

## Examining Moral Typologies in Decision-Making Regarding Socio-Scientific Issues: Students' Interpretations of Right and Wrong

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### ABSTRACT

Penelitian ini bertujuan untuk mengkaji tipologi penilaian moral mahasiswa dalam pengambilan keputusan terkait isu-isu sosio-sains. Metode Tinjauan Pustaka Sistematis (SLR) digunakan untuk menganalisis 22 artikel jurnal nasional dan internasional yang membahas empat tipologi moral: absolutis, subjektivis, situasionis, dan eksepsionalis, serta proses pengambilan keputusan dalam konteks isu-isu sosio-sains. Tahapan penelitian meliputi perumusan pertanyaan penelitian, pencarian dan pemilihan literatur yang relevan, dan melakukan analisis mendalam untuk mengidentifikasi kecenderungan pengambilan keputusan berdasarkan tipologi moral. Temuan penelitian mengungkapkan bahwa mahasiswa absolutis menjunjung tinggi nilai-nilai moral universal dengan penekanan pada masalah sosial dan lingkungan; mahasiswa subjektivis mendasarkan keputusan mereka pada nilai-nilai pribadi yang dipengaruhi oleh agama dan budaya; mahasiswa situasionis menyesuaikan keputusan mereka sesuai dengan konteks situasional tertentu tanpa secara konsisten mematuhi standar moral umum; dan mahasiswa eksepsionalis memilih keputusan yang dianggap memberikan dampak positif terbesar meskipun menyadari norma-norma moral. Memahami tipologi moral membantu pendidik merancang strategi pengajaran yang efektif untuk mengembangkan keterampilan pengambilan keputusan mahasiswa.

*This study aimed to examine the typology of students' moral judgment in decision-making related to socio-scientific issues. A Systematic Literature Review (SLR) method was employed to analyze 22 national and international journal articles addressing four moral typologies: absolutists, subjectivists, situationists, and exceptionists, as well as the decision-making processes within the context of socio-scientific issues. The research stages included formulating research questions, searching and selecting relevant literature, and conducting an in-depth analysis to identify decision-making tendencies based on moral typology. Findings revealed that absolutist students uphold universal moral values with an emphasis on social and environmental concerns; subjectivist students base their decisions on personal values influenced by religion and culture; situationist students adjust their decisions according to the specific situational context without consistently adhering to general moral standards; and exceptionist students choose decisions perceived to yield the greatest positive impact despite being aware of moral norms. Understanding moral typology helps educators design effective teaching strategies to develop students' decision-making skills.*



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## INTRODUCTION

Decision-making competence is a pivotal focus within science education owing to its critical role in cultivating citizens equipped to apply scientific knowledge in addressing societal challenges and contributing to national progress (Gasparatou, 2017; Hsu & Lin, 2017a; Ratcliffe, 1997). This competence involves stages of problem identification, integration of complex information, and selection of optimal alternatives, necessitating advanced cognitive skills built upon foundational cognitive abilities (Luan et al., 2020; Bayram-Jacobs et al., 2019; Kinslow et al., 2019).

The development of decision-making skills is contingent upon students' acquisition of sufficient scientific knowledge and competencies, alongside a comprehensive understanding of socio-scientific issues (SSI). SSI refer to complex and often contentious social problems grounded in scientific evidence, which stimulate ethical reasoning and multifaceted analysis (Sakamoto et al., 2021a; Wahono et al., 2021; Zhang & Hsu, 2021a; Gresch et al., 2013). Exemplary SSI topics include climate change, food scarcity, biodiversity loss, and sustainable development, all of which embody intricate interactions among environmental, social, economic, and political dimensions (Kinslow et al., 2019; Lee, 2007; Sutter et al., 2019).

Incorporation of SSI into science curricula provides authentic learning contexts that foster the development of decision-making capabilities via evidence-based evaluations and metacognitive reflections on multifaceted issues (Sutter et al., 2019; Casas-Quiroga & Crujeiras-Pérez, 2020; Jafari & Meisert, 2021). Educators are thus encouraged to implement structured decision-making frameworks that enable students to consider diverse perspectives and engage in critical moral assessments (Lee, 2007; Zhang & Hsu, 2021b).

From an ethical philosophical standpoint, decision-making regarding SSI can be conceptualized using Forsyth's (1980, 1988) ethical ideology framework, which delineates two principal dimensions: relativism and idealism. Individuals' moral orientations are thereby classified into four typologies: absolutists, subjectivists, situationists, and exceptionists. Absolutists adhere strictly to universal moral principles and maintain that morally correct actions invariably lead to positive consequences; they assess actions through rigid moral codes emphasizing societal and environmental welfare, interpreting adverse outcomes as serious transgressions. Subjectivists ground their moral evaluations in personal values and individual perspectives, often shaped by cultural and religious contexts, without reference to absolute moral standards. Situationists integrate relativistic and idealistic elements, prioritizing situational context in moral evaluation and assessing actions based on the specific circumstances rather than universal rules. Exceptionists recognize universal moral norms yet adopt a pragmatic stance allowing exceptions when violations yield significantly greater benefits; this approach aligns with utilitarian ethics, emphasizing outcomes even at the cost of contravening established moral standards.

Understanding these moral typologies furnishes a robust analytical framework for elucidating the diversity of students' decision-making patterns when confronting complex socio-scientific issues. Such insights underpin the design of instructional strategies that nurture reflective, ethical, and meaningful decision-making skills. This study addresses a notable gap in the literature concerning the role of moral typologies in SSI education, particularly the influence of moral orientations on the quality of students' decisions and on cultivating critical civic dispositions amidst contemporary social and scientific challenges.

Furthermore, schools can enhance formal decision-making capacities by fostering awareness of psychological biases and developing skills to integrate personal values with scientific information during decision processes (Sutter et al., 2019). Employing authentic scenarios with inherent real-world risks motivates students to seek relevant evidence and to participate in rational, participatory deliberations as engaged citizens confronting complex social issues (Kurup et al., 2021; Rizal et al., 2019).

This article presents a systematic literature review that examines students' moral typologies in decision-making related to SSI within science education contexts. The review aims to deepen understanding of the diverse decision-making patterns among students, thereby supporting educators in crafting effective and meaningful pedagogical strategies that advance both academic achievement and critical character development.

## METHOD

This study utilized a Systematic Literature Review (SLR) methodology, a structured and rigorous approach to identifying, evaluating, and synthesizing relevant academic literature systematically and objectively. The focus is on investigating students' moral typologies and their decision-making processes in the context of socio-scientific issues (SSI). Literature searching and selection employed multiple national and international academic databases, including Scopus, Web of Science, Google Scholar, and national journal repositories. The study examined peer-reviewed scholarly articles addressing students' moral typologies, namely absolutists, subjectivists, situationists, and exceptionists, and their decision-making patterns in science education focused on SSI. After applying inclusion criteria, 22 articles were selected for comprehensive analysis. The review process comprised the following stages:

1. **Planning:** The primary research question was formulated to investigate the relationship between students' moral typologies and their decision-making patterns regarding socio-scientific issues.
2. **Literature Search:** Systematic searches were conducted in the selected databases employing specific keywords such as "moral judgment typology," "student decision-making," "socio-scientific issues," "absolutists," "subjectivists," "exceptionists," and "situationists." Search filters included publication within the last ten years and articles published in English or Indonesian.
3. **Article Selection:** Initial screening based on titles and abstracts ensured topic relevance. Subsequently, full-text screening was applied to include only peer-reviewed articles focused on science education contexts addressing students' decision-making and moral typologies. Duplicate articles, incomplete data, or those irrelevant to the core topic were excluded.
4. **Data Extraction:** Key data extracted included major findings concerning moral typologies in students' decision-making, methodologies utilized in each study, and identified decision-making patterns. The extracted data were classified and coded according to moral typology categories and decision-making characteristics.
5. **Data Analysis:** A qualitative-descriptive thematic analysis was performed to identify trends and relationships between moral typologies and decision-making in SSI contexts. The analytical synthesis aimed to derive pedagogical implications for science education strategies.

### ***Data Collection Instruments and Techniques***

Data collection was conducted via a systematically designed extraction checklist aligned with the study variables, covering moral typologies and descriptions of decision-making. As this research relied exclusively on secondary data, no primary data collection instruments were utilized.

### ***Data Analysis Techniques***

Thematic qualitative analysis was applied to each selected article to detect prevalent decision-making patterns according to the four moral typologies. Findings were systematically synthesized to develop a comprehensive understanding of the interactions between moral judgments and decision-making in SSI.

## RESULTS AND DISCUSSION

In the context of students' decision-making regarding socio-scientific issues (SSI), moral typologies serve as a vital framework for understanding the divergent patterns of judgment and reasoning that students employ. Each typology reflects distinct ways in which moral values and contextual considerations are integrated when determining solutions to complex social and scientific problems. A thorough comprehension of these typologies provides a foundational basis for developing more effective and ethically grounded instructional strategies. The following sections elaborate on the decision-making characteristics and patterns associated with the four moral typologies identified: absolutists, subjectivists, situationists, and exceptionists.

### ***Absolutists: Adherence to Universal Moral Principles in Decision-Making***

Students classified as absolutists tend to base their decisions on unwavering universal moral principles and idealistic evaluations. They approach socio-scientific issues concretely, demonstrating deep scrutiny of negative aspects (Jafari & Meisert, 2021a; Sutter et al., 2019). For example, in cases involving wind turbine development, these students critically evaluate environmental impacts, effects on wildlife, and legal regulations (Luan et al., 2020; Rizal et al., 2017; Zaikauskaitė et al., 2020). They

carefully balance the function and objectives of the issues, relying on idealistic moral considerations rather than personal opinions (Casas-Quiroga & Crujeiras-Pérez, 2020), and systematically assess alternatives by weighing social and environmental consequences (Hsu & Lin, 2017).

When confronted with complex issues, absolutist students frequently seek advice from authoritative figures or experts regarded as reliable sources to guide their decisions (Luan et al., 2020). Their decision-making process involves extensive information gathering, dialogue, reflection, and clear evaluation of impacts (Jafari & Meisert, 2021b; Kolarova et al., 2013; Zhang & Hsu, 2021). This approach emphasizes universal values and strives to minimize harm (Lee & Grace, 2012; Grace et al., 2015; Lee et al., 2019). Their preferred solutions prioritize health, well-being, and environmental sustainability, while demonstrating openness to technology-based interventions (Ottander & Simon, 2021; Bayram-Jacobs et al., 2019). Consequently, science education should connect real-world environmental experiences with collective decision-making that upholds social justice and responsibility (Kurup et al., 2021; Rizal et al., 2019).

#### ***Subjectivists: Decisions Grounded in Personal Values and Perspectives***

The subjectivist typology is characterized by decision-making based heavily on personal values and perspectives, exhibiting high degrees of relativism and limited adherence to universal moral principles (Forsyth, 1981). Within SSI contexts, subjectivist students tend to make decisions reliant on individual viewpoints, occasionally disregarding scientific evidence and counterarguments (Sakamoto et al., 2021; Gresch et al., 2017). For instance, regarding coral reef degradation issues, subjectivist students demonstrate limited exploration of information, basing choices more on personal preference (Ladachart et al., 2021; Zhang et al., 2021).

Cultural, religious, and personal experiences significantly influence their decision-making patterns (Emery et al., 2016; Rizal et al., 2017). Decisions in this category often manifest as intuitive, spontaneous, and insufficiently reflective (Luan et al., 2020). Thus, subjectivists exhibit more individualistic, emotional, and occasionally impulsive decisions, with limited consideration of broader social or ecological impacts (Dauer et al., 2016).

#### ***Situationists: Contextual Adaptation in Relative Moral Judgments***

Situationist students prioritize situational context as the decisive factor in moral judgment and decision-making, adopting a relativistic stance toward general moral rules (O'Boyle & Forsyth, 2021; Forsyth, 1980). They focus on evaluating the benefits derived from decisions and are willing to accept potential breaches of moral standards if justified by relevant conditions and circumstances (Dauer et al., 2016; Garrecht et al., 2020; Sutter et al., 2018, 2019; Wahono et al., 2021).

In practice, their decisions are influenced by cultural background, scientific knowledge, and social context, as demonstrated in cases such as shark conservation debates in the UK and Hong Kong, where decisions reflected local values and scientific perspectives (Lee et al., 2019). Their decisions are flexible and sometimes tolerate violations of absolute moral norms—for example, in issues like whaling and waste management (Grace et al., 2015; Paraskeva-Hadjichambi et al., 2015). This relativism also manifests in decisions about global warming, smoking bans, and public facility placement, where students adjust decisions based on local conditions and pragmatic considerations (Mastura Halim & Rohaida Mohd Saat, 2017; Lee, 2007; Hsu & Lin, 2017).

#### ***Exceptionists: A Utilitarian Approach Accommodating Moral Exceptions***

Exceptionists acknowledge the existence of universal moral truths but adopt a pragmatic, utilitarian approach to decision-making that emphasizes maximizing benefits while minimizing unavoidable harms (Forsyth, 1980). Research shows that a minority of students align with exceptionist orientations, demonstrating openness to exceptions in moral norms when such deviations produce significantly better outcomes (Grace et al., 2015; Gresch et al., 2017; Jafari & Meisert, 2021).

An illustrative case involves genetically modified rice development, where exceptionist students proposed voluntary trials accompanied by transparent risk communications to balance benefits against potential harms (Sakamoto et al., 2021). They also show openness toward controversial issues such as gene therapy and regulated whaling (Kolarova et al., 2013; Grace et al., 2015). Some exceptionists experience moral dilemmas leading to indecision, often deferring to trusted authorities (Sutter et al., 2019). Their generally lower idealism allows for greater flexibility in accepting morally contentious solutions, such as those involving genetic modification technologies (Zaikauskaite, 2020; Ceyhan & Sahin, 2015).

The comprehensive characteristics and implications of each moral typology are summarized in Table 1 below. This table shows a clear visual comparison and facilitate identification of diverse moral reasoning patterns among students, while offering insight for crafting relevant and targeted pedagogical strategies.

**Table 1.** Moral Typologies and Characteristics of Student Decision-Making in SSI

<b>Moral Typology</b>	<b>Core Principle</b>	<b>Decision-Making Characteristics</b>	<b>Example SSI Contexts</b>	<b>Pedagogical Implications</b>
Absolutists	Strict adherence to universal and idealistic moral values; prioritizes social and environmental interests	Critical analysis, evaluation of negative consequences, consultation with experts, deep reflection, prioritizes harm minimization	Wind turbine development, biofuel, environmental conservation	Curriculum integration with real-world experiences and deliberative social processes
Subjectivists	Decisions grounded in personal values and perspectives with high relativism	Intuitive decisions, limited scientific inquiry, influenced by culture, belief systems, and experience	Coral reef degradation, cultural and religious issues	Emphasizes learning that nurtures scientific literacy and personal value reflection
Situationists	Contextual and situational moral judgment with relativism	Flexible decisions, tolerance of moral norm breaches based on context, influenced by local culture and conditions	Genetic engineering, whaling, waste management	Supports contextual learning incorporating local values and cultural perspectives
Exceptionists	Recognizes universal morals pragmatically with utilitarian focus	Prioritizes greatest benefit, tolerates negative effects, reliance on authorities when unsure	Genetic modification, gene therapy, regulated whaling	Facilitates development of utilitarian ethics and risk-based decision-making support

Beyond describing students' moral reasoning patterns, these findings have significant implications for the design and implementation of pedagogical strategies in science education. This review asserts that moral typologies extend beyond merely clarifying the diversity in students' evaluative and decision-making approaches toward socio-scientific issues (SSI); rather, they constitute a fundamental framework for the deliberate design and implementation of pedagogical strategies that are both pedagogically sound and contextually sensitive. Understanding the nuanced moral orientations that underlie students' reasoning processes enables educators to construct differentiated instructional experiences that not only foster higher-order cognitive engagement but also deliberately nurture essential affective and ethical dimensions of learning. This holistic educational approach supports the development of students' capacities for critical reflection, ethical deliberation, and responsible action, which are paramount in navigating the complex, often ambiguous socio-scientific dilemmas inherent in contemporary society.

Integrating these moral typologies within SSI pedagogy has profound educational implications. It empowers educators to scaffold learning environments that promote moral sensitivity and ethical reasoning alongside scientific literacy, facilitating students' abilities to weigh conflicting values and make informed decisions amidst complexity and uncertainty. Moreover, it encourages the cultivation of metacognitive skills, enabling students to recognize their moral biases and reflect on alternative viewpoints critically. The approach also supports the development of democratic dialogue skills through collaborative problem-solving, fostering respect for diverse perspectives and enhancing social responsibility. Ultimately, embedding moral typology awareness into science education cultivates

adaptive, ethically conscious citizens capable of contributing thoughtfully to sustainable societal development and addressing multifaceted global challenges.

## CONCLUSION

The findings of this study demonstrate that students exhibit four distinct moral typologies when navigating decision-making processes pertaining to socio-scientific issues (SSI). Students characterized by an absolutist orientation consistently uphold universal moral principles, giving precedence to environmental and social considerations while consciously minimizing the influence of personal biases. Conversely, those displaying a subjectivist orientation are principally guided by personal values, religious beliefs, and cultural contexts in their judgments. Situationist students, while also utilizing personal perspectives, emphasize the necessity of context-specific analysis in decision-making, suggesting that moral evaluation should be flexible and informed by situational factors rather than rigid adherence to universal standards. Exceptionists, while acknowledging the legitimacy of universal moral norms, adopt a pragmatic and utilitarian stance that privileges courses of action anticipated to generate the most advantageous outcomes.

A critical phase identified in students' decision-making involves systematic deliberation concerning the prospective positive and negative ramifications associated with each available alternative. This evaluative stage fosters engagement with prevailing regulations, societal norms, cultural traditions, religious guidelines, and established moral principles, frequently resulting in the adoption of absolutist or subjectivist typologies due to recognition of both universal ethics and individual value systems. However, when educational frameworks permit greater autonomy in the selection of decision-making approaches, a broader spectrum of decision outcomes emerges, each nevertheless remaining shaped by the individual's foundational moral orientation.

These findings underscore the imperative for science educators to develop strong competencies in facilitating both scientific knowledge and the cultivation of relevant ethical reasoning. Educators must play an active role in scaffolding students' capacities for reflective, critical, and ethically responsible decision-making, thereby equipping them to address the inherent complexity of contemporary socio-scientific issues. Thus, professional development for science teachers should explicitly emphasize the deliberate integration of scientific and ethical pedagogical approaches, enabling students to reach decisions that are at once scientifically sound and socio-ethically defensible.

This study, while comprehensive, is not without limitations. The primary constraint lies in its focus on observed decision-making outcomes, with limited exploration of the underlying cognitive and affective processes. Accordingly, further research is recommended to explore these mechanisms in greater depth, employing more nuanced theoretical frameworks, such as those addressing levels of responsibility and quality of outcomes, to enrich understanding of students' moral reasoning and decision-making within the context of SSI.

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