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Original Article

A Comparative Study of Energy Saving Behaviour, Attitudes and Knowledge amongst School and College Level Student

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Abstract

Ancient Indian systems have always stressed on the conservation and protection of ecosystems through natural and sustainable techniques. Rise of consumerism and subsequent increase of energy consumption is responsible for creating a lot of pressure on the ecosystems all over the world. This has resulted in devastating effect on climate and survival of many has been endangered. To encounter this, a sustainable style of living is most required. A transition from transmissive to transformative learning can help society to embrace and absorb sustainability as a lifestyle rather than just a theoretical concept. Education systems of today, be it school level or college level, need a paradigm shift. In this direction, this study was undertaken to find out the behavioral patterns, attitude towards energy usage and knowledge and intentions about energy saving amongst school and college level students. A sample of 158 school and college students was collected using convenience sampling and was analyzed using ANOVA. We observed that school students show better behavior and attitude towards energy usage and savings than college students. As far as, knowledge and intentions about energy usage and improvement are concerned, there is no statistical difference between School and college students. It was concluded that by imparting knowledge about energy usage and energy saving in the formative years, may lead to changes in attitude and general behavior of an individual in particular and society at large.

Keywords: *Energy Consumption behavior, Energy Usage knowledge, Energy saving Intentions, Attitude towards energy usage, Renewable Energy*

Introduction

"No Tomorrow" for many unless Consumption falls, the United Nations Environment has again raised its concerns in a statement (quoted by Thomas Reuter's foundation article dated March 13,2019. Website: www.eco-business.com). According to Global Resources Outlook, the exploitation and unsustainable consumption of natural resources at this rate (which has tripled in last 50 years) is accounting for 90 percent of loss of Bio-Diversity and by 2060 will further lead to 10 percent loss of forests and 20 percent of habitats will be lost.According to Global Energy and CO2 Status Report 2017 published by IEA, there was an increase of 2.1% in global energy demand in 2017 which was double that of 2016 and this growth was maximum concentrated in Asia with China and India together contributing to more than 40% of the increase. As far as Carbon emissions are concerned, Asian countries accounted to almost two-thirds of increase in global emissions, the report said.The situation is grim and alarming. To attain the UN Sustainable Development Goals for 2030 that is to eradicate poverty, hunger, gender inequality and provide good education, health, clean water and sanitation and affordable and clean energy to all, humongous efforts at social, political and environmental levels are required. Various stakeholders at international, national and consumer platforms need to be awakened and educated and a behavioral transformational revolution is the need of the hour (website: www.un.org). Thapar(2020) in his study about consumer behavior towards energy usage in India observed that India being one of the top energy consumers in the world, needs many initiatives to reduce energy wastage behaviors. To do so, peak clipping techniques, energy efficient meters, Star Ratings to name a few are helpful. However, awareness plays a big role in energy conservation (Tewathia, 2018). Ilham et al. (2022) in their study on Malaysian schools discussed that sustainability is portrayed By young generation and the responsibility to educate and make people aware about environmental initiatives lies with parents and students also along with other stakeholders.

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Our study focuses on the behavioral aspects of students as consumers regarding energy usage in their daily lives and key findings which may further help us to predict the adoption and diffusion of renewable energy sources.

Knowing the energy literacy, measured on three dimensions namely Behavior, Attitude and Knowledge and Intentions towards energy saving, among the students in Bhopal and Indore cities of Madhya Pradesh, may lead to certain solutions to understand consumer energy behaviors better for instance how this awareness can be helpful in mindful usage of various electric appliances, how an optimum energy mix can be created by shifting to renewable energy resources to some extent, and how various variables affect the energy use in a domestic environment. Furthermore, since students will eventually be the future of the country, it is useful to understand their behavior and sensitize them to be better consumers (Zsóka, 2013).

Literature Review

Frederiks et al. (2015) in their paper elaborated that energy consumption is an outcome of various socio-demographic and behavioural factors. The authors also discussed certain consumer profiles as Energy-Saving and Energy-Wasting ones known as Efficiency and Curtailment Behaviours respectively. These behaviours are considered to be consequences of certain factors such as socio-demographic (age, gender, education, income, household size, type of household, house ownership, geographical location and employment status) and psychological factors (Values, attitudes, beliefs, motives, intentions and goals, personal norms, perceived responsibility, need for personal comfort and social influence to name a few). These behaviours and factors are quite decisive in framing the energy personality or profile of an individual. Sardianou (2003) in his research on Household energy conservation pattern in Greece identified Economic, Demographic and attitudinal variables as critical factors. In their study on energy consumption patterns of Higher education students in Amrita University, Kamal and Barpanda (2017) found that social marketing, personality and education play an important role in deciding the energy consumption behavior amongst students.

Abrahamse et al. (2005), Khambalkar (2010), Heiskanen et al. (2012), Kaplowitz et al. (2012), Dietz, Stern and Weber (2013), Koshman and Ulyanova (2014), Jain et. al. (2014) Rahman et al. (2016) Khan and Halder (2016) and Hu et al. (2017) worked on various energy conservation and energy saving methods and showed that in order to save energy both knowledge and practice are to be taken side by side. Le-Anh et al. (2023) in their study based on Behavioural-Reasoning Theory (BRT) observed that there is a strong correlation between energy saving behavior and energy saving intention.

Eco conservation, Eco literacy and awareness about conventional resources and how energy saving mechanisms can be adopted, is a major area of concern. Having an intelligent mix of Conventional sources and non-conventional sources of energy can lead to wider accessibility, cost reductions, lesser energy leakages and greener ecosystems. Further, educational initiatives need to be an integral part of the curriculum in schools as well as university level studies.

Research Aim and Hypotheses Development

Energy is the prime mover of all especially economic activities which needs to be conserved and preserved for the safety and sustainable living of our future generations. To attain this, awareness and knowledge dissipation about energy and its saving mechanisms, should be assessed first. This paper is basically our attempt to study the three dimensions namely 1) energy saving behavior, 2) attitude and 3) knowledge and intention to save energy amongst school and college students. Consequently, based on literature review and the main hypotheses for the study was designed as –

H1: There is no significant difference between school students and college students regarding energy usage and saving behavior.

H2: There is no significant difference between school students and college students regarding attitude towards energy usage and saving.

H3: There is no significant difference between school students and college students regarding knowledge and intention to save energy.

Material and methods

The study was conducted among students of Bhopal and Indore cities of Madhya Pradesh which are respectively Commercial and Political capitals of the state, in a short duration of May and June 2024. A self-administered questionnaire was given to 325 students, to understand the energy behavior, attitudes and knowledge amongst students. The questionnaire had 3 sections with a 5-point likert scale was distributed with options as Always, Mostly, Occasionally, Rarely and Never and also having terms as Strongly Agree (1), Agree(2), Neutral(3), Disagree(4) and Strongly Disagree (5) . Some of the questions were based on the study by DeWaters and Power(2013) whose model is given in Figure 1. The questionnaire was divided into three sections along with basic demographic details about their family size, number of rooms in their households and whether their grades for instance whether they are in school, doing under graduation or post graduation.

Based on the model by DeWaters and Power (2013), information about knowledge and intention about energy consciousness (Cognitive), attitude (affective) and behavioral aspects (behavioral) was asked through a set of 22 questions. These questions were aimed to study their awareness levels about energy usage, their preferences about energy usage and in general their consciousness about environment conservation and cost saving practices. The study was also based on Cotton et al. (2016) which was carried out to understand the knowledge, attitudes and behavior of on campus university students in UK and Portugal.

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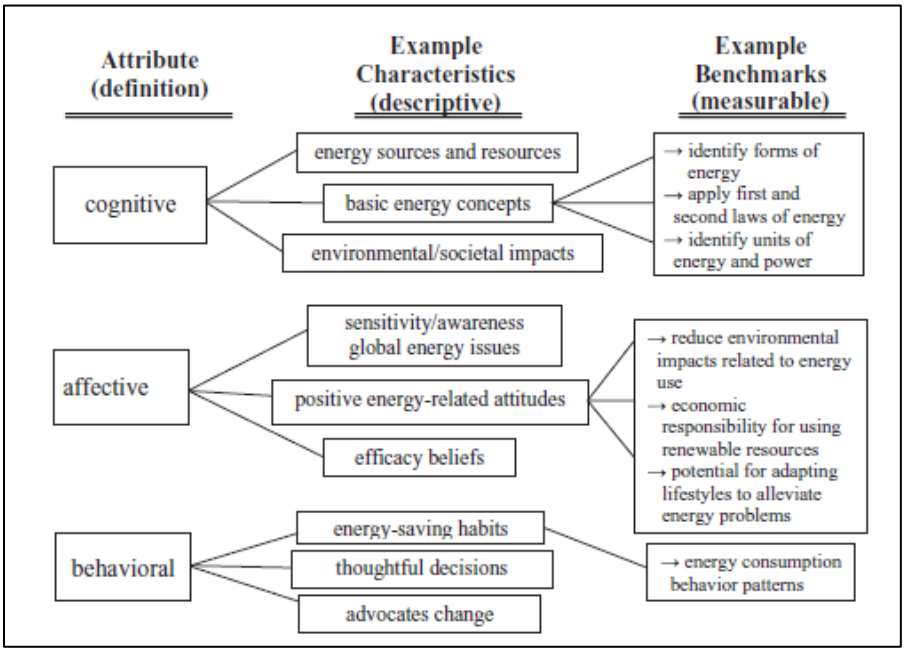
Figure 1: Adapted from DeWaters and Power (2013)



Some of the main questions based on existing studies, are tabulated in Table 1.

Table 1: Major Statements in the Questionnaire and related studies

STATEMENTS (Likert 5-Point Scale)	No. of items	Adapted From
Behavioural Component	**10**	
Opportunity to reduce energy use at home; Try to take steps which will reduce electricity bills		Le-Anh et al. (2023)
Turning lights and fans off when leaving the room, Switching the appliances off immediately when not in use, No wastage of water, Installed some energy saving appliances in home		Cotton et al.(2016); Lee and Tanusia (2016) ; Tewathia (2018)
If possible, using public transport , Using vehicle pooling		Zerinou et al. (2020)
Attitude Towards Energy Saving	**06**	
I would like to know more about energy saving techniques		Zyadin et al.(2014)
I am willing to switch to renewable energy sources.		Zyadin et al.(2014)
I am willing to spend on non polluting form of energy to save environment; solar installations can reduce electricity bills		Le-Anh et al.(2023); Nag et al. (2025); Cotton et al. (2016)
Switching to electric vehicle in place of petrol or diesel car or bike; walking, cycling shorter distances		Cotton et al. (2016); Zyadin et al.(2014)
I am ready to change my daily habits to reduce carbon footprints		Ntanos et al. (2018)
KNOWLEDGE & INTENTION	**06**	
Energy crisis		Ntanos et al.(2018)
Reducing climate change ; Make others in my social circle to be more energy conscious; Moral duty towards energy conservation		Le-Anh et al.(2023)

Demographic Profile of students:

The questionnaires were distributed to 325 school as well as college students. Memon et al.(2020) in their study suggested sample size to be such so that sample-to-item ratio should not be less than 5-to-1. Our questionnaire had 22 items which renders a sample size of 220 if we take 10-to-1 ratio, hence we tried to distribute questionnaires to more than 220 students. School students belonged to eighth to twelfth standard and College students included Undergraduate and Post Graduate students of various schools and colleges of Bhopal and Indore cities. In all 325 questionnaires were distributed, however response percentage was only 50.15 percent. 163 students responded of which 5 records had to be deleted due to missing or improper data. Of the remaining 158 responses, 86 belonged to school students and 72 records were of College students. 83 boys and 75 girls responded properly. Since energy consumption can be affected by household characteristics, details like number of rooms in the house along with number of family members were also asked. The details are tabulated in table 2 as under –

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Table 2: Demographic details of respondents

Parameter	Description	Frequency	Percentage
Grade	School	86	54.4%
	College	72	45.6%
Gender	Boys	83	52.53%
	Girls	75	47.47%
No. of Rooms	Less than 2	41	25.95%
	Between 2 and 4	86	54.43%
	More than 4	31	19.62%

Findings

Major findings of 158 respondents with their proportional percentage in case of answering Always and Mostly are listed in the table 3 below. This is based on Dewaters and Power model of Cognitive, Affective and Behavioral components. The table does not include the neutral and statements where respondents have disagreed since their percentage was very low in comparison to agreed responses.

Table 3: Major Findings

Question	CAB	Always (Strongly Agree)	Mostly (Agree)
I think that we are living in the age of energy crisis	C	2.5	88.6
I get opportunity to reduce energy use at home	A	4.4	88.6
I make it a point to turn lights and fans off when I leave the room	B	0.6	91.8
I switch the appliances off immediately when not in use	B	8.2	81.0
I want repairing of dripping showers and taps	A	5.7	74.7
I don't waste water	B	3.8	84.8
We use energy saving appliances in our home	B	15.8	62.0
We use star rated energy saving appliances in our home	B	5.1	84.8
I try to make others in my social circle to be more energy conscious	B	13.9	66.5
I would like to know more about energy saving techniques	A	1.3	89.9
I don't have access to information about renewable energy sources	C	12.0	77.8

The findings show that nearly 89 percent of students are aware that there is an energy crisis, 62 percent of the respondents were aware of the energy saving appliances being used at their households.
Hence, necessary steps can be taken at individual levels and their households to conserve energy.

Almost 78 percent of the respondents did not have access to information about renewable energy and 90 percent wanted to know more about the energy saving techniques. This leads to an important conclusion that more awareness should be created for alternative and renewable energy sources amongst schools and colleges.

Descriptive Statistics

To understand the descriptive statistics and measuring reliability, Cronbach Alpha testing was done in SPSS for the three factors separately. Cronbach Alpha test is carried out to ascertain the internal consistency and homogeneity and convergence of different statements into one and same factor. A Single factor can have multiple statements to reduce the measurement error. Though its values fall between 0 and 1, 0.75 being the threshold value for a good reliability of the scale, however, it is highly dependent on the sample size (Izah et al., 2023). Larger sample sizes improve the values.

Table 4 shows the Cronbach Alpha values for the three constructs. It is observed that Attitude Construct has a good reliability (Alpha value - 0.771) followed by Behaviour and Knowledge and Intention. As discussed, the reliability for both these constructs is close to 0.7 and may increase with sample size.

Table 4: Reliability and other descriptive statistics

Factors Under Study	Reliability (Cronbach Alpha)	Mean Scores (School Students)	Mean Scores (College Students)	Mean Difference	Standard Deviation (School)	Standard Deviation (College)
Behaviour	0.693	1.32	1.19	0.13	0.619	0.500
Attitude	0.771	1.28	1.17	0.11	0.560	0.459
Knowledge & Intention	0.622	1.31	1.27	0.04	0.603	0.623

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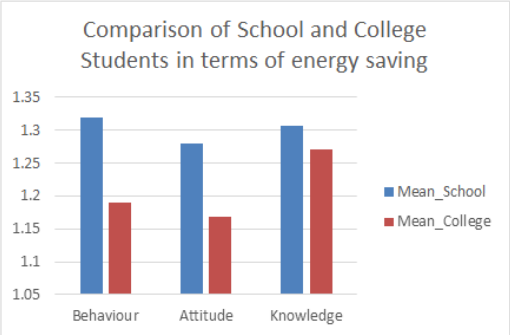
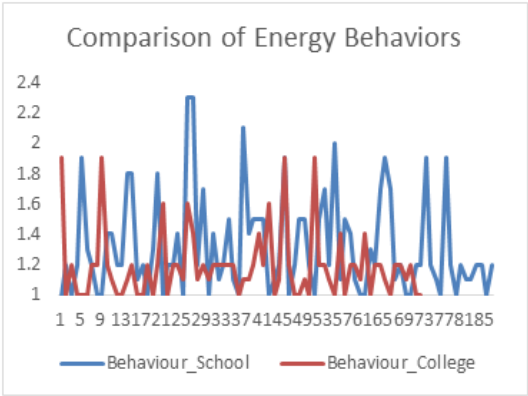
The mean scores for school and college students are shown in Graph 1 giving a broad comparison between the two groups based on three dimensions namely behavior, attitude and knowledge. It can be seen that there is a considerable difference between the two groups as far as behavior and attitudes are concerned with school students being more proactive and participative in energy usage and saving activities, than college students, however the difference is reduced in case of knowledge and intentions component.

Graph 1: Broad Comparison of school and college students in terms of energy saving



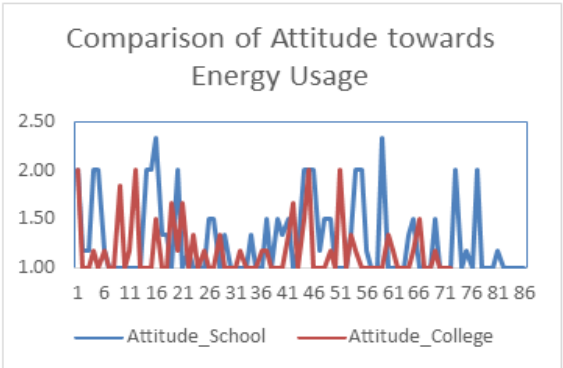
Graph 2 shows a comparative performance of school and college students based on their mean scores in case of their behavior towards energy usage. Here, it can be seen that the highest response in case of school students is 2.3 which is 1.9 in case of college students.

Graph 2: Comparison of Energy Behaviour



Graph 3 shows a comparative performance of school and college students based on their mean scores in case of their attitude towards energy usage. Here, it can be seen that the highest response in case of school students is 2.3 which is 2 in case of college students, similar to their behavioral response.

Graph 3: Comparison of Energy Attitude



Graph 4 shows a comparative performance of school and college students based on their mean scores in case of their knowledge and intention towards energy usage. Here, it can be seen that the highest response in case of school students is 2 which is 2.33 in case of college students, which was slightly different to their behavioral and attitudinal responses.

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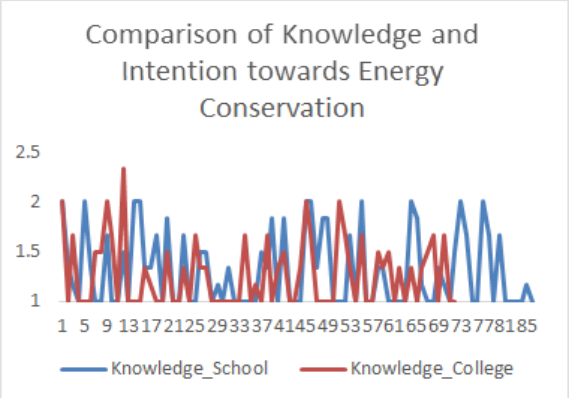
Graph 4: Comparison of Energy knowledge and Intention



Inferential Statistics

T-test and one –way ANOVA tests were conducted to understand the differences between the three constructs based on their grades that is they belong to school or college. For all components, t-test was conducted at 95% confidence level and significance levels of 0.05, to test the hypothesis that there is no significant difference between school going and college going students. T-test values (unequal variances assumed) are given in Table 4.

Table 4: t-test results

Test Results	No. of School Students	No. of College Students	T-test value	p-value
Behaviour	86	72	2.947	.004
Attitude	86	72	2.037	.043
Knowledge & Intention	86	72	.629	.530

Hypotheses H1 and H2 that there is no significant difference between school going and college going students as far as behavior and attitude towards energy usage and saving are concerned, is rejected (t (158) = 2.947, p=.004; t(158) = 2.037, p=,043) however we fail to reject the third hypothesis that there is no significant difference between school going and college going students as far as knowledge and intention towards energy saving and usage are concerned (t(158) = .629, p=.530).

The ANOVA test results were obtained at an alpha Value of 0.05 that is at a confidence level of 95%. The results (done in SPSS) reflect that the energy behavior and attitude of school students are statistically different from the college students since p-value is less than .05 thus rejecting H1 and H2. However there is no statistical difference between knowledge and Intention to save energy in school and college students, H3 being accepted. Table 4 shows the results.

Table 4: ANOVA test for comparison between school and college students based on 3 dimensions of Behaviour, Attitude and Knowledge

ANOVA test Results	SS (Sum of Squares)	df	MS (Mean Square)	F-Value	Sig.
Behaviour					
Between Groups	6.235	12	.520	2.286	.011*
Within Groups	32.955	145	.227		
Total	39.190	157			
Attitude					
Between Groups	3.421	7	.489	2.050	.050*
Within Groups	35.768	150	.238		
Total	39.190	157			
Knowledge & Intention					
Between Groups	2.744	7	.392	1.614	.136
Within Groups	36.446	150	.243		
Total	39.190	157			

(*) $p < 0.05$

Discussions

Since school and college students are both equally aware about energy usage and have knowledge about energy saving mechanisms, they can help proactively in bringing sustainable change in society. Zachariou et al. (2019) in their study observed that students who are more

aware of environmental problems, about energy crisis and energy saving mechanisms are more likely to participate in environmental education initiatives. School students are more conscious about energy usage and wastage like wastage of water, dripping of taps, switching off lights when not in use. Many school students adopt school buses to commute and generally accompany their family, teachers or go to places in groups, hence their behavior is better than college students as far as energy usage and saving are concerned. Attitudes of school students towards energy saving are also better than college students. This may be due to the fact that students are more environmentally conscious owing to the educational initiatives at school levels which is less or missing in college students. Further, college students are more seasoned in giving comfort precedence over other factors which may require sacrifice for instance using bicycles or walking over shorter distances. It is difficult for them to change their habits than their school counterparts. Monitoring and better teacher interventions may also be one of the reasons for a more positive attitude amongst school students towards energy saving. Results of the study are in congruence with many studies (see Álvarez et al., 2010, Boyes et al., 2009, Zsóka et al., 2013) stating that pro environmental attitudes and awareness are closely related to the educational initiatives and thus stress the need for knowledge dissemination at all school as well as college levels, particularly targeting the university levels. As far as limitations and scope of the study are concerned, the study was undertaken in only two major cities of Madhya Pradesh which could be extended to other areas and also with more variables such as studying demographic factors like types of schools, school grades and parents and teachers characteristics, to name a few. The analysis could be taken further by using Confirmatory factor analysis and thus confirming the stated model.

Conclusion

Information Deficit is an important factor present in all sections of society and people need to be educated at individual, social and institutional levels so that conservation of energy and environment can take place at mass levels. The energy educated and conscious people are the change agents which society needs desperately. In this regard, students can prove to be the most useful change agents.Energy use at domestic level is a habitual phenomenon and is almost invisible due to its routine nature. The energy consuming behavioral patterns are deep rooted and seasoned. The consumers are mostly unaware of their usage patterns and they use energy as they have been using for years altogether without analyzing and knowing the repercussions and impact they make on ecology and environment. Creating awareness at school as well as university levels about daily usage patterns of energy and energy saving through mundane tasks can really be beneficial in the long run. Changing behaviors, attitudes and imparting knowledge about energy usage and saving has to be done through the initial years and has to be a continuous process, since all of them are correlated and impact each other strongly (Zsóka et al., 2013). In our study, school students were found to be more behaviorally active and their attitudes were also well framed towards energy saving and usage in respect to college students, however knowledge levels and intentions to save energy were statistically same in both cases. This underlines the already stated fact that education about energy conservation as a part of eco literacy drive has to be continued at university levels also.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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