

ENGINEERING ETHICS FOR GENERATION Z: A REVIEW OF CURRENT APPROACHES AND PROPOSAL FOR FUTURE DIRECTIONS

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ABSTRACT: The engineering profession has a crucial role to play in shaping the future of our society, and with the increasing complexity of technology, there is a growing need for engineers to have a strong understanding of ethical principles. This paper provides a comprehensive review of the current approaches to teaching engineering ethics, with a specific focus on how these approaches can be tailored to meet the needs of the Generation Z students. The authors examine the current approaches and its key challenges faced by this generation, such as the impact of technology on the teaching and learning approaches. The role of case studies and experiential learning in promoting ethical decision-making among this group of generation is also reviewed. Finally, the paper discusses the future directions for teaching engineering ethics, including the use of emerging technologies such as virtual and augmented reality. The paper concludes with a call for further research to better understand the ethical challenges facing the engineering profession and to develop effective strategies for addressing these challenges and for the students to internalize the importance of the ethical decision and become the agent of change in the society for the betterment of Ummah.

ABSTRAK: Profesion kejuruteraan mempunyai peranan penting dalam membentuk masa depan masyarakat kita, dan dengan peningkatan kerumitan teknologi, adalah satu keperluan bagi jurutera untuk mempunyai pemahaman yang kukuh tentang prinsip-prinsip etika seorang jurutera. Kertas kerja ini menyediakan ulasan menyeluruh tentang pendekatan semasa untuk mengajar etika kejuruteraan, dengan tumpuan khususnya bagaimana cara pendekatan ini boleh disesuaikan untuk memenuhi keperluan pelajar Generasi Z. Penulis mengkaji pendekatan semasa dan cabaran utama yang dihadapi oleh generasi ini, sebagai contoh kesan teknologi terhadap pendekatan pengajaran dan pembelajaran. Selain itu, peranan kajian kes dan pembelajaran berasaskan pengalaman dalam membuat keputusan beretika dalam kalangan kumpulan generasi ini juga dikaji. Akhir sekali, kertas kerja ini membincangkan hala tuju masa depan untuk mengajar etika kejuruteraan, termasuk penggunaan teknologi baru seperti realiti maya dan realiti terimbuh. Kertas kerja ini diakhiri dengan saranan bagi melauskan penyelidikan di masa hadapan untuk lebih memahami cabaran etika yang dihadapi oleh profesion kejuruteraan dan untuk membangunkan strategi yang berkesan bagi menangani cabaran ini supaya pelajar lebih memahami kepentingan keputusan beretika dan menjadi agen perubahan dalam masyarakat untuk kebaikan ummah.

KEYWORDS: *Engineering Educations, Engineering Ethics, Generation Z, Ethical decision*

1. INTRODUCTION

The engineering profession plays a vital role as a key driver of technological progress and innovation in society. As technology becomes increasingly complex, engineers must grapple with a wide range of ethical issues. These issues can include everything from privacy concerns to the ethical use of emerging technologies like artificial intelligence and autonomous systems. As engineers continue to develop ground-breaking technologies and shape the future, it is essential for them to have a strong understanding of ethical principles. In a survey of engineering students, it was found that students had limited knowledge of engineering ethics and the ethical implications of their work [1]. The authors argue that there is a growing need for engineers to be trained in ethics, both as part of their formal education and as part of their ongoing professional development. Not just that, the engineers must also take a holistic approach to their work, considering social, economic, and environmental factors in addition to technical considerations, includes:

Ethical Considerations in Technological Progress: Technological progress brings about numerous ethical considerations that engineers must address. Issues such as data privacy, artificial intelligence, autonomous systems, and genetic engineering require engineers to make ethical decisions that have far-reaching societal implications. According to Johnson and Wetmore (2019), engineers have a responsibility to consider the ethical, social, and environmental impacts of their work to ensure technological progress aligns with human values and societal well-being [2].

Responsible Innovation and Sustainable Development: Engineering ethics plays a pivotal role in driving responsible innovation and sustainable development. By integrating ethical considerations into the design and development process, engineers can minimize negative impacts and maximize positive outcomes. For instance, ensuring sustainable practices in engineering projects can mitigate environmental harm and promote long-term viability [3]. Engineers must be mindful of ethical frameworks, codes of conduct, and sustainability principles to create a more sustainable and equitable future.

Social Implications and Public Trust: Technological advancements have profound social implications, and public trust is vital for the successful implementation of these innovations. Engineering ethics helps foster public trust by ensuring transparency, accountability, and adherence to ethical standards. According to van de Poel et al. (2017), ethics in engineering contributes to the establishment of responsible and trustworthy technological systems that benefit society as a whole [4].

Global and Cross-Cultural Perspectives: In a globally interconnected world, engineering ethics must consider diverse cultural, social, and ethical perspectives. Engineering professionals must navigate ethical challenges arising from cultural differences, power dynamics, and differing value systems. Incorporating cross-cultural perspectives in engineering ethics education promotes inclusive and culturally sensitive decision-making [5].

As technology continues to shape society, engineering ethics emerges as a crucial component in guiding responsible and sustainable technological progress. Engineers have a responsibility to consider the ethical implications of their work and ensure that technological advancements align with societal values and aspirations. The challenges faced currently are on how to ensure the current generation, Generation Z, internalise these moral values and ethical decision making in carrying these responsibilities.

2. GENERATION Z

Generation Z, born between the mid-1990s and early 2010s, possesses distinct characteristics that make them particularly relevant to the field of engineering ethics [6]. Generation Z individuals are known for their digital fluency and immersion in technology, having grown up in an era of rapid technological advancement and connectivity. They are highly adaptable, innovative, and quick to embrace new ideas and technologies. They are also marked by a strong sense of social responsibility, social justice, and ethical business practices. They value transparency, inclusivity, and the ethical use of technology. In the context of the engineering profession for generation Z, engineering ethics education plays a critical role in preparing them to understand and address ethical issues. There are, however, some difficulties facing by the engineering ethics educators in teaching and making the students of this Generation to internalize the subject due to:

1. Generation Z's exposure to constant digital stimuli may lead to a shorter attention span and difficulty in engaging with in-depth discussions on complex ethical issues.
2. Generation Z students may have idealistic aspirations for ethical decision-making, but they need guidance in navigating the practical constraints and trade-offs that occur in real-world engineering scenarios. Helping them understand the complexities of balancing ethical considerations with other project constraints can be challenging.
3. Generation Z's exposure to simplified online information may lead to a misunderstanding of the complexity of ethical dilemmas in engineering.
4. Generation Z tends to value hands-on experiences and practical applications of knowledge. Integrating real-life case studies, simulations, and experiential learning opportunities can help them connect ethical principles to tangible engineering scenarios.
5. Generation Z students, like any group, may display overconfidence in their ability to make ethical decisions and may be unaware of their ethical blind spots. Educators should foster humility and self-awareness to ensure a more comprehensive understanding of ethical challenges.
6. While Generation Z is generally aware of ethical principles, translating this knowledge into consistent ethical behavior can be challenging.

Therefore, there is a need to address these difficulties, and the efficiency of the current approaches needs to be analyzed and suggestions as well as recommendations for the future direction in approaching this subject can be made.

3. CURRENT APPROACHES TO TEACHING ENGINEERING ETHICS

There are several approaches to teaching engineering ethics, each currently offering unique benefits and opportunities for students to engage with ethical principles in a meaningful way. Among the common approaches, include classroom-based instruction, case studies, and experiential learning [7].

3.1. Classroom-based instruction

Classroom-based instruction is a traditional, yet effective method employed in teaching engineering ethics. It forms the backbone of ethics education, where instructors deliver lectures

and facilitate discussions to impart ethical knowledge and foster a deeper understanding of ethical principles in the context of engineering practice. Its instruction serves as a platform for students to build a foundational understanding of ethics. Instructors introduce fundamental ethical theories and concepts, such as utilitarianism, deontology, virtue ethics, and professional codes of conduct. Through these lectures, students gain essential knowledge about ethical frameworks that guide their decision-making processes [8].

In the classroom, students explore theoretical concepts related to engineering ethics. They analyze case studies, hypothetical scenarios, and historical examples that highlight ethical dilemmas faced by engineers in various industries. This theoretical exploration allows students to consider the ethical dimensions of engineering beyond mere technical considerations. While classroom discussions enable students to apply ethical principles to engineering practice. Instructors facilitate conversations on real-world engineering projects and the ethical challenges they entail. Students learn to identify potential ethical issues and consider how ethical decision-making can influence the outcomes of engineering endeavors. This pedagogy also encourages students to engage in critical analysis of ethical dilemmas. They are prompted to question assumptions, evaluate arguments, and challenge ethical norms. By actively participating in discussions, students develop their critical thinking skills, enabling them to navigate complex ethical situations in their future careers.

The classroom setting allows for interactive learning experiences. Students can ask questions, seek clarifications, and engage in debates with their peers and instructors. This interactive exchange fosters a collaborative learning environment, where diverse viewpoints contribute to a more comprehensive understanding of ethical issues. Instructors with expertise in engineering ethics provide guidance and mentorship to students. They offer insights into ethical decision-making processes, drawing from their own experiences and expertise. This mentorship helps students develop their ethical reasoning abilities and professional judgment. Instructors can adapt their teaching approach to suit the specific needs and interests of the students. They can tailor discussions and examples to resonate with the diverse backgrounds and experiences of the class, making the learning experience more relevant and relatable.

Classroom-based instruction lays the foundation for students to become ethical leaders in engineering. As they advance in their careers, they can draw on the ethical knowledge and skills developed in the classroom to guide their teams and organizations in making responsible and ethical decisions. On top of that, it can build an ethical culture within engineering programs and institutions. By emphasizing the importance of ethical conduct and values, it instills a sense of ethical responsibility in future engineers, shaping a generation of professionals committed to ethical engineering practices.

3.2. Case Study instruction

Case studies play a crucial role in engineering ethics education by providing students with tangible and authentic examples of ethical challenges that engineers encounter in their professional lives. These real-world scenarios allow students to analyze and discuss ethical dilemmas, enabling them to bridge the gap between theoretical knowledge and practical application [9]. Case studies present students with real and complex ethical situations that engineers may encounter in their careers. These scenarios are often based on actual events, offering students a glimpse into the real challenges faced by engineering professionals. By immersing themselves in these authentic scenarios, students can better appreciate the intricacies and nuances of ethical decision-making in engineering. When presented with a case

study, students are prompted to critically analyze the ethical dimensions of the situation. They evaluate the actions and decisions of the individuals involved, considering the ethical principles and consequences at play. This process encourages students to think deeply about the ethical implications of various courses of action and the ethical reasoning behind those decisions.

This approach provides context-specific situations, reflecting the diverse settings and industries in which engineers operate. Students must consider the unique factors and constraints in each case, such as cultural norms, regulatory requirements, and project objectives. This context-specific analysis helps students understand that ethical decision-making is not one-size-fits-all but rather requires adaptability and sensitivity to varying circumstances. It serves as a practical platform for applying ethical principles and theories learned in the classroom. Students can identify which ethical theories align with specific actions taken in the case and assess the ethical justifications behind them. This application of ethical principles helps students see the relevance of theoretical concepts in real-life situations.

Case studies often include examples of both ethical lapses and ethical successes in engineering practice. Students can learn valuable lessons from the mistakes made in past cases, understanding the consequences of unethical behavior. Conversely, they can also learn from cases where ethical decisions positively impacted the outcome of engineering projects, reinforcing the importance of ethical conduct. Through this approach, students are encouraged to consider the perspectives of various stakeholders impacted by engineering decisions. They learn to recognize the needs and concerns of clients, communities, and the environment, fostering empathy and a holistic understanding of the ethical implications of engineering projects.

Case studies often evoke diverse opinions and viewpoints among students. This diversity of perspectives sparks lively discussions and debates, enriching the learning experience. Students learn to appreciate the complexities of ethical issues and the value of engaging in ethical deliberations with colleagues and stakeholders. By engaging with case studies, students develop their ethical reasoning skills. They learn to identify ethical dilemmas, evaluate alternative actions, and consider the long-term consequences of different decisions. These skills are essential for future engineers to make ethically sound choices in their professional roles. Exposure to a wide range of case studies equips students with the tools to navigate ethical challenges they may face in their engineering careers. By understanding how others have addressed ethical dilemmas, students are better prepared to handle similar situations with ethical integrity and confidence [10].

3.3. Experiential Learning

Experiential learning is a powerful approach in engineering ethics education that emphasizes hands-on activities and practical exercises to immerse students in ethical challenges and decision-making processes. This method goes beyond traditional theoretical discussions, offering students the opportunity to actively engage with ethical issues in a tangible and immersive manner [11]. This approach requires students to actively participate in activities, making the learning process more dynamic and engaging. Rather than passively receiving information, students are encouraged to interact with real or simulated ethical scenarios, making decisions and experiencing the consequences of their choices. On top of that, its learning activities provide a connection to real-life engineering contexts, making the ethical dilemmas more relevant and relatable to students. Through practical exercises, service-learning

projects, or internships, students encounter ethical challenges that they might face in their future careers, preparing them to navigate these situations with ethical integrity.

Experiential learning allows students to apply ethical theories and principles learned in the classroom to practical situations [12]. By grappling with ethical dilemmas first-hand, students develop a deeper understanding of how ethical considerations play out in engineering practice and the significance of ethical decision-making in real-world projects. Engaging in experiential learning activities fosters critical thinking and problem-solving skills. Students must analyse complex ethical issues, weigh different factors, and consider various perspectives to arrive at well-reasoned ethical decisions [13]. This analytical process enhances their ability to think critically about ethical challenges they may encounter in their careers and encourages students to consider the perspectives of various stakeholders affected by engineering decisions. This empathetic approach helps students understand the broader impact of their choices on clients, communities, and the environment, promoting ethical decision-making that aligns with societal values.

The activities in this approach often provide immediate feedback to students on their decisions and actions. This feedback loop allows for reflection on the consequences of their ethical choices and helps students learn from their experiences, reinforcing ethical reasoning and sensitivity to ethical implications. Experiential learning contributes to the development of students' ethical identity. As they engage in ethical decision-making through practical experiences, students become more aware of their values, beliefs, and ethical principles, shaping their ethical character as future engineers.

By combining these approaches - classroom-based instruction, case studies, and experiential learning - educators can create a comprehensive and engaging learning environment for teaching engineering ethics. This multi-faceted approach enables students to develop a well-rounded understanding of ethical principles and their practical application in engineering practice.

4. CHALLENGES IN CURRENT APPROACHES

While the approaches of classroom-based instruction, case studies, and experiential learning are valuable for teaching engineering ethics, there may be some challenges and considerations when applying them to Generation Z students. As a result of growing up in the digital age, this generation is exposed to a vast array of digital stimuli, including social media, smartphones, and online entertainment. While this exposure has its advantages in terms of access to information and connectivity, it has also led to concerns about the attention span and focus of this generation of students, particularly when it comes to engaging in-depth discussions on complex ethical issues.

One of the primary challenges for educators is capturing and retaining the attention of Generation Z students during ethics classes. Traditional methods of teaching, such as lengthy lectures or reading assignments, may struggle to hold their interest. To address this issue, educators must employ innovative and interactive teaching approaches that cater to the digital preferences and learning styles of Generation Z.

On top of that, due to their shorter attention span caused by exposure to constant digital stimuli, this Generation Z has difficulties maintaining their focus and interest throughout their

learning process. Notifications, messages, and other digital stimuli may divert their attention away from the topic at hand, impacting their ability to fully focus on ethical discussions. In a digitally connected world, there may be limited time for students to engage in offline activities that encourage self-reflection and critical thinking. Deep thinking and contemplation, crucial for ethical reasoning, may be overshadowed by the constant need for online stimulation. With easy access to information online, this generation of students might rely on quick answers without delving deeper into ethical complexities. This may result in a superficial understanding of ethical dilemmas and the underlying principles that inform ethical decision-making. They have been bombarded with an overwhelming amount of information on the internet. Sorting through this vast pool of data can be challenging, and students may struggle to identify accurate and trustworthy sources amidst the noise, and they need guidance to recognize and critically assess the credibility of the information they encounter online.

Generation Z, as a generation that has witnessed various societal and political challenges, may display cynicism or skepticism towards institutions, authority figures, and traditional structures. This skepticism can extend to educational settings, including skepticism towards educators and the information presented in the classroom and towards traditional teaching methods, including case studies and lectures and the much in need to emphasize the real-world relevance of ethical principles and their impact on engineering practice and society.

While idealism is a valuable characteristic that can inspire positive change, this Generation Z is struggling to balance it with pragmatism to navigate the complexities of real-world engineering scenarios. There are also major challenges that need to be addressed and quite crucial; to balance between the theory and the practice. It lies in the potential disconnect between understanding ethical principles in a theoretical context and applying them effectively in real-world engineering scenarios. While students may grasp ethical theories and concepts in the classroom, they may face challenges when it comes to translating that knowledge into practical ethical decision-making during their engineering careers. Several key issues contribute to this gap between theory and practice in engineering ethics education:

1. *Complexity of Real-World Scenarios*: Engineering projects often involve complex and multifaceted ethical dilemmas that are not fully captured in theoretical discussions. Real-world scenarios can present conflicting values, various stakeholders with different interests, and practical constraints, making ethical decision-making more challenging and nuanced than theoretical models might suggest.

2. *Ambiguity and Uncertainty*: Unlike textbook examples, real-life engineering situations can be ambiguous and uncertain, leaving engineers with imperfect information when making ethical choices. Students may struggle to navigate this uncertainty and apply ethical principles in a context where there is no clear "right" or "wrong" answer.

3. *Time and Resource Constraints*: In real-world engineering practice, professionals often face tight project schedules and limited resources. This can create pressure to prioritize other project considerations over in-depth ethical analysis, leading to decisions that may not fully align with theoretical ethical principles.

4. *Ethical Blind Spots*: Even when students are well-versed in ethical principles, they may still face ethical blind spots, where they are unaware of potential ethical implications in certain situations. Ethical blind spots can result from overconfidence in one's ethical judgment or a lack of exposure to diverse ethical challenges.

5. *Cultural and Contextual Differences*: Engineering projects often involve working in diverse cultural and international contexts. Ethical norms and practices can vary across cultures, leading to potential ethical clashes or misunderstandings that students may not have encountered in theoretical settings.

6. *Lack of Guidance and Mentorship*: Students may not have sufficient guidance or mentorship in ethical decision-making during their educational journey. Having ethical role models and mentors can help students navigate ethical challenges and gain insights into practical ethical considerations.

7. *Integration of Ethics into Technical Training*: Engineering programs may not fully integrate ethics education into technical training. When ethics education is treated as a separate or optional component, students may struggle to see its relevance to their technical coursework and future careers.

5. PROPOSAL FOR FUTURE DIRECTION

Proposing future directions in teaching approaches for engineering ethics can help address the specific needs and characteristics of Generation Z students while enhancing the overall effectiveness of ethics education. The authors would like to propose some potential future directions:

1. **Technology-Integrated Learning**: Embrace emerging technologies such as virtual reality, augmented reality, and interactive simulations to create immersive and engaging learning experiences. These technologies can allow students to explore complex ethical dilemmas in realistic engineering scenarios, promoting active learning and critical thinking [14].
2. **Blended Learning Models**: Adopt a blended learning approach that combines traditional classroom-based instruction with online resources and interactive platforms. This allows for flexible learning, catering to diverse learning styles and accommodating the digital preferences of Generation Z students [15].
3. **Gamification and Game-Based Learning**: Introduce gamification elements into ethics education to enhance motivation and student engagement. Developing ethical decision-making games and simulations can foster experiential learning while making the learning process enjoyable [16].
4. **Role-Playing and Ethical Debates**: Organize role-playing exercises and ethical debates to encourage students to take on different perspectives and explore ethical dilemmas from multiple angles. These activities promote empathy and a deeper understanding of the complexity of ethical decision-making [17].
5. **Collaborative Learning and Peer Discussions**: Foster collaborative learning environments where students can engage in group discussions and peer-to-peer interactions on ethics-related topics. Encouraging open dialogue and the exchange of diverse viewpoints can enhance critical thinking and ethical reasoning [18].
6. **Service-Learning and Community Engagement**: Integrate service-learning projects that allow students to apply ethical principles while addressing real community needs.

Engaging in ethical problem-solving within real-world contexts instils a sense of social responsibility and practical ethical application.

7. **Global Perspectives on Ethics:** Explore ethical considerations in a global context and address challenges related to cultural diversity, international collaborations, and the impact of engineering decisions on a global scale.
8. **Mentorship and Ethical Leadership Development:** Establish mentorship programs with industry professionals and ethical leaders to provide guidance and role models for Generation Z students. Ethical leadership development can empower students to become ethical advocates in their future engineering careers.
9. **Well-Being and Mindfulness Practices:** Integrate well-being and mindfulness components into ethics education to support students' emotional intelligence and resilience. Emphasizing the importance of personal well-being can enhance ethical decision-making and promote a healthy work-life balance.
10. **Ethical Innovation and Design Thinking:** Incorporate design thinking methodologies into ethics education, encouraging students to identify ethical challenges, generate creative solutions, and consider the ethical implications of their engineering designs and innovations.

By embracing these future directions, educators can create an enriching and transformative learning experience for Generation Z students, empowering them to become ethical and socially responsible engineers who contribute positively to society's well-being and sustainable development. While the proposed future directions in teaching engineering ethics offer valuable opportunities, there are also some limitations and challenges to consider:

1. **Access to Technology:** Implementing technology-integrated learning, gamification, and virtual reality simulations may require access to advanced technological resources. Ensuring equal access to technology for all students can be a challenge, as some institutions or students may face limitations in obtaining the necessary equipment and infrastructure.

2. **Time Constraints:** Integrating new teaching approaches and experiential learning activities may require additional time and resources, which can be a constraint within a traditional curriculum. Finding a balance between covering essential theoretical concepts and engaging in practical experiences can be challenging.

3. **Faculty Training:** Educators need to leverage technology and interactive tools to enhance the learning experience and cater to Generation Z's digital preferences. Faculty members may require training and support to effectively implement innovative teaching approaches. Faculty development programs are essential to equip educators with the necessary skills and expertise to navigate the changing landscape of ethics education.

4. **Ethical Considerations in Technology Use:** While technology can enhance learning experiences, educators must consider the ethical implications of using certain technologies, such as data privacy and security concerns in virtual learning environments.

Despite the challenges faced in introducing new methods of teaching engineering ethics to Generation Z, the integration of Islamic values is imperative to foster internalization of ethical principles and promote the well-being of society. Generation Z students, with their unique characteristics and preferences, may require innovative approaches to engage with ethics education effectively. By incorporating Islamic values, such as integrity, compassion, justice,

and social responsibility, educators can appeal to the inherent moral compass of students and align ethical teachings with their cultural and Islamic backgrounds. The ethical teachings of Islam emphasize empathy, fairness, and concern for the greater good, aligning closely with the broader goals of engineering ethics in promoting societal well-being. Embedding Islamic values in ethics education not only resonates with students' personal beliefs but also enhances their motivation to make ethically sound decisions that positively impact their communities and the world at large. Ultimately, this approach can contribute to the development of ethically conscious and socially responsible engineers who actively work towards the betterment of Ummah through their engineering practices.

By embedding engineering ethics education with Islamic values, educators can create a more holistic and culturally relevant learning experience for students while promoting a broader understanding of ethics in engineering practice. This approach fosters ethical engineers who are not only technically proficient but also grounded in their values and committed to making positive contributions to society guided by Islamic principles.

6. THE NEED FOR FUTURE RESEARCH

While significant strides have been made in understanding the role of engineering ethics and its integration with Generation Z, it is evident that further research is needed to address certain key aspects comprehensively. Firstly, as Generation Z continues to evolve and adapt to the changing technological landscape, there is a necessity to explore the dynamic impact of digital distractions and online ethics on their ethical decision-making processes. Investigating the long-term effects of these influences on ethical behavior can provide valuable insights into the development of effective ethics education strategies. Secondly, while the proposal for incorporating Islamic values in engineering ethics education shows promise, further research is essential to understand its impact on internalization and the promotion of societal well-being. Studies comparing the effectiveness of different ethical frameworks, including Islamic values, in various cultural and educational contexts can help identify best practices for fostering ethical values among Generation Z students.

The effectiveness of innovative teaching methods, such as gamification, role-playing, and experiential learning, requires further examination. Longitudinal studies assessing the retention of ethical knowledge and its practical application in engineering careers can shed light on the sustained impact of these approaches on ethical decision-making abilities. Researching the potential impact of engineering ethics education on the attitudes and behaviors of Generation Z engineers throughout their professional journey is essential. Understanding how ethics training influences their decision-making and social responsibility can guide the continuous improvement of ethics education curricula.

While the existing research provides valuable insights into engineering ethics education for Generation Z, further investigation is warranted to address the complexities and challenges unique to this dynamic generation. By engaging in continued research and assessment, educators and stakeholders can refine ethics education strategies, develop targeted interventions, and empower the next generation of engineers to become ethical leaders who contribute positively to society. The call for ongoing research in this field is crucial to ensure that engineering ethics remains effective, relevant, and responsive to the ever-changing landscape of engineering practice and societal needs.

7. CONCLUSION

The field of engineering ethics plays a crucial role in shaping the future of our society. With the increasing complexity of technology and the emergence of Generation Z as the next cohort of engineers, it is vital to adapt teaching approaches to effectively engage and internalize ethical principles. Despite the challenges of short attention spans, digital distractions, and skepticism, educators can bridge the gap between theory and practice by incorporating real-world case studies, experiential learning, and diverse perspectives. Moreover, the integration of Islamic values offers a valuable opportunity to resonate with Generation Z students and promote the internalization of ethical values. By addressing these challenges and embracing innovative teaching methods, we can empower the next generation of engineers to navigate ethical dilemmas effectively, develop a strong ethical foundation, and contribute to the well-being of society. As we prepare Generation Z for their roles in engineering, we must ensure that they not only possess technical expertise but also embody ethical leadership, compassion, and social responsibility to create a sustainable and equitable future for all.

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