem, champa, elanji, sandalwood, beetal nut, Asoka tree, coconut palm, juniper, lotus, pepper, hibiscus, and other plants were all preserved in this way. In Kerala, in accordance to Hindu custom, each boy or girl who is born under a traditional birth star will be connected with a specific plant or tree species/animals in such a way that every individual is given the responsibility to protect at least one plant and animal.

Traditional cultural attitudes, based on religious faith, have made a significant contribution to the conservation and propagation of various species of trees and plants in India. (Nair, 2020 a 2020b). In India, certain birds, rodents and reptiles are regarded sacred and serve as vehicles for gods and goddesses. The peacock was thought to be Lord Karthkeya's chariot, the eagle was thought to be Lord Vishnu's vehicle, and the blue rock pigeon was thought to be sacred and is protected in the Bengal region. The mouse represents Lord Ganapathy's vehicle, and the bull represents Lord Siva's. Elephants in Indian temples were given the highest respect and consideration.

In Kerala, there are multiple snake temples with little woods spread across wide swaths of land. Temples in Kasargod, Kerala, protect crocodiles. Feeding fishes are a tradition in many communities across India. One of the wealthiest temples in India called Padmanabhaswami temple at Thiruvanathapuram has Lord Vishnu reclining on a serpent which depicts a sign of respect towards reptiles. Tortoise is being protected and worshipped in South Indian temples.

**Role of Indian history in conservation of nature**

Asoka, the great Indian ruler, was a nature conservator and wildlife protector. His inscriptions on rocks and iron pillars concerned the loss of forests and the killing of numerous species protected nature. Even today, this is thought to be the first documented conservation measure (Nair 2020a). According to historical evidence, in 1730 AD, the Bishnoi communities in Rajasthan's Khejarli villagers staged a massive strike against the cutting of khejri (*Prosopis cineraria*) trees for the construction of the fort, which is regarded as the first major protest against deforestation and environmental conservation. (Bhatt and Rakesh, 2015; Bishnoi *et al* 2000).

The Chipko movement against deforestation, led by the village women of Gopeswar village in Garhwal in the Himalaya, was another successful environmental effort. Their aggressive approach resulted in the preservation of 12,000 square kilometres of a crucial water catchment area. (Petruzzello, Melissa.(ed.) 2018) Another successful conservation initiative was the Apiko movement in Karnataka's southern state. (Bhatt and Rakesh, 2015); (Bishnoi et al 2000).

**Conclusion**

In conclusion, it was observed that in India, the practice of nature conservation is deep-rooted within the culture and traditions of the country. It was also observed that rituals and customs were mainly meant to protect natural resources. Ancient culture and traditions of Indian society had contributed a lot to the conservation of natural ecosystems, plants, and animals. Government, conservation agencies and powerful laws alone cannot make a large movement in people for the values we look for in the conservation of environment. It was generally believed that people are inclined to value anything considered to be holy or sacred. Early humans made great efforts to protect such rare species with a vision of sustainable environmental protection under religious cover. The focus must be on changing the way we live in order to either directly or indirectly contribute to environmental protection for leisure and to the promotion of mental health in light of the stressful conditions we face in today's competitive society. Religious means of protection can be chosen to be the best way of evolving a conservation strategy that one can adopt for the keeping the earth, sustainable. It is need of the day to follow the steps of the ancients.

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