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Analysis of High School Students' Perception and Knowledge of Renewable and Nuclear Energy

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Introduction

From driving a car to refrigerating food, energy is practically everywhere in modern society. According to the United States Energy Information Administration (2022), or EIA, total energy consumption in the United States has risen drastically from approximately 35,000 trillion Btu in 1950 to 93,000 trillion Btu by the end of 2020.

Fossil fuels, responsible for over 75% of consumed energy that year (EIA, 2022), have been known to harm the environment, especially the climate. The combustion of fossil fuels releases carbon dioxide, which can also lead to public health complications (Perera, 2018). Furthermore, fossil fuels can lead to complications concerning unstable market prices and uneven distribution (Martins et al., 2019).

Renewable[1] and nuclear sources have presented themselves as lucrative alternatives, as they can mitigate environmental issues by diminishing carbon dioxide emissions (Schneider et al., 2000; Prăvălie & Bandoc, 2018). Although these energy sources have great potential to address many prevalent issues with fossil fuels, the public is ambivalent. Surveys conducted by PEW Research Center (Tyson et al., 2022), WorldPublicOpinion (2008), and other researchers have shown relatively positive support for renewable energy but a more nuanced opinion on nuclear energy around the world (Hagen & Pijawka, 2015; Paraschiv & Mohamad, 2020).

Numerous studies have been conducted concerning the perception and knowledge of these energy sources, but not much pre-existing research investigates high school students. Gauging public opinion and knowledge is crucial (Solarz et al., 2022), especially with the students of future generations (Tortop, 2011). Additionally, although research has been produced from many regions across the globe, previous studies have not been conducted in the San Francisco Bay Area specifically. This study's exploration of perception and understanding will provide better insight into high school students' opinions and knowledge of these crucial topics.

Literature Review

Public Perception

According to a Pew Research Center survey taken by over ten thousand adults, 69% of surveyees supported prioritizing the development of renewable sources; nuclear energy received a less friendly reception, with only about a third supporting its development (Tyson et al., 2022). A poll from WorldPublicOpinion.org (2008), completed by over twenty thousand participants from 21 countries found similar results: support for renewable energy and a mixed response to nuclear energy (WorldPublicOpinion.org, 2008).

[1]Renewable sources: hydroelectric, geothermal, solar, wind, biomass (EIA, 2022)

Researchers have investigated some of the reasons for the positive perception of renewables. A study conducted by professors Bjoern Hagen and David Pijawka (2015) found a generally positive attitude toward renewable energy in North America, supporting the poll results stated above. Interestingly, the perceived risk of climate change had the greatest influence on respondents' support of renewables (Hagen & Pijawka, 2015). Perceived risks and benefits, which includes climate change, is a broad perspective that impacts perception, according to Río and Burguillo (2008). Previous research has taken another approach of analyzing socioeconomic and demographic factors that may influence support for renewables. For instance, researcher Birku Reta Entele (2020) found that age, income and cost all affected rural Ethiopians' support of renewables. On the flip side, Henrik Karlstrøm and Marianne Ryghaug (2014) asserted that a majority of socio-demographic factors do not significantly impact the public's support, and Djurisic et al. (2020) reported that age did not affect their findings significantly.

The public's perception of nuclear energy, compared to renewables, is much more complex, as seen in previously conducted polls (Tyson et al., 2022; WorldPublicOpinion, 2008). A study conducted by Ningle Yu et al. found that while around 70% of participants supported renewable energy development, only about 35% supported nuclear energy expansion, reciprocating the general attitude found in polls (Yu et al., 2012). To explain this finding, researchers have argued that the public's perception based on risks and benefits influences attitude toward nuclear power (Paraschiv & Mohamad, 2020; Visschers et al., 2011). Yu et al. (2012) also discovered that over 80% of respondents living around the Tianwan power plant feared improper waste handling and bodily harm, two major reasons for the public's low opinion according to Jonathan Baron and Stephen Herzog (2020). These perceived risks can be attributed to the reluctance of accepting nuclear power, as seen in the massive upsurge in opposition to nuclear power following the Fukushima disaster (Wang et al., 2019; Kitada, 2016). On the other hand, perceived benefits have also been explored in previous literature. A study conducted in the vicinity of the Dukovany power plant in the Czech Republic revealed a positive attitude toward nuclear power and the benefits it provided for the locals (Frantál et al., 2016). Demographic factors such as distance, gender, and income, have also been an avenue of analysis in conjunction with perceived risks and benefits (Hu et al., 2021). For instance, Frantál et al. (2016) discovered a positive support of nuclear energy in young, highly-educated people residing close to a nuclear plant. Yu et al. (2012), reported a more critical opinion of nuclear energy in female respondents and people living closer to the nuclear plant, in contrast to Frantál et al. (2016).

Similar Research

Researchers have studied high schoolers' attitude and knowledge of renewable sources, although the amount of published research is lacking (Tortop, 2011). In a study aiming to gauge the opinions of Turkish students on this topic, researchers discovered that over half of students were hesitant to pay for more renewably-generated energy (Çelikler & Aksan, 2015). Notably, about half of the students surveyed believed that renewable power stations could negatively affect living organisms and people, and over half stated their reluctance to live in proximity to one (Çelikler & Aksan, 2015). Zyadin et al. (2012) investigated certain factors that influence student perception and found living area, school institution, and gender impacted results; for example, urban public schools were shown to have a more positive perception than private schools. Studies have also reported a lower trend in knowledge regarding renewable energy with students having misconceptions of renewable energy (Tortop, 2011). Interestingly, Çelikler and Aksan (2015) found that school accounted for over 80% of secondary students' first exposure to the topic, with the Internet, media, and family having little reported effect.

Nuclear power has also been studied amongst high school students, but the number of studies available is limited. A Turkish study published in 2010 by faculty of Gazi university found that students extensively believed in the harmful effects of nuclear power, with over 55% of respondents stating that nuclear energy was harmful (Gökmen et al., 2010). A much smaller number of respondents, about 18%, reported a positive view of

the benefits of nuclear energy, according to Gökmen et al. (2010). Other studies have also demonstrated this shared fear of nuclear power among young people, to differing extents however (Kılınç et al., 2012). Gökmen et al. (2010) also investigated the demographic factors of grade and gender; notably, female students showed a higher perception of risk than male students, and tenth graders demonstrated greater knowledge than ninth graders. The same study additionally highlights a lower understanding of nuclear energy, as only 4.5% reported a sense of "adequate knowledge"(Gökmen et al., 2010, p. 2353).

Research Gap

While the public's perception and understanding of renewable and nuclear energy sources have been researched extensively in previous literature, there are some notable gaps that exist. In addition to the lack of focus on high school students specifically, studies have not investigated both renewable and nuclear energies in conjunction. Nanyang Technological Institute professor Shirley Ho argues that it is crucial to include other energy sources in future studies of nuclear energy (Ho & Kristiansen, 2019). By gauging opinions of both renewable and nuclear sources, research will provide a better context for attitudes on nuclear power (Ho & Kristiansen, 2019). Ho et al. (2018) also presented another issue with the geographical distribution of previous literature being limited to only a few regions on earth (Ho et al., 2018; Ho & Kristiansen, 2019). Literature concerning high school students specifically is limited, and few have been based in California, let alone the San Francisco Bay Area. Moreover, school institution type as an influential factor has not been explored much in previous research. In light of some of these missing facets, the analysis conducted in this paper will be looking to bridge some of the mentioned gaps.

Methods

Study Structure

To effectively address the research goal, a multi-part electronic questionnaire was employed because of the advantages of quick response time and easy data compilation, according to Jones et al. (2013). The questions used within the survey were largely inspired by previous papers with similar research goals.

Questionnaire Design

Section 1

Q1: Do you live in the San Francisco Bay Area?
Q2: If you answered "yes" above, which county?
Q3: Age (in numerical form)*
Q4: Grade
Q5: Gender
Q6: School Institution
Q7: Which courses have you taken that relate to this topic?*
Q8: Ethnicity (optional)*
Q9: How concerned are you about climate change?
Q10: Which THREE aspects of energy generation are the MOST important to you?**

The first part of the questionnaire serves as a background section focusing on demographics and preliminary energy information. The first eight questions are demographic, with Q1, Q2, and Q4 specifically aiming to identify the target population, a crucial step in survey research (Ponto, 2015). Q9 focuses on climate change perception that will be analyzed for correlation with other findings, and Q10 asks respondents to select three aspects of energy generation they view as most important. The last question was inspired by Çelikler and Aksan (2015) and Kılınç et al. (2012).The overall purpose of this section is to gather important background information that will be used in later analyses.

Section 2

Q11: On a scale of 1 to 5, how knowledgeable are you on the topic of renewable energy and its sources?
Q12: Which of the following are renewable sources of energy?**
Q13: How beneficial/harmful do you believe renewable sources are for society?
Q14: How beneficial/harmful do you believe renewable sources are for the environment?
Q15: How safe do you believe renewable sources are?
Q16: I would be willing to live next to a renewable resource power plant.
Q17: I would be willing to pay more for renewably-generated energy.
Q18: We should implement more renewable energy into energy generation.
Q19: Where did you first hear/learn about renewable energy?
Q20: Where do you attain your knowledge about renewable energy?**

Q13-Q18 are Likert scale questions that focus on perception and attitude toward renewables. Q16-Q18 are standard Likert scale questions with options ranging from "I strongly disagree" to "I strongly agree." Q13 and Q14 follow a similar scale of "Extremely harmful" to "Extremely beneficial," and Q15 uses a scale of "Extremely dangerous" to "Extremely safe." Q13-Q15 include an option of "No opinion," while Q16-Q18 utilize "I neither agree nor disagree" as a neutral selection. These questions were used by previous studies (Djurisic et al., 2020; Çelikler & Aksan, 2015). To gauge students' knowledge, respondents were asked to self-evaluate their understanding on a scale of one to five and complete a multi-select question identifying renewable sources from a list of various options (Q11-Q12). This approach has been adapted from similar studies on young people (Çelikler & Aksan, 2015; Zyadin et al., 2012; Çoker et al., 2010). The last two questions, Q19 and Q20 can reveal implications about certain sources of information that contribute to the target audience's perception and understanding of renewables (Tortop, 2011; Çelikler & Aksan, 2015).

Section 3

Q21: On a scale of 1 to 5, how knowledgeable are you on the topic of nuclear energy and its sources?
Q22: How beneficial/harmful do you believe nuclear power is for society?
Q23: How beneficial/harmful do you believe nuclear power is for the environment?
Q24: How safe do you believe nuclear power is?
Q25: I would be willing to live next to a nuclear power plant.
Q26: I would be willing to pay more for nuclear-generated energy.
Q27: We should implement more nuclear power into energy generation.
Q28: Where did you first hear/learn about nuclear energy?
Q29: Where do you attain your knowledge about nuclear energy?**

*Open-ended question
**Multi-select question

The last section investigating nuclear energy largely parallels the renewable energy section to allow for better comparison between the two sections' responses, addressing the limitation presented by Ho and Kristiansen (2019). All six perception questions were worded accordingly to address the topic of nuclear energy, and they largely resemble questions from questionnaires used by Gökmen et al. (2010) and Kılınç et al. (2012).

Distribution

The anonymous survey was created in Google Forms and distributed through online messaging platforms like Discord to high school students. In total, the survey was completed by 75 total surveyees currently enrolled in high school, with 62 from the San Francisco Bay Area (BA). As 82.6% of total respondents were from the BA, narrowing the target audience to this specific region avoided the biases of unrepresentative data that would occur if the audience was the entire high school population. Looking specifically at the BA respondents, 41.9% identify as female, while 58.1% identify as male. Additionally, 43.5% attend a public high school, while 56.5% attend private institutions.

Analysis

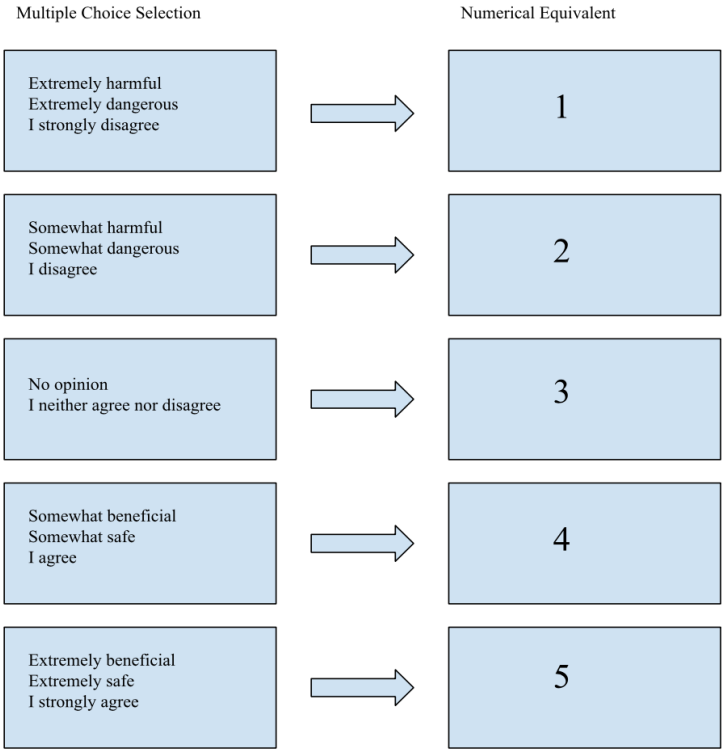

Figure 1. Likert Scale Conversion

To analyze Likert scale questions effectively, each selection was converted to numerical form. Figure 1 displays the validated score conversion system that was utilized by Zyadin et al. (2012) and Halder et al. (2010). This scoring system allows for the averaging of all 62 responses for specific questions and all six perception questions as a total. In the latter case specifically, a total mean closer to 5 would designate an overall positive view while a total mean closer to 1 would denote a more negative view.

After numerically converting the responses, two sample unequal variance t-tests were used between individual question means and the total mean to reveal statistical significance between variables. Linear regression analysis was also used between certain variables to determine possible correlations. While six demographic and background questions were asked, only gender and school institution were analyzed in this study due to sample size and time constraints. For example, the vast majority of ethnicities reported were "Asian," so comparison with the minuscule number of other ethnicities would not be effective. Additionally, analyzing every demographic thoroughly would be incredibly time consuming, so this paper only focuses on the select two that have the most representative sample sizes.

Results

Section 1: Preliminary Information

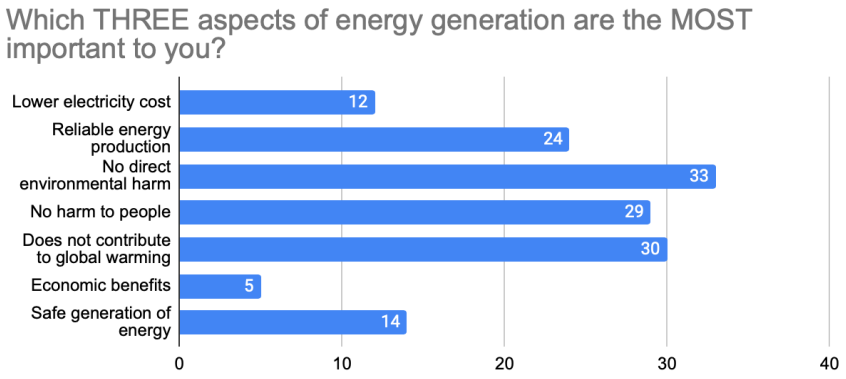

Figure 2. Ranking of Energy Generation Aspects

*Note: 13 respondents selected more than three choices, so only 49 surveyees' results were considered for this question

As seen in **Figure 2**, the top three aspects chosen by students were "No direct environmental harm," "Does not contribute to global warming," and "No harm to people" with 67.3%, 61.2%, and 59.2% selecting each result respectively.

Section 2: Renewable Energy

Table 1. Renewable Energy Perception

Question	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)

Q13	0	1.61	3.23	41.9	53.2
Q14	0	0	3.23	33.9	62.9
Q15	0	1.61	11.3	51.6	35.5
Q16	8.06	21.0	24.2	32.3	14.5
Q17	1.61	21.0	14.5	50.0	12.9
Q18	0	0	4.84	41.9	53.2

95.1% of respondents viewed renewable energy as beneficial for society and 96.8% for the environment. 46.8% were willing to pay more for renewable energy, and 95.1% supported the expansion of it.

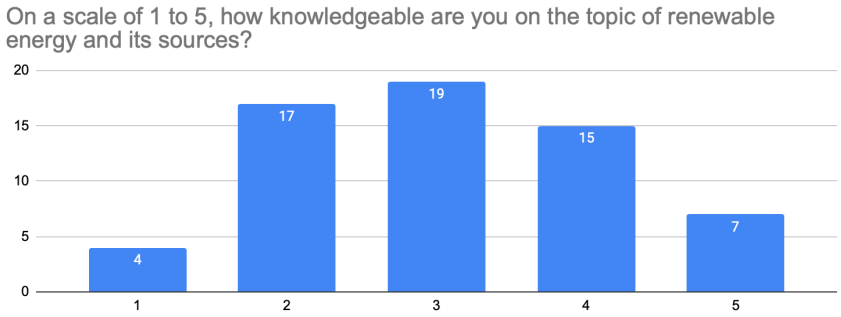

Figure 3. Renewable Knowledge Self-Evaluation

Self-reported knowledge follows a normal distribution as seen above.

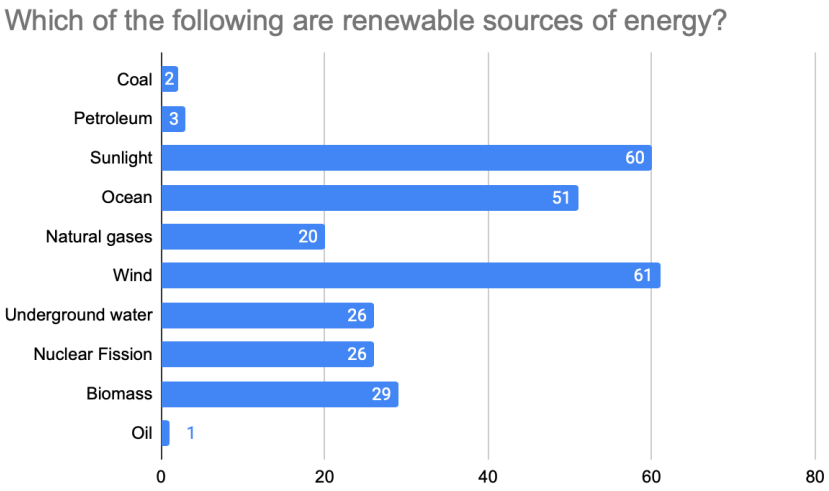

Figure 4. Renewable Source Identification

As seen in Figure 4, 98.4% and 96.8% of students were able to identify wind and sunlight (solar) as renewable sources of energy respectively. Although 82.3% correctly identified the ocean (hydroelectric) as a source, the percentages of respondents who picked underground water (geothermal) and biomass were significantly lower at 41.9% and 46.8% respectively. Additionally, 41.9% of respondents incorrectly chose nuclear fission (nuclear power) as a renewable source, and 32.3% incorrectly picked natural gasses.

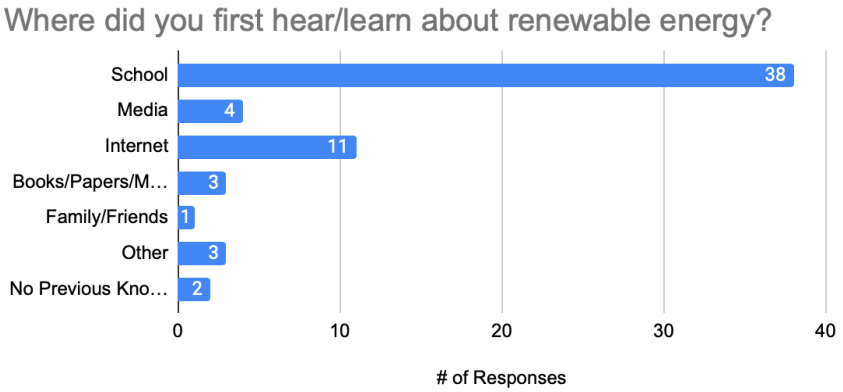

Figure 5. First-time Sources of Renewable Energy Information

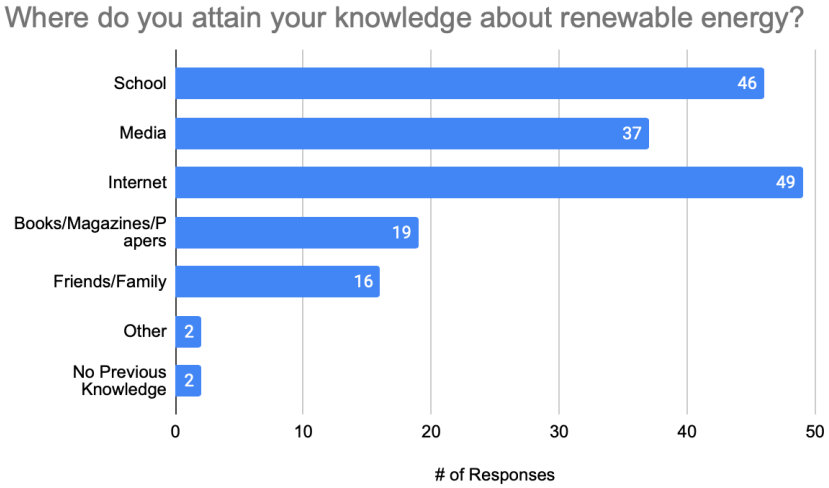

Figure 6. General Sources of Renewable Energy Information

61.3% of respondents linked their first exposure to school, while 17.7% first encountered the topic through the internet. Every other source each contributed to under 7%. However, the most commonly reported source of general information is the internet (79.0%), followed closely by school (74.2%). Other notable sources are the media (59.7%), written sources (30.6%), and close relationships (25.8%).

Section 3: Nuclear Energy

Table 2. Nuclear Power Perception

Question	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)

Q22	4.84	16.1	17.7	33.9	27.4
Q23	16.1	33.9	12.9	29.0	8.06
Q24	27.4	32.3	9.68	22.6	8.06
Q25	48.4	29.0	14.5	3.23	4.84
Q26	8.06	37.1	32.3	22.6	0
Q27	4.84	27.4	27.4	24.2	16.1

61.3% of respondents viewed nuclear energy as beneficial for society and 37.1% for the environment. 8.1% were willing to live near a nuclear plant, and 40.3% supported the expansion of it.

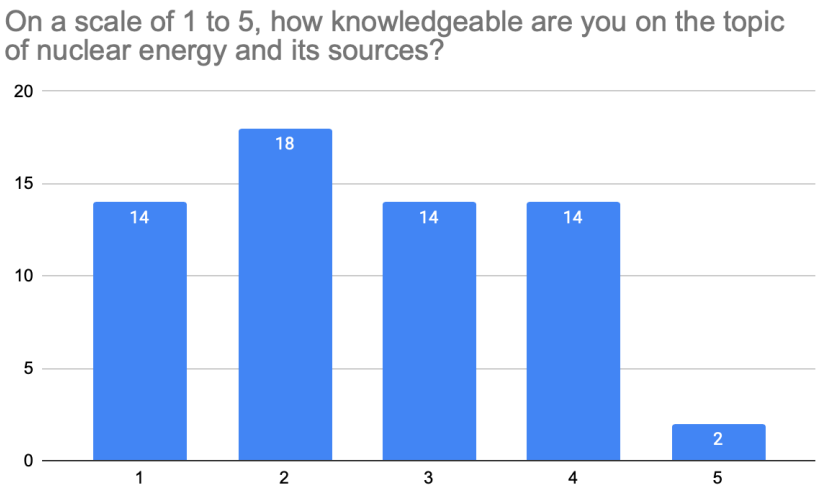

Figure 7. Nuclear Knowledge Self-evaluation

The largest percentage of respondents, 29.0%, answered 2, and only 3.23% selected 5 for self-reported knowledge.

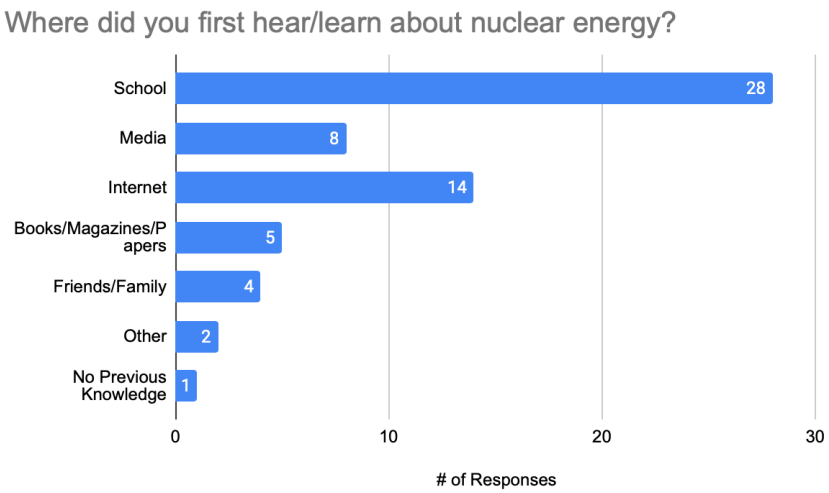

Figure 8. First-time Sources of Nuclear Energy Information

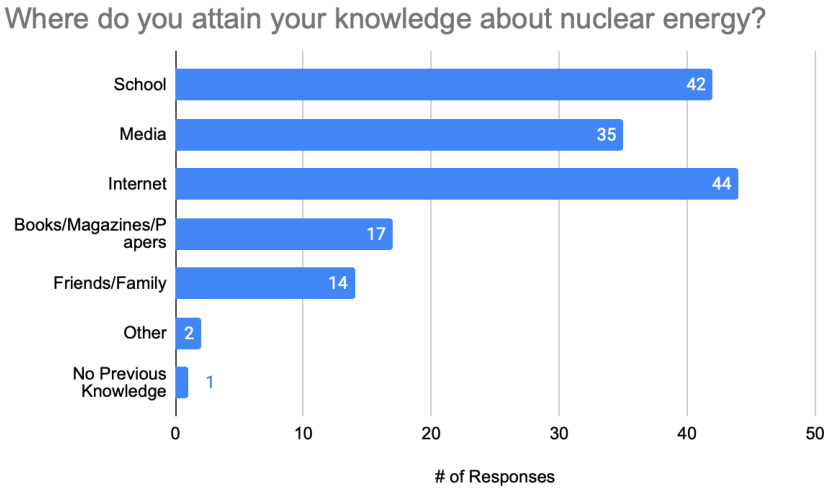

Figure 9. General Sources of Nuclear Energy Information

Similar to renewable sources, school is the most common source of information at 45.2%. The internet (22.6%) and media (12.9%) also have similar frequencies. Students' responses for school (71.0%) and the internet (67.8%), as seen in **Figure 9,** are also close to those displayed in **Figure 6**.

Section 4: Analysis

Table 3. Total Mean Perception of Renewable and Nuclear Energy

Energy Type	Total	Male	Female	Public	Private
Renewable (R)	4.09	4.12	4.04	4.24***	3.97***

Nuclear (N)	2.78	3.09****	2.36****	2.86	2.72

Table 3a. Students' Mean Perception of Renewable Energy Sources - Individual Questions

Question	Total	Male	Female	Public	Private
Q13	4.38	4.56	4.35	4.63*	4.35*
Q14	4.38	4.69	4.46	4.59	4.59
Q15	4.08	4.31	4.08	4.37	4.09
Q16	3.24	3.19	3.31	3.67**	2.94**
Q17	3.52	3.42	3.65	3.63	3.41
Q18	4.48	4.56	4.38	4.56	4.44

Table 3b. Students' Mean Perception of Nuclear Power - Individual Questions

Question	Total	Male	Female	Public	Private
Q22	3.63	4.22****	2.81****	3.52	3.71
Q23	2.79	3.06**	2.42**	2.81	2.74

Q24	2.52	2.81**	2.12**	2.67	2.35
Q25	1.87	2.06*	1.62*	2.15	1.68
Q26	2.69	2.81	2.54	2.74	2.68
Q27	3.19	3.58****	2.65****	3.30	3.15

Categories for 2-sample unequal variance t-test: (Male/Female), (Private/Public). * 0.05 < p < 0.1, ** 0.01< p < 0.05, *** 0.001 < p < 0.01, **** p < 0.001

Averaging the scores from all six perception questions for both renewable and nuclear reveals significant differences between R and N scores for certain categories. Male students' overall mean score was higher than female students' in both R and N categories; however, only the difference in N was statistically significant. Public school students' overall perception score was higher than private school students' in both R and N categories, with only the difference in the R overall score being statistically significant.

Individual questions give a more focused view at where each demographic factor differs compared to an overall average. No significant differences exist between male and female responses for each of the R questions (Q13-Q18); However, significant differences do exist between the two reported genders for four of the six N questions (Q22, Q23, Q24, Q27), with male mean scores being higher for all six. No significant differences exist between public and private responses for each of the N questions (Q22-Q27). A significant difference does exist between public and private for one of the R questions (Q16), with public school mean scores being higher for five of the six.

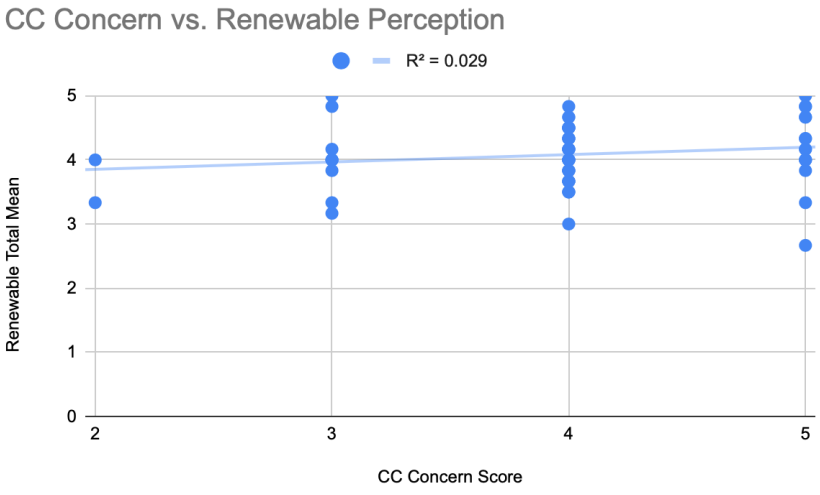

Figure 10. Climate Change Concern vs. Renewable Perception

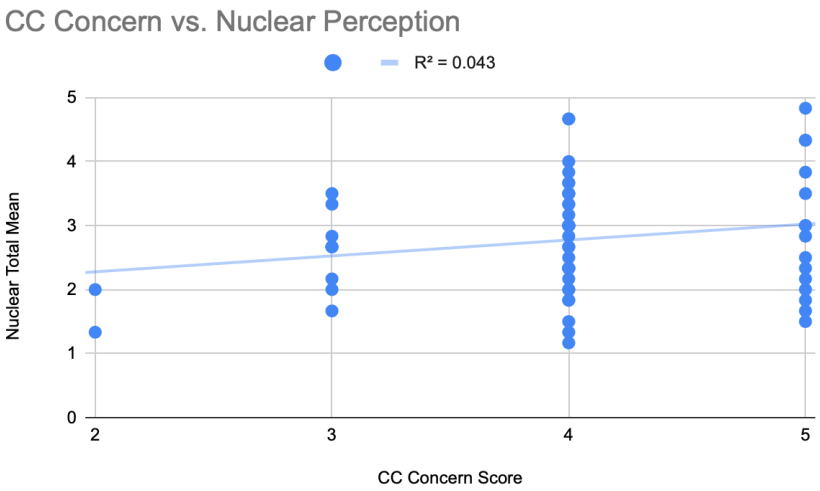

Figure 11. Climate Change Concern vs. Nuclear Perception

Climate change concern has a weak positive relationship with perception of both renewable and nuclear energy (r=0.170, r=0.207).

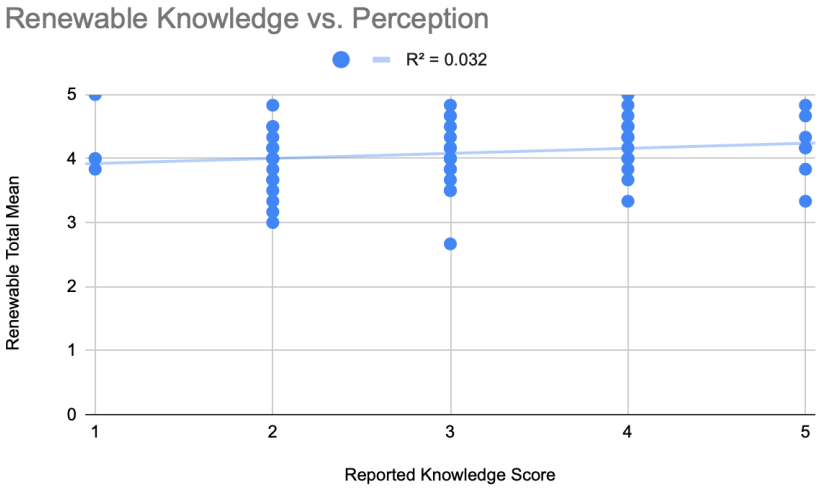

Figure 12. Renewable Knowledge vs. Renewable Perception

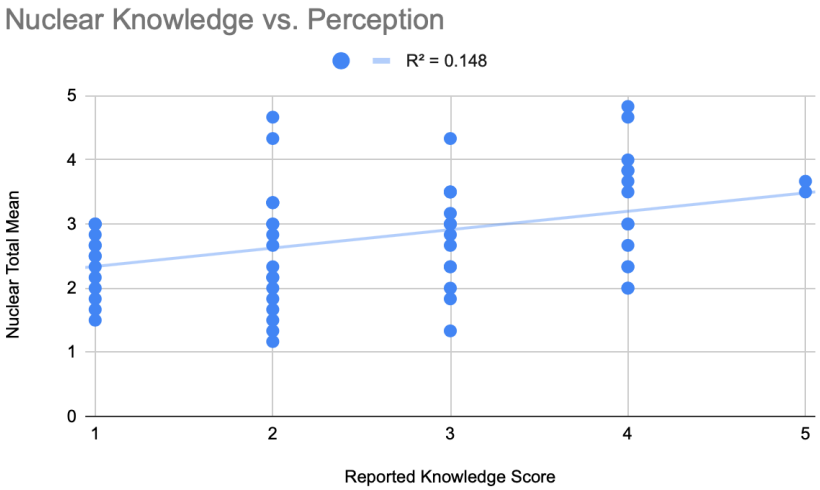

Figure 13. Nuclear Knowledge vs. Nuclear Perception

There is a weak correlation between both renewable and nuclear self-reported knowledge and perception (r=0.179, r=0.384).

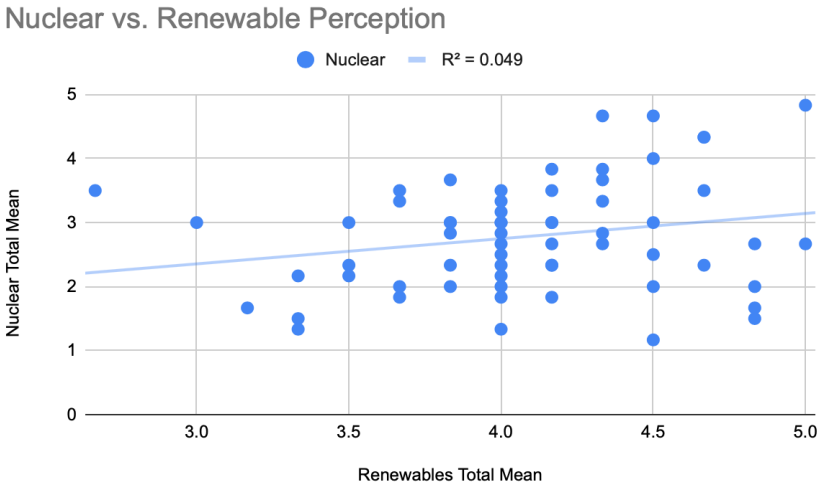

Figure 14. Nuclear Perception vs. Renewable Perception

There is a weak positive relationship between nuclear and renewable perception (r=0.221).

Discussion

Perception

Table 1 highlights the positive perception of renewable energy that students have. Over 95% viewed it as beneficial for society and the environment, and a similar amount supported the expansion of this type of energy. About 29.1% of students stated unwillingness to live close to a plant compared to the unwilling 62.0% found by Çelikler and Aksan (2015). Interestingly, Çelikler and Aksan (2015) found that 54.1% of respondents were

not willing to pay more for renewable energy, which is contrast to the 22.6% found in this study. Zyadin et al. (2012), on the other hand, found a higher willingness to pay of 71% compared to this study's 63%. This number is much larger than the 15% found by Djurisic et al. (2020) in adults, which could be due to high school students having minimal experience with personal finances.

Table 2 displays nuclear energy perception, which poses some similarity and contrast with previous research. Overall, perception of this type of energy was largely negative, although about 61% viewed nuclear energy as beneficial for society. Kılınç et al. (2012) found that 70% of responding students viewed nuclear power as damaging toward the environment, which is substantially larger than the 50% found in this study. 22% of students found by Kılınç et al. (2012) would be willing to pay more for nuclear energy, and 81% would not live next to a nuclear plant. These results are similar with this paper's findings of 22.6% and 77.4% respectively. 40.3% of the survey's respondents supported further expansion of nuclear energy, which is quite similar to the 34.7% found by Yu et al. (2012) in their study on adults. This research's findings on perception reveal a critical view of nuclear energy that has been shown in studies on students and adults alike. Notably, a much larger portion of the respondents had a neutral stance on nuclear energy compared to renewables, which could point to less exposure to the topic reflected in Figure 7.

Important energy generation aspects are displayed in Figure 2. Similar to findings produced by Çelikler and Aksan (2015) and Kılınç et al. (2012), students placed high significance on energy not harming people, the environment, and the climate. Each student's personal value of each aspect could impact how positively or negatively they view an energy source depending on their perception of benefits or risks (Kılınç et al., 2012). Although this was not explored in depth within this study, the similar aspects found in this study compared with previous studies could point to certain reasons for similar perception findings.

Knowledge

Figure 4 shows responses in identification of renewable energy sources. Over 96% of students, as seen, were correctly able to identify solar and wind as renewable sources, mirroring findings by Zyadin et al. (2012) and Çelikler and Aksan (2015), who both reported high percentages. 82.3% reported hydroelectric sources in comparison to the 60% in Çelikler and Aksan's study, but only 41.9% correctly selected "underground water" (geothermal) compared to 62.5% in their findings. Notably, the percentage (41.9%) of students in this study who incorrectly selected nuclear as a renewable source is higher than both previous studies mentioned; on the flip side, both previous studies had higher percentages that misidentified fossil fuels (Çelikler & Aksan, 2015; Zyadin et al., 2012).

Sources of first-time information on renewable energy, seen in Figure 5, reveal school (61.3%) and the internet (17.7%) as major avenues for students' first encounter with the topic. These findings are similar to findings by Altuntaş and Turan (2018), which reported school as 69.5% and the internet as 5.7%. Çelikler and Aksan's (2015) study, however, found a much larger 80.2% who reported school. School overall, contributes to a large majority of first-time and general information, as seen in Figure 6. However, while the internet does not have much effect as an introductory source, in general, it was reported by 79% of students as a source of information. In addition, the media (59.7%), written material (30.6%), and friends/family (25.8%) all served as major sources of information, while not having major influence on first-time information. Figure 8 displays results for nuclear energy, with school (43.5%), the internet (22.6%), and the media (12.9%) serving as major introductory sources. General information, Figure 9, follows a similar pattern as Figure 6 in terms of sources. Gökmen et al. (2010), however, found strikingly different results with television serving as a larger source of information than school and the internet. This may be due to the design of their questions, which only allows for singular selections compared to the multi-select questions in this survey. Other than study design, factors such as geographical location and time could have had an influence on differences. Çelikler and Aksan's (2015)

and Altuntaş and Turan's (2018) studies both take place in Turkey, which could have different patterns in student internet usage compared with the tech-dominated Bay Area. Additionally, Gökmen et al. (2010) conducted their study over a decade ago, and internet access and development has advanced tremendously since then, which could have caused differences seen..

Analysis

Previous literature has explored relational factors and their influence, seen in Table 3. A statistically significant more positive view of nuclear energy was found in male students, and a significantly more positive view of renewable energy was found in public school students. A large difference between genders was found for N, which has been displayed in previous research. Gökmen et al. (2010) and Kılınç et al. (2012) both found greater risk perception of N in female students compared to male students. Interestingly, when investigating school institution type, Zyadin et al. (2012) found that urban public school students had a more positive perception of R than private school students, which was reciprocated in this study.

Other notable findings are displayed in Figures 10 & 11 and Figures 12 & 13. Figures 10 & 11 display a weak positive correlation between climate change concern and both perception scores. Similarly, Figure 12 displays a weak positive correlation between R knowledge and perception. Figure 14 displays a relationship between R and N perception, addressing the major research gap posed by Ho and Kristiansen (2019). A weak positive correlation was found between the two variables, possibly signifying how a more positive opinion of renewable energy correlates to a more positive opinion on nuclear energy. Because of the small correlation coefficient in all cases, additional research should be conducted before arriving at conclusions.

Conclusions

New Understandings

This paper has expanded on previous research both through new discoveries and support of previous findings. Overall support for renewable energy and a critical opinion of nuclear energy was found in this study, along with a gender impact on nuclear perception, supporting previous research. School was also indicated as a major source of first-time and general information.

School institution, a factor not analyzed much in previous studies, was found to impact perception of renewables. Furthermore, the internet was also revealed to be a major source of first-time and general information in comparison with findings of previous studies. Finally, analyses within this paper also found weak correlation between renewable and nuclear perception, which has not been explored previously.

Implications

This research highlights the prevalence of school as an information source of renewable and nuclear energy, which emphasizes the importance of school curriculums and material in young people's understanding of these crucial topics. While Çelikler and Aksan (2015) also reciprocated school's impact, they only analyzed the issue through the lens of first-time knowledge. The spread of general information sources points to the internet playing a major role, even larger than school, revealing the significance of the internet for the spread of information. The media also plays a vital role, which further emphasizes the importance of information as technology advances, especially in tech-oriented locations such as the San Francisco Bay Area. Río and Burguillo (2008) highlight the connection between perception, acceptance, and the viability of renewable energy implementation,

so research on significant information sources such as the internet is crucial for understanding successful methods of expanding renewable and nuclear energy.

Limitations

One of the most glaring limitations within this study is the sample size. Ponto (2015) stresses the importance of a large sample size for a more indicative reflection of an entire population, and compared to previous studies, the 62 students studied in this paper is much smaller. Distribution could have also acted as a major downside of data collection, as not all respondents were truly random which may have resulted in sampling bias. A fully electronic questionnaire also excludes members of the population without access to internet or communication tools used for distribution (Ponto, 2015).

The inherent design of the questionnaire could have created issues with response quality, as all questions asked were made mandatory. The large number of questions may have discouraged some students from responding to the best of their ability or even completing the questionnaire. Although much of the data was examined, because of the sheer number of questions, many avenues of analysis like ethnicity and age were not explored within this paper.

Future Research

Additional research should look into some of the similar avenues explored in this paper such as the effects of gender and school institution on perception to possibly reciprocate and explain results. The correlation between perception of renewables versus nuclear, a major gap identified, was found to be weak, so more evaluation is required to confidently arrive at conclusion. Besides expanding on this paper's work, many approaches were not looked into with much depth, like actual knowledge rather than self-reported, which should be gauged comprehensively. Furthermore, other demographics such as grade level, household income, and ethnicity should be expanded on in future research across various other locations around the world.

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