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Inspiring Ethical Minds: Integrating Space Exploration Ethics into Early-Stage Education

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Abstract

The rapid expansion of the global space industry is bringing forward new ethical challenges, including planetary protection, fair allocation of space resources, and the governance of future human settlements. These questions are already shaping international treaties, policy debates, and commercial initiatives, and they will directly affect the world today's primary students will inherit. This paper proposes a framework for introducing space ethics into Stage 3 (Years 5–6) education in New South Wales, aligning with existing Science and Technology syllabus outcomes while building on the proven discussion-based pedagogy of the Primary Ethics program. Three core themes: planetary protection, resource allocation, and human settlement, are presented as developmentally appropriate entry points for fostering ethical reasoning, critical thinking, and civic awareness in upper primary classrooms. Rather than guiding students toward predetermined conclusions, the proposed lessons encourage open-ended inquiry, role-play, and dialogue that mirror the processes of ethical debate at the international level. In doing so, they equip students to engage with complex dilemmas about fairness, sustainability, and responsibility in a space-faring future.This framework can be adapted not only for Stage 3 but also for other stages of primary and secondary education, and it holds potential for application beyond New South Wales, offering a model for integrating space ethics more broadly into curricula worldwide.

Acronyms/Abbreviations

ACARA Australian Curriculum, Assessment and Reporting Authority

COPUOS Committee on the Peaceful Uses of Outer Space

ESA European Space Agency

JAXA Japan Aerospace Exploration Agency

NASA National Aeronautics and Space Administration

NESA New South Wales Education Standards Authority

OST Outer Space Treaty

UNOOSA United Nations Office for Outer Space Affairs

Author Positionality

This paper is informed by the author's interdisciplinary background as a systems engineer working in the Australian defence sector and her contributions to the space industry, and as a volunteer ethics teacher at Hurstville Public School with Primary Ethics. The author holds a Bachelor of Aerospace Engineering (Honours) and a Bachelor of Science in Physics, bringing both technical expertise and a strong foundation in scientific inquiry. This dual perspective offers insight into the complex realities of space exploration as well as the practical pedagogical strategies needed to engage primary students in ethical reasoning. The development of this curriculum is further supported by feedback from senior members of Primary Ethics: Jarrah Aubourg, Chair of the Academic Advisory Board and Dr. Nick Brancazio, Curriculum and Development Manager. Their guidance strengthens the philosophical and educational grounding of the proposed space ethics curriculum.

1. Introduction

The emergence of a rapidly growing space industry in Australia raises new ethical issues concerning the exploration and use of space. As the global space industry expands, space agencies and policymakers are increasingly focused on the ethical implications of off-Earth activity, including how we protect celestial environments, govern access to space resources, and design future space settlements. These are not distant or abstract concerns: they are shaping international frameworks today, and will continue to inform legislation, treaties, and public opinion in the decades ahead. Today's primary school students will be the future voters, scientists, engineers, and leaders tasked with responding to these issues. This paper proposes a developmentally appropriate introduction to three core ethical themes currently under global discussion: planetary protection, resource allocation, and human settlement. These proposed topics are a way of preparing students to think critically about the societal challenges of a spacefaring future. Unlike topics such as climate science, where educational outcomes often aim to guide students toward evidence-based consensus, these space ethics topics are

inherently open-ended. There are no definitive "right" or "wrong" answers. Instead, they invite students to explore different perspectives, articulate their reasoning, and engage in respectful dialogue which are core skills in both ethics education and democratic citizenship. This makes them particularly well-suited to the pedagogical approach used in Primary Ethics, where students are encouraged not only to think carefully about why they believe what they do, but also to engage respectfully and constructively with the views of others.

2. Global Ethical Challenges in Space

As humanity expands its activities in space, ethical challenges are increasingly at the forefront of international discussion. The foundational Outer Space Treaty (OST), adopted in 1967 and endorsed by the United Nations, asserts that "the exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind." (Article I) [1]. It also indicates that States "shall pursue studies of outer space, including the Moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose." (Article IX) [1]. These provisions ground planetary protection and interstate cooperation within space policy.

At the institutional level, the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) serves as the primary multilateral body responsible for developing international frameworks that guide ethical and legal conduct in space. Since its establishment in 1959, COPUOS has overseen the creation of five core international treaties, each addressing key dimensions of space activity. The 1967 Outer Space Treaty (OST) establishes the foundational principle that outer space shall be used exclusively for peaceful purposes and that all states have equal rights to explore and use space. The 1968 Rescue Agreement sets protocols for the rescue of astronauts in distress and the return of space objects. The 1972 Liability Convention clarifies that launching states are internationally liable for any damage caused by their space objects. The 1975 Registration Convention mandates that all space-faring nations register launched objects with the United Nations, promoting transparency and accountability. Lastly, the 1979 Moon Agreement extends the OST's provisions to the Moon and other celestial bodies, affirming their status as the common heritage of mankind and outlining principles for resource sharing and environmental stewardship [2]. Its annual sessions have become increasingly vital for reconciling interests and ensuring space activities serve peaceful and cooperative ends. Collectively, these treaties form the backbone of international space law and reflect a normative commitment to peaceful, cooperative, and responsible space activity.

Although enforcement mechanisms remain limited, COPUOS continues to provide a critical forum for addressing emerging challenges such as space debris, satellite coordination, and equitable access to space. These discussions are becoming increasingly urgent due to the rapid acceleration of space activity, particularly in the commercial sector. Private companies are not only launching satellites at an unprecedented rate (many via low-cost CubeSat platforms), but are also proposing ambitious long-term projects that raise complex ethical and legal questions. For example, ispace, a Japanese startup, has outlined plans to develop lunar infrastructure and establish a long-term human presence on the Moon [3]. Meanwhile, companies such as SpaceX, Blue Origin, Rocket Lab, and AstroForge are leading the way in reusable launch systems, asteroid mining concepts, and mega-constellations of satellites. With over 9,000 active satellites currently in orbit and thousands more planned, issues such as orbital crowding, spectrum allocation, and space traffic management are no longer hypothetical, but immediate and growing concerns.

These conversations are not just technical or diplomatic, they are profoundly ethical. They will shape the world that the next generation will inherit. They will be the ones participating in or regulating lunar economies, contributing to off-Earth infrastructure, and deciding how humanity balances exploration with responsibility. Ensuring that they are equipped with the ability to critically engage with these ethical questions, not just scientifically, but thoughtfully and inclusively, is essential. By embedding space ethics into early education, students can begin to explore the principles of fairness, sustainability, and shared responsibility that underpin current international space dialogues. In doing so, they are prepared not only to understand the world they are growing into, but to shape it with intention.

More recently, the Artemis Accords, a set of non-binding international guidelines drafted by NASA and the U.S. Department of State, have elaborated operational norms for lunar and Martian exploration. By affirming commitments to transparency, interoperability, peaceful purposes, and scientific information sharing, the Accords explicitly build upon and extend the principles of the OST [4]. As of May 2025, 55 countries have joined, signaling a global convergence on shared, responsible standards for exploration and resource utilization. Together, these in-

struments reflect a shift toward more inclusive and ethics-focused governance in space. From the OST's emphasis on planetary protection and peaceful use, through COPUOS's deliberative frameworks, to the Artemis Accords' practical norms, the international community is grappling with questions of contamination, resource equity, national responsibility, and scientific integrity.

However, ethical decision-making remains constrained by institutional limits, much of the historical framing of space missions has prioritized strategic or technological imperatives over moral reflection. The governance models embodied in COPUOS and the Artemis Accords offer important progress, but they are only as effective as the public engagement, transparency, and ethical reasoning embedded within them.

This evolving global policy landscape underlines the relevance of the three educational topics selected: planetary protection, resource allocation, and human settlement and demonstrates how these conversations are not only theoretical but grounded in ongoing international efforts to define and uphold ethical boundaries in space.

3. Ethics in Primary Education

Introducing space ethics into primary education builds on established research showing that children across all primary years are capable of ethical reasoning to some degree, particularly when supported by age-appropriate materials and guided discussion. By Stage 3 (Years 5 and 6), students are developmentally ready to engage with more complex issues: as they approach adolescence, they begin moving from concrete to formal operational thinking. This enables them to grapple with hypothetical scenarios, weigh conflicting values, and consider multiple perspectives [5]. These are precisely the cognitive tools needed for deliberating open-ended ethical questions such as: Who gets to use space resources? Should we mine other planets? How do we ensure space settlements are fair, inclusive and sustainable?

Programs such as *Primary Ethics*, currently operating across New South Wales, provide a well-tested pedagogical framework for engaging students in these kinds of discussions. Weekly lessons are structured around thought experiments, analogies, and dialogue-based activities that encourage students to explain and evaluate their reasoning. The Primary Ethics Teacher Handbook emphasizes the importance of neutrality and facilitation, where volunteer teachers guide discussion without imposing their own views [6]. This creates a safe and structured environment where students can engage in respectful disagreement and explore multiple viewpoints. The curriculum modules are structured around ethical questions that have no clear right or wrong answers, such as "Is it ever okay to lie?" or "Should animals be kept in zoos?", all which mirror the ambiguity inherent in many of today's space ethics dilemmas. This approach is supported by educational literature that finds reason-giving and peer discussion to be especially effective in fostering ethical understanding among young learners [7, 8].

One of the key advantages of discussion-based ethics programs is that they move away from didactic or values-imposition models of moral education. Instead of teaching students what to think, they focus on teaching them how to think, a model endorsed by scholars such as Narvaez and Lapsley, who argue for moral education that emphasizes critical reflection, rather than conformity to moral rules [9]. This is especially important in the context of space ethics, where topics like planetary protection or settlement governance do not have single "correct" answers but require deliberation about competing values such as scientific progress, environmental preservation, and fairness.

At the curriculum level, research has shown that ethics is frequently present across subjects but often goes unrecognized. In a study of syllabi across multiple disciplines, Van Wart et al. found that many courses included ethically relevant content despite not being explicitly labeled as ethics education [10]. This aligns with observations by Matchett, who noted that ethics is often taught implicitly across the curriculum but remains poorly coordinated and inconsistently assessed [11]. Integrating a space ethics module within the primary school science or humanities syllabus offers a more intentional approach, ensuring that ethical thinking is not an incidental outcome but a central learning goal.

Embedding ethics into education responds to a broader call to prepare morally responsible and socially aware citizens. Rather than moralising or imposing values, ethics education should aim to foster critical thinking, civil engagement, and the capacity to navigate complex dilemmas, skills that will be vital in addressing the challenges of a spacefaring future. Zembylas argues that schools in liberal democracies are best positioned not to "teach" moral and civil courage directly, but to stimulate critical reflection and discussion around such concepts. His study highlights the limitations of neoliberal approaches that reduce ethics education to a matter of cultivating individual competencies. Instead, he advocates for empowering teachers and students to engage meaningfully with civic values and real-world issues through open dialogue and reflection [12].

The ethical dimensions of space exploration are ideal for such educational aims. Currently, discussions surrounding the subject are up for debate and require balancing competing values such as scientific progress, envi-

ronmental preservation, and intergenerational fairness. Introducing these themes in primary education encourages students to articulate their reasoning, consider alternative perspectives, and build ethical literacy grounded in both empathy and logic.

The Primary Ethics program itself offers a blueprint for curriculum development. It is already structured to engage students in sequential, age-appropriate modules and has a proven system of teacher training, classroom delivery, and resource design. Drawing on this existing infrastructure provides an efficient, pedagogically sound foundation for incorporating new modules on planetary protection, space resource allocation, and human settlement. These three topics reflect the most pressing ethical debates in current global space policy.

By extending this proven pedagogical model to future-oriented content, we can cultivate a generation that is not only scientifically literate but also ethically aware, capable of informed decision-making in the face of unprecedented societal and technological challenges.

4. Curriculum Alignment with NSW Stage 3

The proposed curriculum is designed to align with the Stage 3 Science and Technology syllabus developed by the New South Wales Education Standards Authority (NESA). Specifically, the content strand Earth and Space provides an ideal entry point for introducing ethical discussions. Students in Years 5 and 6 explore topics such as Earth's position in the solar system, key features of planets, and current developments in astronomy and planetary science [13]. These topics naturally invite ethical inquiry, including questions around planetary protection, sustainable exploration, and responsible innovation.

As ethics is introduced into primary education through the lens of space exploration, it is important to note that ethics is not always taught as a standalone subject. In many educational settings, ethical reasoning is embedded within broader themes such as civic responsibility, leadership, or scientific innovation. This understanding is particularly important when aligning a space ethics curriculum with the NSW Stage 3 syllabus, where students begin engaging with scientific concepts related to Earth, space, and inquiry-based learning. To ensure relevance and developmental appropriateness, this curriculum aligns closely with both the outcomes and general capabilities outlined by the Australian Curriculum, Assessment and Reporting Authority (ACARA). The Primary Ethics program supports the development of key general capabilities including [6]:

Ethical understanding: By exploring ethical concepts, values, rights, responsibilities, and norms.

Critical and creative thinking: Through evaluating actions, questioning assumptions, and justifying opinions.

Literacy: By listening for key ideas, participating in discussion, and constructing reasoned arguments.

Personal and social capability: Through developing empathy, collaboration, and community awareness.

Intercultural understanding: By reflecting on cultural diversity, navigating different contexts, and cultivating cultural empathy .

These capabilities support the existing Stage 3 outcomes in the Science and Technology Syllabus (K-6) [13] where students begin to develop knowledge and understanding of:

- The natural world including living things, materials, forces, energy, and Earth and space.
- The built environment including engineering principles and systems, food and fibre production, and material technologies.
- Digital technologies including digital systems and how digital technologies represent data.

The following outcomes are directly relevant to the proposed curriculum:

ST3-10ES-S: Explains regular events in the solar system and geological events on the Earth's surface.

ST3-1WS-S: Plans and conducts scientific investigations to answer testable questions, and collects and summarizes data to communicate conclusions.

ST3-2DP-T: Uses design thinking and processes to develop solutions, often with sustainability as a guiding principle. Plans and uses materials, tools and equipment to develop solutions for a need or opportunity.

ST3-4LW-S: Examines how the environment affects the growth, survival and adaptation of living things.

ST3-7MW-T: Explains how the properties of materials determines their use for a range of purposes.

This proposed ethics curriculum builds directly on the Stage 3 Science and Technology Inquiry and Focus question, *"How does the Earth compare to other planets in the*

solar system?", by extending students' comparisons beyond scientific features to include ethical considerations of exploration, protection, and use of those planets.

Rather than adding to cognitive load, ethical content can be introduced in parallel with scientific inquiry. For example, a unit on planetary characteristics could incorporate ethical questions about terraforming Mars, drawing connections between scientific knowledge and real-world implications. Likewise, space mining discussions can be linked to lessons on natural resources and sustainability on Earth, encouraging students to draw parallels between planetary and terrestrial responsibility.

The Primary Ethics pedagogical model is centered on philosophical inquiry and community of inquiry approaches and thus supports this integration. By using structured dialogue and scaffolded questioning, students can explore challenging and ambiguous topics without needing definitive answers . This reinforces the notion that ethics education is not about imposing values, but about cultivating the ability to reflect, reason, and engage respectfully with multiple perspectives.

5. Classroom Implementation and Delivery

5.1 Planetary Protection

Planetary protection refers to the ethical and scientific responsibility to prevent biological contamination between Earth and other celestial bodies. This includes both forward contamination (carrying Earth life to other planets) and backward contamination (bringing extraterrestrial material back to Earth) [14]. A real-world example is NASA's planetary protection protocols for Mars missions, which ensure that landers and rovers are sterilized before launch.

The ethical questions posed to students are deliberately open-ended. Appropriate ethical questions for this topic could include:

- Should humans land on planets that may harbour microbial life?
- Is it ever acceptable to risk contaminating another world for the sake of exploration?

These questions align with outcome **ST3-10ES-S**, as students compare planets in our solar system and explore how science and technology shape our understanding of space. Importantly, they mirror the Primary Ethics pedagogy of philosophical inquiry, where students are encouraged to give reasons for their views, consider alternatives, and refine their arguments through respectful dialogue rather than being guided to a "correct" conclusion [6].

5.1.1 Planetary Protection Lesson Framework

The following lesson framework demonstrates how planetary protection can be introduced in a Stage 3 classroom. It combines scientific knowledge about microbes and contamination with ethical reasoning about responsibility and preservation.

1. **Stimulus/Story:** Present students with a short narrative: "Scientists have discovered signs that Mars may once have had microbial life. A new rover is preparing to land, but some experts worry it could bring Earth bacteria that would destroy any trace of Martian life. What should we do?"

2. **Individual Reflection:** Give students one minute of "thinking time" (used in Stage 3 Primary Ethics lessons) to decide what they think should happen and why.

3. **Small Group Discussion:** In groups of 3–4, students share their views, guided by prompts such as: 1. Would it be worse to lose the chance of discovering Martian life, or to miss an opportunity to explore? 2. Who should make the decision: scientists, governments, or the public?

4. **Whole-Class Discussion:** Groups share their reasoning, the teacher facilitates connections between different views, and students practice clarifying disagreements and weighing values (curiosity, preservation, responsibility).

5.1.2 Why it is Appropriate for Stage 3

Stage 3 students are developmentally ready to compare evidence, assess competing values, and recognize that beliefs influence actions. This mirrors existing Stage 3 lessons like 'Why Trust Science?', which teaches students how scientific beliefs shape decisions in everyday life and why evidence matters [15]. Planetary protection builds on this capacity by connecting scientific facts (about planets and microbes) with ethical reasoning (about responsibility, preservation, and exploration).

By situating these dilemmas in the NSW syllabus strand Earth and Space, students simultaneously strengthen their scientific literacy and their ethical understanding. The activities directly support outcome **ST3-10ES-S**, as students explain planetary events, and **ST3-1WS-S**, as they reason about evidence and communicate conclusions. This ensures engagement without cognitive overload: the science content provides context, while the ethical questions invite exploration of diverse viewpoints.

5.2 Resource Allocation

Resource allocation in space explores who gets to use space-based resources such as water ice, minerals, and energy, and on what terms. This theme invites reflection on fairness, global cooperation, and economic justice. For example, the Artemis Agreements [4] lay out principles for responsible use of space resources, yet questions remain about how access is governed and who benefits.

Appropriate ethical questions for this topic could include:

- If one group discovers resources in space, should they share with others or keep it for themselves?
- If two groups want the same resource, how should they decide who gets it?
- Do you think resources in space belong to everyone, or only to the people who get there first?

These connect to outcome **ST3-2DP-T**, where students consider sustainability and ethics when designing solutions, and encourage them to think and reason on fairness, ownership, and shared responsibility which are concepts they already encounter in contexts such as sharing playground equipment, stationary or managing group work.

5.2.1 Resource Allocation Lesson Framework

The lesson framework below outlines a way to explore fairness and resource sharing through role-play and group discussion. It connects abstract debates about space mining to familiar situations of sharing and fairness that students encounter in everyday life.

1. **Stimulus/Story:** Present a short scenario: "A private company finds a large supply of water ice on the Moon. They want to use it to make rocket fuel. Other countries say that space resources should belong to everyone. What should happen?"
2. **Individual Reflection:** Students think for one minute about whether they would allow the company to keep the ice or require sharing.
3. **Small Group Discussion:** Students are divided into small groups, each representing a different stakeholder. Each group discusses their perspective and then presents their position to the class. Possible stakeholder roles include:

   Private company: Wants to mine the resources to make profit and develop new technologies.

   Developing country: Argues that resources should be shared fairly, since not all countries can afford space programs.

   Government of a spacefaring nation: Believes their investment in technology gives them the right to take the lead.

   Scientists: Want resources used for research and exploration, not profit.

   "Earth citizens" group: Represents ordinary people who argue that no one should own space resources and that they belong to everyone.

4. **Whole-Class Discussion:** Groups share their perspectives; the teacher prompts students to answer questions:

   a. If one group has the technology and money, should they get more?

   b. Should there be rules to make sure all countries benefit equally?

5.2.2 Why it is Appropriate for Stage 3

Here, resource allocation encourages students to recognize how questions of ownership and equity in space echo familiar debates on Earth (e.g., over food, land, or water). By framing space resourcing and mining within the NSW syllabus, students engage with **ST3-2DP-T**, as they consider sustainability and design fair solutions, and **ST3-7MW-T**, by connecting how the properties and uses of materials shape decisions about resources. Students also practice inquiry skills aligned with **ST3-1WS-S**, through evaluating evidence and presenting reasoned arguments.

Additionally, role-play builds empathy and helps students understand that ethical dilemmas are not just about their own views, but about weighing multiple perspectives. This approach mirrors Primary Ethics lesson structures, where students explore different sides of an argument before forming or refining their own view. It also deepens engagement by giving students an active role in exploring fairness, justice, and sustainability. Students are also able to develop skills in critical and creative thinking (evaluating consequences, weighing fairness) and ethical understanding (rights, responsibilities, and justice).

5.3 Human Settlement

Human settlement in space raises ethical questions about what kind of societies we want to build beyond Earth. This discussion sits within the broader concept of space colonization, which explores the long-term habitation of celestial bodies and the societal, scientific, and ethical challenges this entails [16]. From proposed lunar bases to Mars colonies, these conversations are no longer hypothetical. Companies like ispace and SpaceX are actively pursuing missions that could lead to permanent human presence on the Moon or Mars.

Appropriate ethical questions for this topic could include:

- What rules should apply to future space communities?
- How can we ensure settlements are fair, inclusive and sustainable?
- Should human colonization of space be a priority before solving problems on Earth?

These align with outcomes **ST3-1WS-S** and **ST3-4LW-S**, particularly in investigating how changes in environments affect living conditions and how to use scientific data to design for safety and resilience.

5.3.1 Human Settlement Lesson Framework

The framework for this topic encourages students to imagine themselves as members of future space communities. By reflecting on rules, governance, and inclusion, students can link ideas about colonization and sustainability with ethical reasoning and civic awareness.

1. **Stimulus/Story:** "In 2050, humans build the first city on Mars. People from many countries live there. Some want to follow Earth's laws, others want new rules. What should happen?"
2. **Individual Reflection:** Students imagine they are one of the settlers and write one rule they would want for their new community.
3. **Small Group Discussion:** Prompts may include:

   a. Who should be in charge of a new settlement?

   b. Should settlers be free to make their own rules, or follow Earth's laws?

   c. How can settlements avoid repeating unfair practices from Earth?
4. **Whole-Class Discussion:** The teacher records each group's suggested rules on the whiteboard. Students then raise their hands to vote on the rules they agree or disagree with. After each vote, the teacher invites students to explain why they support or oppose a rule, and encourages discussion of potential consequences and trade-offs (e.g., freedom vs. governance, fairness vs. authority).

5.3.2 Why it is Appropriate for Stage 3

This topic allows Stage 3 students to engage with complex societal questions in a structured and developmentally appropriate way, similar to Primary Ethics topics which also connect abstract ideas to practical reasoning. The activity begins with individual reflection and small-group discussion, and the whole-class discussion stage is where the teacher records suggested rules on the whiteboard and invites students to vote and ensures that every student has the opportunity to participate. By justifying why they agree or disagree with particular rules, students practice explaining their reasoning, listening to alternative perspectives, and considering the consequences of different choices.

This structured approach makes abstract issues of governance, inclusion, and sustainability concrete and relatable. It supports outcomes **ST3-4LW-S**, as students examine how environments affect survival and adaptation, and **ST3-1WS-S**, as they reason about evidence and communicate ideas. Additionally, by linking settlement design with fairness and resilience, students touch on **ST3-2DP-T**, applying design thinking to anticipate and manage challenges in future environments. Students will also develop their ethical understanding (weighing fairness, rights, and responsibilities), critical and creative thinking (comparing rules, anticipating outcomes), and personal and social capability (engaging in respectful dialogue and collaborative decision-making).

5.4 Future Work

It is important to note that the lesson frameworks, discussion questions, and suggested activities presented in this section are illustrative and not finalized. They are intended as a starting point for integrating space ethics into Stage 3 classrooms and will be refined in collaboration with Primary Ethics curriculum developers to ensure developmental appropriateness and pedagogical consistency. As demonstrated in existing Primary Ethics Stage 3 lesson materials, ethical inquiry in the primary classroom requires carefully scaffolded activities that support reasoning, dialogue, and respectful disagreement. Similarly, the proposed space ethics curriculum will remain subject to iterative development before implementation.

6. Discussion

The frameworks proposed in this paper demonstrate that space ethics can be meaningfully embedded within primary education without overwhelming existing curriculum structures. By aligning ethical inquiry with the NSW Stage 3 Science and Technology syllabus, lessons on planetary protection, resource allocation, and human settlement complement scientific learning while extending it into the moral and civic domain. This interdisciplinary approach reinforces the idea that science education is not only about facts and methods, but also about values, consequences, and responsibilities.

A key insight from this work is that the open-ended

nature of space ethics questions where there are no definitive right or wrong answers. This makes them especially well suited to the Primary Ethics model. Lessons structured around stimulus materials, reflection, discussion and group-work provide opportunities for students to practice reason-giving, consider competing perspectives, and engage in respectful disagreement. These are core skills for democratic citizenship and mirror the pedagogical scaffolds already in use across the Primary Ethics program. In this sense, space ethics does not require inventing a new pedagogy, but rather adapting proven practices to future-facing content.

At the same time, the frameworks presented here are preliminary. The discussion questions and lesson activities must be refined in collaboration with experienced curriculum developers to ensure developmental appropriateness and coherence with established Primary Ethics modules. As seen in existing Stage 3 topics such as 'Why Trust Science' and 'Killing Animals for Food' [15] [17], structured support and gradual complexity are essential for enabling students to explore challenging questions productively. Future research and pilot programs will be necessary to test how students respond to space ethics topics and to refine delivery methods accordingly.

Moreover, while this framework has been designed in alignment with the NSW Stage 3 syllabus, its foundations are rooted in scientific content and well-established pedagogical practices. This combination of scientific grounding and adaptable teaching strategies makes the approach transferable across different educational contexts. The integration of space ethics could therefore extend beyond New South Wales as the ethical themes chosen for this framework are not unique to Australia. They reflect global debates currently taking place through international treaties, space agency policies, and commercial ventures. Because the research base informing this curriculum is drawn from international frameworks such as the Outer Space Treaty, COPUOS discussions, and the Artemis Accords, the approach is inherently global. This underscores the adaptability of the framework, which can be implemented not only within the NSW Stage 3 context but also in other national and international education systems seeking to embed ethics into science and technology learning.

Bringing these same issues into the classroom bridges the gap between international governance and everyday learning, cultivating a generation of students who are not only scientifically literate, but also ethically prepared to engage with the realities of a space-faring future.

7. Conclusions

This paper has proposed a framework for introducing space ethics into Stage 3 primary education in New South Wales by focusing on three globally relevant topics: planetary protection, resource allocation, and human settlement. This research demonstrates how students can be guided to engage with open-ended ethical questions that mirror the dilemmas currently faced by policymakers, scientists, and industry leaders. These topics connect directly to syllabus outcomes in the Earth and Space strand and align with the broader general capabilities outlined by ACARA, particularly ethical understanding, critical and creative thinking, and personal and social capability.

The key argument is that early introduction of ethics education equips students with essential skills for navigating the complexities of a rapidly changing world. The accelerating commercialization and internationalization of space activity makes it likely that today's primary students will grow up to face decisions about how humanity uses, shares, and governs the cosmos. Preparing them now to reason through such dilemmas fosters a more thoughtful, inclusive, and responsible citizenry.

Going forward, this proposed framework will undergo refining in collaboration with Primary Ethics curriculum developers and educators. Pilot lessons, classroom feedback, and interdisciplinary partnerships will be essential to translating the ideas presented here into practical teaching resources. Although the proposed curriculum is framed within the NSW Stage 3 Science and Technology syllabus, its reliance on scientific content and discussion-based pedagogy makes it readily adaptable to other educational systems. The themes of planetary protection, resource allocation, and human settlement are globally relevant, and the framework can be scaled to different stages of schooling or integrated into curricula beyond New South Wales. This flexibility underscores the potential of the model to serve as a foundation for embedding space ethics education more broadly.

By investing in this work, educators and policymakers can ensure that the next generation is not only prepared to participate in a space-faring society, but is also capable of shaping it with ethical awareness and democratic values.

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