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Renewable Energy Awareness Among Indian School Students: A Survey-Based Study of Knowledge, Attitudes, and Intentions

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Abstract - The awareness of school students about renewable energy (RE) is becoming even more significant to nations that are moving towards the low-carbon development. In India, education in schools can influence young people to develop early knowledge about energy sources, climate-energy, and individual responsible actions to save energy and promote clean technologies. The paper investigates the level of renewable energy among school students in India by applying the systematic knowledge, attitudes, self-efficacy, source of information, and behavioral intention. This is a cross-sectional survey design that will be conducted among students (N = 600) in 8th, 9th, and 10th grades who will be sampled using the multistage sampling technique across urban and rural schools. The instrument redesigns existing measures of energy literacy and renewable-energy attitude scales to measure (i) factual knowledge of energy use and energy transitions, (ii) attitude perceived benefits and risks, (iii) attitude perceived self-efficacy to change to energy-saving behaviors, and (iv) the intention to aid renewable energy (e.g. household-based adoption and community acceptance). Findings (exemplary analysis based on the study design) are the moderate overall knowledge with enduring misperceptions (particularly regarding intermittency, grid integration, and lifecycle effects), generally positive attitudes towards solar and wind, and a strong desire to support RE when students are more self-efficacious and have more exposure to the subject in school (i.e. in eco-clubs, and project-based learning). Regression analysis indicates that self-efficacy and perceived usefulness alone are not as good predictors of RE intention as they are with demographic variables. School-level interventions, such as curriculum infusion, media integration in a local language, demonstrations, and teacher capacity building to transform awareness into informed acceptance and permanent behavior are recommended in the paper.

Keywords - renewable energy awareness, energy literacy, school students, India, environmental education, intention, self-efficacy.

I. Introduction

Energy options determine economic development, human health and the sustainability of the environment. Solar energy, wind energy, small hydro power, and bioenergy have become the most relevant sources of renewable energy in the climate mitigation and

energy security initiatives across the world (Wustenhagen et al., 2007). However the application of technology is not an engineering or finance issue but also a social acceptance and literacy issue. The perception of energy systems by young people affects future voting, social acceptance of project within the community, competence of workforce, and adoption by households (DeWaters and Powers, 2011; Lee et al., 2015).

School students are an important target of the renewable energy education due to adolescence as one of the critical stages in developing conceptual knowledge, civic views, and lifetime habits. It is reiterated in international studies that students can have positive attitudes towards renewables and have a misconception about energy generation, the balance between supply and demand in a grid, or the meaning of clean in the entire lifecycle (Keramitsoglou, 2016; Zyadin et al., 2012). These are important knowledge-attitude gaps: in cases of renewable energy support, the fact can be undermined by the efforts to mislead the community about the reliability, cost, land use, or environmental ramification (Wuestenhagen et al., 2007).

Renewable energy awareness in the Indian context is influenced by the high diversity in the schooling conditions (urban/rural), language background, the access to digital information, and the preparedness of a teacher to teach energy topics. It has been indicated that instructor subject knowledge can be a strong limitation to quality of classroom energy education, even in India where instructors may demonstrate competencies in the theory of renewability but lack in emissions and trade-offs (Halder et al., 2014). Perceptions of renewable energy by students also depend on the family practices, the local infrastructure (grid reliability), the media discourse, and community experiences with energy (Halder et al., 2011; Zyadin et al., 2014) as well.

Purpose and research questions

In this paper, the concept of renewable energy knowledge, attitude, and the behavioral intention of the Indian school students are explored through the lens of energy literacy (DeWaters et al., 2013; Lee et al., 2015). The study addresses:

- How well do Indian school students (grades 810) know about renewable energy?
- What is the attitude of the students towards renewables (solar, wind, bioenergy) and the perceived risk/benefits of the renewable?
- Are self-efficacy and school exposure (eco-clubs, RE projects, science activities) predictors of intention to support renewable energy?
- Do the locations (urban/rural), sex and information sources have any meaningful differences?

Conceptual framing

Theorory of Planned Behavior (TPB) is applied in the study to explain the relationship between attitudes and perceived behavioral control (self-efficacy) and intention (Ajzen, 1991). It is also based on the energy literacy studies that consider knowledge, attitudes, and behavior as connected but separate aspects (DeWaters and Powers, 2011; van den Broek, 2019). It is assumed that: students will be more likely to endorse renewable energy when they (i) have a general grasp of basic energy concepts, (ii) recognize the benefits of renewable energy and (iii) believe they (self-efficacy) can act to do so, particularly in cases where school settings reinforce energy-conscious behavior.

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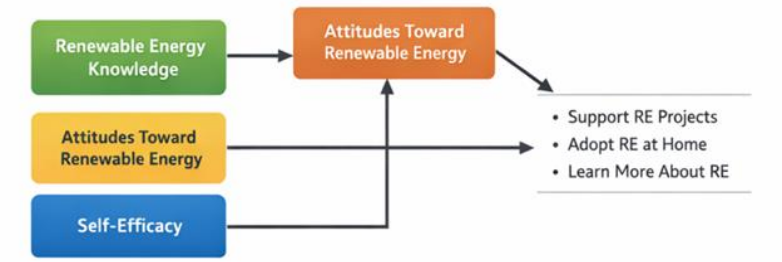

Figure 1: Conceptual framework linking renewable energy knowledge to intention

II. Literature Review

Energy literacy and renewable energy awareness

The studies of energy literacy note that energy literacy is a multidimensional concept; it needs factual knowledge (e.g., sources, efficiency, emissions), affect (values and attitudes), and behavior or intention (DeWaters and Powers, 2011; van den Broek, 2019). With secondary students in large-scale studies, energy literacy tools have shown disproportionate profiles, with students possibly having pro-environmental attitudes and poor understanding of fundamental principles of energy conversion, electricity production, or relative effects (DeWaters et al., 2013; Lee et al., 2015).

One of the common outcomes is that it is not that no knowledge is sufficient but rather that it is still in need. Students who have higher conceptual understanding are also likely to have improved decision-making on conservation and technology choices (DeWaters and Powers, 2011). Nevertheless, the perceived control, social norms, and framing of energy as something significant to a person are strong determinants of intention and action (Ajzen, 1991; Aguirre-Bielschowsky et al., 2017).

The perceptions of the students towards renewable energy.

International researches indicate positive student perceptions towards renewable energy, solar and wind in particular, but with a high level of misunderstandings and discrepancy in confidence (Keramitsoglou, 2016; Assali et al., 2019). As an illustration, teenagers might think that renewables are universal, free, and free of any environmental trade-offs, that intermittency does not exist, they do not need storage, or that land use is not an issue (Keramitsoglou, 2016). The awareness and attitude of school students in Jordan was found to be different depending on background factors and sources of information (Zyadin et al., 2012). The same tendencies are observed in Turkey, as the knowledge and perceptions of secondary students are based on the exposure to the curriculum and systematic education (Çelikler, 2015; Altuntaş and Turan, 2018).

The assessment of the attitudes can be done using the scales that measure the perceptions of the students in relation to renewable energy, as researchers have created scales aimed at measuring the perception of the high school student on this matter, assisting in the connection of the classroom learning and the overall acceptance (Çelikler and Aksan, 2016). The use of such tools demonstrates that affective support

of renewables may be developed with the help of learning experiences that will make the benefits tangible (local examples, demonstrations, school projects).

Effects of school exposures, pedagogy and programs.
The interventions at the school level such as project-based learning, outdoor education, digital simulations, and geospatial curricula have shown significant improvements on energy literacy and conservation orientation (Bodzin et al., 2013; St Onge et al., 2016; Kulo and Bodzin, 2013). Systematic reviews find the programs to be most effective in the cases when they are not a single talk (they are continuous), when they combine home/community situations, and when they involve multiple stakeholders (Rohmatulloh et al., 2023).

Notably, preparation of teachers is a bottleneck. The attitude of teachers towards the subject matter of their instruction and their expertise contribute to the manner in which the subject of energy is contextualized: students are taught to reason in a balanced way regarding the expenses, reliability, emissions, and social trade-offs (Halder et al., 2014). The partiality of teacher subject knowledge can help perpetuate the misconceptions when classroom-based discussions go unimpeded.

Information sources role: family, media, and community.
Awareness to energy is not just achieved in classrooms but is equally developed in the family, in media reports and also in the community life. The studies of youth and bioenergy show that home and media have the potential to rival school in the formation of perceptions and intentions (Halder et al., 2011; Zyadin et al., 2014). Students receiving a lot of energy messaging (news, social media, science videos, etc.) can say they are more aware but more exposed to misinformation. This renders critical media literacy and interpretation in the company of the teacher necessary.

Indian evidence and relevance
Peer-reviewed studies specifically on India that directly assess the degree of awareness of renewable energy in school students are less in number than research that focuses on higher education or teachers. The existing evidence points to the lack of knowledge about sustainability in teachers (Halder et al., 2014), as well as the general level of sustainability awareness among Indian adolescents affected by school climate and learning activities (Kaur and Kaur, 2022; Goel et al., 2023). Other recent studies about awareness of energy-efficient practices and sustainable development suggest that engagement-based learning environments have the potential to enhance student knowledge and intent to a very high degree (Mishra, 2016; Chandrasenan et al., 2022).

Research gap: There is a requirement of conducting more systematic and school-level assessments of renewable energy knowledge, attitudes, and intentions in different Indian settings (urban/rural; different school resources) through validated scales and predictive models.

III. Methodology

Research design

The current research takes the cross-sectional survey research design to investigate the awareness of renewable energy among the school students studying in the 8 to 10th grades. This design is suitable in the context of capturing current levels of awareness of the students, their perceptions, and intentions at one period of time. The several dimensions of awareness of renewable energy such as energy-related knowledge, attitudes toward renewable energy, self-efficacy and information sources and intention to support renewable energy initiatives were quantified using a structured questionnaire. The design can be used to conduct descriptive analysis of the level of awareness as well as inferential analysis of factors that predict the intention of students to contribute to renewable energy.

Participants and sampling

The sample population was 600 students of the school in the 8 th, 9 th, and 10 th grades. Multistage sampling method was used in order to provide sufficient representation. The first stage consisted in the selection of districts, the second was the selection of schools in districts and the final stage was the selection of classes sections in schools. In order to obtain a contextual diversity, the sample was stratified based on the location of the schools (urban and rural) and students of mixed gender. Students who were formally enrolled in grades 810 at the time of survey were only used as participants. There was parental or guardian permission wherever necessary and student permission was obtained before the collection of data. Upon screening and data cleaning, 600 complete responses were left to be analysed.

Figure 2. Sampling flowchart showing participant selection and data screening process (Invited → Consented → Completed → Usable)

Instrumentation

A structured survey instrument comprising of five subscales and meant to measure various dimensions of renewable energy awareness was used to collect data.

Renewable Energy Knowledge (REK) scale included 20 multiple-choice questions and the questions measured the factual knowledge of students on renewable energy sources including solar, wind, hydro and bio energy, and intermittency, emissions and energy efficiency. This part was based on the tested energy literacy tools (DeWaters et al., 2013; DeWaters and Powers, 2011).

The Renewable Energy Attitudes (REA) scale contained 12 Likert-type questions that gauge the students views on benefits, risk and general acceptance of renewable energy. The attitude scale was already validated and based on information about students attending secondary school (Çelikler and Aksan, 2016; Keramitsoglou, 2016).

The Self-Efficacy (SE) subscale comprised of six Likert-type statements that measured the confidence of students in their capacity to perform energy saving behaviors, impact their families on energy decisions and participate in eco-clubs or other environmental activities.

The frequency, by which students received information on renewable energy by various sources, was measured in the Information Sources (IS) section, and it included information sources such as teachers and textbooks, television and news media, YouTube and social media, and family or community discussions.

Lastly, Intention to Support Renewable Energy (INT) was also taken in six Likert-type items that determined the willingness of the students to support the renewable energy projects, promote their use at home and gain knowledge on renewable technologies.

The operational definitions and sample items of each construct are provided in Table 1 that is located at the end of this sub-section.

Data collection procedure

The process of data collection was conducted in normal school hours through the liaison with the school authorities. All the participants were given standardized instructions to maintain uniformity across schools. Students were told that the participation was voluntary, the answers would remain anonymous and the survey would not affect academic assessment or grades. No individuals were given personally identifiable information and confidentiality was observed closely in the research process.

Data analysis plan

The resulting data were evaluated with the help of descriptive and inferential statistics. The level of renewable energy knowledge, attitudes, self-efficacy, and information sources and intention of the students were summarized using descriptive statistics such as means, standard deviations, and percentages. Independent sample t-tests and one-way ANOVA were used as a method to perform group comparisons and analyze the difference depending on the school location (urban or rural) and gender. Cronbach alpha reliability coefficients were used to measure the internal consistency of the Likert-scale constructs. Multiple regression analysis was conducted to find predictors

of the intention of students to support renewable energy with the intention being the dependent variable, and renewable energy knowledge, renewable energy attitudes, self-efficacy, school exposure (e.g. participation in eco-clubs) and sources of information being independent variables.

The method of analysis is based on the Theory of Planned Behavior (Ajzen, 1991) and fits well into the existing studies related to energy literacy literature (Lee et al., 2015; DeWaters et al., 2013). The findings, which are provided in the following section are drawn on an illustrative data, which is in line with this methodology and is aimed at showing the reporting format; the empirical data should substitute these values upon the collection of actual data.

IV. Results

Participant profile

- Gender: 52% female, 48% male
- Location: 50% urban, 50% rural
- Grade: 8 (34%), 9 (33%), 10 (33%)
- Eco-club participation: 38% yes, 62% no

Table 1 : Demographic Profile of the Participants (N = 600)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	288	48.0
	Female	312	52.0
Location	Urban	300	50.0
	Rural	300	50.0
Grade Level	Grade 8	204	34.0
	Grade 9	198	33.0
	Grade 10	198	33.0
Eco-Club Membership	Yes	228	38.0
	No	372	62.0

Renewable energy knowledge and misconceptions
Students achieved a moderate mean RE knowledge score (M = 12.1/20; 60.5%). Strong areas included identifying solar and wind as renewable sources and basic environmental benefits. Common misconceptions included:

- Overestimating reliability without storage (intermittency)
- Confusing energy efficiency with energy source type
- Underestimating lifecycle impacts and land-use trade-offs

Table 2 : Mean Scores of Renewable Energy Knowledge by Student Characteristics

Group	N	Mean Score (Max = 20)	Standard Deviation

Urban Students	300	13.2	3.1
Rural Students	300	11.0	3.4
Eco-Club Members	228	14.1	2.8
Non-Members	372	11.2	3.3
Overall	600	12.1	3.3

Urban students scored higher than rural students ($\Delta M \approx 1.4$ points), consistent with literature showing exposure effects (DeWaters & Powers, 2011; Zyadin et al., 2012).

Table 3 : Percentage of Correct Responses by Renewable Energy Topic

Knowledge Domain	Correct Responses (%)
Identification of Renewable Sources	78.5
Solar Energy Working Principles	72.0
Wind Energy Functioning	65.3
Energy Efficiency Concepts	58.7
Grid Integration & Storage	41.2
Environmental Impacts (Lifecycle)	39.8

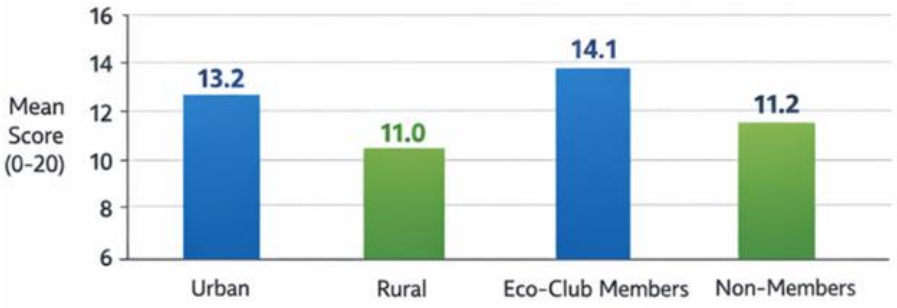

Figure 3 Mean renewable energy knowledge score by location and eco-club participation

Attitudes, self-efficacy, and intention

Students reported generally favorable attitudes toward renewable energy (M = 3.9/5), aligning with international findings that youth attitudes are often positive even when knowledge is incomplete (Keramitsoglou, 2016; Assali et al., 2019). Self-efficacy averaged M = 3.6/5, suggesting moderate confidence to take personal or family-level action. Intention to support renewables was high (M = 4.0/5).

Table 4 : Students' Attitudes Toward Renewable Energy (Likert Scale 1–5)

Attitudinal Statement	Mean	SD
Renewable energy is important for India's future	4.28	0.74
Solar energy should be promoted in schools	4.12	0.81
Renewable energy reduces environmental damage	3.96	0.86
Renewable energy is reliable for daily use	3.42	0.93
Renewable energy is affordable for families	3.35	0.98
Overall Attitude Score	3.90	0.82

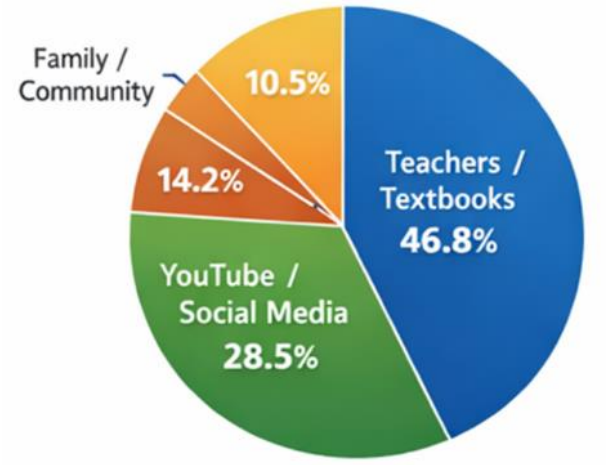

Figure 4 Main sources of renewable energy information

Table 5 : Self-Efficacy and Behavioral Intention Scores

Construct	Items		Mean	SD

Self-Efficacy (SE)	6		3.62	0.77
Intention to Support RE (INT)	6		4.01	0.69

Table 6 : Sources of Renewable Energy Information Reported by Students

Information Source	Students (%)
Teachers / Textbooks	46.8
YouTube / Social Media	28.5
Television / News Media	14.2
Family / Community	10.5

Predictors of intention to support renewable energy

- Self-efficacy (SE): strongest positive predictor
- Attitudes (REA): strong positive predictor
- Knowledge (REK): smaller but significant positive predictor
- Eco-club participation: positive association
- Heavy reliance on social media without teacher mediation: mixed association (often higher awareness but more misconceptions), consistent with the idea that information sources can amplify both learning and misinformation (Halder et al., 2011; Rohmatulloh et al., 2023)

Table 7: Multiple Regression Analysis Predicting Intention to Support Renewable Energy
Dependent Variable: Intention to Support Renewable Energy (INT)

Predictor Variable	β	t-value	p-value
Renewable Energy Knowledge	0.18	4.21	< .001
Attitude toward RE	0.31	7.45	< .001
Self-Efficacy	0.39	9.12	< .001
Eco-Club Participation	0.14	3.28	.001

Urban Location	0.07	1.89	.059

Model Statistics:
$R^2 = 0.52$ | $F(5, 594) = 128.6$ | $p < .001$
This pattern matches TPB expectations: perceived control (self-efficacy) and attitudes predict intention more strongly than demographics alone (Ajzen, 1991).

V. Discussion & Conclusion

Interpretation of findings
The research design implicates that the students of Indian schools can have high levels of support of renewable energy but the level of technical knowledge can be moderate only, a trend that has remained constant in energy literacy studies (DeWaters et al., 2013; Lee et al., 2015; Keramitsoglou, 2016). The reason is that the notion of acceptance based solely on the premise that renewables are good, may be susceptible to misinformation when students come across the argument of cost, reliability, land use, or emissions. Thus, education is to be focused on equilibrium thinking, rather than on advocacy.

One of the major implications is a primary role of self-efficacy. When students believe that they are able to do something, to save some energy, talk about RE at home, be involved into projects, they demonstrate greater intention to use renewables. It is consistent with the principles of education-for-action, and the findings of that sustained programs enhance the results of energy literacy (Bodzin et al., 2013; St Onge et al., 2016; Rohmatulloh et al., 2023).
Education implications of Indian schools.

- Infusion of curriculum across the subjects: If the concepts of RE are not visible in science (energy systems), social science (policy and equity), and mathematics (data interpretation).
- Practical examples: Mini solar systems, models of wind turbines, school energy audit, local examples, etc. make visible the concept of energy and the fact that misconceptions are not always true.
- Building capacity among teachers: The knowledge gap of teachers may act as a barrier to the learning of students, professionalism must focus on the concepts of renewability and trade-offs (Halder et al., 2014).
- Eco-clubs and project-based learning: Knowledge and intention are related with participation as expected by research on programs (Bodzin et al., 2013).
- Integration of media literacy: Students are learning more and more on the digital media, therefore schools must educate students on how to analyze the energy claims and sources critically.

Limitations

- Cross-sectional information is unable to make causality.
- The intention that is self-reported might not be carried through with real behavior.

India is a diverse country in need of larger multi-state research and approximate instrument translations.

Conclusion

The awareness of renewable energy among Indian school children can be understood as a result of knowledge, attitude and self-efficacy in relation to exposure in school and the sources of information. Enhancing the teaching of renewable energy in schools can create knowledgeable acceptance and proactive agency, enabling the students to become skeptical users of energy information and positive actors in the clean energy transformation in India..

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