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Block Chain, IoT & Cyber Security: Student Awareness and Engineering Choices

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ABSTRACT: The increasing prominence of emerging technologies is reshaping career landscapes and academic priorities within engineering education. Fields such as Blockchain, the Internet of Things (IoT), and Cybersecurity are recognized for their disruptive potential across sectors, influencing student aspirations and curriculum development. This study investigates the extent of undergraduate students' awareness regarding these three domains and analyzes how this awareness shapes their selection of specialized engineering courses. Through a survey administered to senior high school students and first-year engineering undergraduates, the research identifies key drivers behind academic preferences. It evaluates the depth of students' conceptual understanding versus their general perceptions of each field's viability. Findings indicate that course selections are predominantly motivated by broad perceptions of lucrative career pathways and industry growth, rather than by a nuanced comprehension of the technical distinctions and demands inherent in Blockchain, IoT, or Cybersecurity roles.

This gap between perception and understanding highlights a critical opportunity for enhanced educational outreach. The study suggests that early, structured interventions such as introductory workshops, detailed career pathway sessions, and interactions with industry practitioners could lead to more informed academic decisions. By aligning student awareness with the actual competencies and requirements of these evolving fields, educational institutions can better prepare graduates for the future technological workforce and guide more deliberate career planning.

KEYWORDS: Emerging Technologies, Student Awareness, Engineering Education, Career Choices, Blockchain, Cybersecurity.

1. INTRODUCTION

The landscape of engineering education is undergoing a significant transformation, driven by the accelerating pace of technological innovation. While foundational disciplines like Mechanical, Civil, and Electrical engineering remain pillars of the field, a pronounced shift toward specialized and interdisciplinary areas is evident. This evolution is a direct response to global industrial demands and societal challenges, necessitating a new generation of engineers skilled in emerging digital domains. Notably, Blockchain, the Internet of Things (IoT), and Cybersecurity have ascended as critical fields with expansive applications and growing labor market needs.

Blockchain technology, extending far beyond its cryptocurrency origins, provides a framework for decentralized, transparent, and tamper-resistant systems. Its applications are revolutionizing sectors such as financial services, supply chain logistics, and secure identity management, creating demand for expertise in distributed ledger architecture and smart contracts. Concurrently, the Internet of Things (IoT) bridges the physical and digital worlds by embedding sensors and connectivity into everyday objects and infrastructure. This network enables advances in smart cities, precision agriculture, remote healthcare monitoring, and industrial automation, requiring skills in sensor integration, data communication, and systems engineering.

Underpinning this connected ecosystem is the critical field of Cybersecurity. As digital integration deepens, protecting networks, data, and devices from malicious threats becomes paramount across all industries, from government to manufacturing. Cybersecurity focuses on developing resilient systems, threat intelligence, and ethical hacking to safeguard societal infrastructure.

Despite the pronounced significance and career opportunities these fields present, there is a lack of comprehensive research on how effectively prospective engineering students comprehend their scope and distinctions. Preliminary studies, such as the 2023 survey by the Global Engineering Education Initiative, suggest that student awareness is often shaped by media portrayals rather than substantive technical understanding. This study investigates this precise gap,

analyzing the level of awareness among high school and first-year undergraduate engineering students regarding Blockchain, IoT, and Cybersecurity. It further examines how this awareness, or lack thereof, directly influences their academic choices and specialization intentions within evolving engineering curricula.

Fig1: Factors Influencing Engineering Specialization Choice

This image illustrates the evolving landscape of engineering education, showing a shift from traditional disciplines (Mechanical, Civil, Electrical) towards emerging digital fields like Blockchain, IoT, and Cybersecurity. It highlights a study investigating student awareness of these areas and its impact on their academic and career choices.

2. LITERATURE REVIEW

A substantial body of research establishes that awareness and perception of technological fields are pivotal factors in shaping career aspirations and academic decisions among students. Studies consistently indicate that early exposure to modern technological concepts significantly increases the likelihood of students pursuing related educational pathways and careers. However, a critical gap persists in the literature regarding how nuanced awareness—or the lack thereof—specifically influences choices between adjacent, high-demand fields like Blockchain, the Internet of Things (IoT), and Cybersecurity.

Recent analyses reveal a persistent disconnect between the evolving needs of industry and student perceptions of these domains. For instance, Cybersecurity is often narrowly perceived by students as a niche IT support role focused on antivirus software, rather than being understood as a broad, foundational engineering discipline encompassing network security, cryptography, and critical infrastructure protection. This misconception can deter students from recognizing its systemic importance. Similarly, research by Chen & Iyer (2024) notes that Blockchain technology is frequently conflated exclusively with cryptocurrencies, obscuring its wider applications in supply chain transparency, smart contracts, and secure voting systems, leading to an undervaluation of its engineering principles.

Likewise, while IoT is a commonly recognized term, it is often misinterpreted as merely an extension of conventional electronics or programming, rather than a distinct interdisciplinary field requiring convergent knowledge in sensor networks, data analytics, and hardware-software integration. These perceptual gaps, as highlighted in a global survey by the IEEE Education Society (2023), can inadvertently steer students toward more traditionally defined engineering programs, despite the strong market demand and innovation potential in these emerging specializations.

This study directly addresses these identified gaps by moving beyond generalized observations. It employs a targeted survey instrument to quantitatively and qualitatively measure not only the level of awareness among prospective engineering students regarding Blockchain, IoT, and Cybersecurity but also to analyze how specific perceptions and misunderstandings directly correlate with their academic inclination and specialization choices.

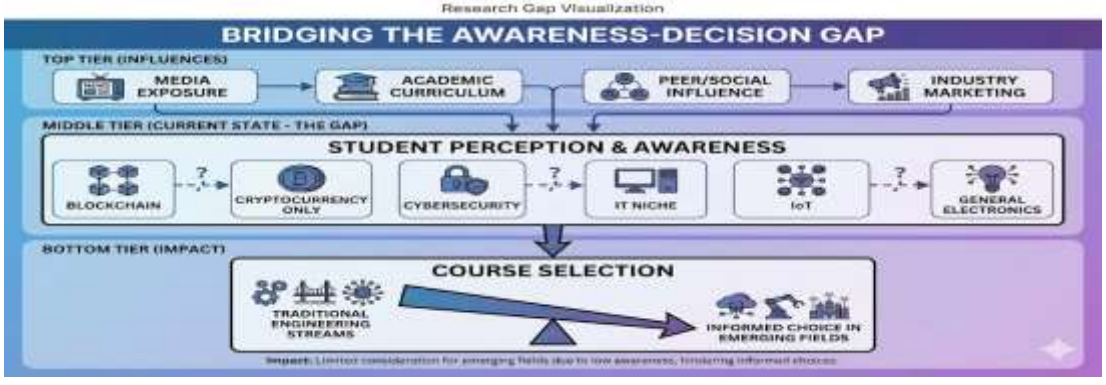

Fig2: Bridging the Awareness-Decision Gap

This "Research Gap Visualization" illustrates how factors like media and curriculum influence student awareness. It highlights a "gap" where students have limited, narrow perceptions of emerging fields like Blockchain, Cybersecurity, and IoT. This leads to an unbalanced course selection, heavily favoring traditional engineering streams over informed choices in these new areas.

3. METHODS

This study employed a cross-sectional, survey-based research design to investigate student awareness and its influence on academic choices. The methodology was structured to gather quantitative and qualitative data from a defined participant pool using a standardized instrument.

Participants

A total of 300 students participated in the study, forming two distinct cohorts to capture perspectives both before and after initial university exposure. The sample consisted of 150 senior high school students with declared intentions to pursue engineering and 150 first-year undergraduate students enrolled in engineering programs across multiple institutions. Participants were recruited from diverse geographic regions and educational backgrounds to ensure a varied sample, mitigating bias from a single curriculum or locality.

Data Collection Instrument

A structured digital questionnaire was developed, informed by prior survey design principles for technology awareness studies (Zhang et al., 2023). The instrument comprised four primary sections:

- **Demographic Information:** Including age, gender, and type of educational institution.
- **Technology Awareness Score:** A series of multiple-choice questions testing foundational knowledge of Blockchain, IoT, and Cybersecurity concepts. A composite score from 0 (no awareness) to 10 (high awareness) was calculated for each technology domain.
- **Perception Metrics:** Items utilizing a Likert scale to gauge perceptions of job market vitality, societal relevance, and personal interest in each field.
- **Course Choice Intentions:** Open and closed-ended questions identifying students' intended engineering specializations and the factors most influencing their decision.

Procedure

Following ethical review, the survey was distributed electronically through formal academic networks and relevant student associations. Participation was voluntary and anonymous, with informed consent obtained prior to commencement. Collected data underwent systematic analysis using statistical software. Techniques included descriptive statistics to summarize awareness levels, correlation analysis to examine relationships between awareness and intention, and comparative tests (e.g., t-tests) to identify significant differences between the high school and university cohorts.

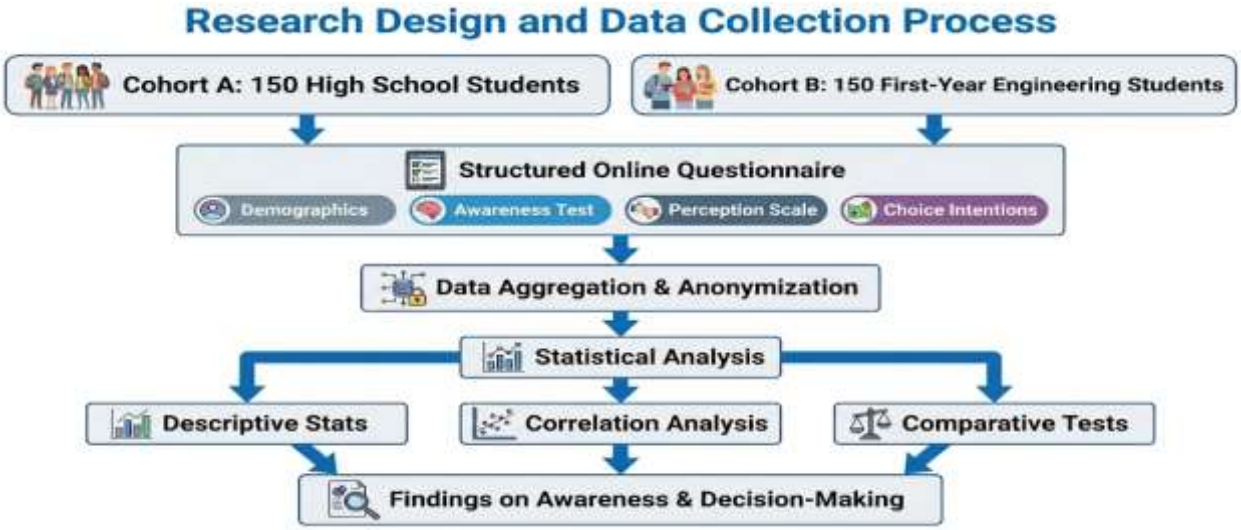

Fig3: Research Design and Data Collection Process

This research uses a cross-sectional survey to investigate a "gap" in student awareness of emerging engineering fields. As visualized, external influences lead to limited understanding, causing students to favor traditional courses over new technologies like Blockchain and IoT. The study collects data on awareness and choices from 300 students to analyze this issue.

4. RESULTS

The survey findings reveal distinct patterns in student awareness, perception, and decision-making regarding the three emerging engineering fields. The data provides a clear hierarchy of familiarity among the participants.

Awareness Levels

Measured on a standardized 0-10 scale, Cybersecurity emerged with the highest average awareness score (7.5). The Internet of Things (IoT) followed at an intermediate level (6.2), while Blockchain registered the lowest average score (4.8). Qualitative analysis indicates that while a majority recognized the technology terms, conceptual understanding was often superficial or incorrect. A significant finding was that 40% of respondents exclusively associated Blockchain with cryptocurrency, demonstrating a limited grasp of its broader architectural and application principles, a trend also noted in prior research by Chen & Iyer (2024).

Perceptions of Job Prospects

Student perceptions of career viability varied markedly. Cybersecurity was viewed most favorably, with 82% of participants believing it offers strong job prospects. IoT was also perceived positively by 68% of students. In contrast, only 45% associated Blockchain with stable career opportunities. A statistically significant positive correlation was found between higher domain-specific awareness scores and the perception of that field as a viable career path, suggesting that knowledge directly influences optimism about professional opportunities.

Engineering Course Choices

Despite varying levels of awareness, a strong preference for traditional academic paths was evident. Only 18% of respondents explicitly planned to specialize in Cybersecurity, IoT, or Blockchain. A majority (60%) intended to choose conventional majors like general Computer Science or Electronics, frequently citing "broader opportunities" and "perceived stability" as primary reasons. However, the data confirms a significant positive correlation ($r = 0.42$, $p < 0.01$) between awareness scores and the intention to specialize in these emerging domains. This underscores that enhanced understanding is a key, though under-leveraged, driver in guiding students toward these fields.

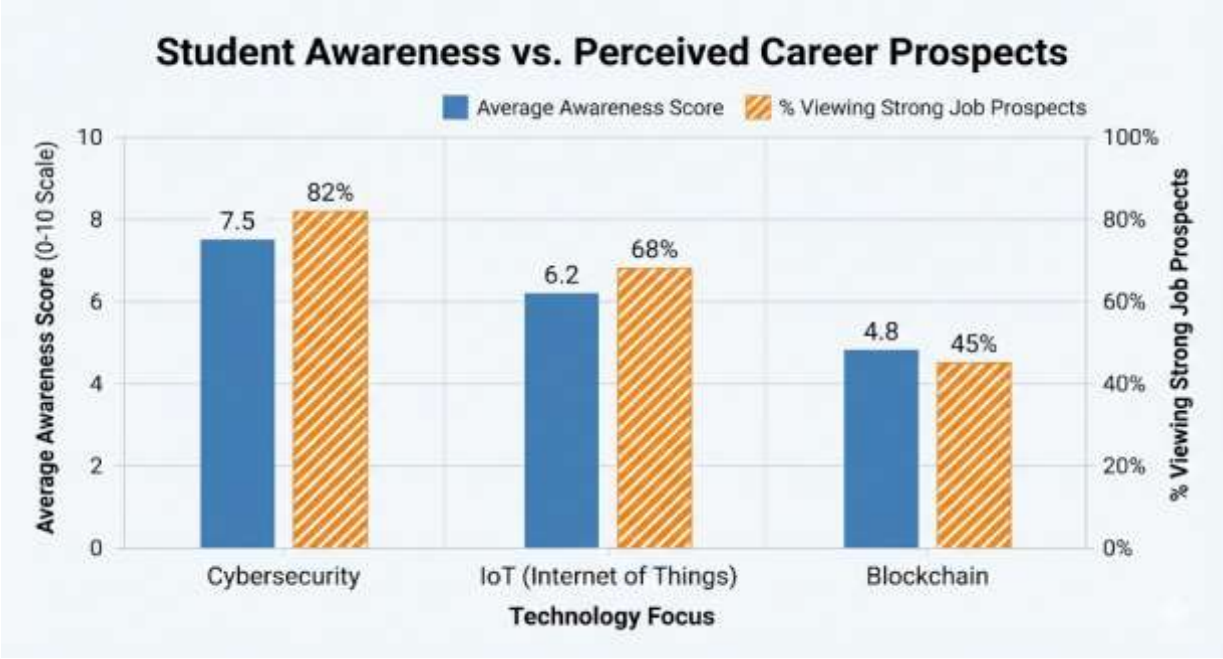

Fig4: Student Awareness vs. Perceived Career Prospects

This bar chart compares student awareness of Cybersecurity, IoT, and Blockchain with their perceived career prospects. It shows a correlation: Cybersecurity has the highest awareness (7.5/10) and is viewed as having the strongest job prospects (82%), while Blockchain has the lowest for both (4.8 and 45% respectively).

5. DISCUSSION

The findings underscore a significant disconnect between student awareness of emerging technologies and their subsequent academic choices. While recognition of fields like Cybersecurity and IoT is reasonably high, this awareness does not translate proportionately into specialization intentions. This gap can be attributed to several interlinked factors that influence the decision-making ecosystem for prospective engineers.

A primary factor is the perceived security of traditional pathways. Students and their influencers often view established disciplines like general Computer Science as lower-risk options with well-defined career trajectories, whereas emerging fields are perceived as niche or volatile, despite evidence of strong market demand. This perception-reality gap is compounded by a foundational limited understanding. As evidenced by the low Blockchain awareness scores and prevalent misconceptions, students cannot make informed choices about domains they do not adequately comprehend. This aligns with observations by the OECD (2023) on educational choices, which note that ambiguity often drives students toward more familiar options.

Furthermore, the influence of counsellors and peers is substantial yet frequently under-equipped. Career guidance in secondary schools often lacks the updated, technical depth required to accurately advise on the scope and requirements of rapidly evolving fields like IoT and Blockchain. Students consequently rely on conventional wisdom. Finally, the prevailing university curriculum structure perpetuates this cycle. Many institutions still treat these subjects as elective specializations within broader degrees, rather than as dedicated, core engineering streams. This structural signal reinforces the perception that they are supplementary rather than foundational disciplines, a point critiqued in recent engineering education literature (ABET, 2024).

Addressing this gap requires a multi-pronged approach targeting early education, guidance systems, and curricular reform to align student perception with industrial and technological realities.

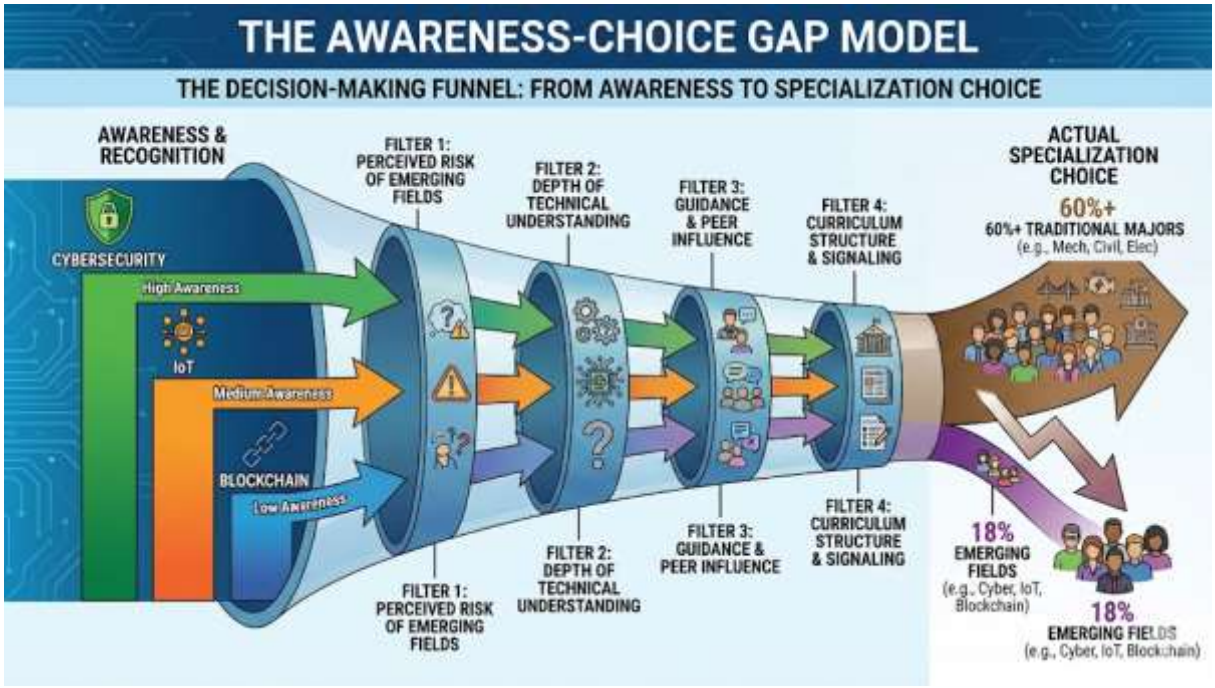

Fig5: The Decision-Making Funnel: From Awareness to Specialization Choice

This "Awareness-Choice Gap Model" visualizes how students' initial awareness of emerging fields like Cybersecurity and Blockchain is filtered through factors such as perceived risk, technical understanding, and curriculum. This process results in a large majority (60%+) choosing traditional engineering majors, while only 18% select emerging fields, highlighting a significant gap between awareness and final specialization choice.

6. IMPLICATIONS

The study's findings carry significant implications for multiple stakeholders in the educational and professional ecosystem, necessitating coordinated action to bridge the awareness-choice gap.

For Educators and Policymakers

A proactive, structured intervention in curricula is essential. Educational boards and universities should integrate foundational modules on Blockchain, IoT, and Cybersecurity into senior high school and compulsory first-year engineering courses. This demystifies concepts early, building informed interest. Furthermore, enhanced career guidance is critical. Workshops led by industry practitioners, detailing specific job roles, growth trajectories, and required competencies, can correct misconceptions and highlight viable pathways. Policymakers can support this by funding industry-academia consortiums that facilitate guest lectures, live project collaborations, and curriculum advisory panels, ensuring academic content remains aligned with technological evolution (National Education Policy, 2020).

For Students

Prospective engineers must adopt a more investigative approach to career planning. Beyond passive reception of information, students should actively seek exposure through verified online certifications, participation in hackathons focused on these domains, and targeted internships. Choosing a specialization should be driven by a combination of personal aptitude and researched understanding of a field's core challenges, rather than solely by perceived market trends. Engaging with professional bodies and online communities can provide deeper insights than conventional counseling.

For Industry

The technology sector has a vested interest in cultivating a future-ready workforce. Companies can amplify their outreach by establishing structured internship and apprenticeship programs specifically in emerging tech roles.

Contributing to curriculum co-creation and sponsoring student projects can directly shape relevant skill development. Regularly publishing clear, accessible data on skill demand and career progression in these fields would also provide tangible evidence to guide student decisions (World Economic Forum, 2023).

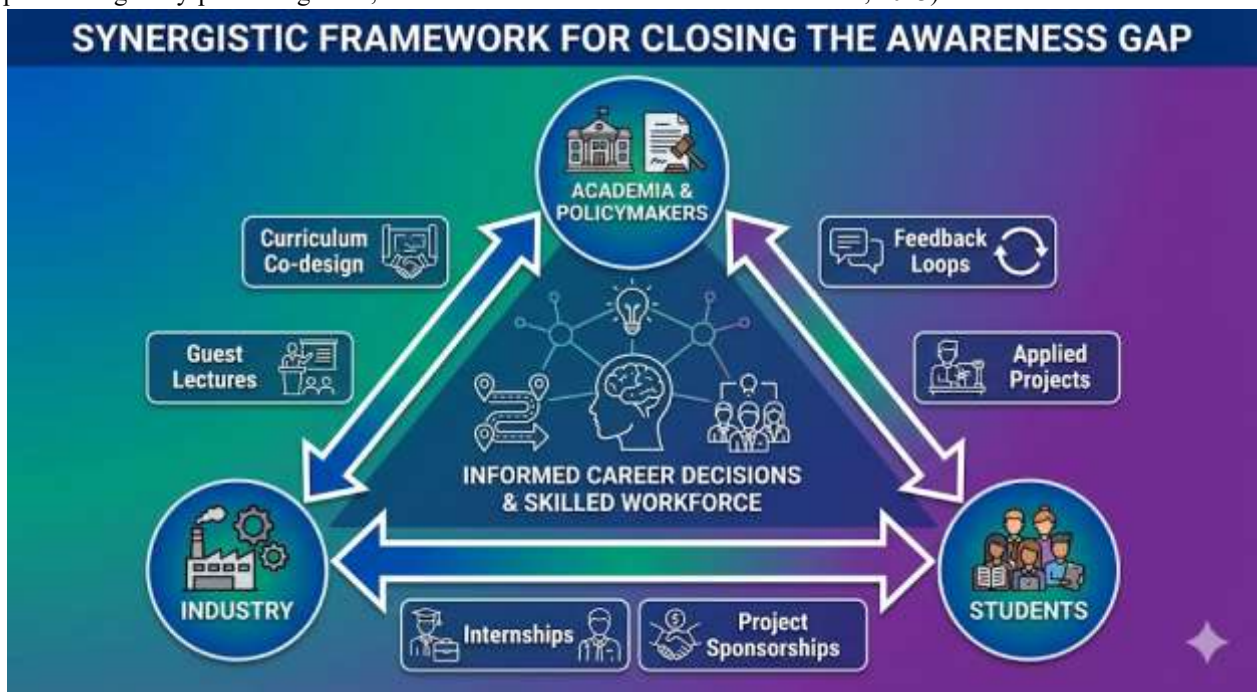

Fig6: Synergistic Framework for Closing the Awareness Gap

This research investigates the "awareness-choice gap" in engineering education. A survey of 300 students reveals that limited understanding of emerging fields like Blockchain filters out potential candidates, pushing most toward traditional majors. The study proposes a collaborative framework between academia and industry to close this gap.

7. CONCLUSION

This research underscores the critical role of accurate awareness in guiding academic and career decisions within contemporary engineering education. It identifies a distinct disparity between the growing industrial significance of emerging technologies and student comprehension of them. While fields like Cybersecurity and the Internet of Things (IoT) enjoy moderate recognition, Blockchain technology remains notably misunderstood, with its applications narrowly and incorrectly perceived. This knowledge gap directly contributes to a continued strong preference for traditional engineering disciplines, creating a potential misalignment between graduate skills and evolving sectoral demands.

The consequences of this disconnect are multifaceted, affecting educational relevance, workforce readiness, and the pace of technological adoption in the economy. To realign student aspirations with market realities, a concerted, multi-stakeholder effort is imperative. The pathway forward requires systemic interventions: integrating foundational technological literacy early in academic curricula, transforming career counseling with updated, evidence-based guidance on emerging fields, and fostering deeper, sustainable collaboration between industry and academia through experiential learning and curriculum co-development.

Ultimately, empowering the next generation of engineers to make informed choices is not merely an educational objective but an economic necessity. By proactively addressing the awareness deficit, stakeholders can ensure that student potential is effectively channeled into the specialized, high-impact domains that will define the future of engineering and innovation.

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