# Social Cognitive Theory and the Engineering Gap: A Communication Perspective on Industry-Student Alignment

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## ABSTRACT

As artificial intelligence (AI) continues to redefine global industry demands, engineering education faces a critical need for structural realignment to ensure graduate readiness. This study identifies the primary determinants of engineering student competence at INTI International College Penang (IICP), framing the investigation within the multifaceted lens of Social Cognitive Theory (SCT). By examining the triadic reciprocity between cognitive, behavioural, and environmental factors, the research evaluates the impact of curriculum gaps, AI awareness, and the efficacy of industry-academia collaboration on professional development. Employing a quantitative methodology, a survey was administered to 50 diploma and degree engineering students, utilizing a five-point Likert scale to measure perceptions of these specific determinants. Descriptive analysis revealed a compelling shift in student perspectives: while respondents perceived outdated curricula and a lack of AI awareness as less influential than initially anticipated, the adoption of AI tools, practical on-the-job training, industry collaboration, and organizational cultural dynamics emerged as the most significant drivers of competence. These findings advocate for strategic educational reforms that prioritize the integration of AI-driven technologies and the expansion of experiential learning opportunities to bridge the industry-student divide. Furthermore, the study highlights the importance of communicative proficiency alongside technical mastery in modern media ecologies. This research provides policymakers and higher education providers with actionable insights to enhance curricular relevance, ensuring the development of a workforce that is both technically adept and communicatively prepared to navigate the complexities of an increasingly AI-driven industrial landscape. Through this alignment, institutions can better foster innovation and long-term employability for future engineers.

**Keywords:** Social Cognitive Theory, Curriculum Gap, Engineering Students, Industry Demands, Quantitative Survey.

## INTRODUCTION

The global engineering landscape is currently at a critical crossroads, where the technical and communicative dimensions of the profession are increasingly intertwined. According to Loumpourdi (2024), engineering graduates have become a focal point of academic and professional discourse as industries worldwide navigate the transformative challenges and opportunities introduced by artificial intelligence (AI). Furthermore, employers increasingly prioritize graduates who possess a balanced synthesis of cognitive and transferable skills (Otieno et al., 2026). These rapid technological advancements have necessitated a paradigm shift in industry requirements, placing a premium not only on technical mastery but also on communicative competencies, including adaptability, problem-solving, and collaborative capacity (Olaya-Escobar et al., 2024). However, a significant systemic tension persists within the educational media ecology: there is growing concern that academic curricula are not evolving at a commensurate pace, leading to a widening gap between graduate competencies and employer expectations (Madonsela, 2022). This misalignment, often resulting from ineffective information flow among stakeholders, has directly threatened graduate employability and stifled the innovative potential of industries that depend on fresh talent (Xi et al., 2022). While efforts to bridge this divide have focused on aligning education with industry needs through practical, industry-specific technical training, societal perceptions and prevailing cultural narratives often continue to undervalue these pathways in favor of traditional academic routes (Tran et al., 2022). Consequently, the challenge remains to modernize educational programs while simultaneously shifting public perceptions to recognize the vital role of vocational and technical training in building a competent workforce (Zhang et al., 2024).

To address these evolving demands, educational institutions must fundamentally overhaul traditional curricula and pedagogical communication frameworks (Tsephe & Makoele, 2024). The strategic integration of AI-related technologies is now essential to prepare students for a digitally mediated future of work (Auer et al., 2020). Such an evolution requires fostering project-based, multidisciplinary environments that utilize interactive resources to individualize the learning experience (Carella & Colombo, 2024). As Seshoka et al. (2023) observe, this technological revolution is reshaping both industrial operations and the core competencies, such as technical and interpersonal, that the next generation of engineers will require. Nevertheless, achieving true alignment is a multifaceted communication challenge involving diverse organizational cultures (Elkosantini et al., 2023). It demands a concerted, tripartite effort among academia, industry, and policymakers to ensure the relevance of the skills imparted (Lumo et al., 2024). Research by Ferreira et al. (2024) and Hol et al. (2023) suggests that robust, dialogic collaboration between educational institutions and industry partners is the most effective model for developing curricula informed by real-world demand, thereby directly enhancing graduate employability.

These collaborative efforts allow for the infusion of practical relevance into academic programs through continuous feedback loops. By integrating case studies, guest lectures, and industry-sponsored projects, institutions can effectively bridge the symbolic and practical chasm between theory and practice (Dwivedi et al., 2024). Beyond technical proficiency, graduates must master workplace rhetoric by cultivating soft skills, including effective communication, teamwork, ethical decision-making, and adaptability. Therefore, curricula should provide structured opportunities for students to develop these traits; Major et al. (2022) note that collaborative design projects, internships, and extracurricular activities are vital for fostering such abilities. Finally, to ensure total alignment, assessment strategies must mirror real-world communicative expectations. Moving beyond traditional exams, performance-based assessments, and portfolio evaluations allows students to demonstrate creativity and project management skills, while competency mapping provides a clear roadmap to link course outcomes to the specific skills demanded by industry (Strang & Vajjhala, 2024).

On top of that, continuous professional development ensures that educators stay up to date with industry advancements. Encouraging faculties to engage in industry-sponsored research, consultancies, and collaborative projects enriches their understanding of practical challenges. Malhotra et al. (2024) find that guest lectures by industry professionals and company experts can further enhance faculty expertise. In an interconnected world like today, engineering graduates often work in multicultural environments. As such, the curricula should also focus on fostering cultural competence, global awareness, and an appreciation for diversity. Exposure to cross-cultural communication workshops and study abroad programs contributes to graduates' adaptability and open-mindedness towards different cultures (Dolce et al., 2023). The pace of technological change demands that graduates embrace lifelong learning. The curricula should instill a mindset of constant growth, encouraging students to seek out new knowledge independently. The study conducted by Zou et al. (2024) found that integrating micro-credentials and industry certifications helps graduates stay relevant throughout their careers. Hence, the alignment of engineering curricula with industry needs is an ongoing process. It requires collaboration, adaptability, and a shared commitment to producing competent professionals. As educational institutions and industry partners work together, they contribute not only to individual employability but also to the resilience and innovation of entire industries.

Beyond classroom instruction, joint employer projects allow students to engage directly with real-world problems, data, and cutting-edge technologies. By partnering with industry experts, students gain insights into practical challenges and contribute to the creation of knowledge. These experiences foster critical thinking, innovation, and a deeper understanding of industry dynamics (O'Dwyer et al., 2022). As the engineering curricula evolve, ethical dimensions must still remain as the forefront. Graduates should not only possess technical knowledge but also understand the ethical implications of their work. Courses on engineering ethics, responsible AI development, and privacy considerations can equip students to navigate complex ethical dilemmas more effectively. Responsible innovation, like balancing progress with societal well-being, becomes a focal point (Burr & Leslie, 2022). Limited knowledge hinders creativity. Thus, the curricula should encourage interdisciplinary exploration. Exposure to fields such as design thinking, entrepreneurship, environmental science, or even the creative arts can lead to novel solutions. Therefore, Fortuin et al. (2023) argue that graduates who can bridge disciplinary boundaries by communicating with experts across diverse domains are valuable assets. The ability to translate engineering concepts into accessible language for non-technical stakeholders is a sought-after skill.

While global trends shape engineering practices, regional context still matters. The curricula should reflect both. Graduates need awareness of global megatrends such as climate change, urbanization, and digital transformation, as well as an understanding of local industry ecosystems. Case studies from different regions provide nuanced perspectives. Whether it is sustainable infrastructure in Scandinavia (Karlsson et al., 2024) or smart cities in Southeast Asia (Joo, 2021), contextual relevance enhances graduates' problem-solving abilities. Engineering solutions impact diverse populations, so graduates should also appreciate the principles of inclusive design to create products and systems that accommodate everyone, regardless of ability, age, or background. Courses on universal design, assistive technologies, and human-centered approaches develop empathy and ensure that graduates contribute to a more equitable world (De Silva et al., 2024). Holistic education extends beyond technical competencies. Thus, graduates should navigate life beyond the workplace. Financial literacy, stress management, time management, and resilience are essential in the industry. Workshops on mindfulness, work-life balance, and mental health awareness further equip graduates to develop personally and professionally (Trombeta et al., 2024).

The significance of this study lies in its examination of curricular gaps and industry evolution to understand their impact on student competencies within various disciplines. It delves into the cultural and organizational influences on education and the critical need for improved collaboration between academia and the corporate sector. This study's insights will contribute to the literature on educational preparedness and communication strategies, with the aim of fostering a more proficient workforce in the social sciences. Furthermore, this study examines the educational and socio-emotional factors that influence student competencies within the social sciences. It explores the alignment of tertiary curricula with professional practices, the impact of industry-academia collaboration, and the role of practical training in shaping student preparedness. Additionally, it investigates the cultural and organizational influences on student development. This study aims to identify the factors contributing to the gap between engineering students and industry needs and to propose strategies to enhance the educational experience and meet the evolving demands of the professional landscape.

Hence, the research hypotheses of this study are structured as follows:

H1: The outdated curriculum gaps in STEM education are a cognitive factor influencing the competency of engineering students.

H2: The lack of awareness of artificial intelligence is a cognitive factor influencing the competency of engineering students.

H3: The adoption of artificial intelligence in the industry is a behavioural factor influencing the competency of engineering students.

H4: The insufficient on-the-job training in the industry is a behavioural factor influencing the competency of engineering students.

H5: The limited industry and higher education collaboration is an environmental factor influencing the competency of engineering students.

H6: The cultural and organizational dynamics in the industry are environmental factors influencing the competency of engineering students.

## LITERATURE REVIEW

The science, technology, engineering, and mathematics (STEM) industry is a critical driver of innovation and economic prosperity. However, there is growing concern about graduates' readiness to meet these industry needs. The industry reports a significant skills gap in interpersonal skills, which are essential for driving innovation and maintaining competitiveness (Ayeni et al., 2024). Educational institutions are challenged to align their STEM curricula with the industry's fast-paced, ever-evolving demands. This includes not only imparting technical knowledge but also fostering soft skills like critical thinking, creativity, and teamwork (Hamad et al., 2024). Moreover, Jafarov (2023) reaffirms that integrating emerging technologies, such as AI and machine learning, into the curriculum is becoming increasingly important.

The industry also emphasizes the need for practical, first-hand experience. Internships, co-operative education, and industry-sponsored projects can bridge the gap between theory and practice, providing students with a clearer understanding of real-world challenges (Al-Asfour & Zhao, 2024). Bahri et al. (2024) find that such experiences are invaluable for developing the agility and critical thinking skills that employers highly value. The STEM industry is recognizing the importance of diversity and inclusion in fostering innovation. A diverse workforce brings a variety of perspectives, which is crucial for creativity and problem-solving. Educational programs must, therefore, strive to be more inclusive and supportive of underrepresented groups, ensuring that all students have the opportunity to succeed in STEM fields (Marzuki et al., 2024).

Furthermore, the STEM industry’s rapid evolution necessitates a workforce adept in a diverse array of skills. While technical proficiency remains foundational, the ability to synthesize knowledge across various STEM disciplines is increasingly crucial (Melikuzievich, 2024). This interdisciplinary approach enables professionals to tackle complex challenges with innovative solutions, integrating concepts from multiple fields to create novel applications (Han et al., 2021). Soft skills are equally vital in the STEM landscape. Emotional intelligence, adaptability, and effective teamwork are among the attributes that complement technical expertise. These skills enhance communication, facilitate collaboration, and contribute to successful project outcomes as the demand for a workforce with robust STEM skills is of utmost importance (Keng, 2024).

In today’s economy, cultural competency, and the ability to engage in international collaborations are essential (Ogodo, 2023). STEM professionals must navigate cross-cultural environments with ease, leveraging diverse perspectives to foster innovation. This global mind-set is instrumental in driving progress and maintaining a competitive edge in the international market (Sydon & Phuntsho, 2022). As noted by Abina et al. (2024), the STEM industry requires professionals committed to lifelong learning. The field’s dynamic nature demands continuous skill development to keep pace with technological advancements. This learning agility enables STEM professionals to adapt to new tools, technologies, and methodologies, remaining relevant and effective in their roles (Ko & Law, 2023). They must exhibit cultural competence, learning agility, and a commitment to continuous skill development as the role of STEM professionals is more critical now than ever before (Amalu et al., 2023).

Building upon the established understanding of skills required in the STEM industry, the Social Cognitive Theory (SCT), developed by Albert Bandura in 1997, serves as an extensive framework for comprehending the influence of cognitive, behavioural, and environmental elements on learning and growth (Bandura, 2001). SCT, as explained by Bandura, the significance of factors such as observational learning, self-efficacy, and self-regulation is that, as individuals engage with their surroundings, they assimilate new knowledge and abilities (Egele et al., 2025). In the STEM context, SCT has been used to investigate how students’ perceptions of their capabilities affect their educational and career trajectories (Chen et al., 2024). For instance, self-efficacy beliefs, which are known to shape students’ interest in STEM subjects and their determination to overcome obstacles in these areas, are influenced by personal mastery and experiences, as well as by role models (Kim, 2024; Mensah et al., 2023).

Moreover, the theory's emphasis on the interaction between personal factors and the environment aligns with the need for STEM education to provide supportive learning environments that encourage student participation and drive (Neher-Asylbekov & Wagner, 2023). Additionally, SCT posits that individuals acquire knowledge and behaviors through observational learning, specifically by modeling those they perceive as influential figures (Hui et al., 2025). SCT also emphasizes that observational learning from peers and experts can motivate students to cultivate the required skills (Van Hoe et al., 2024). This is particularly important for underrepresented students in science and engineering, where social cognitive and ethnic variables play a significant role in shaping academic goals (Castle et al., 2024). Moreover, SCT's focus on goal-setting and self-regulation aligns with the STEM industry's emphasis on innovation and problem-solving, where professionals are tasked with achieving complex goals (Sellami et al., 2023). The ability to convey technical information to diverse audiences is valuable, as it bridges the gap between specialists and the broader community (Idris et al., 2023).

SCT provides valuable perspectives on the factors that foster the development of a competent, versatile STEM workforce. By recognizing and applying these factors, educators and industry leaders can devise strategies to improve STEM education and ready students for prosperous careers in this constantly advancing field. The globalized nature of the STEM industry necessitates technologies that support cultural competence and international collaboration (Harlow et al., 2020). Dwivedi et al. (2022) find that tools that enable professionals to engage with diverse perspectives and navigate cross-cultural environments are more likely to be adopted, as they are essential for maintaining a competitive edge in the international market. The dynamic nature of the STEM field requires a commitment to lifelong learning. As emphasized by Grote et al. (2021), technologies that facilitate continuous skill development are crucial for professionals to remain relevant and effective in their roles. Hence, the proposed theoretical framework is illustrated in Figure 1:

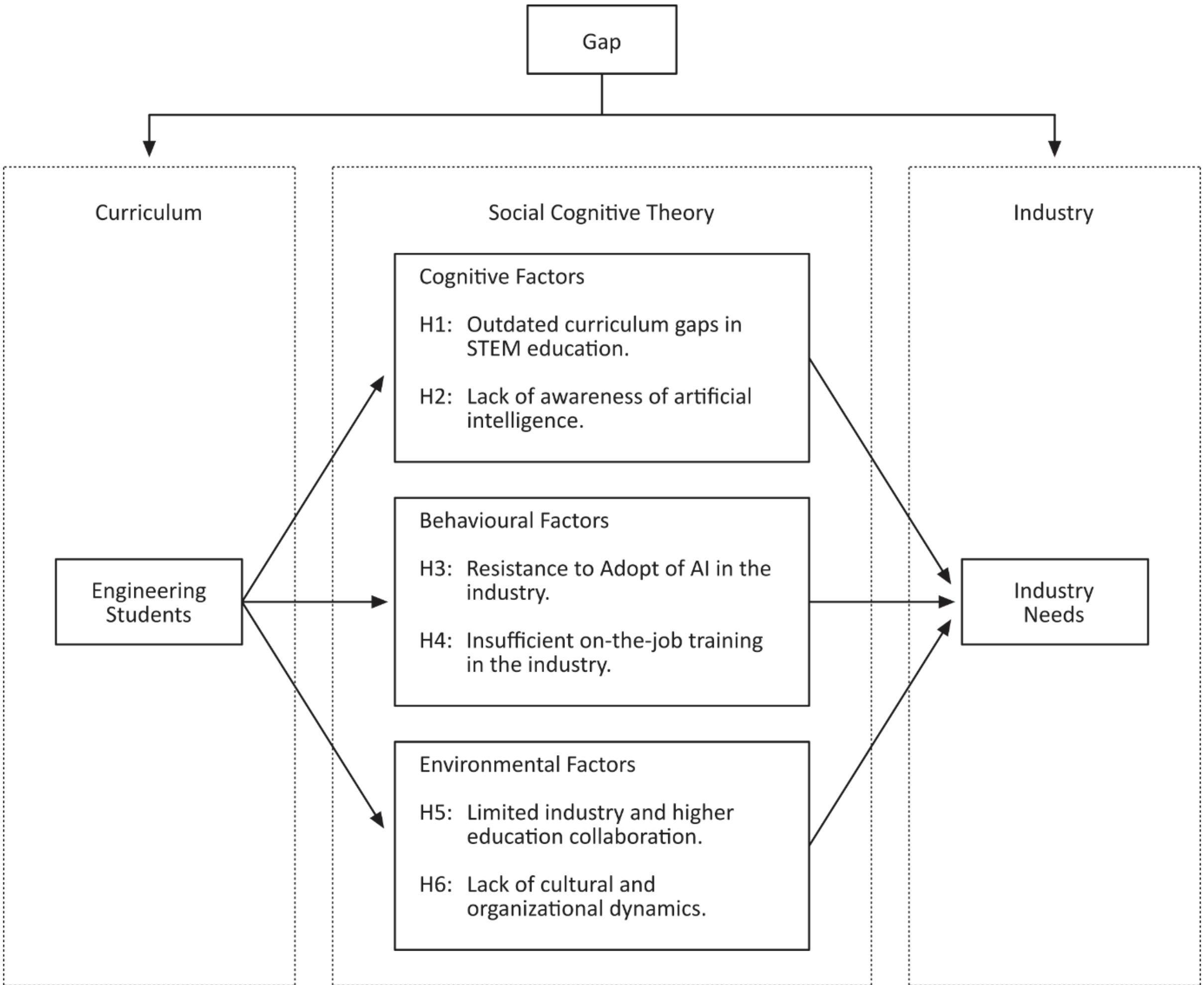


Figure 1: Theoretical Framework of SCT to Bridge the Gap Between Engineering Students and Industry Needs (Adapted from Egele et al., 2025 and Bandura, 2000)

# METHODOLOGY

This study utilizes a descriptive quantitative survey, a methodological approach that enables the systematic collection of countable, empirical data (Dehalwar & Sharma, 2024). This approach is particularly suitable for establishing knowledge that can be quantified and statistically analyzed. The survey's structured format enables the efficient collection of primary data, which will be pivotal in identifying the factors contributing to knowledge gaps among engineering students. This study was adapted from studies conducted by Chatterjee and Bhattacharjee (2020), Ayonmike and Okeke (2016), and Johan (2015) to ensure the instrument's reliability and validity. The survey will feature five-point Likert-scale statements, designed to measure respondents' attitudes towards several factors, with options ranging from strongly disagree to strongly agree. According to Jebb et al. (2021), this scale effectively captures the intensity of respondents' perceptions and provides nuanced insights into their attitudes. Participants were gathered in one week, from June 22, 2023, to June 28, 2023. The subsequent data will be analyzed using descriptive statistics, with mean scores and standard deviations to summarize the data, as emphasized by Cooksey (2020), which ensures that the results are communicated in a clear and accessible manner.

The sample will consist of diploma and degree engineering students from INTI International College Penang (IICP), who will serve as representatives of the broader population affected by the identified skills gap within the engineering curriculum. The study aims to recruit 50 respondents using snowball sampling. Snowball sampling is particularly advantageous in quantitative contexts where the population of interest may be difficult to access. By leveraging existing networks, this non-probability sampling method enables the recruitment of participants who might otherwise be unreachable, thereby ensuring a more representative sample (Atkinson et al., 2021). In conducting this study, ethical considerations will be meticulously observed. Participants will be informed about the purpose of the study, the nature of their involvement, and their rights to confidentiality and anonymity. Informed consent will be obtained from all participants, ensuring that they are fully aware of their participation and can withdraw at any time without penalty.

# RESULTS

This data collection focused on two primary variables, which included gender, with options male and female, to analyse the gender distribution among the participants and to understand any gender-related trends or disparities within the engineering disciplines; and program, with four distinct engineering disciplines included, allowing for a more detailed examination of the representation and preferences across different fields of engineering. The gender composition of the sample shows that 74% of participants are male, whereas 26% are female. Just as with gender, the program also sees one option dominate, with 50% of participants from the Bachelor's in Electrical Engineering. 20% of participants are from the Diploma in Electrical Engineering and the Diploma in Mechanical Engineering, respectively, whereas only 10% are from the Bachelor's in Mechanical Engineering. To provide a clear visual representation of these demographics, the collected data are summarized in Table 1.

Table 1: Distribution of Demographic Information (N=50)

| **Variable** | **Description** | **Distribution** |
|---|---|---|
| Gender | Male | 37 (74%) |
| | Female | 13 (26%) |
| Engineering Discipline | Diploma in Electrical Engineering | 10 (20%) |
| | Diploma in Mechanical Engineering | 10 (20%) |
| | Bachelor in Electrical Engineering | 25 (50%) |
| | Bachelor in Mechanical Engineering | 5 (10%) |

These 50 survey responses were analyzed to identify factors affecting engineering students' competency. By using descriptive statistics, the study provided insight into the data, revealing patterns and trends that might affect students' competence. The mean (*M*) provides insight into the average impact of each factor, while the standard deviations (SD) indicate variability in responses, revealing areas of consensus or divergence among participants. To gauge the influence of each factor on engineering students' competency, 24 survey statements from strongly disagree (SD), disagree (D), neutral (N), agree (A), and strongly agree (SA) were provided across the following six sections, which included outdated curriculum gaps in STEM education; lack of awareness of AI; adoption of AI in the industry; insufficient on-the-job training; limited industry and higher education collaboration; and cultural and organizational dynamics.

In the outdated curriculum gaps in STEM education section of the survey, 60% (N=30) disagreed that the curriculum prepares them for the industry (*M*=2.70, *SD*=1.20). 54% (N=27) disagreed on the curriculum covering necessary skills (*M*=2.24, *SD*=1.29). 46% (N=23) disagreed on the effective incorporation of case studies and projects (*M*=2.88, *SD*=1.08). 56% (N=28) disagreed on the curriculum's currency with industry advancements (*M*=2.82, *SD*=1.17). The relatively low mean for the outdated curriculum gaps in STEM education indicates that the participants have perceived this factor to have a moderate influence on the competency of diploma and degree engineering students. The standard deviation suggests that there is a moderate level of variability among participants' responses, which indicates that there are some differences in the participants' perceptions regarding the extent of this influence. See Table 2 for the results of this section.

Table 2: Outdated Curriculum Gaps in STEM Education Section Results (N=50)

| **Statements** | **SD** | **D** | **N** | **A** | **SA** | ***M*** | ***SD*** |
|---|---|---|---|---|---|---|---|
| Curriculum prepares for industry requirements. | 5 (10%) | 25(50%) | 5(10%) | 10(20%) | 5(10%) | 2.70 | 1.20 |
| Curriculum covers essential industry knowledge. | 22 (44%) | 5(10%) | 15(30%) | 5(10%) | 3(6%) | 2.24 | 1.29 |
| Curriculum includes practical projects and case studies. | 3 (6%) | 20(40%) | 10(20%) | 14 (28%) | 3(6%) | 2.88 | 1.08 |
| Curriculum stays current with industry advancements. | 3 (6%) | 25(50%) | 5(10%) | 12(24%) | 5(10%) | 2.82 | 1.17 |

In the lack awareness and implementation section of the survey, 50% (N=25) disagree on guidance for industry practices (*M*=2.90, *SD*=1.15). 60% (N=30) disagree on support for entrepreneurship (*M*=2.46, *SD*=1.15). 56% (N=28) agree on the importance of certifications and skill development (*M*=3.36, *SD*=1.12). An equal split on assistance in career pursuit (*M*=3.00, *SD*=1.63). This factor obtained an overall mean that indicates that participants perceive this factor to have a moderate level of influence on the competency of diploma and degree engineering students. The standard deviation suggests that there is a moderate level of variability among the participants, indicating that there is variation in the participants' perception regarding the extent of this influence. See Table 3 for the results of this section.

Table 3: Lack of Awareness of AI Section Results (N=50)

| **Statements** | **SD** | **D** | **N** | **A** | **SA** | ***M*** | ***SD*** |
|---|---|---|---|---|---|---|---|
| Guides students on industry practices and trends. | 5(10%) | 15(30%) | 15(30%) | 10(20%) | 5(10%) | 2.90 | 1.15 |
| Fosters entrepreneurship with supportive resources. | 10(20%) | 20(40%) | 10(20%) | 7(14%) | 3(6%) | 2.46 | 1.15 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Emphasizes professional certificates and skill growth. | 5(10%) | 5(10%) | 12(24%) | 23(46%) | 5(10%) | 3.36 | 1.12 |
| Aids in career identification and pursuit. | 15(30%) | 5(10%) | 10(20%) | 5(10%) | 15(30%) | 3.00 | 1.63 |

In the adoption of AI in the industry section of the survey, 66% (N=33) disagree on staying updated with industry practices (*M*=2.56, *SD*=1.13). 50% (N=25) agree that the program stresses continuous software updates (*M*=3.40, *SD*=1.51). 50% (N=25) agree on encouragement for internships and work experiences (*M*=3.60, *SD*=1.31). Equal disagreement and agreement on exposure to emerging technologies like AI (*M*=3.20, *SD*=1.41). This factor obtained a moderate overall mean, this indicates that participants view this factor to have moderate influence on the competency of diploma and degree engineering students. The standard deviation suggests that a moderate level of variability in the participants' perceptions of this factor's extent of influence. See Table 4 for the results of this section.

Table 4: Adoption of AI in the Industry Section Results (N=50)

| **Statements** | **SD** | **D** | **N** | **A** | **SA** | ***M*** | ***SD*** |
|---|---|---|---|---|---|---|---|
| Program updates with new industry practices. | 5(10%) | 27 (54%) | 8 16%) | 5(10%) | 5(10%) | 2.56 | 1.13 |
| Program stresses continuous software updates | 5(10%) | 15 (30%) | 5(10%) | 5(10%) | 20 (40%) | 3.40 | 1.51 |
| Program promotes industry internship experiences | 5(10%) | 3(6%) | 17 (34%) | 7(14%) | 18 (36%) | 3.60 | 1.31 |
| Program provides students with exposure to AI. | 5(10%) | 15 (30%) | 10 (20%) | 5(10%) | 15 (30%) | 3.20 | 1.41 |

In the insufficient on-the-job training section of the survey, 66% (N=33) agree on sufficient practical training (*M*=3.66, *SD*=1.29). 70% (N=35) agree on offering internships and co-ops (*M*=3.88, *SD*=1.22). 50% (N=25) disagree on preparation for on-the-job challenges (*M*=2.56, *SD*=1.18). 38% (N=19) neutral on bridging theory and practice (*M*=3.34, *SD*=1.00). This factor obtained an overall mean that indicates that participants see this factor to have moderate influence on the competency of diploma and degree engineering students. The standard deviation indicates that there is a lower level of variability, indicating that there is less variation in participants' perceptions regarding the extent of the factor's influence. See Table 5 for the results of this section.

Table 5: Insufficient On-the-Job Training Section Results (N=50)

| **Statements** | **SD** | **D** | **N** | **A** | **SA** | ***M*** | ***SD*** |
|---|---|---|---|---|---|---|---|
| Program offers ample practical training. | 5(10%) | 5(10%) | 7 (14%) | 18 (36%) | 15 (30%) | 3.66 | 1.29 |
| Internships and co-ops for hands-on experience. | 3(6%) | 5 (10%) | 7(14%) | 15 (30%) | 20 (40%) | 3.88 | 1.22 |
| Prepares for real-world engineering challenges. | 10 (20%) | 15 (30%) | 17(34%) | 3(6%) | 5(10%) | 2.56 | 1.18 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Bridges theory with practical application. | 3(6%) | 5(10%) | 19(38%) | 18 (36%) | 5 (10%) | 3.34 | 1.00 |

In the limited industry and higher education collaboration section of the survey, 56% (N=28) agree that active industry collaboration is important (*M*=3.64, *SD*=1.19). 70% (N=35) strongly agree on opportunities for guest lectures and industry visits (*M*=3.80, *SD*=1.28). Equal disagreement and agreement on curriculum seeking industry feedback (*M*=2.80, *SD*=1.41). 70% (N=35) strongly agree on assistance with employer connections (*M*=3.76, *SD*=1.32). The results indicated that this factor had an overall mean, suggesting that participants perceived it to have a relatively strong influence on the competence of diploma and degree engineering students. The standard deviation suggests a moderate level of variability in responses, indicating that participants' views vary in the extent of this influence. See Table 6 for the results of this section.

Table 6: Limited Industry and Higher Education Collaboration Section Results (N=50)

| **Statements** | **SD** | **D** | **N** | **A** | **SA** | ***M*** | ***SD*** |
|---|---|---|---|---|---|---|---|
| Active collaboration with industry professionals. | 3(6%) | 5 (10%) | 14 (28%) | 13 (26%) | 15 (30%) | 3.64 | 1.19 |
| Opportunities for guest lectures and plant visits. | 5 (10%) | 3 (6%) | 7 (14%) | 17 (34%) | 18 (36%) | 3.80 | 1.28 |
| Seek industry feedback to improve curriculum. | 15 (30%) | 5 (10%) | 10 (20%) | 15 (30%) | 5 (10%) | 2.80 | 1.41 |
| Assistance in networking with potential employers. | 5 (10%) | 5 (10%) | 5 (10%) | 17 (34%) | 18 (36%) | 3.76 | 1.32 |

In the cultural and organizational dynamics section of the survey, 62% (N=31) agree on promoting teamwork and communication (*M*=3.64, *SD*=1.43). 54% (N=27) agree on encouraging diversity and inclusivity (*M*=3.52, *SD*=1.11). 60% (N=30) agree on fostering innovation and critical thinking (*M*=3.56, *SD*=1.26). 46% (N=23) agree on preparing for diverse work cultures (*M*=3.52, *SD*=1.34). The results obtained for organizational dynamics had an overall mean that suggests that participants view this factor to have moderate influence on the competency of diploma and degree engineering students. The standard deviation indicates that there is a moderate level of variability in participants' perceptions in regard to the extent of this factor's influence. See Table 7 for the results of this section.

Table 7: Cultural and Organizational Dynamics Section Results (N=50)

| **Statements** | **SD** | **D** | **N** | **A** | **SA** | ***M*** | ***SD*** |
|---|---|---|---|---|---|---|---|
| Encourages teamwork and communication skills. | 5(10%) | 9(18%) | 5(10%) | 11(22%) | 20(40%) | 3.64 | 1.43 |
| Dynamics in the organization supports diversity and inclusivity. | 3(6%) | 5(10%) | 15(30%) | 17(34%) | 10(20%) | 3.52 | 1.11 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Values innovation, creativity, and critical thinking. | 5(10%) | 5(10%) | 10(20%) | 17(34%) | 13(26%) | 3.56 | 1.26 |
| Readies students for diverse work cultures. | 5(10%) | 5(10%) | 17(34%) | 5(10%) | 18(36%) | 3.52 | 1.34 |

# DISCUSSION

The duration allocated for this study was 14 weeks, with only one week to gather participants for the survey. Due to the time constraints, careful planning was done to streamline the process, which limited the depth of data collection and analysis. As a result, the study was unable to thoroughly explore all aspects of the study topic. Furthermore, the sample size for the study was relatively small, comprising only 50 participants in the survey. This limited sample size restricted the study's access to a more diverse, larger participant pool, potentially affecting the generalizability of the findings.

The participant demographics of the sample, with a majority enrolled in electrical engineering, not only reflect current trends within IICP but also point to a broader issue of disparities in STEM fields. This disparity has implications for the industry's diversity of thought and innovation. The literature suggests that a diverse workforce is crucial for fostering creativity and problem-solving (Marzuki et al., 2024), and the study's demographic skew indicates a potential underutilisation of female talent in engineering disciplines. The study highlights the multifaceted nature of competency development in the STEM industry and emphasizes the need for educational reforms to address evolving industry requirements. These reforms should aim to enhance curricula, provide practical training, foster industry-academia collaboration, cultivate a diverse and inclusive workforce, and equip students with the necessary competencies for their future roles.

The observed moderate influence of curriculum gaps on students' competencies warrants further analysis. Beyond mere awareness, students' comprehension of these gaps profoundly impacts their readiness for industry roles. Ayeni et al. (2024) aptly raise concerns about graduates' preparedness. To address this, curricular reforms must extend beyond technical knowledge. Soft skills are often overlooked, but they play a pivotal role. Critical thinking, problem-solving, adaptability, and effective teamwork are competencies that flourish in a comprehensive, holistic curriculum. Graduates must not only grasp theoretical concepts but also navigate through the complexities of real-world scenarios. Thus, the curricula should integrate technical and interpersonal training seamlessly, ensuring that graduates emerge as agile, well-rounded professionals (Hamad et al., 2024).

Besides that, the contradiction surrounding AI's relevance and students' understanding of it is intriguing. While students acknowledge AI's importance, they may lack a comprehensive grasp of its transformative impact. Jafarov (2023) advocates for a more immersive approach. It is insufficient for students to merely recognize AI, but they must also wield it effectively. Integrating AI and machine learning pervasively within the curriculum becomes of utmost importance. Consider AI-driven simulations in which students grapple with real-world datasets, fine-tune algorithms, and confront ethical dilemmas. Hands-on projects such as building recommendation systems or training neural networks can play a role to bridge the gap between theory and practice. By doing so, graduates not only comprehend AI's significance but also acquire the practical skills to use it effectively.

Furthermore, this study's alignment with existing literature stresses the urgency for educational institutions to keep up and adopt technological advancements. Al-Asfour and Zhao (2024) emphasizes the need for such agility. As industries embrace AI, blockchain, and quantum computing, graduates must also be adept at translating theory into tangible solutions. The classroom alone is not sufficient in this matter. Practical training like internships and hackathons becomes the foreground where theoretical knowledge fuses with hands-on experience. In such training, graduates have to grapple with messy data, debug code, and collaborate across disciplines. They will learn that innovation thrives at the intersection of theory and practice. Thus, the curricula must be dynamic, mirroring the ever-evolving tech landscape (Bahri et al., 2024).

This study's findings regarding limited collaboration between academia and industry resonate deeply within educational institutions. Graduates often emerge from lecture halls equipped with theoretical knowledge but lacking the practical experience in demand to tackle real-world challenges. The remedy lies in robust partnerships. Industry-academic collaborations where seasoned practitioners and scholarly minds converge yield substantial benefits for graduates. Guest lectures by experienced engineers infuse academic gaps with experiential advice. Additionally, joint research initiatives, whether to optimize supply chains or to design sustainable energy systems, exposes students to such industry complexities. As such, Melikuzievich (2024) strongly advocates for collaborations that nurtures interdisciplinary ethics. Graduates, drawing insights from economics, sociology, and psychology, are better equipped to tackle problems no matter the complexity.

SCT provides a valuable lens for understanding competency development. At its core lies self-efficacy, which can the understood as the unwavering belief in one's own capacity to succeed. Chen et al. (2024), Kim (2024), Mensah et al. (2023), and Bandura (2001) emphasizes on its significance as mentorships nurture self-efficacy. Role models are people with experience who seamlessly blend technical prowess with emotional intelligence. Thus, they can inspire resilience. Graduates persist through code bugs, design flaws, and project pivots, recognizing that competence is not a solitary endeavour. It is a process of learning, unlearning, and relearning. Thus, the curricula should intentionally foster mentorship ecosystems in which graduates find a sense of belonging through shared struggles and celebrate collective accomplishments.

Communication is not confined to syntactical correctness of code and algorithms, as it extends to semantic finesse. Idris et al. (2023) stress that communication is not merely a mechanical assembly of words; it is an intricate landscape in which words take on meaning. Graduates equipped with technical awareness may face the challenge of conveying complex ideas concisely while evoking curiosity. The STEM industry thrives on dialogue; it is a balance where engineers not only connect with their peers but also with designers, marketers, policymakers, and an array of stakeholders. Semantic finesse is the ability to choose the right words for the right audience; it is the difference between advocacy and negotiation, and between resonance and impact. Graduates who can achieve this balance wield a potent ability to convey complex ideas persuasively in a digestible narrative, navigating through semantic nuances to build trust and drive progress.

## CONCLUSION

To sum up, this study provides critical insights into engineering students' perceptions at IICP regarding the determinants of their professional competence. The empirical findings indicate that students perceive the adoption of artificial intelligence, insufficient on-the-job training, limited industry-academia collaboration, and prevailing socio-cultural organizational factors as significant influences on their competence, each impacting their readiness to a greater-than-moderate extent. Consequently, hypotheses H3, H4, H5, and H6 are accepted. Conversely, the data suggest that students perceive outdated curriculum gaps in STEM education and a lack of AI awareness as having a less-than-moderate impact on their professional development, thereby rejecting hypotheses H1 and H2. Within the framework of Social Cognitive Theory (SCT), these outcomes indicate that environmental and behavioural factors associated with industry immersion and technological integration are perceived as more critical than traditional cognitive factors, such as explicit curriculum content. From a communication perspective, this highlights a significant gap in the dialogic alignment between academic instruction and the real-world industrial environment.

Building upon these findings, future research should address several key areas to enhance the generalizability and depth of the current work. First, extending the geographical and institutional scope beyond Penang to include major metropolitan hubs such as Kuala Lumpur and Selangor, or conducting a nationwide survey, would enable a more representative analysis of the Malaysian engineering education landscape. Furthermore, increasing the sample size beyond the initial cohort of 50 participants would strengthen the statistical power and validity of the results. Methodologically, extending future studies to a longitudinal period of 21 weeks or more would enable a more nuanced investigation of how student perceptions and information flows evolve over time.

Additionally, integrating qualitative research methods, such as semi-structured interviews or focus groups, could offer deeper, more granular insights into the complex socio-cultural communication dynamics influencing student competence. Future inquiries should also incorporate a wider range of demographic variables, including race, ethnicity, and socioeconomic status, to ensure a more inclusive and comprehensive understanding of the diverse student population. By addressing these limitations, subsequent scholarship can further refine the communication strategies required to bridge the industry-student gap, fostering a more innovative and competent workforce capable of navigating the rapidly evolving demands of the global industrial sector.

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