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INFORMAL REASONING PATTERNS AND INFLUENCING FACTORS OF SCIENCE TEACHERS IN THE CONTEXT OF LOCAL SOCIOSCIENTIFIC ISSUES

*Nurcan Tekin[1]
Oktay Aslan[1]
[1] Mathematics and Science Education Department,
Aksaray University, Türkiye
[2] Mathematics and Science Education Department,
Necmettin Erbakan University, Türkiye

*tekinnurcann@gmail.com

ABSTRACT

Socioscientific issues (SSIs), which are an important component of scientific literacy in science education, are scientific-based issues with dilemmas and no clear answers. SSIs can be local issues that affect a region or global issues that affect the world. This study aimed to investigate informal reasoning (IR) patterns and their influencing factors on science teachers about local SSIs. The research was designedas a case study. The participants consisted of 38 science teachers from various provinces of Central Anatolia, where the local features of context were at the forefront. Teachers were asked to form an IR about the texts with dilemmas addressed to them. Using content analysis, teachers' IR patterns were based on rationalistic, emotive, and intuitive reasoning; factors affecting their reasoning were analyzed according to sociology-culture, environment, economy, science, technology, ethics-morality, and policy (SEE-STEP). In the results, science teachers mostly use rationalistic IR and rationalistic and intuitive IR patterns about energy-related local SSIs. While the factors that most influence teachers' IR regarding local SSIs are economy and environment, the factor that least influences their IR is ethics. As a result of the study, IR is closely related to the context and environmental/socio-cultural background that can influence IR. Based on the result that teachers' IR is affected by the content, the main suggestion of this study is to investigate the IR of different contents in local SSIs.

Keywords: *informal reasoning patterns, local issues, science teachers, socioscientific issues*

INTRODUCTION

Socioscientific issues (SSIs) that come to the fore as important factors in the acquisition of scientific literacy draw attention to the effects of decisions made in the fields of science and technology on society (Zeidler et al., 2019). SSIs are scientifical based issues, including dilemmas in their nature, and are often debated by societies with political and social influence (Sadler & Zeidler, 2005). Cloning, genetically modified organisms, nanotechnology, and nuclear energy can be SSIs (Sadler, 2004; Sadler & Zeidler, 2005). These issues can be handled both locally and globally (Dolan et al., 2009). According to Capkinoglu et al. (2020), many global SSIs stem from concerns about the globalization of local SSIs. Individuals may be concerned with local issues such as lead pollution of the municipal water supply in their area, while at the same time they can deal with global environmental issues such as climate change

on a large scale (Kinslow et al., 2019). As observed, every global problem has a local connection. Since individuals are more interested in the issues that they are confronted with in daily life and that concern them, they are more interested and willing to find solutions to local problems (Capkinoglu et al., 2020). Therefore, it would be beneficial from an educational viewpoint to address both the global and local aspects of an up-to-date issue covered in science lessons. In the section below, energy issues that affect individuals locally in the Central Anatolian Region of Türkiye, as well as globally, are discussed from a socioscientific perspective.

Energy as a Local Socioscientific Issue

SSIs can be from many local, regional, or global areas (Chang Rundgren & Rundgren, 2010). According to Sadler (2004), researchers or instructors may perceive the importance of global-scale SSIs, such as global warming or genetic engineering, but students may have different perceptions of such issues. Therefore, curricula addressing such issues need connections that can combine students' classroom experiences with their own lives (Sadler, 2004). SSIs such as cloning, global warming, nuclear energy, and genetically modified organisms in the curriculum can be discussed both globally and locally in terms of their characteristics specific to a region or country (Atasoy et al., 2019).

The energy issues addressed in the current study have multidisciplinary characteristics (Eisenkraft et al., 2014) and thus can contribute to the development of decision-making skills and citizenship in students, as well as their participation in social discussions (Sakschewski et al., 2014). They also occupy an important place in the agenda of Türkiye. In this section, the issues of nuclear energy, solar energy, and thermal insulation, which are closely related to the lives of people living in the Central Anatolian Region of Türkiye, are discussed in terms of their local socioscientific characteristics related to energy. The first unit of the first nuclear power plant in Türkiye,which started construction in 2018, is planned to be completed in 2023 (Dinçer, 2019). Two more nuclear power plants were planned to be constructed together with this power plant, which was established for the first time in Türkiye (Ministry of Energy and Natural Resources [MENR], 2022a). The decision to build the power plant was reached by asking the opinions of the people in the region where the power plant would be established and by obtaining permissions from the necessary institutions responsible for evaluating the environmental impact (MENR, 2022a). Therefore, nuclear energy has been seen as a local issue that impacts both the region and the country in general.

Another issue discussed in this study is solar energy. With the worldwide investment in solar energy increasing by 25% in 2014, solar energy became the first type of renewable energy with the highest investment (Çanka Kılıç, 2015). In these recent years, higher importance has been regarded towards energy investments in Türkiye. Türkiye has a high solar energy potential due to Türkiye's geographical location (MENR, 2022b). Thus, many regions of Türkiye are suitable for solar energy production (Çanka Kılıç, 2015). Aside from its availability in Türkiye, solar energy is an issue that is maintained on the agenda by local communities as it provides employment opportunities for the people of the region. The study which was conducted in the Central Anatolian Region has a continental climate, and summers are somewhat hot and winters are cold (Şensoy et al., 2008). In the cities in this region, winter is long. A large part of the energy demands of individuals living in this region are for heating. Energy consumption in Türkiye occurs mostly in buildings. Therefore, thermal insulation is critical for energy saving (Bektaş et al., 2017).

Energy-related issues are addressed in the current study because they are critical in terms of energy saving, reduction of foreign-dependency in energy, and contributions to the country's economy. This multicomponent nature of energy has revealed the need to investigate the diversity that may occur in teachers' informal reasoning in terms of revealing different perspectives. According to Capkinoglu et al. (2020), social factors that may affect students' decisions about SSIs affect the quality of the arguments they construct. The informal reasoning of teachers toward local SSIs is important in terms of creating quality arguments about local problems that may occur in the region where their students live. For this reason, the reflection of the social aspect of energy issues, which are handled locally, on the informal reasoning of teachers is worth investigating.

Socioscientific Issues, Informal Reasoning, and SEE-STEP

Informal reasoning (IR) involves developing and evaluating responses to controversial issues that lack definite solutions (Sadler, 2004). According to Tsai and Jack (2019), students' participation in the formal or IR process develops multiple perspectives in students and helps them enjoy the development of their personal ethical feelings during this process. Because SSIs are open-ended and debatable issues, IR is one of the most effective methods of decision-making on these issues (Sadler, 2004). In IR, a given subject, situation, or decision is examined with its reasons, consequences, advantages, and disadvantages (Atasoy et al., 2019). According to Sadler et al. (2007), IR has four dimensions: complexity, inquiry, perspective taking, and skepticism. Zeidler et al. (2019) stated that they are evaluated in five dimensions by adding affordances and limitations of science to these.

Recently, many studies have been conducted on the "Quantitative Assessment of Socioscientific Reasoning (QuASSR)," which allows the quantitative evaluation of socioscientific reasoning (SSR) (Romine et al., 2017), on the evaluation of SSR in large samples by using open-ended scenarios and computerized automatic scoring models (CAS) (Womack, 2019), and on the classification of the patterns of IR (Ratcliff & Grace, 2003; Sadler & Zeidler, 2005; Wu & Tsai, 2007). On the basis of the results they encountered in the responses of college students to genetic scenarios, Sadler and Zeidler (2005) examined the IR pattern in three dimensions: rationalistic, emotive, and intuitive. Ratcliff and Grace (2003) categorized students' reasoning into four groups to compare their responses to different reports: mature reasoning, partial reasoning, naïve reasoning and incomplete response. Wu and Tsai (2007), in their study investigating the IR of 10th grade students regarding nuclear energy in terms of qualitative and quantitative features, identified the reasoning styles of the students in four categories: social, ecology, economic, and science- or technology-oriented. Additionally, Topçu et al. (2014) grouped the factors influencing the IR of individuals under four headings: personal experiences, social factors, moral-ethical factors, and technological concerns. With these classifications, the tendency to conduct studies on the factors influencing reasoning has increased. Here, it is necessary to mention Chang Rundgren and Rundgren's (2010) SEE-SEP model, which was created to form a holistic perspective for students about the multidimensional structure of SSIs. This model addresses the connections between the six areas of SSIs: sociology/culture (S), environment (E), economy (E), science (S), ethics/morality (E), and policy (P) and personal situations such as value perceptions and experiences (Chang Rundgren & Rundgren, 2010). According to Eş and Öztürk (2021), technology is included in the 'science' dimension in the SEE-SEP model, but these two areas are evaluated separately according to the nature of science. For this reason, Eş and Öztürk (2021) considered science and technology to be separate fields and created a new model called SEE-STEP. In this study, this model was used to identify factors that influence teachers' reasoning in local SSIs.

The feature that makes SSIs important today and in the future is the necessity of communicating with the world that students face and shaping it for future generations (Zeidler et al., 2019). Individuals face many situations in daily life. This will enable them to diversify their knowledge and experiences arising from these situations. On the basis of this information and experience obtained from different sources through the informal process, individuals can conclude about their own lives (Eş & Varol, 2019). For example, according to Zeidler et al. (2019), although issues such as evolution or natural selection are controversial issues among American society, they are non-discussable issues among evolution scientists, which are among the subtopics of evolution and which the mechanism of evolution can explain thoroughly. However, issues such as nuclear energy, cloning, and climate change are fairly clear in some regions but ambivalent in others. That is, because SSIs originate from a sociocultural structure, they should be evaluated in accordance with that context (Zeidler et al., 2019). Ladachart and Ladachart (2021), in their study in which they examined the IR of pre-service biology teachers about culture-based SSIs, concluded that the participants discussed both issues from multiple perspectives and that these were especially dependent on cultural and religious factors. In this study, Ladachart and Ladachart (2021) stated that in addition to technology-based SSIs, culture-based SSIs should be addressed in classes, which would encourage the teaching of science and contribute to the development of citizenship skills. Therefore, a subject that is region-specific and local will be completely related to the socio-cultural structure of that region and should be handled in that context. In this way, individuals will have the opportunity to make common decisions despite some situations they encounter in a similar geography.

Ha et al. (2022), in their study examining teachers' SSR regarding the opening of schools during the COVID-19 pandemic, asked the participants to address the issue by taking the role of a minister of education, a teacher, and a parent. In their research, they concluded that these roles taken by the teachers created a perspective and that this perspective was effective in the decisions made. Therefore, this study can be supportive for teachers who evaluate the different perspectives of their students as individuals to have different professions in the future about the local issues discussed in the study.

In this study, nuclear power plants and solar energy that meet the energy needs of the people of the region and thermal insulation for energy saving will be discussed. This will allow the comparison of the IR of science teachers for similar situations. According to Sadler (2004), teachers aiming to use SSIs should choose local SSIs to make science more relevant to students' lives. As they allow the discussion of the social, political, or scientific aspects of an issue, reasoning, and decision-making process in a democratic environment, SSIs have greatly contributed to the development of science literacy (Sadler & Zeidler, 2005). In the harsh winter conditions of the Central Anatolia Region, where the study participants work, the energy needs of the participants have an important place in their lives. It is thought that the ability of science teachers to reason for local SSIs and to transfer these skills to their students is critical for students who are educated as future decision makers. Therefore, this study aims to investigate science teachers' IR about local SSIs related to energy and the factors influencing their IR.

In this regard, there are two research questions:
1. What type of IR do science teachers have about local SSIs?
2. What are the factors influencing reasoning by science teachers about local SSIs?

METHODOLOGY

Research Design

This study was designed according to a case study, which is a qualitative research approach. Case studies are those in which an entity is identified and customized to a specific time and place (Büyüköztürk et al., 2016). A holistic single-case study was used because it aimed to determine the informal reasoning of teachers working in a certain region on local issues (Yin, 2014). In this study, addressing local issues, selecting teachers working in this region as participants, and including descriptive information about their IR required using this approach.

Participants

The participants comprised 38 science teachers who were selected using the purposive sampling method and who worked in public schools in various provinces of the Central Anatolian Region of Türkiye. There are 13 cities in this region. Participants were obtained from nine of these 13 cities (Aksaray, Ankara, Çankırı, Eskişehir, Kayseri, Kırıkkale, Konya, Nevşehir and Niğde). The most important reason for selecting the teachers from the Central Anatolian Region is that it aimed to determine the reasoning of teachers living in the same geography and having similar experiences about local SSIs in terms of producing solutions to similar problems. Participants were selected from volunteer teachers. The information on the participants is given in Table 1.

Table 1
Descriptive Information of the Teachers

Characteristics		f	%
Gender	Female	24	63.16
	Male	14	36.84
Teaching experience	1–5 years	6	15.79
	6–10 years	19	50.00
	11–15 years	7	18.42
	16 years and above	6	15.79
Educational degree	Undergraduate	22	57.90

	Postgraduate	13	34.21
	Doctorate	3	7.89

As shown in Table 1, 24 (63.16%) teachers participating in the study were female and 14 (36.84%) were male. Most teachers (50.00%) had 6 to 10 years of teaching experience. Of the participating teachers, 22 (57.90%) had bachelor's degrees, 13 (34.21%) had master's degrees, and 3 (7.89%) had doctoral degrees.

Data Collection

In this study, a form consisting of three scenarios and questions about these scenarios was used to determine the IR of the science teachers about local SSIs. The scenarios given to the teachers in this form, adapted from the scenarios used by one of the researchers (Author, 2018) in her doctoral thesis, are dichotomous texts containing local SSIs under the titles of "Energy Generation in Nuclear Power Plants," "Thermal Insulation" and "Solar Energy Powered Roads." These scenarios were created using situations involving the advantages and disadvantages of nuclear energy, thermal insulation, and solar energy. These texts were studied with a group of teachers in a pilot study in which the time required to answer the questions, compatibility of the scenarios with the in-class activities of the teachers, and comprehensibility of the questions were checked. To ensure the validity of the data collection tool, it was reviewed by four experts. Three of these experts work in the field of science education and one in the field of physics. Percentage of agreement is followed according to Miles and Huberman's (1994) formula. With the feedback from the experts, the data collection tool was finalized with 90% agreement. Teachers were asked questions about whether they agreed with this issue, the reasons for it,and the process of persuading someone else. The participants' reasoning about the three scenarios lasted approximately 20–30 minutes. Almost all participants gave their opinions on all scenarios.

Data Analysis

In this study, content analysis was used in the analysis of the data. Descriptive results are included, and sample quotations are presented to provide more in-depth information. Content analysis can be performed using both the codes that emerged during the analysis (open coding) and ready-made codes (Patton, 2014). Here, the IR patterns created by Sadler and Zeidler (2005) were used to determine the IR patterns used by the science teachers. These reasoning patterns are rationalistic, emotive and intuitive reasoning. Sadler and Zeidler (2005) illustrated these patterns of IR on a Venn diagram (Figure 1).

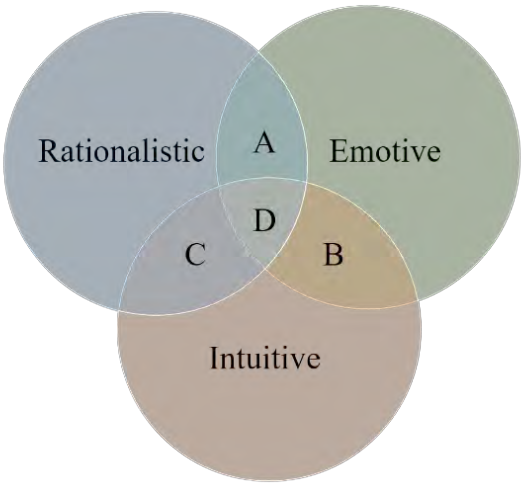

Figure 1
IR Pattern (Sadler & Zeidler, 2005)

According to this diagram, IR may not simply be rationalistic, emotional, or intuitive. It can be rationalistic and emotive (area A), emotive and intuitive (area B), intuitive and rationalistic (area C), as

well as all patterns of IR (area D). NA grouping is added for statements not suitable for any pattern by Dawson and Venville (2009). Explanations and examples of the IR patterns are given in Table 2.

Table 2
Samples of IR by Science Teachers

Informal reasoning patterns	Description	Examples
Rationalistic	Logical, rational, scientific understanding, and scientific language are dominant. Reasons can be used. This may involve comparisons between benefit and harm or between advantage and disadvantage.	I have students examine the energy bills of insulated and non-insulated buildings. Moreover, I show that materials that can be recycled with newly developed technologies and that can cause the least harm to the environment are used during insulation. I would also show that the money spent on insulation would pay off in a few years. (T5)
Emotive	It includes states such as emotional response, interest, empathy, sympathy, or concern.	Also, wherever there are people, accidents can happen. Even a 1% chance of radiation or accident can harm people and other living things. (T1)
Intuitive	It can include gut feeling, an immediate reaction, often a negative reaction, or subjectivity.	I want my house to be insulated. I believe that the wars in the world until today are because of energy. (T2)
NA	Includes unclassified expressions.	I can't make a clear decision. (T18)

To determine the factors influencing the IR of science teachers, the SEE-STEP model adapted by Eş and Öztürk (2021) from the study of Chang Rundgren and Rundgren (2010) was used. Each letter in this model represents a factor. Accordingly, IR can be influenced by sociology-culture, environment, economy, science, technology, ethics-morality, and policy. Examples of factors influencing participants' IR are presented in Table 3.

Table 3
Factors Influencing Science Teachers' IR and Examples

Factors influencing informal reasoning	Examples
Sociology-culture	Wherever there are people, accidents can happen. Even a 1% chance of radiation or accident can harm people and other living things. A life is worth more than thousands of dollars in money or energy. (T1)
Environment	Given the damage to the environment during the installation and operation of nuclear power plants, the use of renewable energy sources should be preferred. (T3)
Economy	One of the biggest issues related to thermal insulation is natural gas imports. When all houses are insulated, consumption will decrease. This will provide savings for both the individual and the country's economy. (T11)
Science	I do not defend solar-energy-powered roads in our country. I do not find it appropriate because the shading will be excessive and the energy efficiency will decrease on highways with heavy traffic. Panels laid

	horizontally are not as efficient as panels laid on roofs with a 30-degree slope, according to Morris, author of "Energy Switch." (T10)
Technology	Today, many technological tools are produced to make peoples lives easier, and most of them use electrical energy. Therefore, energy resources are precious today. (T25)
Ethics-morality	A life is worth more than thousands of pounds of money and energy. (T1)
Policy	It is necessary to create resources before it becomes more difficult to meet the energy needs of the rapidly growing population. Yes, there is risk in the nuclear power plant, as there is risk in everything. However, when we consider the negative examples, it will not be possible for us to develop as a country. (T27)

The researchers independently coded the answers provided by the teachers for each scenario. Both researchers are academicians with a focus on science education and teaching SSIs. According to the first round data, using Miles and Huberman's (1994) percentage of agreement, the coding agreement between researchers was calculated to be 48%. The researchers then reviewed the analysis of the data and recorded them. After this coding, the coding agreement between the researchers was 92%. This rate was an acceptable result in terms of achieving consensus (Miles & Huberman, 1994).

RESULTS

In this section, results in the reasoning patterns of science teachers about local SSIs and the factors affecting these reasoning patterns are discussed.

Science Teachers' Informal Reasoning Patterns Regarding Energy*-Related Local Socioscientific Issues*

The IR patterns of science teachers on local SSIs are shown in Figure 2.

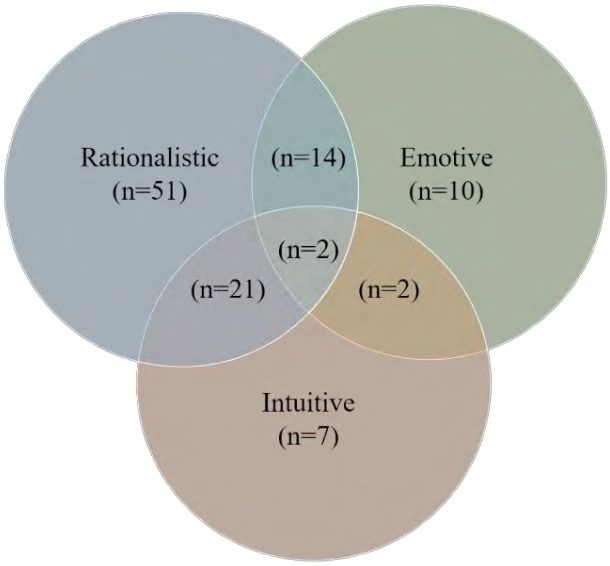

Figure 2
IR Patterns of Science Teachers

As shown in Figure 2, the science teachers mostly used rationalistic reasoning pattern (n=51) in their reasoning on local SSIs, including the establishment of nuclear power plants, thermal insulation, and solar energy-powered roads. Teachers' expressions containing both rationalistic and intuitive reasoning (n=21) were also frequently encountered. Teachers also used rationalistic and emotive IR (n=14) and emotive reasoning (n=10). However, it is seen that few teachers used intuitive (n=7), emotive and

intuitive (n=2) and rationalistic, intuitive, and emotive reasoning together (n=2). Additionally, there are expressions that cannot be classified in the reasoning of the teachers (n=7). Below are examples of teachers' reasoning patterns.

"Even if we turn to renewable energy sources, 59.4% of the country's energy needs can be met. In other words, renewable energy sources, because of their high cost, cannot fully meet the energy needs of a country." (Rationalistic, T6)

"Today, many technological tools are produced to make people's lives easier, and most of them work with electrical energy. Therefore, energy resources are precious today. Today, it is impossible to meet all energy needs from renewable energy sources. The development of countries that produce more energy and produce it cheaper is better than that of other countries. Our countrys production of more energy and diversification of its energy resources will develop our country." (Rationalistic, T25)

"We should turn to renewable energy sources so that what happened in Japan and Chernobyl would not happen in our country in a possible nuclear disaster. We must meet our energy needs without harming nature." (Emotive, T8)

"No, I'm not defend. Turning to solar energy is the right strategy, but I am against the risk of wasting these costly panels on roads." (Intuitive, T6)

"I want to have my house insulated. I believe that the wars in the world until today are because of energy. Careful selection of the materials used (not containing asbestos etc.) will also eliminate some problems." (Rationalistic and Emotive, T2)

"I installed thermal insulation by researching many factors such as material quality, lifespan, environmental impact, and economy. There are many buildings around me with thermal insulation. Based on my observations, I can say that the reason for thermal insulation is to reduce heating costs in winter and to renew the exterior of the building. In my opinion, thermal insulation reduces the emission of greenhouse gases into the environment." (Rationalistic and Intuitive, T29)

"Although nuclear power plants are thought to make a great contribution to the economies of countries, I think they should not be established because of possible accidents. In other words, there may not be much radiation leakage while the power plant is in use. However, major disasters can occur following accidents. Because establishing nuclear power plants is a big risk regarding how important the life of even a single person is." (Emotive and Intuitive, T36)

"I want to thermal insulation. Because energy is not easily obtained, we must appreciate it. Insulated blocks considered for new buildings will also extend the life of the buildings. This will reduce consumption." (Rationalistic, Emotive and Intuitive, T9)

***Factors Influencing Science Teachers' Informal Reasoning About Energy**-Related Local Socioscientific Issues*

Factors influencing the IR of science teachers on local SSIs are shown in Table 4.

Table 4
Factors Influencing the IR of Science Teachers

Factors influencing informal reasoning	Nuclear power plants (n)	Solar power (n)	Thermal insulation (n)	Total (n)
Sociology-culture	11	4	7	22
Environment	26	11	23	60
Economy	16	12	33	61
Science	2	1	1	4

Technology	10	1	1	12
Ethics-morality	-	-	2	2
Policy	11	2	1	14

According to Table 4, the factors that most influence the reasoning of the participants about local SSIs are the economy (n=61) and environment (n=60). When the results for the three scenarios are analyzed separately, a similar result is observed. On the other hand, ethics (n=2) and science (n=4) affect the teachers' reasoning the least. When the scenarios are analyzed separately, ethical factors related to nuclear power plants and solar energy are not effective in the reasoning of the participants. Below are examples of factors that influence teachers' reasoning.

"It is necessary to create new resources before it becomes more difficult to meet the energy needs of the rapidly growing population." (Sociology-culture, T27)

"I have my house insulated. Given the damages and costs of fossil fuels used for heating purposes and given that most of the electrical energy used in cooling is obtained from fossil fuels, the damage they can cause to the environment is much more than the damage caused by the insulation materials used." (Environment, T7)

"Turning to solar energy is the right strategy, but I am against the risk of wasting these costly panels on roads." (Economy, T6)

"Moreover, I show that materials that can be recycled with newly developed technologies and that cause the least harm to the environment are used during insulation." (Technology, T5)

"In a world where all wars and struggles are about energy, I do not want my country to depend on foreign sources. It seems pointless to me to avoid it when the risk of a possible accident is so low. I care about the economic independence of my country and its strength in the international arena in the fields of defense and energy." (Policy, T2)

DISCUSSION

In this study, IR by science teachers about local SSIs with energy content was examined, and the following results were obtained. The science teachers' IR about local SSIs was mostly based on rational reasoning. However, the teachers benefited the least from their intuition in their reasoning on energy-related local SSIs. Herman et al. (2021) obtained impressive results in their study in which they investigated how place-based ecological worldviews affect socioscientific orientations of post-secondary students. In their study, the students frequently resorted to SSIs in their environment and cared about being responsible for finding sustainable solutions to environmental problems. A more effective result is that the participants realized that they could discuss scientific evidence by considering socio-cultural effects in producing solutions to SSIs in their region. Cebesoy (2021) investigated the IR patterns of pre-service science teachers about gene therapy and showed that the participants used multiple reasoning patterns. However, the researcher draws attention to the fact that when asked about the reason for their intuitive behaviors, the participants continued to answer with reasonable concerns. Demir and Namdar (2021) investigated the reasoning of secondary school students after they modeled on issues such as forestation, precipitation level, and soil structure in their study, in which they obtained solution suggestions for the region they were in. While there was no rationalistic reasoning in the statements of the students before modeling, they concluded that there was a tendency toward rationalistic reasoning after modeling. Demir and Namdar (2021) stated that students used the scientific activities they learned during modeling to justify their statements. According to them, modeling can promote evidence-based reasoning by providing reasonable inferences. Therefore, the involvement of participants in a scientific process may influence their judgments. Since the participants were science teachers, they worked to develop themselves and their students as individuals interested in science and scientifically literate individuals. According to Sadler and Zeidler (2005), rational reasoning requires scientific understanding. Therefore, this learning/teaching process may have enabled them to exhibit a

rational perspective in situations they encounter in scientific research. From this perspective, similar studies can be conducted on non-major science groups.

Environmental and economic factors strongly influence the IR of science teachers. In contrast, ethical factors have the least influence. In the study of Saglam and Eroglu (2022), in which they examined the IR of pre-service science teachers about nuclear power plants, they stated that the participants adopted ecological and social IR more. Similarly, Powell (2021), in his study examining secondary school students' reasoning about hydraulic fracturing, a place-based SSI, concluded that students made their reasoning by drawing attention to the impact of hydraulic fracturing on public health, economy, and the environment. Cebesoy and Chang Rundgren (2021), in their study with pre-service science teachers, examined the participants' decisions about abortion, which included three scenarios related to genetics, and the factors influencing these decisions. Contrary to the current study, Cebesoy and Chang Rungren (2021) concluded that participants attributed their decisions mostly to ethical and scientific factors. Here, these results are highly influenced by the context of the issue because while issues such as nuclear power plants or thermal insulation do not ethically affect individuals, issues such as abortion, which are met with concern by societies, may be more affected by ethics. Topçu et al. (2010) also stated that real-life issues are influenced by the context. Beniermann et al. (2021) also emphasize that certain scientific results are subject-specific. According to them, subjective justifications do not help much in achieving consensus on scientific issues. Therefore, the context of the subject in question is important.

CONCLUSION

IR can be influenced by context. The environment and sociocultural background of individuals influence both their reasoning patterns and their reasoning. This result may have provided researchers with data that might direct them to a deeper investigation of the effectiveness of out-of-school environments. Undoubtedly, this study provides descriptive/explanatory data to the readers, and the results of the study need to be supported by further research. The researchers suggest repeating this study on different issues with both science and non-science major study groups. Simultaneously, further research can use different types of data to create a better grasp of local SSI reasoning.

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