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Cultivating Energy Conscious Communities: The Path to Increased Efficiency

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Abstract

This research addresses the critical need for increased energy efficiency in communities, emphasizing the pivotal role of community involvement and awareness. With the growing concern for sustainable energy practices, empowering communities to contribute to energy efficiency initiatives is imperative. Thus, the research aims to investigate and understand the role of community empowerment in increasing energy efficiency through community role and awareness. The theory applied to the research is the theory of planned behavior. A descriptive quantitative approach is employed, utilizing a structured questionnaire based on the Likert scale. Then, after the questionnaires were collected, statistical data processing was carried out using the T-test, F-test, and validity and reliability tests. The questionnaire gauges participants' perceptions and behaviors about energy efficiency, enabling a comprehensive analysis of the community's role and awareness in promoting sustainable energy practices. Preliminary findings indicate a positive correlation between community empowerment, heightened awareness, and increased energy efficiency. The Likert scale responses provide valuable insights into the areas where communities excel and areas that require targeted interventions. The data also reveal notable patterns in community behaviors and perceptions of energy consumption and conservation. In conclusion, the research underscores the significance of community empowerment as a catalyst for enhancing energy efficiency. The findings suggest that fostering community awareness and active involvement can lead to tangible improvements in sustainable energy practices. This study contributes valuable insights for policymakers, community leaders, and energy advocates seeking effective strategies to address the global energy challenge through localized, community-driven initiatives.

1. Introduction

World energy demand is predicted to continue increasing, driven by population growth, urbanization, and industrialization [1, 2]. However, the rapid demand increase needs to be balanced with sufficient energy supply, resulting in energy crises that have frequently occurred over the last few decades [3]. Therefore, public awareness regarding the importance of saving energy, energy conditions, and renewable energy sources is very important to minimize the occurrence of an energy crisis [4–6].

One of the factors influencing the economic crisis is climate change, where global warming is caused by burning fossil fuels, which produces carbon dioxide and

greenhouse gas emissions [7]. Global warming is what triggers extreme climate changes throughout the world [8, 9]. One of the largest gas-emitting countries in the world is Indonesia, where Indonesia contributes up to 85% of GHG emissions. However, Indonesia has made efforts to minimize carbon emissions. This is proven in Presidential Decree No. 61 of 2011 related to the National Action Plan for Reducing Greenhouse Gas Emissions (RAN-GRK) [10].

The world is at a critical juncture in combating climate change. Urgent action is needed to reduce greenhouse gas emissions, and the transition to renewable energy is a key part of the solution [11, 12]. Indonesia has the potential to replace conventional energy sources with renewable energy sources due to the large number of energy sources in Indonesia [13–15]. Energy sources that can be used include geothermal energy, water energy, wind energy, bioenergy (bioethanol, biodiesel, and biomass), marine energy, nuclear energy, and solar energy [16]. However, the development of renewable energy sources in Indonesia has experienced various obstacles, including the lack of public awareness of the need to use new renewable energy [17]. Therefore, there is a need for a strategy to increase the efficiency of energy use. One of the ways to do this is by carrying out a campaign to save energy. Energy saving campaigns have proven effective in increasing public awareness about the importance of efficient energy use. This can encourage changes in people's behavior and habits when using energy [18]. Similar results were also obtained from research conducted by Esty and Winston, which found that campaigns and outreach related to green entrepreneurship could increase public awareness of saving energy and making good use of natural resources [19].

Our planet faces a critical challenge: ensuring access to affordable, reliable, sustainable, and modern energy for all as outlined in the United Nations (UN) Sustainable Development Goal 7: Affordable and Clean Energy. This necessitates a dramatic shift towards increased energy efficiency. This article explores the concept of energy-conscious communities and how fostering them paves the way for a more sustainable future.

The current increase in energy demand needs to be balanced with sufficient energy supply [20]. This causes a shortage or crisis of non-renewable energy [21]. Wasteful habits and lifestyles, such as excessive use of electronic equipment and lack of awareness of energy efficiency, are among the main factors driving increased energy consumption [22]. Therefore, efforts are needed to minimize the energy crisis that is occurring, one of which is energy efficiency. Simple steps to improve energy efficiency, such as replacing energy-saving light bulbs, insulating the home, and minimizing energy waste, can have a significant impact on reducing overall energy consumption [23]. However, the need for more public awareness of the importance of saving energy is an inhibiting factor in implementing energy efficiency programs, so there is a need for education or dissemination of information about energy efficiency's importance.

Technological advancements like light-emitting diode (LED) lighting and smart appliances have reduced energy consumption. Policymakers have implemented stricter building codes and appliance standards, while consumers are increasingly opting for energy-efficient products. International organizations like the UN play a role through the Sustainable Development Goals, which highlight the importance of clean and affordable energy.

However, challenges remain. While innovation is crucial, we need to bridge the affordability gap so energy-efficient technologies are accessible to everyone. Individual and community-level behavioral changes, alongside investments in smart infrastructure, can significantly reduce energy waste. Finally, strengthening international cooperation allows for sharing best practices and creating a unified approach towards a more efficient future.

Education and information play an important role in encouraging and increasing public awareness about the importance of energy-saving behavior. This can be done through various media, such as educational programs in schools, public campaigns, and providing easily accessible information [24]. Knowledge about environmental issues and their impact on humans and nature is an important factor that can encourage environmentally friendly behavior. A person with extensive knowledge about environmental issues is likelier to behave pro-environmentally than a person with less knowledge [25].

Thus, the aim of this research is to understand how the community can contribute to increasing knowledge and awareness about energy saving and, likewise, how psychological factors such as personal attitudes, subjective norms, and perceived behavioral control can influence energy efficiency. Through this research, a better understanding can be gained about cultivating energy consciousness in the community, which can be an effective instrument in encouraging behavioral change towards more energy-efficient practices in society.

2. Materials and Methods

2.1. Theory Applied to Research

2.1.1. Theory of Planned Behavior

According to the Planned Behavior theory put forward by Ajzen and Fishbein, there are three interrelated factors in shaping individuals to behave in a caring way for the environment: Personal Attitudes, Subjective Norms, and Perceived Behavior Control [26]. Attitudes are defined as beliefs in behavior or beliefs about the possible impacts that will occur in behavior [27]; subjective norms are an individual's perception of what others expect from him in terms of certain behavior. These norms can come from various sources, such as family, friends, colleagues, communities, and society as a whole [28]. Perceived behavioral control is an individual's belief about how much control they have over their behavior. These beliefs can be influenced by various factors, such as the resources available to an individual, the obstacles they face, and their own beliefs about their abilities [29].

2.1.2. Personal Attitudes

According to Ajzen and Fishbein, it is a concept formed by three components, which include cognition (place of knowledge, opinions, beliefs, and thoughts about an object), affect (feelings towards the object of attitude), and conation (behavioral tendencies, intentions, commitments and related actions with attitude objects), so that if the individual is convinced that the behavior given is positive, then the person concerned will form a good attitude towards that behavior [30].

2.1.3. Subjective Norms

Subjective norms refer to an individual's perception of social pressure from those around them to behave in a certain way. In the context of Planned Behavior theory, subjective norms are measured by asking an individual to rate his beliefs about whether people important to him (e.g., family, friends, colleagues) think they should behave in a certain way [31], the extent to which an individual is willing to carry out a behavior based on people who are meaningful to the individual.

2.1.4. Perceived Behavioral Control

Behavior is indicated when controlling someone's behavior that is perceived as encouragement or resistance. Perceived Behavioral Control reflects past experiences and anticipated obstacles in performing behavior [32]. Perceived Behavioral Control is an important factor in the theory of Planned Behavior that predicts individual intentions and behavior. Perceived Behavioral Control reflects an individual's beliefs about his control over behavior, not just his ability to carry out that behavior [33].

The Planned Behavior theory by Ajzen and Fishbein highlights three main factors that shape environmental care behavior. Personal Attitudes involve cognition, affect, and conation, forming a positive attitude towards behavior. Subjective Norms include the subjective influences and norms of meaningful people, influencing the desire to follow their opinions. Perceived Behavior Control involves controlling behavior that is perceived as an encouragement or obstacle, influenced by past experiences and information from other people. This research focuses on explaining the theory of Planned Behavior and aims to explore the connection between these factors with survey methods and data analysis. Although this theory provides a solid basis for understanding environmentally conscious behavior, contextual and situational factors also play an important role in shaping individual behavior.

2.2 Statistical Method Used

The theory used in this research is the Theory of Planned Behavior. The independent variables (X) in this research are factors related to public awareness campaigns and community empowerment efforts, including Personal Attitudes, Subjective Norms, and Perceived Behavioral Control, while the dependent variable (Y) is energy efficiency in society. Data analysis carried out included validity tests, reliability tests, partial tests (T-tests), and simultaneous tests (F tests). The entire analysis was carried out with the assistance of a statistical program.

This study employs a descriptive quantitative research design using a survey approach. The research was carried out in a residential housing complex located in Bandung Regency, Indonesia, over a period of one month. The participants in this study were residents living within the selected housing complex. The sampling process was carried out using a purposive sampling technique, namely by the criteria required by the researcher. The sample criteria used were at least 30 years old, at least three family members, at least high school education, and a minimum electrical power of 1,300 VA. Based on these criteria, the number of respondents was 125.

The data in this research was obtained from a questionnaire distributed to the respondents. The questionnaire used consisted of 24 statement items which included: 6 statements of Personal Attitudes, six statements of Subjective Norms, six statements of Perceived Behavioral Control, and 6 statements of energy efficiency. The questionnaire sheet used a Likert scale of 1 – 4 in its measurement, namely strongly disagree (1),

Table 1. Questionnaire used in this research.

Variable	Inquiries Number	Statement
Personal Attitudes (P1 – P6)	1	We have to try to save energy
	2	I always try to save energy
	3	Energy-saving activities have many benefits
	4	I think energy-saving activities are important to do
	5	For me, not turning off the light switch when not in use is a detrimental action
	6	I only use electronic devices when needed
Subjective Norms (S1 – S6)	7	People around me try to save energy
	8	My family encouraged me to try to save energy
	9	My family reprimanded me when I forgot to turn off an unused switch
	10	My community encouraged me to try to save energy
	11	I am always reminded by people around me when I forget to turn off electronic devices that are not in use
	12	I care about the opinions of people around me regarding efforts to save energy
Perceived Behavior Control (B1 – B6)	13	I can find information about efforts and ways to save energy on any social media
	14	The circumstances and conditions of the surrounding environment make it easy for me to implement energy-saving efforts
	15	Economic factors can influence energy-saving efforts
	16	Energy-saving activities do not interfere with my daily activities
	17	I can easily get energy-efficient electronic devices in my local area
	18	I didn't find any hindrances in trying to save energy
Energy Efficiency (E1 – E6)	19	For me, it is a responsibility to carry out energy efficiency
	20	I only turn the light or electronic devices on when it's needed
	21	I always turn off switches or lights that are not in use
	22	I only turn on the fan/Air Conditioning when needed
	23	I choose to use energy-saving types of equipment such as sensor faucets, energy-saving lights (LED)
	24	I only turn on the dispenser when needed / I set the temperature of the refrigerator at the suitable temperature at the range (1.67 – 3.3 Celsius) and freezer (-18 Celsius)

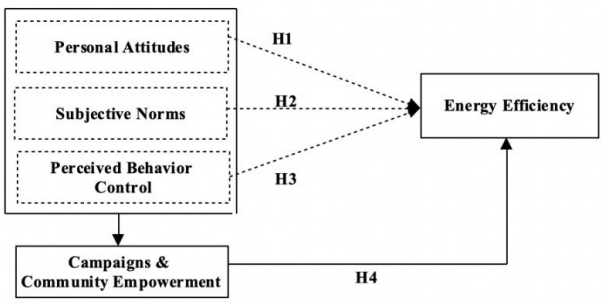

Figure 1. Hypothesis framework.

disagree (2), agree (3), and strongly agree (4). The questionnaire used in this research is shown in Table 1.

The following is the hypothesis in this research, as seen in Figure 1:

- H1: Personal Attitudes have a positive and significant influence on increasing energy efficiency.
- H2: Subjective Norms have a positive and significant influence on increasing energy efficiency.
- H3: Perceived Behavior Control has a positive and significant influence on increasing energy efficiency.
- H4: Public awareness campaigns and community empowerment efforts affect increasing energy efficiency in society.

3. Results and Discussion

3.1. Results

This research delves into the potential of communities to cultivate energy-conscious behaviors. The research

Table 2. Demographic characteristics of respondents.

Characteristics	Category	Amount	Percentage (%)
Age	30-40 years old	69	55.2
	41-50 years old	47	37.6
	>50 years old	9	7.2
	Total	**125**	**100**
Electrical Power	1,300 VA	97	77.6
	2,200 VA	28	22.4
	Total	**125**	**100**
Level of Education	High School	24	19.20
	Diploma	30	24.00
	Bachelor Degree	57	45.60
	Master or Doctoral	14	11.20
	Total	**125**	**100**
Number of Family Members	3	72	57.60
	3 until 5	33	26.40
	> 5	20	16.00
	Total	**125**	**100**

aimed to understand how communities contribute to increased knowledge, awareness, and adoption of energy-saving practices. Additionally, it explored how personal attitudes, subjective norms (perceived expectations of others), and perceived behavioral control (belief in one's ability to save energy) influence individual energy efficiency.

There were two main findings in this research, i.e., community influence and psychological factors. The study found that strong community programs and initiatives significantly increased knowledge and awareness about energy-saving measures. Individuals residing in communities with active energy-conscious initiatives demonstrated a greater willingness to adopt energy-efficient practices. The research confirmed the influence of psychological factors on energy efficiency. Individuals with positive personal attitudes towards energy conservation, a sense of social pressure to save energy (subjective norms), and a strong belief in their ability to make a difference (perceived behavioral control) were more likely to engage in energy-saving behaviors.

The findings highlight the synergistic effect of community support and individual psychology. Communities with strong energy-conscious initiatives not only increase knowledge but also create a social environment that reinforces positive attitudes, promotes a sense of shared responsibility (subjective norms), and empowers individuals (perceived behavioral control) to adopt energy-saving behaviors.

The research demonstrates a clear correlation between community engagement and increased knowledge about energy conservation. Furthermore, individuals residing in active communities exhibited a stronger sense of social pressure to save energy and a greater belief in their ability to make a difference, ultimately leading to more energy-efficient practices.

The research design may not have captured the full spectrum of factors influencing energy efficiency. Cultural variations or specific program elements within communities might have yielded unexpected results. Further investigation into these nuances is recommended. The study may have limitations in generalizability due to the sample size or the specific communities chosen. Further research with a broader scope is necessary to confirm the findings across diverse communities.

Understanding the interplay between community influence and psychological factors provides valuable insights for designing effective interventions. By cultivating a culture of energy consciousness and supporting positive attitudes, communities can play a pivotal role in promoting the widespread adoption of energy-saving behaviors, contributing significantly to a more sustainable future. This research contributes to the growing body of knowledge on the social dimensions of energy conservation. Emphasizing the crucial role of communities in promoting energy-conscious behaviors offers a fresh perspective on achieving increased energy efficiency.

Future research can explore the effectiveness of specific community program elements, delve deeper into the role of cultural influences, and investigate long-term behavioral changes associated with community-based interventions. Examining the economic benefits of increased energy efficiency within communities would also be valuable. This research lays the groundwork for a deeper understanding of how communities can empower individuals to adopt energy-conscious practices. By building on these findings, we can create a

Table 3. Statistical analysis of personal attitudes variables.

	Statistics					
	P1	P2	P3	P4	**P5**	P6
Mean	3.44	3.31	3.30	3.32	**3.58**	3.21
Median	3.00	3.00	3.00	3.00	**4.00**	3.00
Mode	3	3	3	3	4	3
Std. Deviation	.498	.677	.476	.468	.662	.408
Variance	.248	.458	.226	.219	.438	.166
Range	1	2	2	1	2	1
Minimum	3	2	2	3	2	3
Maximum	4	4	4	4	4	4
Sum	430	414	412	415	448	401

Table 4. Statistical analysis of subjective norms variables.

	Statistics					
	S1	**S2**	S3	S4	S5	S6
Mean	3.32	**3.58**	3.44	3.32	3.20	3.24
Median	3.00	**4.00**	3.00	3.00	3.00	3.00
Mode	3	4	3	3	3	3
Std. Deviation	.468	.662	.498	.679	.402	.429
Variance	.219	.438	.248	.461	.161	.184
Range	1	2	1	2	1	1
Minimum	3	2	3	2	3	3
Maximum	4	4	4	4	4	4
Sum	415	448	430	415	400	405

Table 5. Statistical analysis of perceived behavioral control.

	Statistics					
	B1	B2	B3	B4	B5	B6
Mean	**3.58**	3.44	3.32	3.32	3.23	3.32
Median	**4.00**	3.00	3.00	3.00	3.00	3.00
Mode	4	3	3[a]	3	3	3
Std. Deviation	.662	.498	.679	.468	.424	.468
Variance	.438	.248	.461	.219	.180	.219
Range	2	1	2	1	1	1
Minimum	2	3	2	3	3	3
Maximum	4	4	4	4	4	4
Sum	448	430	415	415	404	415

future where strong communities pave the path toward a more sustainable and energy-efficient world.

Based on Table 2, it is known that the majority of respondents are 30 – 40 years old, namely 55.2%. Based on the electrical power used, the majority is 1,300 VA, 77.6%, while 22.4% uses 2,200 VA electrical power. Based on the most recent educational background, respondents were dominated by 45.6% with a bachelor's degree (S1), followed by a diploma (D3) with 24%, high school with 19.20%, and 11.20% with a master's and doctoral degree, while based on the number of family members, the majority of respondents had three family members, 57.6%, 26.40% with 3 to 5 family members, and 16% of respondents with more than five family members.

According to the data presented in Table 3, respondents strongly support energy-saving activities (P5). This is evident from the high mean and median values, which indicate that a significant majority of respondents expressed strong agreement with the statement that failing to turn off switches or lights when not in use is a harmful practice.

The data in Table 4 reveals that respondents strongly support subjective norms for energy conservation (S2). This is demonstrated by the high mean and median values, indicating that a significant majority of respondents expressed strong agreement with the idea that families can be encouraged to make efforts to save energy.

Table 5 data shows that respondents strongly agree with the concept of behavioral control in energy conservation (B1). The high mean and median values suggest that a substantial majority of respondents firmly believe that information about energy-saving efforts can be readily found on various social media platforms.

The information presented in Table 6 indicates that the respondents' energy efficiency practices are highly commendable (E3). This is evidenced by the high mean and median values, which show that a significant proportion of respondents consistently demonstrate excellent energy efficiency habits, such as always turning off switches and lights when not in use.

Data quality is crucial in research and measurement, and two fundamental concepts ensure this quality: validity and reliability. Validity is the degree to which a test or measurement accurately assesses the intended characteristic or attribute. In other words, a valid test measures what it is supposed to measure. Reliability, in contrast, is concerned with the consistency of the results. A reliable test produces consistent outcomes when repeated under similar conditions. If a test is reliable, it will yield comparable results each time it is administered, assuming the conditions remain the same.

In essence, validity and reliability are the cornerstones of trustworthy data. They ensure our measurements accurately represent reality and facilitate confident interpretation and analysis. Without validity and reliability, research findings risk being misleading or inconclusive.

The null hypothesis (H0) and alternative hypothesis (H1) for validity and reliability can be seen as follows:

- H0 = There is no significant connection between independent variable (X) and dependent variable (Y).

Table 6. Statistical analysis of energy efficiency.

	Statistics					
	E1	E2	**E3**	E4	E5	E6
Mean	3.50	3.41	**3.65**	3.54	3.49	3.45
Median	4.00	3.00	**4.00**	4.00	3.00	3.00
Mode	4	3	4	4	3[a]	3
Std. Deviation	.502	.493	.543	.500	.518	.499
Variance	.252	.243	.294	.250	.268	.249
Range	1	1	2	1	2	1
Minimum	3	3	2	3	2	3
Maximum	4	4	4	4	4	4
Sum	438	426	456	443	436	431

Table 7. Validity test results of research instruments.

S	r Calc.	S	r Calc.	S	r Calc.	S	r Calc.
P1	0.38	S1	0.18	B1	0.24	E1	0.60
P2	0.24	S2	0.35	B2	0.18	E2	0.44
P3	0.19	S3	0.26	B3	0.48	E3	0.36
P4	0.22	S4	0.43	B4	0.66	E4	0.33
P5	0.54	S5	0.57	B5	0.18	E5	0.55
P6	0.18	S6	0.61	B6	0.66	E6	0.37

Table 8. Reliability test results of research instruments.

Statement	Cronbach's Alpha
Personal Attitudes	0.85
Subjective Norms	0.81
Perceived Behavioral Control	0.86
Energy Efficiency	0.80

Table 9. T-Test results.

Statement	T Calc.	Sig	Note
Personal Attitudes	11.21	0.00	Partial Influence
Subjective Norms	8.91	0.00	Partial Influence
Perceived Behavioral Control	13.74	0.00	Partial Influence

Table 10. F-Test Results.

F Calc.	Sig	Note
79.71	0.00	Simultaneous Influence

- H1 = There is significant connection between independent variable (X) and dependent variable (Y).
- H0 = The research instrument does not have sufficient reliability to measure independent variables (X).
- H1 =The research instrument has sufficient reliability to measure independent variables (X).

Based on the test results, it is known that all instruments used in this research were declared valid and reliable. This is proven by the fact that the r-calculated value of the entire instrument in Table 7 is higher than the r-table for 125 respondents, which has a value of 0.175. The r table value itself can be seen in the table with a significance level of 5% or 0.05 for 125 respondents, which is 0.175, and Cronbach's Alpha for each statement in Table 8 has a value above 0.70. In general, reliability is considered satisfactory when the Cronbach's Alpha value is ≥ 0.700.

While the hypotheses for simultaneous tests and partial tests are as follows:

- H0 = There is no influence of the independent variable (X), which consists of Personal Attitude, Subjective Norms, and Perceived Behavioral Control, with the dependent variable (Y), i.e., energy efficiency.
- H1 = There is an influence of the independent variable (X), which consists of Personal Attitude, Subjective Norms, and Perceived Behavioral Control with the dependent variable (Y), i.e., energy efficiency.

Partial test (T-Test) and simultaneous test (F-Test) were carried out to test the hypotheses, i.e., H0 and H1. Simultaneous and partial tests are two approaches used in hypothesis testing, particularly when dealing with multiple comparisons. Simultaneous tests are crucial for controlling the overall error rate when conducting multiple comparisons. Partial tests, on the other hand, are valuable for isolating the effects of specific variables while controlling for others.

Table 9 shows that each statement has a calculated T value, which is above the T table; the T table value itself can be seen in the table with a significance level of 5% or 0.05 for 125 respondents, which is 1.97912. Meanwhile, it can be seen from the Sig value for each statement with a value of 0.00; it can be confirmed that the Sig value is < 0.05, which indicates that Personal Attitude, Subjective Norms, and Perceived Behavioral Control each have a partial influence on energy efficiency or in other words H1 is accepted, and H0 is rejected.

Based on Table 10, a decision can be obtained that H0 is rejected and H1 is accepted. This can be seen from the calculated F value, which is 79.71. F table value itself can be seen in the table with a significance level of 5% or 0.05 for 125 respondents which is 2.712. Showed that F calculated value (79.71) is above the F table value (2.712).

Meanwhile, the resulting significance value is 0.00, which is smaller than 0.05 (with significance level used is 5% or 0.05). Thus, it can be concluded that this multiple regression model is suitable for use, and the independent variables (X) which include Personal Attitudes, Subjective Norms, and Perceived Behavioral have a simultaneous

Table 11. One way ANOVA.

Descriptives								
Energy Efficiency								
	N	**Mean**	**Std. Deviation**	**Std. Error**	**95% Confidence Interval for Mean**		**Minimum**	**Maximum**
					Lower Bound	**Upper Bound**		
Personal Atitude	125	20.16	.979	.088	19.99	20.33	17	23
Subjective Norm	125	20.10	1.197	.107	19.89	20.32	19	23
Perceived Behavioral Control	125	20.22	1.267	.113	19.99	20.44	19	24
Total	375	20.16	1.152	.059	20.04	20.28	17	24

Table 12. Homogeneity test.

		Levene Statistic	**df1**	**df2**	**Sig.**
Energy Efficiency	Based on Mean	8.518	2	372	.000
	Based on Median	8.078	2	372	.000
	Based on Median and with adjusted df	8.078	2	355.207	.000
	Based on trimmed mean	7.747	2	372	.001

Table 13. Comparison test.

ANOVA					
Energy Efficiency					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.784	2	.392	.294	.745
Within Groups	495.616	372	1.332		
Total	496.400	374			

Table 14. Post hoc test – homogeneous subsets.

Energy Efficiency		
Duncan[a]		
Groups	**N**	**Subset for alpha = 0.05**
		1
Subjective Norm	125	20.10
Personal Atitude	125	20.16
Perceived Behavioral Control	125	20.22
Sig.		.474

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 125.000.

influence on the dependent variable (Y) i.e., Energy Efficiency.

Following the rejection of the null hypothesis (H0), a Duncan test was performed, and its results, along with corresponding explanations, are presented in Tables 11, 12, 13, and 14. The Homogeneity Test yielded a value of 0.000, which is less than 0.05, indicating that the data is not homogeneous. However, the one way Analysis of variance (ANOVA) test revealed a sig value of 0.745, which exceeds 0.05, leading to the conclusion that there is no significant difference between the variables. Furthermore, the post hoc analysis confirmed that Subjective Norm, Personal Attitude, and Perceived Behavioral Control belong to the same subset, suggesting no discernible difference among these variables.

3.2. Discussion

This research has potential applications in various fields, especially in the development of energy awareness programs with a focus on three main aspects: Personal Attitudes, Subjective Norms, and Perceived Behavior Control [34]. The results can be integrated into the school curriculum can help students develop the knowledge, skills, and expected attitudes to become responsible and sustainable citizens [35] by developing learning materials that emphasize attitudes, subjective norms, and behavioral control towards energy efficiency [36]. Previous research conducted by Belaïd and Joumni showed that energy-saving attitudes have a significant effect on energy-saving behavior [37]. Attitudes are relatively stable beliefs, feelings, and tendencies toward an object or idea. Attitudes can influence behavior and habits in various ways [38]. In addition, research findings

provide an empirical basis for more effective environmental policy planning, focusing on aspects of community behavior. Environmental regulations and norms in society can encourage increased efficiency in various sectors in several ways [39].

This research contributes significantly to increasing public awareness of the importance of energy-saving behavior, providing a basis for designing more effective communication strategies in conveying energy-awareness messages [40]. Apart from that, it also contributes to the development of pro-environmental behavior theory by providing empirical evidence regarding the relationship between Personal Attitude, Subjective Norms, and Perceived Behavior Control variables on energy efficiency, enriching the literature and providing a strong scientific basis [41]. This research supports environmental policy by providing empirical support for changes in people's behavior towards energy efficiency, providing clear direction in efforts to achieve this goal [42].

The development of integrative models needs to be explored to investigate the relationship between psychological variables and external factors that influence energy efficiency behavior [43]. Furthermore, case studies in specific contexts, such as specific sectors or specific communities, can provide deeper insights [44]. Evaluation of the impact of energy awareness programs is essential to assess the effectiveness of such programs and to identify areas that can be improved. This evaluation must be conducted using an intense methodology and must consider various factors, such as changes in the knowledge, attitudes, and energy behavior of program participants [45].

The practical application of this research is not only in community empowerment and increasing energy efficiency but can also be applied to other energy efficiency at building management with adjustments as necessary. This research contributes to achieving energy savings with a proper Energy Management Control System (EMCS) and energy goal setting. Concept of Information Control Systems for Green Manufacturing Industries with IoT-Based Energy Efficiency and Productivity [46] also designing system management energy to achieve efficient energy at building campus [47]. Reducing energy and water consumption in the textile dyeing Industry with reuse wastewater [48]. Potential energy efficiency and solar energy applications in small industries [49], energy efficiency in aluminum parts industries with EMCS, and energy efficiency with exhaust hot air for the scrap process [50, 51].

Personal beliefs and the social environment significantly impact energy consumption. Individuals with positive attitudes towards conservation, fueled by environmental or economic concerns, are more likely to embrace energy-saving practices. Social pressure also plays a role. Perception of what others expect (subjective norms) shapes actions. If we believe those around us value conservation, we are more likely to conform, motivated to avoid disapproval or maintain a positive social image. Finally, confidence in the ability to make a difference (perceived behavioral control) is crucial. People who feel empowered to take control, like switching off lights, are more likely to act. These three factors – personal attitudes, subjective norms, and perceived behavioral control – work together to create a complex web of influences on energy efficiency. Understanding these psychological factors is key to designing effective community interventions and promoting widespread adoption of energy-saving practices.

4. Conclusions

This research investigated how communities can cultivate energy-conscious behaviors. It explored the role of communities in raising awareness and knowledge about energy-saving practices, as well as the influence of personal attitudes, social pressures (subjective norms), and self-belief in one's ability to conserve energy (perceived behavioral control) on individual energy efficiency. The research found a synergistic effect between community influence and individual psychology. Strong community programs not only increased knowledge about energy conservation but also fostered a social environment that encouraged positive attitudes and a sense of shared responsibility and empowered individuals to adopt energy-saving practices.

However, the study acknowledges its limitations in capturing the entirety of factors shaping energy efficiency. Cultural variations or specific program elements within communities could have yielded unforeseen results. Further research is needed to explore these potential nuances. This research contributes to the growing body of knowledge on the social aspects of energy conservation. By highlighting the critical role of communities in promoting energy-conscious behaviors, it offers a fresh perspective on achieving increased energy efficiency.

Moreover, there may be discrepancies between this research and other studies due to limitations in generalizability. The sample size or specific communities chosen might not represent the broader population. Further research with a wider scope is necessary to confirm the findings across diverse communities. Future

research can delve deeper into the effectiveness of specific community program elements, cultural influences, and long-term behavioral changes associated with these interventions.

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