STUDENTS' ACCEPTANCE OF NUCLEAR POWER IN THE PHILIPPINES

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ABSTRACT

Nuclear power as a source of energy remains a contentious technology issue that divides public opinion and acceptance, particularly in developing nations that lack an operational nuclear power plant. Students, being the future decision-makers and having a vital role in society's progress, make their acceptance of nuclear energy symbolize public opinion to a large extent. Incorporating the Theory of Planned Behavior (TPB) and the Protection Motivation Theory (PMT) helped identify the factors influencing students' acceptance of nuclear power. Utilizing a descriptive correlational research design highlighted the relationships between the model elements: nuclear power knowledge, nuclear power stigmatization, trust in government, perceived benefits, perceived drawbacks, attitude, subjective norm, perceived behavioral control, intention, and nuclear power acceptance. Of the 19 hypothesized relationships, 14 are regarded as directly and significantly influential. The findings suggest that knowledge of nuclear technology can promote students' acceptance of nuclear power in the Philippines and that this acceptance can be further reinforced by the ease of the perceived acceptance, favorable attitude towards the adoption of nuclear power plants, and perceived positive social influence of other people. However, stigmatized information adversely influences their adoption through the negative perception and disadvantages of nuclear power plants. Thus, the inclusion of their benefits and risks in currently taught science and technology subjects in senior high school and college may improve the students' knowledge and understanding of nuclear power and nuclear energy and provide a platform for scientific literacy of the various potential energy sources to resolve the energy crisis in the Philippines.

Keywords: *nuclear knowledge; nuclear stigma; nuclear energy adoption; nuclear power acceptance*

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INTRODUCTION

Many emerging countries remain concerned about their energy security (Yap, 2021). Energy security is defined by the International Energy Agency (IEA) as "the continuous availability of energy sources at a fair price." Nuclear power, among the prospective energy sources, contributes considerably to achieving sustainable energy goals and enhancing energy security. Nuclear power has resulted in a reduction in carbon dioxide emissions of more than 60 gigatonnes in the past 50 years (Rosen & Dincer, 2007). Nuclear power is also a viable source of clean energy to assist cheaper industrialization considering that new, smaller, safer, and more flexible designs are expected to join the market in the coming decade (Khatib & Difiglio, 2016).

Despite the acknowledged benefits of nuclear power, it is nevertheless commonly considered a contentious technology that divides public opinion and acceptance (Ho et al., 2019). Public opinion and acceptance of nuclear power are vital factors in the construction of a nuclear energy program by governments all over the world. As a result, understanding the elements that impact the opinion of the public and their resulting acceptance of nuclear power is crucial (Kim et al., 2014). One method for enhancing public acceptability is to improve public understanding and awareness of nuclear energy. According to Seçkin, G. (2016), the level of acceptability of technology is determined by its perceived ease of use and usefulness. Consequently, if people understand the value of nuclear energy, they may be more willing to embrace it.

Acceptance of publicized facts would contribute to success in any planned development, including the use of nuclear energy (Hsu et al., 2019). Nuclear energy research can be applied in agriculture, industry, public health, and safety. Public acceptability difficulties can occasionally hamper technology transmission to end users (Aleta, 1992). This challenge in acceptability includes stigmas that lead to the notion that irradiated food will become radioactive, a feeling of hate for everything associated with radiation, and a general antipathy to nuclear energy. The presence of nuclear power plants stigmatizes the surrounding environment, as well as the people who live there and the products they produce (Nam-Speers et al., 2020). Nuclear stigma influences people's views and attitudes, regardless of whether the nuclear stigma is factual or based on opinions. Disseminating nuclear energy knowledge is difficult yet important to its expansion and acceptance. (Wang et al., 2020).

Considering people’s acceptance and perception is not new to the notion of exploring nuclear energy and its uses for the generation of electricity. In the Philippines, the 623-megawatt (MW) Bataan Nuclear Power Plant (BNPP) in Luzon was shut down in 1986 due to the post-Chernobyl political and safety difficulties that arose during a shift in government administration (Yap, 2020). Given the controversy in the past, the issue of nuclear energy must be approached with a clean slate to achieve a satisfactory resolution on this matter.

In July 2020, President Rodrigo Duterte, through the issuance of Executive Order (EO) 116, gave the go signal to assess the viability of using nuclear energy and recommended measures for the use thereof (Esguerra 2020). EO 116 had served as a roadmap for President Duterte's policy decisions on the country's nuclear power formation. In 2021, according to the Department of Energy (DOE) public opinion poll, the degree of approval for the potential restoration of the BNPP and the construction of a new nuclear power plant was very high, at 79 percent and 65 percent, respectively (Gonzales, 2020). In February 2022, President Duterte signed EO 164 directing the DOE to create and implement a nuclear program (Dempsey Reyes, 2022). The EO has directed the Nuclear Energy Program Inter-Agency Committee (NEP-IAC) to submit its recommendations on the usage and feasibility of the BNPP, as well as to create other nuclear energy-related facilities. With these executive orders in place, the utilization of nuclear energy as part of the Philippines' energy mix has become a possibility.

Although public approval is relatively high, it is critical to promote further understanding and acceptance for the new generation. Generations that matured with the icons of fear and destruction from nuclear energy are not likely to easily change their minds (Sinclair 1998). The uninfluenced students and the future generation are the ones who will benefit from the possible sustainability of nuclear energy in the Philippines. Yttredal and Homlong (2020) defined sustainability as any development that will help the current generation and will not compromise the future generation. Therefore, the current perception and acceptance regarding the application of nuclear energy to electricity generation should be explored.

Students from high schools, colleges, and graduate schools in today's classrooms, will become future decision-makers (Powell et al., 1994). These students have a vital role in societal evolution; their acceptance of nuclear energy would symbolize and influence public opinion to a large extent (Hao et al., 2019). Their acceptance of nuclear power can impact its predominance and direct attempts to enhance the energy mix by lowering the reliance on fossil fuels. Thus, it is essential to consider the factors that influence students' acceptance of nuclear energy.

According to the research of Salloum et al. (2019), Zhu et al. (2020), as well as of Meher et al. (2021), knowledge and comprehension are critical in determining the student opinion on embracing nuclear power in the generation of electricity. The curriculum in high schools, colleges, and even graduate schools, may help students gain a better understanding and appreciation of nuclear technology. In the Philippines, for example, senior high school students are taught about disaster risk reduction and management (Ong et al., 2021). Also, the Commission on Higher Education (CHED), in its CMO No. 20, series of 2013, has included the mandatory topics on climate change, energy crisis, and environmental awareness in the course Science, Technology and Society-General Education Curriculum (STS-GEC). These make these subjects a platform for scientific literacy on the various potential energy sources aimed at resolving the energy crisis in the country, including tapping nuclear power in the energy mix. In addition, the students from high school, college, and graduate schools can become the prospective respondents of this study.

The current literature shows few studies about the student acceptance of nuclear power in the Philippines. Identifying their perception will greatly impact its acceptability and public opinion. Thus, this study aims to descriptively measure the factors influencing student acceptability of nuclear power in the Philippines. These factors shall include the knowledge and stigma related to nuclear power utilization. In addition, quantifying relationships between these factors can provide a better understanding of how to improve nuclear power acceptability among high school, college, and graduate students in the Philippines.

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

There are several studies on the public acceptability of nuclear power, but very few on nuclear power acceptability in the Philippine context (Hao et al., 2019). However, there are risk assessments for nuclear power plants (Lagmay et al. 2012). On the BNPP, there are case studies about the Filipinos' perceptions, specifics, history, and knowledge (Alipario, 2020). More recently, Ong et al. (2021) focused on the study concerning the acceptance of the reopening of the BNPP in the Philippines. Several factors that influence the acceptance of nuclear energy need to be identified and investigated. These factors include safety perception, perceived benefits, environmental awareness, social trust, and perceived nuclear knowledge (Hao et al., 2019).

Based on prior research by Hao et al. (2019) and Ong et al. (2021), the perspective of students may be explored by incorporating the extended Theory of Planned Behavior (TPB). TPB can be used to monitor behavior holistically and identify factors influencing students' acceptance of nuclear power. According to Ong et al. (2021), knowledge is one of the most important components in people's acceptance of the reopening of the BNPP. It would help to properly assess the students' knowledge about nuclear power and provide a more specific explanation for the factors considered in their acceptance.

Acceptance can be defined as an individual assent to or recognition of a process, condition, or situation. In the context of nuclear power, acceptance is essentially the product of rational decisions by assessing the predicted drawbacks and benefits of nuclear facilities (Visschers et al., 2011). People tend to make decisions that help them avoid danger or strengthen protection by weighing the perceived factors that compromise their safety. This concept is observed in the Protection Motivation Theory (PMT).

Individuals tend to make decisions that will protect them from natural disasters and environmental threats (Lindell & Perry, 2012). When tragedy strikes, people tend to assess danger perceptions, protective action perceptions, and stakeholder views. Nuclear power plant accidents are seen as possible environmental risks. These situations pose an impending or long-term threat similar to natural disasters, and these fundamental beliefs serve as the foundation for judgment in the public response to volcanic hazards (Perry et al. 1982), COVID prevention (Duan et al., 2020), and the use of genetically modified crops (Guehlstorf, 2008). According to Liu et al. (2019), perceived risks and perceived public trust by stakeholders have a considerable impact on public response and acceptance indicators. These factors have been integrated with the TPB to identify the predictors of public acceptance of nuclear power plants (Hu et al. 2021).

According to Prasetyo et. al. (2020), TPB can be combined with PMT to measure human behavior. PMT states that people react in a specific way to danger because they weigh the potential benefits and drawbacks for themselves (Janmaimool, 2017). This is demonstrated by Wang et al. (2019), who found that a broad public understanding of nuclear energy has a favorable influence on perceived benefit (PB). PB can be defined as the belief about the positive outcome of a behavior or response. In contrast, PD is the belief in a negative outcome. Huang et al. (2013) concentrated on the Fukushima nuclear disaster, which is an example of the perceived drawbacks (PD) of nuclear power. PB and PD strongly influence public attitudes toward potentially hazardous technology (Siegrist, 2000).

Understanding nuclear energy and its benefits and drawbacks can help individuals decide whether to accept or reject it. Zhang et al. (2020) used the TPB to track infractions and risky conduct in nuclear power plants. Acceptance is proportional to preparation, including knowledge of the subject matter, and inversely proportional to growing perceived drawbacks and decreasing perceived benefits (Smith, 2013). This viewpoint emphasizes an individual's atomized judgment of drawbacks and benefits while neglecting the effect of trust in government and regional stigma. Nam-Speers et al. (2020) have found causal relationships between local inhabitants' perceived risks and benefits, trust in government, nuclear stigma in the region, and acceptance of a nuclear power plant.

Stigma, or "technology stigma," as defined by Edelstein (1988), has been applied to a variety of studies to investigate a separate phenomenon in which certain products, locations, or technologies are seen as feared hazards, threats, or dangers and, as a result, are avoided by humans. Kasperson (2012) investigated the effects of nuclear stigma and identified that health risks connected with nuclear energy plants promote unfavorable attitudes. Prior nuclear catastrophes such as the Three Mile Island, Chernobyl, and Fukushima nuclear tragedies have exacerbated unfavorable impressions of nuclear power (Palfreman, 2006). These historical incidents demonstrate how the government handles any tragedy resulting from a nuclear catastrophe since they are in charge of planning, executing, and reviewing several nuclear energy rules and regulations, as well as providing important information on nuclear plants. Having trust in the government (T) is described as having confidence in its capabilities to manage nuclear policies and developments. Nuclear stigma, therefore, influences the acceptability of nuclear energy through perceived disadvantages and benefits, as well as trust in the government (Pidgeon et al., 2008).

By using the TPB, the factors influencing public acceptance may be measured (Ong et al., 2021). TPB correctly predicts intents or behaviors by categorizing them based on their motivations, actions, context, and period (Ajzen, 2020). As a result, different behavioral predictions can be made. This idea has been widely used in several nations, notably in health (Godin & Kok, 1996), renewable energy adoption (Shakeel & Rahman, 2018), and nuclear energy acceptance (Kim et al., 2014). The TPB places a premium on an individual's intention to complete a certain activity. An individual's tendency toward, willingness, or measurement of motivation toward the goal to use or execute an activity is referred to as intention (Mammam et al., 2016). In general, intention (I) significantly affects acceptance (Ajzen, 1991).

Research has demonstrated that this general rule influences the acceptance of a specific issue. Park and Ohm (2014) discovered that public adoption of renewable energy is influenced by perceived trust, risk, attitude, and intention. According to Xiao et al. (2017), the majority of their respondents accept nuclear technology owing to goodwill trust and competence trust. However, Lim et al. (2017) discovered that those who are less prone to power plant dangers embrace nuclear technology. These characteristics show people's actual influence over their behavior; they tend to lean toward particular activities that are perceived to be beneficial to them.

According to TPB, there are conceptually distinct elements that have an indirect impact on behavior (Ajzen, 1991). The first is a person's attitude (A) toward the behavior, which is defined as how favorably or adversely a person assesses or appraises the action (LaMorte, 2019). Research has found that attitude is one of the elements influencing behavioral intention. Foltz et al. (2016) investigated the elements that influence people's decisions about security settings and social networking. When it comes to attitude towards nuclear energy, people tend to first assess its potential benefits and drawbacks.

Trust is another key aspect that can influence a person's attitude. Cheung et al. (2017), for example, hypothesized that trust promotes favorable attitudes toward in-app marketing. One of the important variables predicted to increase the adoption of nuclear energy is trust in the governing authority (Sugiawan et al., 2019). According to Otsuka (2015), people’s trust in the organization in charge of managing the nuclear power plant was positively related to their acceptance. Ong et al. (2021) also suggest that trust in the government be considered through the potential responses of the people to provide assurance and promote the industrialization of nuclear power plants in a country.

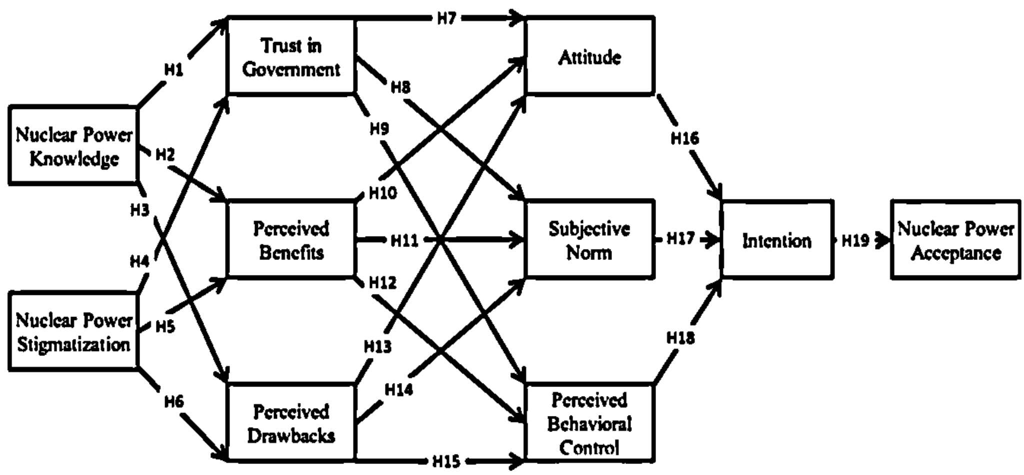
The second predictor of intention (I) is a social component known as the subjective norm (SN). SN refers to feeling social pressure to engage in or refrain from engaging in an action. This notion may be found in a variety of disciplines dealing with technology acceptability, technology use, and consumer purchasing intents (Jung et al., 2020). The opinions of others conveyed in the form of social norms, have a substantial impact on an individual's value judgment. Consequently, people are more likely to participate in specific acts that other people support to be beneficial.

Schepers et al. (2007) found that subjective norms had a substantial influence on perceived usefulness and intention to use.

The degree of perceived behavioral control (PBC) is the third antecedent of intention (I). It represents past experiences as well as anticipated challenges and hurdles. PBC, one of the most potent intention factors, is defined as the perceived ease or difficulty of carrying out an activity. Energy research supports this notion. PBC has a significant impact on the kind of activities and intents in a nuclear site (Zhang et al., 2020). PBC determines the acceptability level, which is influenced by the possible benefit or harm of a technology.

The researcher combined the aforementioned model elements of the theories TPB that contains attitude, subjective norm, perceived behavioral control, intention, and acceptance with those of PMT that encompass perceived trust in government, perceived benefits, and perceived drawbacks. Nuclear stigmatization and knowledge are regarded as having a direct influence on people's opinions toward government trust, as well as the benefits and drawbacks of utilizing nuclear energy to generate electricity. As a result, the investigation's conceptual framework and related hypotheses are established.

Figure 1
Conceptual Framework of Students' Acceptance of Nuclear Power



If students have a better understanding and appreciation of nuclear energy, they will be more accepting of it. On the contrary, the belief in the stigma surrounding nuclear power yields a more hesitant reaction toward it. Students weighing their understanding of nuclear power based on knowledge or stigmatization will affect the model elements. As a result, the following hypotheses were developed:

H1, H2, and H3: Knowledge about nuclear power significantly affects the trust in government, perceived benefits, and perceived drawbacks.

H4, H5, and H6: Stigmatization of nuclear power significantly affects the trust in government, perceived benefits, and perceived drawbacks.

H7, H8, and H9: Trust in government significantly affects attitude, subjective norm, and perceived behavioral control.

H10, H11, and H12: Perceived benefits significantly affect the attitude, subjective norm, and perceived behavioral control.

H13, H14, and H15: Perceived drawbacks significantly affect the attitude, subjective norm, and perceived behavioral control.

H16: Attitude significantly affects intention.

H17: Subjective norm significantly affects intention.

H18: Perceived behavioral control significantly affects intention.

H19: Intention significantly affects acceptance of nuclear power.

METHODOLOGY

This research investigates students' acceptance of nuclear power in the Philippines. College students who have already studied the subject in the course STS-GEC, senior high school students, junior high school students, and those who are currently in their graduate studies are the primary target respondents. Due to the researcher's limited ability and resources to conduct a statewide survey, the majority of the respondents come from the schools and colleges in Nueva Ecija and the nearby provinces in Central Luzon. However, potential volunteer respondents via social media platforms yielded respondents from different regions of the country. The conceptual framework and model elements were used to design the questionnaire. Age, gender, educational background, and location of residence were included in the demographic data.

According to Ong et al. (2021), it would be helpful to properly assess the individual's knowledge of nuclear power. Thus, the researcher formulated a 5-item questionnaire to assess the respondents' understanding of the concepts, risks, and specific policies in the Philippines regarding the utilization of nuclear power. The factual information about nuclear power was gathered from the article of Nunez (2021), the published research by Dempsey Reyes (2022), and the official websites of the Philippine Nuclear Research Institute (PNRI), and the International Atomic Energy Agency (IAEA).

The subsequent sections of the questionnaire were about the respondents' self-assessment of the 10 model elements/variables of the conceptual framework. These model elements/variables are as follows (their corresponding construct references are listed in Table 1): nuclear power knowledge (Nunez, 2021; Dempsey Reyes, 2022; PNRI; IAEA), nuclear power stigmatization (Yap, 2020; Nam-Speers et al., 2020), trust in government (Nam-Speers et al., 2020), perceived benefits (Yap, 2020), perceived drawbacks (Yap, 2020), attitude (Guo et al., 2017), subjective norm (Ru et al., 2018), perceived behavioral control (Chen et al., 2011; Mishra et al., 2014; Fornara et al., 2016), intentions {Thongsri et al., 2018), and acceptance (Hao et al., 2019). The data-gathering instrument utilized a 5-point Likert scale to evaluate the different constructs. The Likert scale used excluded a "neutral" answer since the study focused more on "acceptance" or "non-acceptance." The exclusion of a "neutral" option reduced the social desirability pressures. The essential components of the questionnaire used are shown in Table 1.

Table 1
The Measurement Items

Variable	Item no. and Construct	References
Nuclear Power Knowledge (NK)	1. Nuclear power plants create steam by heating water with radioactive fuel that has undergone nuclear fission. The steam is then used to power turbines, which generate electricity.	(Nunez 2021)
	2. Radiation is all around us. However, increasing levels of radiation beyond the natural background, such as nuclear radiation, pose a risk of health damage.	(IAEA)
	3. Although nuclear energy is not renewable, nuclear power plants that are in operation emit no greenhouse gases that contribute to global warming.	(Nunez 2021)
	4. There is a government body in the Philippines tasked with advancing and regulating the safe and peaceful applications of nuclear science and technology.	(PNRI)
	5. In the Philippines, a signed executive order explains the government's position on using nuclear energy in the energy mix, taking into consideration economic, political, social, and environmental goals.	(Dempsey Reyes 2022)

Table 1 *(continuation)*

Variable	Item no. and Construct	References
Nuclear Power Stigmatization (NS)	1. Nearby areas surrounding nuclear power plants are contaminated and radioactive.	(Nam-Speers et al. 2020)
	2. Residents living near a nuclear power plant are at a high risk of cancer and radiation illness.	(Nam-Speers et al. 2020)
	3. Nuclear power plants have the potential to explode in the same way as the atomic bombs dropped on Hiroshima and Nagasaki did.	(Nam-Speers et al 2020)
	4. The presence of nuclear power plants scares tourists and visitors away.	(Nam-Speers et al. 2020)
	5. The building of a nuclear power plant in the Philippines is prone to corruption and controversy.	(Yap 2020)
Trust in Government (T)	1. The government's concern is for the people.	(Nam-Speers et al., 2020)
	2. The government's policymaking is ethical and founded on principles.	(Nam-Speers et al., 2020)
	3. The government is open, transparent, and trustworthy in publicizing information.	(Nam-Speers et al., 2020)
	4. Nuclear power plants can be safely managed by the government.	(Nam-Speers et al., 2020)
	5. The government welcomes public input and participation.	(Nam-Speers et al., 2020)
Perceived Benefits (PB)	1. Nuclear power plants offer minimal operating costs.	(Yap, 2020)
	2. Nuclear energy is a dependable energy source.	(Yap, 2020)
	3. Nuclear energy has a consistent base load energy.	(Yap, 2020)
	4. Nuclear energy produces very little pollution.	(Yap, 2020)
	5. Nuclear power has a high energy density.	(Yap, 2020)

Table 1 *(continuation)*

Variable	Item no. and Construct	References
Perceived Drawbacks (PD)	1. The construction of a nuclear power plant is costly.	(Yap, 2020)
	2. Accidents at nuclear power plants are possible.	(Yap, 2020)
	3. Nuclear power generates radioactive waste.	(Yap, 2020)
	4. Nuclear energy is a security risk.	(Yap, 2020)
	5. There is a limited supply of nuclear fuel.	(Yap, 2020)
Attitude (A)	1. The use of nuclear power is an excellent concept.	(Guo et al., 2017)
	2. The Philippines will definitely benefit from nuclear energy.	(Guo et al., 2017)
	3. Nuclear energy is a valuable energy source.	(Guo et al., 2017)
	4. The construction of new nuclear power plants is extremely important.	(Guo et al., 2017)
	5. Nuclear energy is environment-friendly.	(Guo et al., 2017)
Subjective Norm (SN)	1. My friends and/or classmates are in favor of using nuclear energy.	(Ru et al., 2018)
	2. My family is in favor of using nuclear energy.	(Ru et al., 2018)
	3. The government is in favor of using nuclear energy.	(Ru et al., 2018)
	4. There are well-known people who advocate the use of nuclear energy.	(Ru et al., 2018)
	5. My teachers and mentors are in favor of using nuclear energy.	(Ru et al., 2018)
Perceived Behavioral Control (PBC)	1. I feel that using nuclear energy will benefit society.	(Chen et al. 2011)
	2. I am completely aware of the nuclear energy hazards.	(Fornara et al., 2016)
	3. I am confident in nuclear power facilities' safety.	(Mishra et al., 2014)
	4. I am confident in nuclear power plants' quality.	(Mishra et al., 2014)
	5. I am confident in nuclear power plant’s reliability.	(Mishra et al., 2014)

Table 1 *(continuation)*

Variable	Item no. and Construct	References
Intention (I)	1. I want nuclear energy to be our primary source of electricity.	(Thongsri et al., 2018)
	2. I seek to persuade people to use nuclear energy.	(Thongsri et al., 2018)
	3. I believe our government should embrace nuclear energy.	(Thongsri et al., 2018)
	4. I want nuclear energy to improve society.	(Thongsri et al., 2018)
	5. I predict that our society will support the development of nuclear power plants.	(Thongsri et al., 2018)
Nuclear Power Acceptance (A)	1. I am in favor of nuclear power plant development in the Philippines.	(Hao et al., 2019)
	2. I support the country's strong investment in nuclear energy research and development.	(Hao et al., 2019)
	3. The advantages of nuclear energy exceed the disadvantages.	(Hao et al., 2019)
	4. Nuclear energy is an absolute necessity in the Philippines.	(Hao et al., 2019)
	5. I am in favor of nuclear energy and its applications in the industry.	(Hao et al., 2019)

The Statistical Package for the Social Sciences (SPSS) 26, and the Microsoft Excel software were used to compute the necessary values for the data analysis. Descriptive measures and Pearson Correlation was utilized to measure the variables: Nuclear Power Knowledge (NK), Nuclear Power Stigmatization (NS), Trust in Government (T), Perceived Benefits (PB), Perceived Drawbacks (PD), Attitude (A), Subjective Norm (SN), Perceived Behavioral Control (PBC), Intention (I), and Nuclear Power Acceptance (NA).

The Pearson correlation coefficient measures the strength of the relationship between two variables and is often used in social science and behavioral studies that utilize TPB (Courneya & McAuley, 1995; Lynne et al., 1995; Côté et al., 2012), and PMT (Ling, Kothe, & Mullan 2019; Sadeghi et al., 2019; Wang et al., 2021). This particular test for relationships measures the direct and indirect effects of knowledge and stigmatization on the students' acceptance of nuclear power in the Philippines.

RESULTS AND DISCUSSION

Demographic data is required in nuclear development projects to offer baseline information about the location (Patil et al., 2012).

Table 2

Respondents' Demographic Information

Characteristics	Category	N=396	%
Gender	Female	287	72.5%
	Male	109	27.5%
Age	Below 15 years old	5	1.3%
	15-16 years old	10	2.5%
	17-18 years old	23	5.9%
	19-20 years old	147	37.1%
	21-22 years old	161	40.6%
	Above 22 years old	50	12.6%
Current Education Level	Junior High School Student	15	3.8%
	Senior High School Student	18	4.5%
	College Student	335	84.6%
	Graduate Student	28	7.1%
Location	National Capital Region (NCR)	93	23.5%
	Central Luzon (Region III)	239	60.4%
	CALABARZON (Region IV-A)	44	11.1%
	Other Regions	20	5%

Table 2 shows the demographic profile of the 396 respondents. The majority (72.5%) are female, with the male respondents accounting for the remaining 27.5%. In terms of age, nearly half (40.6%) are 21 to 22 years old, 37.1% are 19 to 20, 12.6% are above 22, 5.9% are 17 to 18, 2.5% are 15 to 16, and 1.3% are below 15. The majority (84.6%) of the respondents are college students, the rest are graduate students (7.1%), senior high school students (4.5%), and junior high school students (3.8%).

In terms of location, the majority of respondents (60.4%) came from Central Luzon, which is home to the non-operational BNPP. The rest of the respondents are from the National Capital Region (23.5%), CALABARZON or Region IV-A (11.1%), and other regions of the country (5%).

Table 3
Model Elements Statistical Analysis

Variable	Item	Mean	SD	Factor Loading
Nuclear Power Knowledge (NK)	1	2.909	0.890	0.728
	2	3.434	0.689	0.492
	3	2.843	0.900	0.682
	4	2.760	0.900	0.722
	5	2.611	0.911	0.776
Nuclear Power Stigmatization (NS)	1	3.028	0.849	0.658
	2	3.260	0.793	0.761
	3	2.985	0.877	0.791
	4	2.717	0.942	0.670
	5	3.035	0.882	0.615
Trust in Government (T)	1	2.843	0.955	0.814
	2	2.879	0.836	0.828
	3	2.414	0.949	0.849
	4	2.616	0.914	0.811
	5	2.624	0.929	0.852
Perceived Benefits (PB)	1	2.503	0.964	0.705
	2	3.043	0.793	0.777
	3	3.003	0.755	0.798
	4	2.487	0.979	0.656
	5	3.225	0.692	0.622
Perceived Drawbacks (PD)	1	3.518	0.658	0.720
	2	3.520	0.642	0.751
	3	3.290	0.693	0.798
	4	3.250	0.712	0.764
	5	3.005	0.783	0.617
Attitude (A)	1	3.010	0.874	0.891
	2	3.159	0.800	0.868
	3	3.232	0.741	0.836
	4	3.005	0.877	0.828
	5	2.639	0.956	0.731
Subjective Norm (SN)	1	2.717	0.901	0.845
	2	2.684	0.916	0.859
	3	2.891	0.815	0.649
	4	2.997	0.813	0.763
	5	2.722	0.835	0.880

Table 3 *(continuation)*

Variable	Item	Mean	SD	Factor Loading
Perceived Behavioral Control (PBC)	1	3.078	0.864	0.777
	2	3.232	0.806	0.415
	3	2.669	0.957	0.870
	4	2.854	0.897	0.911
	5	2.871	0.878	0.905
Intention (I)	1	2.735	0.959	0.909
	2	2.614	0.952	0.905
	3	2.833	0.924	0.926
	4	3.018	0.893	0.878
	5	2.884	0.887	0.853
Nuclear Power Acceptance (NA)	1	2.942	0.952	0.920
	2	3.048	0.917	0.884
	3	2.922	0.875	0.862
	4	2.823	0.957	0.888
	5	2.944	0.912	0.922

Table 3 shows the descriptive measurements for each construct, including the mean and standard deviation. Radiation is a well-understood concept in nuclear power. However, some students remain unaware of the policies concerning the Philippines' adoption of nuclear power in the energy mix. When the average of the mean scores was computed, NS (3.0005) had a higher score than NK (2.9114). There is stigmatized information about nuclear power. The perception that citizens living near a nuclear power plant have a greater risk of developing cancer and radiation-related illness had the highest mean score among the stigma. Students are aware of the many concepts, principles, and policies associated with nuclear power. However, the nuclear power stigma remains prevalent.

Table 4
Construct Validity of the Model

Variable	Cronbach's Alpha	Composite Reliability
Nuclear Power Knowledge	0.720	0.814
Nuclear Power Stigmatization	0.738	0.828
Trust in Government	0.887	0.918
Perceived Benefits	0.750	0.838
Perceived Drawbacks	0.777	0.852
Attitude	0.884	0.918

Table 4 *(Continuation)*

Variable	Cronbach's Alpha	Composite Reliability
Subjective Norm	0.861	0.900
Perceived Behavioral Control	0.846	0.892
Intention	0.937	0.952
Nuclear Power Acceptance	0.938	0.953

Table 4 reveals that each variable's Cronbach's alpha value is more than 0.70, which is considered a sufficient indication of an instrument's dependability or internal consistency (Taber, 2018). Furthermore, the composite reliability of the study yielded values better than 0.70, indicating that the constructs were valid and had wide reliability (Ab Hamid et al., 2017).

Table 5
Direct and Indirect Effects

Predictor Variable		Outcome Variable	Pearson r	P-Value
Nuclear Power Knowledge (NK)	→	Trust in Government (T)	0.395**	0.000
	→	Perceived Benefits (PB)	0.412**	0.000
	→	Perceived Drawbacks (PD)	0.220**	0.000
	→	Attitude (A)	0.382**	0.000
	→	Subjective Norm (SN)	0.414**	0.000
	→	Perceived Behavioral Control (PBC)	0.442**	0.000
	→	Intention (I)	0.346**	0.000
	→	Nuclear Power Acceptance (NA)	0.376**	0.000
Nuclear Power Stigmatization (NS)	→	Trust in Government (T)	0.120	0.811
	→	Perceived Benefits (PB)	-0.043	0.398
	→	Perceived Drawbacks (PD)	0.523**	0.000
	→	Attitude (A)	-0.134**	0.008
	→	Subjective Norm (SN)	-0.036	0.470
	→	Perceived Behavioral Control (PBC)	-0.125*	0.012
	→	Intention (I)	-0.173**	0.001
	→	Nuclear Power Acceptance (NA)	-0.199**	0.000

Table 5 *(continuation)*

Predictor Variable		Outcome Variable	Pearson r	P-Value
Trust in Government (T)	→	Attitude (A)	0.448**	0.000
	→	Subjective Norm (SN)	0.484**	0.000
	→	Perceived Behavioral Control (PBC)	0.498**	0.000
	→	Intention (I)	0.495**	0.000
	→	Nuclear Power Acceptance (NA)	0.424**	0.000
Perceived Benefits (PB)	→	Attitude (A)	0.645**	0.000
	→	Subjective Norm (SN)	0.528**	0.000
	→	Perceived Behavioral Control (PBC)	0.602**	0.000
	→	Intention (I)	0.597**	0.000
	→	Nuclear Power Acceptance (NA)	0.599**	0.000
Perceived Drawbacks (PD)	→	Attitude A)	-0.001	0.984
	→	Subjective Norm (SN)	0.017	0.734
	→	Perceived Behavioral Control (PBC)	-0.036	0.477
	→	Intention (I)	-0.131**	0.009
	→	Nuclear Power Acceptance (NA)	-0.105*	0.037
Attitude (A)	→	Intention (I)	0.772**	0.000
	→	Nuclear Power Acceptance (NA)	0.770**	0.000
Subjective Norm (SN)	→	Intention (I)	0.707**	0.000
	→	Nuclear Power Acceptance (NA)	0.701**	0.000
Perceived Behavioral Control (PBC)	→	Intention (I)	0.804**	0.000
	→	Nuclear Power Acceptance (NA)	0.812**	0.000
Intention (I)	→	Nuclear Power Acceptance (NA)	0.883**	0.000

* - Correlation is significant at the 0.05 level (2-tailed).
** - Correlation is significant at the 0.01 level (2-tailed).

Table 5 shows that I towards NA (H19; r=0.883**) has the strongest direct relationship. It implies that the stronger the student is motivated to favor nuclear power as a source of energy, the stronger the acceptance is. Park and Ohm (2014) have observed a similar relationship between I and NA in the public adoption of renewable energy sources.

While I is a strong causal variable for acceptance, there are also variables that significantly indirectly affect the acceptance of nuclear power. Understanding the concepts, policies, and principles behind nuclear power leads to its acceptance as evident in Table 5, where NK to NA had a computed Pearson value of r=0.376**. T to NA (r=0.424**) shows that the more the government can be trusted, the more inclined people are to adopt nuclear power. Goodwill trust and competence trust are indicators of nuclear technology acceptance (Xiao et al., 2017). PB to NA (r=0.599**) demonstrates that perceived advantages and benefits are among the key drivers of technology acceptance. A to NA (r=0.770**) suggests that believing in nuclear power's good implications leads to a favorable attitude toward adopting it. Hussain et al. (2017) and Nguyen et al. (2019) showed that attitude is a predictor of intention by studying mobile health technology and consumers' intention to purchase.

The biggest indirect impact, PBC to NA (r=0.812**), indicates that students are more inclined to embrace nuclear power if they feel they can support it. Among the indirect effects, two have shown an inverse relationship with NA. Students who have a negative perception of nuclear power and comprehend the disadvantages it poses are more inclined to oppose its adoption, as evidenced by the correlations of NS to NA (r=-0.199**) and PD to NA (r=-0.105*). Similarly, Lim et al. (2017) discovered that those who are prone to power plant dangers refuse to embrace nuclear technology.

Looking at the factors influencing intention, PBC has a substantial influence on I (H18; r=0.804**). This implies that people's perception and confidence in nuclear power as a future energy source influenced their decision to accept it. Zhang et al. (2020) found that behavioral control has a significant effect on the intention of having nuclear facilities. The relationship between NK and PBC (r=0.442**) suggests that comprehending nuclear power makes it easier to accept it, but the relationship between NS and PBC (r=-0.125*) shows that stigmatized information limits the capacity to embrace nuclear power. Wang et al. (2019) showed that comprehension positively influences the behavioral perception of adopting nuclear energy.

The direct association between A and I (H16; r=0.772**) demonstrates that good attitudes regarding nuclear power impact students' willingness to adopt nuclear power. Foltz et al. (2016) supported that attitude predicts behavioral intention by studying factors that influence changing security and social networking settings. NK to A (r=0.382**) concludes that adequate knowledge of nuclear power leads to a positive attitude towards accepting it, while NS to A (r=-0.134**) shows that stigma surrounding nuclear power results in a negative attitude that rejects it.

SN to I (H17; r=0.707**) establishes that the students' acceptance of nuclear power is influenced by perceived social influence or pressure from others. Some studies reveal that social networks may influence one's intention regarding technology acceptance (Venkatesh et al., 2003; Ten Kate et al., 2010). In terms of nuclear power acceptability, students are inclined to agree with their family, friends, classmates, mentors, and role models. NK to SN (r=0.414**) shows that acquiring facts about nuclear power technology affects how students perceive the acceptability of other people, while NS to SN (r=-0.036) shows no significant relationship between stigma and subjective norm.

The next strongest direct relationships are the hypothesized relationships of PB to A (H10; r=0.645**), PB to PBC (H12; r=0.602**), and PB to SN (H11; 0.528**). Some studies explain that perceived benefits, opportunities, and resources significantly influence an individual's A, PBC, and SN (Armitage & Conner, 2001; Sinha & Singh, 2017; Jung et al., 2020). In the acceptance of nuclear power, students feel that lower operational costs, increased energy reliability, and less pollution will result in a favorable impact on the economic, environmental, and reliability aspects of nuclear power plants in the Philippines. They are more likely to accept nuclear power because of their impression of the aforementioned benefits. Furthermore, because everyone desires the benefits that come with technology, students tend to feel that others will embrace it as well, pushing them to adopt nuclear power as well.

NS to PD (H6; r=0.523**) shows that stigmatized information about nuclear power is highly associated with the perception of drawbacks. However, according to the results, there is no significant direct relationship between NS to T (H4; r=0.120) and NS to PB (H5; r=-0.043). Similar studies, such as the research of Nam-Speers et al. (2020), also show these findings suggesting that there was no significant impact of the collectively shared concern for nuclear stigmatization on the benefits perceived from the nuclear power facilities. However, stigmatization still has economic, societal, and psychological repercussions by negatively influencing nuclear power acceptance through perceived drawbacks, as seen in the relationship between NS to NA (r=-0.199**). While there are risks associated with nuclear accidents, building costs, and radiation, students who have been exposed to stigmatized information about nuclear power plants sometimes overestimate or assume that these risks are always prevalent. Radiation, for example, is a serious risk, yet areas near nuclear power plants are not necessarily contaminated with harmful amounts of radiation.

Regarding T to PBC (H9; r=0.498**), T to SN (H8; r=0.484**), and T to A (H7; r=0.448**), people's acceptability of nuclear power was enhanced when they had a strong positive belief in their government. In the same way, students feel that if the government can design and implement nuclear power development initiatives, it will be easier for them to accept it. Furthermore, social groups that have confidence in the government's abilities influence their decision to adopt nuclear power. Trust in government and regulation influences nuclear power acceptance indirectly (Ryu et al., 2018).

The lowest significant effects are the direct relationship between NK to PB (H2; r=0.412**), NK to T (H1; r=0.395**), and NK to PD (H3; r=0.220**). Wang et al. (2020) have shown that widespread public understanding of nuclear energy has a considerable influence on PB. The findings demonstrate that people today are better informed of nuclear power ideas, principles, and policies. Understanding the concept of nuclear power empower students with an awareness of its benefits, drawbacks, and how the government may manage the development of nuclear power plant projects.

Lastly, PD to PBC (H15; r=-0.036), PD to SN (H14; r=0.017), and PD to A (H13; r=-0.001) show no significant effects. This may imply that knowing the disadvantages of nuclear power does not necessarily dictate the PBC, SN, and A of an individual. Nevertheless, PD still adversely affects the I (r=-0.131**) and NA (r=-0.105*). But even with PD negatively affecting NA, PB still outweighs it because PB shows a more significant effect on the students' acceptance as evidenced by the indirect relationships of PB to NA (r=0.599**) as against that of PD to NA (r=-0.105*).

In terms of student acceptability of nuclear power in the Philippines, it can be observed that NK had a higher effect than NS. Understanding nuclear power is crucial in acceptance (Salloum et al., 2019). Students with a firm knowledge of the technology are more inclined to accept nuclear power as one of the Philippines' potential sources of energy. Students have an important role in society's evolution, and their adoption of nuclear energy can significantly represent and influence public opinion. Other people's decisions may be influenced by their views. As a result, sufficient awareness about nuclear power plants can lead to people accepting this potential new source of energy in the Philippines.

RECOMMENDATIONS

The present research is limited to student acceptance of nuclear power in the Philippines. Thus, the results may not be generalizable and may not be deemed representative of the views of the country's entire population as regards the acceptability of nuclear power due to the volunteer response sample used to distribute the questionnaire via social media platforms.

Furthermore, even when numerous variables are considered, past events such as the Chernobyl tragedy, the Fukushima accident, and other nuclear power plant issues continue to have an impact on future studies on the subject and may, thus, lead to different results. These incidents should be considered in the conduct of future studies. In the Philippines, large infrastructure projects, such as the BNPP, are often perceived as vulnerable to political meddling for the personal gain of some public officials (Batalla et al., 2018). This has a detrimental impact on the acceptability of nuclear power plants because of the perceived low level of public trust in the government.

To increase trust in the government, it is vital to establish and implement regional protective regulations, as well as highlight the benefits of nuclear power plants. Policymakers and the PNRI, as one of the Philippines' regulating bodies for nuclear technology, may benefit from disseminating relevant educational information via social media platforms, posters, and even by building media networks. The guarantee of risk protection may lead to greater favorable acceptance among

Filipino students. A government that is open and transparent regarding its projects and programs will help gain trust and acceptance among the students.

The findings of this study also indicate that nuclear power knowledge has a substantially greater influence on acceptance than nuclear power stigma. However, the stigma persists, as indicated by respondents' strong belief in it above factual knowledge. Students should work on improving their nuclear comprehension since it provides important information and minimizes stigmatized beliefs. School curricula can be designed and used to disseminate information about nuclear energy in educational institutions. In the Philippines, for example, disaster risk mitigation and management are taught in secondary schools, whereas the subject, Science, Technology, and Society is taught in colleges. Nuclear power plants may be studied carefully considering their advantages and the hazards that they may pose. This subject will help people to comprehend and appreciate nuclear power and explain the nuclear power stigma. Local communities can also organize programs and activities, such as forums or lectures about nuclear power plants, for young people who are unable to attend school.

CONCLUSION

As one source of renewable energy, nuclear power plants have been widely utilized worldwide. This study measured the acceptability of nuclear power and the factors affecting its acceptability among 396 students from various parts of the country. Nuclear Power Knowledge, Nuclear Power Stigmatization, Trust in Government, Perceived Benefits, Perceived Drawbacks, Attitude, Subjective Norm, Perceived Behavioral Control, Intention, and Nuclear Power Acceptance are among the factors examined in this study. The Pearson correlation coefficient demonstrated relationships between elements that influenced Filipino students' acceptance of nuclear power as one of the Philippines' energy sources.

Of the 19 hypothesized relationships, 14 are regarded as having a direct and significant influence. The internal consistency and validity of constructs and variables imply that a framework incorporating TPB and PMT may be used. These frameworks provide a paradigm for measuring people's behavior holistically. In this study, PD does not influence A, SN, or PBC, thus, studies on the effects of PD can be expanded to obtain a more promising conclusion.

The findings reveal that knowledge is one of the most important aspects in determining a student's acceptance; it favors perceived benefits ($r=0.412^{**}$), perceived drawbacks ($r=0.220^{**}$), and trust in the government ($r=0.395^{**}$). Stigma, on the other hand, reduces acceptance by emphasizing perceived drawbacks ($r=0.523^{**}$). Students who have a thorough understanding and appreciation of the benefits of nuclear power are more likely to embrace it, as they believe that the government can improve the advantages and mitigate the disadvantages. However, the stigma that surrounds nuclear power may cause the disadvantages to outweigh the advantages, resulting in non-acceptance. With the prevailing stigma, however, the extent of the student's acceptance of the utilization of nuclear power in the Philippines remains positive. The relationship between NK and NA (r=0.376**) is greater than that of NS and NA (r=-0.199**).

However, the fact that the average NS scores (3.005) are higher than that of the NK scores (2.9114) emphasizes the need for a more comprehensive nuclear power education. The inclusion of nuclear power benefits and risks in the currently taught subjects in the SHS and college may improve students' comprehension of nuclear power. Students and their acceptance of nuclear energy can greatly represent and influence public opinion. Their perspective can influence others, eventually leading to broader public and government approval.

The findings imply that there is a strong motivation for the student to accept nuclear power. This motivation stems from the ease of perceived acceptance, a good attitude towards adopting nuclear power, and the perceived social influence from other people. However, the negative perception of nuclear power, including its disadvantages, poses a hindrance to its adoption.

To highlight its benefits for energy generation, nuclear programs can be presented. Nuclear power program development has the potential to provide cleaner energy, particularly in developing nations. This potential energy source may be used to boost economic growth, minimize environmental concerns, and promote societal progress. Furthermore, the additional industry that can be created by the establishment of a power plant may help the government create jobs, combat climate change, and promote sustainability among Filipinos. This will ultimately provide a platform for the rest of the world to see how nuclear energy may benefit a country.

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