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PAPER

Shared Foundations, Divergent Priorities: United States and Korean Faculty Beliefs about Engineering and University Education

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ABSTRACT

This study explores the beliefs of engineering faculty in the United States (U.S.) and South Korea regarding the nature of engineering and the purpose of university education. It analyzed open-ended survey responses from 23 faculty members—12 from the U.S. and 11 from South Korea. Faculty in both countries consistently defined engineering as a problem-solving discipline based on scientific and mathematical principles aimed at benefiting society. However, notable differences also emerged. U.S. faculty emphasized ethical responsibility, environmental sustainability, design thinking, and teamwork, while Korean faculty focused on economic efficiency and technical competence. Concerning the purpose of university education, U.S. faculty valued holistic student development, including personal growth, critical thinking, and lifelong learning (LLL), whereas Korean faculty prioritized disciplinary expertise and professional readiness. These findings highlight both the similarities and differences in faculty beliefs and how these perceptions can potentially influence ideas about engineering education. The study adds to ongoing discussions on curriculum design, faculty development, and international collaboration within engineering and engineering education.

KEYWORDS

Faculty beliefs, university purpose, engineering education, South Korea, United States (US)

1 INTRODUCTION

Engineering faculty in higher education play a vital role in shaping curricula and educating future engineers. Their teaching practices and curriculum choices are often influenced by their beliefs about engineering and the purpose of higher education. Additionally, in a time of rapid technological advancement and complex global issues, faculty beliefs about the nature of engineering and higher education

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greatly affect how students (i.e., future engineers) navigate changing technologies and address multifaceted global challenges.

Although previous research has examined various aspects of engineering education, such as curriculum design, teaching pedagogies, accreditation processes, and student outcomes, little attention has been paid to faculty beliefs about the purpose of engineering and higher education itself.

This study investigates the beliefs of engineering faculty in the United States (U.S.) and South Korea (hereafter, Korea) regarding the purpose of engineering and higher education. The two countries were chosen for their significant influence in global technology, engineering, and the economy, as well as for strong partnerships across government, industry, and education sectors. The study collected responses from 12 U.S. and 11 Korean engineering faculty members through open-ended text questions and a brief demographic survey. The results highlight similarities and differences in how faculty from both countries view engineering and higher education. These insights help to examine current faculty beliefs and whether they align with the goals of universities, accreditation organizations, governments, or society. They also help identify areas where faculty may consider shifting or emphasizing beliefs to better prepare future engineers for their roles in the workforce and society.

2 LITERATURE REVIEW

Understanding how engineering faculty conceptualize the nature of engineering and the university's role requires placing their perspectives within broader educational, economic, and cultural systems. Korea and the U.S. represent globally influential models of engineering education, shaped by different governance structures, national priorities, and pedagogical traditions.

In Korea, universities operate under a centralized, government-led mandate closely aligned with national economic development. This structure allows for large-scale responses to industry needs and policy directives. In contrast, the U.S. higher education system is characterized by institutional autonomy and decentralized governance [1]. U.S. universities independently establish policies and compete for research funding and student enrollment.

These structural differences also impact workforce production. Korea's higher education system produces a high volume of engineering graduates. In 2020, 20.8% of first university degrees awarded were in engineering, compared to 7.9% in the U.S. [2]. Across STEM, 32% of Korean bachelor's degrees were in STEM disciplines [3]. In 2024, Korea's largest conglomerates, including Samsung, LG, Hyundai, and SK Group, which play a critical role in Korea's highly industrialized and technology-driven economy, accounted for approximately 40% of the national GDP [4]. In 2023, Korea invested nearly 5% of its GDP in research and development, the second-highest among OECD nations [5]. In the U.S., STEMM (including medicine) professionals comprised 34% of the workforce and contributed approximately 40% to the national GDP [6]. Both countries heavily rely on STEM graduates to stay competitive and push technological innovation.

Engineering education in Korea and the U.S. has long been shaped by bilateral collaborations reflecting shared geopolitical and economic priorities. For example, the 2023 U.S.–Korea Presidential STEM Initiative invested $60 million to create the largest cohort of Fulbright STEM grantees in history, signaling a commitment to joint technological progress [7]. University partnerships further support study-abroad

programs, joint research projects, and cultural immersion experiences (e.g., [8], [9]), boosting participants' global awareness, intercultural skills, and employability [10].

2.1 Comparative analyses of educational systems and pedagogy

Both Korea and the U.S. maintain rigorous accreditation systems for engineering programs—ABET in the U.S. and the Accreditation Board for Engineering Education of Korea (ABEEK) in Korea. As signatories of the Washington Accord [11], both systems share similar desired graduate attributes, including problem solving, design, experimentation, teamwork, communication, ethics, and lifelong learning (LLL) [12], [13]. Despite these shared attributes, curricular emphasis and pedagogical approaches differ between the two countries. Korean engineering programs traditionally emphasize theoretical knowledge, with strong foundations in mathematics and science. Although reforms have introduced more design-oriented [14] and industry-engaged learning through capstone projects and university–industry partnerships [15], [16], [17]. U.S. programs have similarly adopted project-based pedagogies that emphasize teamwork, critical thinking, and iterative learning to prepare students for dynamic professional environments [18].

Classroom norms further highlight differences between the two nations. In Korea, academic success is closely linked to cognition-based strategies, with assessments favoring precise reproduction of knowledge [19]. Classroom norms often emphasize attentiveness, with limited verbal challenge or alternative viewpoints [20]. Instructors may heavily weight grades based on students' ability to recall taught material, despite institutional calls for critical learning skills [21]. Korean students report that assessments prioritize receptive learning (i.e., understanding, remembering, and reproducing) over creative or critical learning, and students with high GPAs tend to rate their receptive learning abilities higher than their critical or creative abilities [21].

In the U.S., engineering education emphasizes interactive and participatory learning, integrating teamwork and open discussion to develop problem-solving and communication skills [22], [23]. A cross-cultural study comparing U.S. and Korean students found that U.S. students rated their critical and creative abilities higher than their Korean counterparts and perceived growth in these skills throughout their undergraduate education [21]. These differences have been attributed to contrasting epistemological beliefs and cultural approaches to learning in Eastern and Western societies [20], [24].

2.2 Student outcomes and industry preparedness

Student outcomes are central to engineering education in both Korea and the U.S. Alignment between academic preparation and workforce demands is a key indicator of program effectiveness [25]. However, each engineering education system faces unique challenges. In Korea, a gap exists in technical skill development. For example, students have been found to lack competencies related to Industry 4.0, which threatens Korea's competitiveness in key sectors such as manufacturing. This has led to calls for updating technical curricula [26]. In the U.S., the main gap involves professional skills. Despite their inclusion in ABET criteria, the U.S. system has struggled to effectively implement and assess these skills within engineering curricula [22].

Both countries have addressed these challenges through increased industry collaboration. In Korea, internships and co-op programs significantly improve employability and job satisfaction among engineering graduates [25]. Similarly, U.S. research highlights the importance of work-integrated learning and sustained industry partnerships in preparing students for professional practice [27], [28]. These experiential opportunities not only develop technical skills but also foster professional skills that employers increasingly value.

2.3 Unexamined beliefs of the engineering professors

While prior studies on pedagogical practices and student outcomes provide valuable insights into the structures and priorities of engineering education programs, a critical gap in the literature remains: engineering faculty's underlying beliefs about the nature of engineering and the university's role. Faculty beliefs are fundamental to educational practice, influencing instructional strategies, curricular and program decisions, and mentoring relationships [29], [30], [31], [32]. Mentoring practices often reflect faculty members' own formative educational experiences, suggesting a generational transfer of educational values and philosophies [33], [34]. These beliefs can also manifest as "accidental competencies"—implicit messages that shape students' professional identities, sometimes in unintended ways [35]. Faculty beliefs further shape departmental cultures and educational policies [36].

Despite their importance, faculty beliefs are rarely examined empirically, especially in comparative international contexts. Understanding them is crucial for assessing whether faculty beliefs align with ongoing curricular reforms and national educational goals.

Recent global scholarship in engineering education emphasizes the need for reform in response to technological advances (e.g., AI, biotechnology, and advanced manufacturing), national development priorities, and complex global challenges [37], [38], [39]. Given the central role faculty play in shaping curricula and educating future engineers, studies are urgently needed that systematically examine and compare faculty beliefs across international contexts. Specifically, research should examine how engineering faculty conceptualize the definition and purpose of engineering, the university's role, and the competencies students should acquire.

To fill this gap, the present study investigates the beliefs of engineering faculty in Korea and the U.S. The following research questions guide the study:

1. How do engineering faculty in Korea and the U.S. define engineering, and what do they perceive as its primary purpose?
2. What do engineering faculty in Korea and the U.S. believe is the main purpose of a university, and what key competencies should students gain from their education?

By exploring these fundamental questions, this study moves beyond policy and pedagogy comparisons to uncover the philosophical foundations of engineering education in two globally influential countries. In doing so, it aims to inform future educational reforms, foster cross-cultural understanding, and support more thoughtful collaboration in international engineering education.

3 METHOD

3.1 Data collection

An online survey was administered in Spring 2025 to engineering faculty at universities in Korea and the U.S. The survey included two open-ended questions:

1. How do you define engineering, and what do you see as its primary purpose?
2. What do you believe is the primary purpose of a university or college education? What are the most important things students should gain from it?

In addition to these qualitative items, the survey collected demographic information, including discipline, academic experience, age range, prior engineering work experience, and current academic rank. Institutional Review Board (IRB #STUDY20250074) approval was obtained prior to the commencement of recruitment. Recruitment emails were distributed to faculty in both countries. The survey was available in Korean and English, and participants provided informed consent prior to completing the survey. A total of 23 faculty members completed the survey, comprising 11 from Korea and 12 from the U.S. Demographic details are presented in Table 1.

3.2 Data analysis

Demographic data were summarized using frequency counts. Open-ended responses were analyzed using an inductive coding approach, allowing codes and categories to emerge directly from the data. First, the primary researcher, who is fluent in both Korean and English, translated survey responses from Korean faculty into English. As part of this process, the researcher reviewed the translated responses multiple times against the original Korean text to ensure conceptual equivalence and preserve participants' intended meaning.

Second, the primary researcher first read and re-read all responses to develop an initial set of codes representing distinct ideas expressed by participants. Through an iterative process, similar codes were grouped into broader categories and continuously refined to ensure alignment with the data.

Third, after establishing the categories and operational definitions, three researchers conducted interrater reliability testing. For the first research question, the primary researcher and a second researcher independently coded all the responses using the established categories and definitions. The initial overall Cohen's kappa coefficient was .88, indicating strong agreement between the coders. Discrepancies were subsequently discussed, with each researcher explaining the rationale for their coding decisions until consensus was reached. During this process, instances in which responses warranted multiple codes were also identified and resolved. Based on these discussions, the category definitions were further refined.

A similar procedure was followed for the second research question. The primary researcher and a third researcher independently coded the responses using the coding framework. The initial overall Cohen's kappa coefficient was .85, again indicating strong agreement. The researchers discussed any coding discrepancies and resolved them through consensus.

After completing the coding process, the final categories were compared across the U.S. and Korean faculty groups, with attention to both the frequency of occurrence and the relative prominence of each category within the responses.

Table 1. Faculty participant demographics (N = 23)

Characteristic	United States ($N = 12$)	Korea ($N = 11$)
Primary Discipline		
Mechanical	4	5
Electrical	1	
Civil, Environmental and Geodetic	2	
Aerospace	4	2
Software	1	
Nuclear		2
Integrated		1
Biomedical		1
Number of years working in academia		
2–5 years		4
6–10 years	3	2
11–15 years	3	3
16–20 years	2	2
21–25 years	2	
26–30 years	1	
31–35 years	1	
Worked as a full-time engineer		
Yes	9	7
No	3	4
Gender		
Woman	4	1
Men	7	10
Prefer not to say	1	
Age		
35–44	6	6
45–54	4	3
55–64	1	2
Prefer not to say	1	
Academic Ranks		
Assistant Professor	2	3
Associate Professor	3	4
Professor	4	4
Teaching Professor/Instructor/Lecturer	2	
Professor of Practice	1	

4 FINDINGS

4.1 Perspectives of United States faculty on the nature of engineering

Faculty in the U.S. frequently described engineering as a problem-solving discipline. Definitions emphasized engineering as a process aimed at addressing societal challenges, with participants stating:

- "Problem solving for the benefit of society." (US_P #1)
- "Engineering is the process by which you solve problems (of all types)." (US_P #8)
- "Engineering is the study of how to efficiently solve problems." (US_P #9)

Many responses highlighted the application of scientific and mathematical principles in engineering:

- "Using scientific principles, creativity, and problem-solving." (US_P #2)
- "Based on mathematical and science-based principles." (US_P #4)
- "Application of science, mathematics, and design." (US_P #12)

Engineering was also framed to improve lives and serve humanity:

- "Its primary purpose is to drive the continued growth and development of humanity." (US_P #2)
- "For the betterment of humankind." (US_P #3)
- "Ensure the welfare, safety, and health of the society, ecosystem, and planet." (US_P #5)
- "Making the world a better place." (US_P #11)

Innovation and technological progress were recurring categories:

- "Engineering took us from walking on the plains to building machines that fly." (US_P #2)
- "Create capabilities in the world that did not exist before." (US_P #6)

Design was frequently mentioned, sometimes with problem-solving:

- "Engineering is the practice of design guided by mathematics." (US_P #7)
- "Developing design solutions." (US_P #4)
- "Solve problems with unique design." (US_P #8)

Ethics, sustainability, and responsibility were also emphasized:

- "Upholding ethical responsibility toward people and the environment." (US_Participant 2)
- "Designing for resilience in a rapidly changing world." (US_P #12)

Finally, collaboration was noted as a key aspect of engineering practice:

- "Engineering involves working on a team." (US_P #11)
- "Using the team's collective knowledge and judgment." (US_P #11)

4.2 Perspectives of Korean faculty on the nature of engineering

Faculty in Korea consistently described engineering as a discipline focused on solving real-world problems:

- "I think it is about solving problems" (KOR_P #1)
- "Solving problems in the most economical way" (KOR_P #5)
- "A discipline that solves problems" (KOR_P #6)
- "A discipline that solves social and technical problems" (KOR_P #10)

Engineering was also viewed as the practical application of science and mathematics to develop valuable technologies:

- "Based on phenomena and mechanisms revealed by basic science …" (KOR_P #3)
- "Using scientific knowledge …" (KOR_P #4 and #10)
- "The act of researching and developing technology based on science" (KOR_P #11)
- "Applying basic knowledge of mathematics and science …" (KOR_P #8)

Several faculty emphasized engineering's role in improving the quality of life:

- "To enrich human life …" (KOR_P #1)
- "All technologies that benefit humans …" (KOR_P #2)
- "The purpose of engineering is to improve quality of life" (KOR_P #4)
- "Helping human life" (KOR_P #7)

Innovation and future-oriented thinking were also prominent:

- "Developing or improving technologies, devices, and environments" (KOR_P #8)
- "The process of realizing technology" (KOR_P #9)
- "Technological advancement" (KOR_P #7)
- "A discipline that solves problems the world needs or is expected to need" (KOR_P #6)

A few faculty highlighted the importance of cost-effectiveness and financial considerations:

- "Solving problems in the most economical way" (KOR_P #5)
- "Science + money" (KOR_P #7)

Table 2 summarizes responses from U.S. and Korean faculty on the nature of engineering.

Table 2. Summary of the beliefs held by the studied U.S. and Korean faculty on what engineering is

Category (*Engineering is …*)	U.S. Faculty Perspectives	Korea Faculty Perspectives
Problem Solving	Frequently and consistently described as central to engineering practice.	Frequently and consistently described as central to engineering practice.
Application of Science/Math	Defined as the application of scientific and mathematical principles to real-world problems.	Defined as the application of scientific and mathematical principles to real-world problems.

(Continued)

Table 2. Summary of the beliefs held by the studied U.S. and Korean faculty on what engineering is *(Continued)*

Category (*Engineering is …*)	U.S. Faculty Perspectives	Korea Faculty Perspectives
Service to Society/Humanity	Framed as serving societal needs and contributing to human welfare.	Framed as serving societal needs and contributing to human welfare.
Innovation and Progress	Portrayed as advancing capabilities and driving technological development.	Associated with the creation and improvement of technologies, devices, and environments.
Design	Mentioned as a central component of engineering	Not mentioned explicitly in responses.
Tied to ethical/Environmental Responsibility	Highlighted as a key responsibility of engineers toward society and the planet.	Not mentioned explicitly in responses.
Teamwork and Collaboration	Described as a collaborative effort involving shared knowledge and judgment.	Not mentioned explicitly in responses.
Economic Efficiency, financial, and profit	Mixed views: some emphasized cost-efficiency in problem-solving; others rejected profit as a primary goal.	Emphasized the importance of solving problems economically and acknowledged financial factors.

4.3 Perspectives of United States faculty on the purpose of university education

U.S. faculty frequently emphasized developing students' critical thinking and problem-solving skills as a central purpose of university education. Six of the twelve participants highlighted this category:

- "Critical thinking and ability to apply knowledge is most critical." (US_P #1)
- "The primary purpose of a university education is to give students the critical thinking skills they need to be successful in their future career." (US_P #11)

Another prominent category was career preparation. Faculty viewed universities as institutions that equip students with the skills and awareness needed for professional success:

- "I also think its purpose is to increase awareness of the career path they are following." (US_P #4)
- "The primary purpose is to educate students to be a skilled worker with a potential to grow in the career or professional. This means they should be relatively career-ready." (US_P #5)
- "A college education is to prepare students for their future careers." (US_P #9)
- "Preparing them for the workforce." (US_P #3)
- "Students should graduate with strong job prospects." (US_P #12)

Several faculty members emphasized the importance of foundational disciplinary knowledge:

- "Provide the fundamental baseline skills, methods, knowledge, etc., about math, science, and engineering principles, sufficient enough for them to go into industry and use these baseline skills to build off of." (US_P #4)
- "Students should gain knowledge of fundamentals and how to begin applying them." (US_P #6)

- "Prepare students with the knowledge, skills, and perspectives to contribute meaningfully to their communities and careers." (US_P #12)

In addition to academic and professional preparation, faculty highlighted personal growth and maturity:

- "Beyond academics, college offers space for personal growth ... developing emotional resilience and the ability to navigate life's ups and downs ... how to adapt, and how to move forward with confidence and curiosity." (US_P #2)
- "Curiosity, ethical reasoning, and the ability to navigate complex challenges ... students learn to question assumptions, engage with diverse perspectives, and clarify their values and goals." (US_P #12)

Some faculty extended the university's purpose to include global citizenship and social contribution:

- "To help develop students to be global citizens with consideration of mankind and our broader world ... become agents for the greater good." (US_P #8)
- "They should have the confidence and capacity to help improve the world around them." (US_P #12)
- "...how to be a good and productive citizen." (US_P #9)

Teamwork and collaboration were also noted as essential competencies:

- "Just as importantly, they learn how to engage with diverse people, collaborate in teams." (US_P #2)
- "Work with a team." (US_P #11)
- "Engineering teamwork." (US_P #6)

Finally, several faculty members emphasized the importance of lifelong learning:

- "...learning how to learn." (US_P #2)
- "...engage in lifelong learning." (US_P #11)
- "Learning independently." (US_P #7)

4.4 Perspectives of Korean faculty on the purpose of university education

Korean faculty similarly identified problem-solving and critical thinking as key outcomes of university education:

- "The ability to solve new problems" (KOR_P #5)
- "Basic knowledge for problem solving" (KOR_P #6)
- "The ability to analyze and solve problems" (KOR_P #10)

Some faculty emphasized career preparation, noting the university's role in helping students pursue desired professions:

- "Helping students enter the careers they desire" (KOR_P #9)

A dominant category among Korean faculty was the importance of disciplinary expertise and technological competence:

- "Teaching foundational and specialized knowledge ... helping students grow into experts in their fields" (KOR_P #3)
- "Intellectual maturity and specialized knowledge" (KOR_P #8)
- "Enhancing understanding of engineering and acquiring related technologies" (KOR_P #9)
- "Advancing better technologies through understanding current ones" (KOR_P #7)

One faculty member emphasized the cultivation of well-rounded individuals:

- "Cultivating individuals with basic character and values" (KOR_P #1)
- "Students should not be confined to fixed ways of thinking but should be flexible" (KOR_P #1)

Several faculty members viewed university education as contributing to national development and social responsibility:

- "Training the workforce needed by society" (KOR_P #2)
- "Contribute to national and human development" (KOR_P #4)
- "Students should learn to feel a sense of social responsibility" (KOR_P #5)

Finally, collaboration and interdisciplinary communication were emphasized:

- "Convergence science is important ... education should include communication and integration across disciplines" (KOR_P #3)

Table 3 summarizes responses from U.S. and Korean faculty on the purpose of higher education.

Table 3. Summary of the beliefs held by the studied U.S. and Korean faculty on the purpose of higher education

Category	U.S. Faculty Perspectives	Korea Faculty Perspectives
Critical Thinking & Problem Solving	Frequently emphasized as a core educational outcome, essential for career and life success.	Mentioned as important, but less central; often framed within technical or disciplinary contexts.
Career Preparation & Workforce Readiness	Strong focus on preparing students for professional careers and job market readiness.	Viewed as supporting students' entry into desired professions; linked to technical competence.
Foundational & Specialized Knowledge	Seen as essential for building a base of disciplinary knowledge and applied skills.	Emphasized as a primary goal; foundational and specialized knowledge viewed as critical for expertise.
Personal Growth & Maturity	Viewed as key outcomes alongside the foundational and specialized knowledge. Considered key outcomes include emotional resilience, independence, and ethical reasoning.	Framed as cultivating well-rounded individuals with intellectual maturity and adaptability.
Citizenship & Social Responsibility	Viewed as part of the broader educational mission, it includes global citizenship and civic engagement.	Emphasized in terms of contributing to national development and fulfilling societal roles.
Teamwork & Collaboration	Recognized as important for working in teams	Recognized as important for interdisciplinary collaboration
Lifelong Learning	Highly valued; includes learning how to learn and sustaining intellectual curiosity.	Not explicitly mentioned in responses.

5 DISCUSSIONS AND IMPLICATIONS

5.1 Comparison of United States and Korean faculty perspectives on the nature of engineering

Faculty members in both the U.S. and Korea strongly agreed that engineering exists to solve problems for the benefit of society. Their responses consistently emphasized that engineering should address pressing human challenges and improve the quality of life. Across both groups, engineering was broadly defined as the application of scientific principles, mathematical reasoning, and technological tools to solve complex, real-world problems. Innovation was also a shared category, with faculty in both countries viewing engineering as a driver of technological advancement.

These definitions align closely with how engineering is framed in influential reports, such as the *2024 Impact of National Science Foundation Engineering Research Support on Society* report, which defines engineering as "...the act of creating artifacts, processes, or systems that advance technology and address human needs using principles of sciences, mathematics, computing, and operations" [40]. Similarly, both ABET and the ABEEK emphasize the societal impact and public welfare of engineering in their program outcomes [12], [13].

Despite these shared perspectives, notable differences in emphasis emerged between the two faculty groups. U.S. faculty frequently highlighted engineering's ethical and environmental responsibilities, framing these as integral to the engineering profession. In contrast, Korean faculty did not explicitly mention ethics or environmental responsibility in their definitions. This omission may suggest that these responsibilities are less emphasized in Korean engineering education compared to the U.S., despite their inclusion in the ABEEK criteria. However, it is important to note that even in the U.S., studies such as Cech's have documented a decline in students' public-oriented responsibilities over time [41]. These findings underscore the need to more explicitly integrate ethical, environmental, and social responsibilities into faculty discourse, instruction, and assessment in both countries.

Faculty in Korea placed significant emphasis on the economic dimensions of engineering, frequently referencing cost-effectiveness in problem-solving. This emphasis aligns with ABEEK's outcomes, which require graduates to evaluate engineering solutions in terms of economic, societal, health, safety, legal, and environmental impacts. U.S. faculty expressed a wider range of views on this topic. One U.S. participant acknowledged the importance of financial considerations, while another cautioned against the commercialization of engineering, stating: "I do not think the primary purpose of engineering should be making a profit, but unfortunately I think a number of businesses see it that way" (US_P #11). This contrast highlights a potential misalignment between faculty perspectives and industry expectations in the U.S., despite ABET's similar emphasis on designing under multiple constraints, including economic factors.

Another notable difference relates to the role of design in engineering. Several U.S. faculty identified design as a central component of engineering, consistent with ABET's requirement for a culminating design experience. Korean faculty, however, did not explicitly associate engineering with design in their definitions. This may reflect semantic differences, where "design" is interpreted more narrowly, perhaps as industrial or graphic design rather than engineering design. In Korea, ABEEK mandates both introductory and capstone design experiences, and capstone design is widely implemented as a standalone senior-year course. Thus, the difference may not reflect absence but rather how design is conceptualized.

While the results of this study cannot be generalized to all faculty in the U.S. and Korea, the categories emphasized and omitted offer valuable insight into what faculty perceive as central to engineering. Engineering educators should reflect on their own beliefs and consider whether specific dimensions of engineering are underrepresented or overemphasized in their beliefs and thereby in their teaching and scholarship. Moreover, they should examine how these beliefs are communicated to students explicitly or implicitly. If key aspects of engineering are missing from faculty discourse, this may influence how their students conceptualize the engineering profession and their role within it.

5.2 Comparison of United States and Korean faculty perspectives on the purpose of university education

Engineering faculty in both the U.S. and Korea affirmed the university's role in preparing graduates to contribute to society and the profession. However, their emphasis diverged in other ways. U.S. faculty consistently emphasized the development of critical thinking and problem-solving as central objectives of university education. This aligns with a study by [42], which examined what engineering employers value in their hires, with problem-solving skills ranked highest. U.S. faculty also emphasized the importance of educating the whole person, rather than merely imparting technical knowledge. Personal attributes, including emotional resilience, time management, and self-awareness, were viewed as important outcomes of higher education. Faculty also emphasized the importance of cultivating curiosity, confidence, independent thinking, and the ability to engage with diverse perspectives. Additionally, many U.S. faculty underscored the university's role in fostering ethical citizenship, teamwork, and LLL, preparing students not only for professional careers but also for meaningful societal engagement.

From this perspective, U.S. faculty conceptualize university education as a space for developing personal values, insights, and judgment, and for going beyond the acquisition of behavior-based skills. This raises important questions for future research and curriculum design: How much emphasis should be placed on personal development, especially in already content-heavy engineering programs? Should universities consider extending degree durations, revising curricular content, or offering additional certificate programs to support these broader educational objectives? Passow and Passow [43], for example, suggest implementing integrated projects throughout the four-year engineering programs to develop both non-technical and technical skills. They highlighted the importance of teaching non-technical skills within project contexts, considering the close connection between non-technical and technical skills.

In contrast, Korean faculty placed less explicit emphasis on personal development. Only one participant mentioned cultivating character and values. Instead, Korean faculty emphasized disciplinary expertise and professional competence as the primary goals of university education. University learning was framed as a mechanism for producing skilled individuals capable of contributing to national development and global progress. While problem-solving was acknowledged, the dominant categories centered on building a strong foundation of technical knowledge and preparing students to become responsible professionals within their chosen fields.

This perspective reflects an application-oriented, skills-based view of education, where students acquire and apply knowledge in professional contexts. Korean faculty may have assumed personal development, which was not articulated in their

responses, to be implicit or secondary. This warrants further discussion within Korean engineering education communities to determine whether personal growth should be a more explicit objective and how it might be integrated into institutional goals.

Another key difference lies in the emphasis on LLL. U.S. faculty frequently emphasized the importance of equipping students with LLL skills, recognizing their relevance in a rapidly evolving professional landscape and the impossible task of preparing students for all the problems and processes they will encounter during their engineering careers [44]. The importance of LLL has been highlighted by recent engineering program graduates, who emphasized that learning how to learn and transferring their knowledge, skills, and experiences to new engineering contexts were critical in their early years of employment [44]. In contrast, Korean faculty rarely explicitly emphasized LLL. LLL may be viewed as an individual rather than institutional responsibility. Importantly, however, ABEEK's program outcomes include LLL-aligned criteria, such as recognizing the need for self-development and engaging in self-directed learning [13].

Studies have explored integrating LLL competencies into capstone design courses in the U.S. [45]. While capstone courses in both the U.S. and Korea provide promising contexts for fostering LLL, questions remain about whether a semester- or year-long experience is sufficient to instill an LLL mindset. As AI and rapid technological change compress the lifespan of knowledge and skills, both university systems have incentives to normalize LLL as a habit of mind, supported by assessment strategies, faculty development, and curricular integration across the undergraduate experience. Research has been underway to define LLL in the context of engineering and engineering education [46], which may help further develop LLL skills and attributes in engineering education.

In summary, this study aimed to highlight the similarities and differences in faculty perspectives from the U.S. and Korea regarding the nature of engineering and the purpose of universities. While shared categories emerged, notable distinctions in emphasis underscore the complexity of defining engineering across international contexts.

In an era of heightened global competition, important questions arise: How might engineering education create space for ethical decision-making, social justice, and sustainability? Some argue that these priorities are more urgent than ever, while others offer counterpoints, revealing ongoing tensions in articulating the purpose and priorities of engineering education in a rapidly evolving, interconnected world.

The advent of AI further amplifies these challenges. As AI-driven technologies advance at an unprecedented speed, universities are introducing AI literacy and training, placing additional demands on curricula and students. What should give way to accommodate these changes? Alternatively, how might AI be integrated to enhance student learning and support diverse educational outcomes? These questions invite educators to reflect deeply on the evolving mission of engineering education.

Ultimately, it is essential to acknowledge that faculty members represent only one stakeholder group in engineering education. Other key stakeholders include students, alumni, employers, administrators, government agencies, citizens, accreditation bodies, and policymakers. Each plays a vital role in shaping engineering education and in defining and teaching engineering. Through collaboration among these groups, a more comprehensive and inclusive understanding of engineering should be developed and integrated into educational practice. Where disagreements arise over engineering priorities, they should be openly discussed and debated to ensure engineering education meets the demands of a rapidly evolving global context.

Ultimately, this work aims to capture the current beliefs of Korean and U.S. faculty and to spark a dialogue on how engineering education might be balanced or reimagined in the interconnected, globalized world. Educators, in collaboration with stakeholders, must define a vision for engineering education that prepares students for technical excellence and responsible citizens in a complex world.

6 LIMITATIONS AND FUTURE RESEARCH

While this study offers valuable insights into the beliefs of engineering faculty in the U.S. and Korea, several limitations should be acknowledged. First, the findings are based on open-ended question data, providing a snapshot of faculty perspectives at a single point in time. A more nuanced understanding could be achieved through follow-up interviews that explore the underlying reasons for these beliefs. Such insights may be shaped by faculty members' professional experiences in industry, interactions with recent graduates, or collaborations beyond academia. Capturing these contextual influences would deepen our understanding of faculty beliefs and reveal broader educational or societal factors shaping engineering education in each country.

Second, the study included 23 participants with varied disciplinary backgrounds and faculty appointments. Future research should recruit a larger, more diverse sample to validate these findings and identify additional categories. Expanding the participant pool would also enable comparative analysis by faculty rank and role, such as tenure-track and tenured faculty, assistant and full professors, and teaching professors and professors of practice. These distinctions may influence how faculty conceptualize engineering and the university, offering further insight into the relationship between professional responsibilities and educational beliefs.

Third, future studies could examine the alignment between individual faculty perspectives and their program or institutional missions. This might involve collecting data from academic leaders (e.g., department chairs, deans, provosts) to identify potential gaps or alignment between faculty beliefs and institutional priorities. Such comparisons could illuminate broader tensions or synergies within each country's educational landscape.

Finally, this study focused exclusively on faculty perspectives. Future research should incorporate other key stakeholders in engineering education, including students, alumni, administrators, and industry professionals. Comparing faculty views with those of other stakeholders could reveal areas of alignment or misalignment between educational practices and workforce expectations.

7 CONCLUSION

This study examined the beliefs of engineering faculty in the U.S. and Korea about the nature of engineering and the purpose of university education. There was general agreement that engineering focuses on solving problems, applying scientific and mathematical principles, and improving humanity, although the emphasis varied across aspects such as design, societal responsibilities, and economic issues. Regarding the purpose of university, U.S. faculty generally saw it as a space for holistic student development, emphasizing personal growth, emotional resilience, critical thinking, and transferable skills that prepare students for various careers. In contrast, Korean faculty mainly viewed the university as a place for developing disciplinary expertise and technical skills, focusing on building a strong foundation

of specialized knowledge aligned with professional fields. These different perspectives reflect distinct educational philosophies and national goals, prompting engineering educators to consider what students need most during their limited time at university, especially in an era of rapid technological change and global shifts. As engineering education evolves, faculty beliefs will play a key role in shaping curriculum design, teaching methods, and the broader mission of higher education.

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9 DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this work the author used Microsoft 365 Copilot in order to check for grammar, clarity, concision, and readability in select portions of the manuscript. After using this tool/service, the author reviewed and edited the content as needed and takes full responsibility for the content of the publication.

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