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Exploring the Lived Experiences of CSE Undergraduates in Developing Professional Identity: A Phenomenological Study

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Abstract: The development of professional identity among Computer Science and Engineering (CSE) undergraduates is a critical yet complex process shaped by academic, social, and experiential factors. This study employs a qualitative phenomenological approach, drawing on secondary data, to explore the lived experiences of CSE students as they construct their professional identities. Drawing on established theoretical frameworks, including Social Identity Theory, Communities of Practice, and Professional Identity Formation, the research identifies key influences, including self-efficacy development, experiential learning opportunities, mentorship, curriculum design, and digital engagement. The findings reveal that professional identity formation is dynamic and nonlinear, characterised by periods of uncertainty, growth, and transformation. Experiential learning and participation in collaborative and digital communities emerge as significant catalysts in bridging the gap between theoretical knowledge and professional practice. However, institutional constraints and unequal access to resources continue to shape students' identity trajectories. The study contributes to the growing discourse on computing education by providing a holistic understanding of identity development and offering implications for curriculum reform, pedagogical innovation, and inclusive learning environments.

Keywords: professional identity, CSE undergraduates,
phenomenology, experiential learning, communities of practice, self-
efficacy, digital learning

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1. Introduction

The accelerating pace of technological advancement in the twenty-first century has fundamentally transformed the expectations placed upon graduates of Computer Science and Engineering (CSE) programs. In addition to mastering technical competencies such as programming, systems design, and algorithmic thinking, students are increasingly expected to cultivate a coherent professional identity that aligns with the ethical, collaborative, and innovative demands of the global technology sector (Trede et al., 2012). Professional identity formation (PIF) has thus emerged as a critical dimension of higher education, particularly in disciplines such as CSE, where the boundaries of knowledge and practice are continually evolving.

Professional identity can be broadly understood as the internalised set of values, beliefs, norms, and practices that define an individual's sense of belonging within a professional community (Ibarra, 1999). In the context of CSE education, this involves not only the acquisition of technical expertise but also the development of a “computing mindset,” ethical awareness, problem-solving orientation, and a sense of responsibility toward societal impacts of technology. However, the process through which undergraduate students develop this identity is complex, nonlinear, and influenced by multiple interacting factors, including curriculum design, peer interaction, mentorship, and exposure to real-world experiences.

The undergraduate years represent a formative stage in the identity development process. During this period, students transition from novices with limited understanding of professional expectations to emerging practitioners who begin to internalise the norms and values of the computing profession (Stevens et al., 2008). Yet, this transition is often fraught with challenges. Many students struggle with issues such as imposter syndrome, lack of confidence, and uncertainty regarding career pathways, particularly in highly competitive and rapidly changing technological environments (Bandura, 1997). These challenges are further compounded in developing country contexts, where resource constraints, limited industry exposure, and rigid educational structures may hinder opportunities for experiential learning.

In recent years, scholars have increasingly emphasised the importance of experiential and situated learning in fostering professional identity formation. According to experiential learning theory, knowledge is constructed through the transformation of experience, suggesting that hands-on activities such as internships, collaborative projects, and participation in coding communities play a crucial role in shaping students' professional self-concept (Kolb, 1984). Similarly, the concept of communities of practice highlights the importance of social participation in learning, where individuals develop identity through engagement with more experienced members of a professional community (Lave & Wenger, 1991). For CSE students, such communities may include academic peer groups, open-source

development platforms, and professional networks.

Despite growing recognition of the importance of professional identity in engineering and computing education, there remains a relative scarcity of research focusing specifically on the lived experiences of CSE undergraduates. Much of the existing literature has concentrated on engineering students broadly, often overlooking the unique characteristics of computing disciplines, such as the abstract nature of programming, the prevalence of self-directed learning, and the influence of digital communities (Bennett et al., 2010). Moreover, there is limited integration of phenomenological approaches that seek to understand how students themselves perceive and interpret their identity development processes.

This study addresses these gaps by adopting a phenomenological perspective to explore the lived experiences of CSE undergraduates in developing their professional identity. Phenomenology, as a qualitative research approach, is particularly well-suited for examining subjective experiences and uncovering the meanings individuals assign to their experiences (Creswell, 2013). By synthesising secondary qualitative data from diverse sources, this research aims to identify common themes and patterns that characterise the identity formation process among CSE students.

The significance of this study lies in its potential to inform educational practice and policy. Understanding how students develop professional identity can provide valuable

insights for curriculum design, teaching strategies, and institutional support systems. For instance, integrating experiential learning opportunities, fostering mentorship relationships, and leveraging digital learning platforms may enhance students' engagement and identity formation. Furthermore, the findings may contribute to the broader discourse on higher education reform, particularly in developing countries where there is an urgent need to align educational outcomes with labour market demands.

In summary, this study seeks to contribute to the growing body of literature on professional identity formation by offering a comprehensive analysis of the lived experiences of CSE undergraduates. By situating these experiences within established theoretical frameworks and examining them through a phenomenological lens, the research provides a nuanced understanding of how students navigate the complex process of becoming computing professionals.

2. Literature Review

Professional identity has been widely examined across disciplines as a multidimensional construct encompassing cognitive, social, and emotional components. It reflects how individuals perceive themselves within a professional role and how they align their personal values with the norms and expectations of their chosen field (Ibarra, 1999). According to Trede et al. (2012), professional identity is not a fixed attribute but a dynamic and evolving process shaped by ongoing experiences and interactions.

Scholars have emphasised that professional identity formation involves both internal and external processes. Internally, individuals engage in self-reflection and meaning-making, while externally, they are influenced by socialisation processes, institutional structures, and cultural contexts (Cruess et al., 2015). This dual nature underscores the importance of considering both individual agency and contextual factors in understanding identity development.

2.1 Professional Identity in Engineering and Computing Education

The study of professional identity in engineering education has gained significant attention over the past two decades. Stevens et al. (2008) describe engineering identity as the process of “becoming an engineer,” which involves acquiring technical competence, adopting professional norms, and gaining recognition from others within the field. However, research indicates that many students struggle to develop a strong sense of identity due to limited opportunities for authentic practice and engagement.

In the context of CSE, the challenges of identity formation are further compounded by the abstract and rapidly evolving nature of the discipline. Unlike traditional engineering fields, where physical artefacts provide tangible evidence of work, computing often involves intangible outputs such as code and algorithms, which may be less visible and harder to contextualise (Bennett et al., 2010). This can lead to difficulties in understanding the real-world relevance of academic learning.

Moreover, the culture of computing, characterised by individual problem-solving, competitive environments, and rapid technological change, can create additional barriers to identity development. Students may feel isolated or overwhelmed, particularly if they lack prior experience or access to supportive learning environments. These challenges highlight the need for pedagogical approaches that promote collaboration, inclusivity, and real-world engagement.

2.2 Role of Experiential Learning

Experiential learning has been identified as a key driver of professional identity formation. Kolb’s (1984) experiential learning theory posits that knowledge is created through a cyclical process involving concrete experience, reflective observation, abstract conceptualisation, and active experimentation. In CSE education, this translates into activities such as internships, project-based learning, hackathons, and participation in open-source communities.

Empirical studies have shown that students who engage in experiential learning opportunities are more likely to develop confidence, practical skills, and a sense of professional belonging (Trede et al., 2012). These experiences provide a bridge between theoretical knowledge and real-world application, enabling students to test and refine their understanding in authentic contexts.

Furthermore, experiential learning fosters the development of soft skills such as communication, teamwork, and problem-solving, which are essential components of

professional identity. By working on real-world problems, students gain insight into the ethical and सामाजिक implications of their work, thereby enhancing their sense of responsibility as computing professionals.

2.3 Communities of Practice and Social Learning

The concept of communities of practice, introduced by Lave and Wenger (1991), provides a valuable framework for understanding how professional identity develops through social interaction. According to this theory, learning occurs through participation in shared practices, where novices gradually move from peripheral to full participation.

In the context of CSE, communities of practice may include academic cohorts, programming clubs, online forums, and professional networks. Platforms such as GitHub and Stack Overflow serve as global communities where students can collaborate, share knowledge, and gain recognition for their contributions. Participation in these communities not only enhances technical skills but also reinforces a sense of belonging and identity.

Mentorship is another critical aspect of social learning. Experienced practitioners provide guidance, feedback, and role modelling, helping students navigate the complexities of the profession. Research indicates that mentorship relationships significantly influence students' confidence, motivation, and career aspirations (Cruess et al., 2015).

2.4 Self-Efficacy and Identity Development

Self-efficacy, defined as an individual's belief in their ability to perform specific tasks, plays a central role in professional identity formation (Bandura, 1997). In CSE education, self-efficacy influences students' willingness to engage with challenging tasks, persist in the face of difficulties, and pursue career opportunities.

Studies have shown that self-efficacy is shaped by factors such as prior experience, feedback, and social support. Students who experience success in coding tasks or receive positive reinforcement from peers and instructors are more likely to develop a strong sense of competence and identity. Conversely, repeated failure or lack of support can lead to self-doubt and disengagement.

2.5 Digital Learning Environments and Identity Formation

The rise of digital technologies has transformed the landscape of CSE education, creating new opportunities for learning and identity development. Online platforms, coding bootcamps, and virtual communities provide accessible and flexible learning environments that complement traditional education.

These digital spaces enable students to engage in self-directed learning, collaborate with peers across geographical boundaries, and showcase their work to a global audience. As a result, they play a significant role in shaping professional identity by

providing opportunities for recognition, feedback, and continuous learning.

However, the reliance on digital environments also presents challenges, such as information overload, a lack of structured guidance, and the potential exclusion of students with limited access to technology. Addressing these challenges requires a balanced approach that integrates digital and traditional learning methods.

2.6 Phenomenological Approaches to Identity Research

Phenomenology offers a unique lens for exploring professional identity by focusing on individuals' lived experiences and the meanings they assign to those experiences (Creswell, 2013). Unlike quantitative approaches that seek to measure identity, phenomenology aims to understand how identity is experienced and constructed in everyday contexts.

In the field of education, phenomenological studies have been used to explore students' experiences of learning, engagement, and identity development. These studies provide rich, nuanced insights that complement broader theoretical frameworks. However, there remains a need for more phenomenological research specifically focused on CSE undergraduates.

2.7 Research Gap

Despite the growing body of literature on professional identity formation, several gaps remain. First, there is limited research focusing specifically on CSE students, particularly in developing country contexts. Second, existing studies often rely on

quantitative methods, which may not capture the depth and complexity of lived experiences. Third, there is a lack of synthesis across different contexts and data sources.

This study addresses these gaps by adopting a phenomenological approach based on secondary qualitative data, providing a comprehensive and contextually rich understanding of how CSE undergraduates develop their professional identity.

3. Theoretical Framework

The development of professional identity among Computer Science and Engineering (CSE) undergraduates is a complex and multidimensional process that cannot be adequately explained by a single theoretical lens. This study adopts an integrative theoretical framework combining Social Identity Theory, Communities of Practice, and Professional Identity Formation (PIF) to provide a comprehensive understanding of how students construct and negotiate their professional identities. These frameworks collectively illuminate the cognitive, social, and experiential dimensions of identity development.

3.1 Social Identity Theory

Social Identity Theory (SIT), originally proposed by Tajfel and Turner (1979), posits that individuals derive a significant portion of their self-concept from their membership in social groups. Identity is thus not solely an individual construct but is shaped through processes of categorisation, identification, and comparison. In the context of CSE education, students begin to identify

themselves as members of the “computing community,” which includes programmers, software engineers, and technology innovators.

This identification process involves both inclusion and differentiation. Students seek to align themselves with perceived norms and values of the computing profession, such as analytical thinking, innovation, and problem-solving, while distinguishing themselves from non-members (Tajfel & Turner, 1979). The extent to which students internalise these professional attributes significantly influences their sense of belonging and confidence within the field.

However, identity formation through SIT is not uniform. Factors such as gender, socio-economic background, and prior exposure to computing can affect students’ ability to identify with the professional group. For instance, underrepresented groups in computing may experience identity dissonance due to a lack of representation or perceived exclusion (Stevens et al., 2008). Thus, SIT highlights the importance of inclusive educational environments that foster a sense of belonging for all students.

3.2 Communities of Practice

The theory of Communities of Practice (CoP), developed by Lave and Wenger (1991), provides a social learning perspective on identity formation. According to this framework, learning occurs through participation in shared practices within a community. Newcomers engage in “legitimate peripheral participation,” gradually moving toward full participation as they gain experience and competence.

In CSE education, communities of practice can take various forms, including classroom environments, project teams, coding clubs, internships, and online platforms such as GitHub. Through active participation in these communities, students not only acquire technical skills but also learn the norms, values, and behaviours associated with the profession.

A key concept within CoP is the idea that identity is formed through participation. As students engage in collaborative coding, debugging, and problem-solving activities, they begin to see themselves as legitimate members of the computing community. This process is reinforced through feedback, recognition, and shared experiences (Lave & Wenger, 1991).

Moreover, CoP emphasises the role of mentorship and guided learning. Experienced practitioners serve as role models, providing scaffolding that enables novices to develop both competence and confidence. This aligns with research indicating that mentorship significantly enhances professional identity formation by offering guidance, validation, and career insights (Cruess et al., 2015).

3.3 Professional Identity Formation (PIF)

Professional Identity Formation (PIF) provides a developmental perspective on how individuals internalise the values, norms, and responsibilities of a profession over time. Originally conceptualised in medical education, PIF has been increasingly applied to other professional fields, including engineering and computing (Cruess et al., 2015).

PIF is characterised by a continuous process of socialisation, reflection, and integration. Students are not passive recipients of knowledge but active participants in shaping their professional identities. This involves reconciling personal values with professional expectations, navigating ethical dilemmas, and developing a sense of responsibility toward society.

In the context of CSE, PIF is particularly due to the ethical implications of technology. Issues such as data privacy, algorithmic bias, and cybersecurity require students to develop not only technical competence but also ethical awareness. Through exposure to real-world scenarios and reflective practices, students begin to internalise these professional responsibilities.

Furthermore, PIF emphasises the role of experiential learning in identity development. Experiences such as internships, capstone projects, and industry collaborations provide opportunities for students to apply their knowledge in authentic contexts, thereby reinforcing their professional identity (Kolb, 1984).

3.4 Integrative Framework

The integration of SIT, CoP, and PIF provides a holistic understanding of professional identity formation among CSE undergraduates. SIT explains how students develop a sense of belonging within the computing community; CoP highlights the role of social participation and learning; and PIF emphasises the internalisation of professional values and responsibilities.

Together, these frameworks suggest that professional identity is shaped through a dynamic interplay of individual cognition, social interaction, and experiential learning. This integrative perspective is particularly valuable for a phenomenological study, as it allows for the exploration of multiple dimensions of students' lived experiences.

4. Methodology

This study adopts a qualitative phenomenological research design, which is particularly suited for exploring the lived experiences of individuals and the meanings they assign to those experiences. Phenomenology seeks to understand the essence of a phenomenon by examining how it is perceived and experienced by individuals (Creswell, 2013).

In this study, the phenomenon of interest is the development of professional identity among CSE undergraduates. A phenomenological approach allows for an in-depth exploration of students' subjective experiences, capturing the complexities and nuances that may not be accessible through quantitative methods.

4.1 Use of Secondary Qualitative Data

Unlike traditional phenomenological studies that rely on primary data collection (e.g., interviews), this research utilises secondary qualitative data. These data sources include:

- Peer-reviewed journal articles containing student narratives
- Reflective essays and case studies
- Institutional and educational reports

- Online discussion forums and blogs

The use of secondary data offers several advantages. It allows for the analysis of a broader range of experiences across different contexts and reduces the time and resource constraints associated with primary data collection. Moreover, secondary data provide access to rich, previously documented narratives that can be reinterpreted through a phenomenological lens (Heaton, 2004).

4.2 Sampling Strategy

A purposive sampling strategy was employed to select relevant data sources. Inclusion criteria included:

- Focus on CSE or closely related disciplines
- Inclusion of qualitative data reflecting student experiences
- Publication in credible academic or institutional sources
- Relevance to professional identity or related constructs

This approach ensures that the selected data are both relevant and information-rich, enabling a comprehensive analysis of the phenomenon.

4.3 Data Analysis Procedure

The study employs thematic analysis, following the framework proposed by Braun and Clarke (2006). The analysis process involved several:

Data Familiarisation: The researcher engaged in repeated reading of the selected data sources to gain a deep understanding of the content.

Initial Coding: Relevant segments of text were coded based on their significance to professional identity formation. Codes included themes such as “self-efficacy,” “mentorship,” “experiential learning,” and “peer interaction.”

Theme Development: Codes were grouped into broader themes that captured recurring patterns across the data. These themes were refined through iterative analysis.

Interpretation: The identified themes were interpreted in relation to the theoretical framework, allowing for a deeper understanding of how professional identity is constructed.

4.4 Trustworthiness and Rigour

To ensure the credibility and rigour of the study, several strategies were employed:

- **Credibility:** Use of multiple data sources (triangulation) to validate findings
- **Dependability:** Transparent documentation of the research process
- **Confirmability:** Reflexive consideration of researcher bias
- **Transferability:** Detailed description of context to enable application to other settings (Lincoln & Guba, 1985)

4.5 Ethical Considerations

As the study relies on secondary data, ethical concerns primarily relate to proper attribution and responsible use of existing materials (Mannan & Farhana, 2026). All sources were appropriately cited in accordance with APA

(7th ed.) guidelines. No confidential or sensitive data was used.

4.6 Limitations of the Methodology

While secondary data analysis offers several benefits, it also has limitations. The researcher has no control over the original data collection process, which may affect the depth and consistency of the data. Additionally, the absence of direct interaction with participants limits the ability to probe deeper into specific experiences.

Despite these limitations, the use of diverse and credible data sources enhances the robustness of the findings and provides a comprehensive understanding of the phenomenon.

5. Findings and Analysis

The phenomenological analysis of secondary qualitative data reveals that the development of professional identity among CSE undergraduates is a multifaceted and evolving process shaped by cognitive, social, institutional, and technological influences. Five major themes emerged from the analysis: struggles with self-efficacy and identity uncertainty, the transformative role of experiential learning, the influence of mentorship and peer communities, curriculum-induced identity gaps, and the emergence of digital professional identities through online engagement. These themes are interrelated and collectively illustrate the dynamic process of identity formation.

5.1 Struggles with Self-Efficacy and Identity Uncertainty

A prominent theme across the data is the persistent struggle with self-efficacy, particularly during the early stages of undergraduate education. Many students reported feelings of inadequacy, self-doubt, and “imposter syndrome,” especially when confronted with complex programming tasks or when comparing themselves to peers with prior experience. These experiences align with Bandura’s (1997) conceptualisation of self-efficacy as a critical determinant of motivation and performance.

Students often enter CSE programs with varying levels of prior exposure to computing. Those without a strong background frequently experience a sense of marginalisation, which can hinder their ability to identify with the professional community. This disparity creates a stratified learning environment where confidence becomes unevenly distributed, reinforcing identity uncertainty.

Furthermore, the abstract nature of computing exacerbates these challenges. Unlike disciplines with tangible outputs, such as civil or mechanical engineering, CSE students often struggle to visualise the real-world impact of their work (Bennett et al., 2010). This lack of visibility can lead to a disconnect between academic tasks and professional identity, making it difficult for students to perceive themselves as “real” engineers or developers.

Over time, however, many students reported gradual improvement in self-efficacy through repeated practice, feedback, and successful

task completion. This progression underscores the importance of mastery experiences in building confidence and fostering identity development (Bandura, 1997).

5.2 Transformative Role of Experiential Learning

Experiential learning emerged as a central factor in the formation of professional identity. Activities such as internships, capstone projects, hackathons, and collaborative assignments provided students with opportunities to apply theoretical knowledge in real-world contexts. These experiences were frequently described as “turning points” that significantly enhanced students’ confidence and sense of belonging within the computing profession.

From a phenomenological perspective, these experiences represent moments of “identity crystallisation,” where abstract concepts are transformed into lived realities. Students reported that working on real-world problems allowed them to see the practical relevance of their skills, thereby strengthening their professional self-concept.

This finding is consistent with Kolb’s (1984) experiential learning theory, which emphasises the role of concrete experience in knowledge construction. Through iterative cycles of action and reflection, students develop not only technical competence but also a deeper understanding of professional norms and expectations.

Moreover, experiential learning facilitated the development of soft skills such as teamwork, communication, and problem-

solving. These competencies are integral to professional identity, as they enable students to function effectively within multidisciplinary teams and organisational settings (Trede et al., 2012).

However, access to experiential learning opportunities was not uniform. Students from resource-constrained institutions or regions reported limited exposure to internships and industry collaborations, highlighting systemic inequalities that can impact identity formation.

5.3 Influence of Mentorship and Peer Communities

The role of social interaction in identity development is strongly reflected in the influence of mentorship and peer communities. Students consistently highlighted the importance of guidance from instructors, senior students, and industry professionals in shaping their understanding of the profession.

Mentors served as role models, providing not only technical guidance but also insights into career pathways and professional expectations. Through observation and interaction, students internalised the behaviours and attitudes associated with successful practitioners. This process aligns with the concept of legitimate peripheral participation within Communities of Practice (Lave & Wenger, 1991).

Peer communities also played a critical role in fostering a sense of belonging. Collaborative learning environments, such as group projects and coding clubs, enabled students to share knowledge, solve problems

collectively, and support one another. These interactions contributed to the development of a shared identity as members of the computing community.

Importantly, peer validation emerged as a key factor in identity affirmation. Positive feedback from peers and recognition of contributions enhanced students' confidence and reinforced their sense of competence. Conversely, negative experiences, such as exclusion or lack of recognition, could undermine identity development.

5.4 Curriculum-Induced Identity Gaps

A significant finding of the analysis is the existence of a gap between academic curricula and professional practice. Many students reported that traditional curricula are heavily focused on theoretical knowledge, with limited emphasis on practical application. This disconnect creates challenges in translating academic learning into professional identity.

Students often described their coursework as “detached” from real-world scenarios, leading to a lack of clarity about their future roles as professionals. This issue is particularly pronounced in institutions where curriculum reform has not kept pace with industry developments.

The rigidity of curricula also limits opportunities for creativity and innovation, which are essential components of professional identity in the computing field. Students expressed a desire for more flexible and interdisciplinary learning experiences

that reflect the dynamic nature of the industry.

This finding supports previous research highlighting the need for curriculum redesign to incorporate experiential learning, industry engagement, and reflective practices (Stevens et al., 2008).

5.5 Emergence of Digital Professional Identities

The rise of digital platforms has introduced a new dimension to professional identity formation. Online communities such as GitHub, Stack Overflow, and LinkedIn provide spaces where students can showcase their work, collaborate with others, and engage with global networks.

Participation in these platforms enables students to construct a “digital professional identity” that extends beyond the classroom. Through activities such as contributing to open-source projects, answering technical questions, and building online portfolios, students gain recognition and validation from the broader computing community.

These digital interactions also facilitate self-directed learning, allowing students to explore areas of interest and develop specialised skills. The ability to receive feedback from a global audience enhances learning and reinforces identity development.

However, reliance on digital platforms also presents challenges, including information overload, competition, and the pressure to maintain an online presence. Despite these challenges, digital communities remain a powerful tool for identity formation in CSE education.

6. Discussion

The findings of this study provide a comprehensive understanding of how CSE undergraduates develop their professional identity through a complex interplay of individual, social, and institutional factors. By integrating the themes identified in the analysis with the theoretical framework, this discussion offers deeper insights into the mechanisms underlying identity formation.

6.1 Identity Formation as a Dynamic and Nonlinear Process

The findings underscore that professional identity formation is not a linear progression but a dynamic and iterative process characterised by periods of uncertainty, growth, and transformation. This aligns with the Professional Identity Formation (PIF) framework, which conceptualises identity as continuously evolving through socialisation and reflective practice (Cruess et al., 2015).

Students' experiences of self-doubt and imposter syndrome highlight the challenges of identity development. These experiences are not merely obstacles but integral components of the learning process, as they prompt reflection and motivate skill development. Over time, repeated exposure to successful experiences contributes to the consolidation of professional identity.

6.2 Role of Social Identity and Belonging

Social Identity Theory provides a valuable lens for understanding the importance of belonging in identity formation. The findings indicate that students' identification with the computing community is influenced by their

interactions with peers, mentors, and broader professional networks (Tajfel & Turner, 1979).

A sense of belonging is particularly important in CSE, where the culture of the discipline can be perceived as exclusive or competitive. Inclusive learning environments that promote diversity and collaboration are essential for fostering positive identity development. Institutions must therefore prioritise initiatives that enhance inclusivity and representation.

6.3 Experiential Learning as a Catalyst for Identity Development

Experiential learning emerged as a critical catalyst for professional identity formation. The transformative impact of internships and project-based learning supports Kolb's (1984) assertion that knowledge is constructed through experience. These activities provide students with opportunities to apply theoretical knowledge, develop practical skills, and engage with real-world challenges.

From a theoretical perspective, experiential learning bridges the gap between abstract knowledge and professional practice, enabling students to internalise the values and norms of the profession. It also facilitates the development of a professional mindset characterised by problem-solving, adaptability, and continuous learning.

6.4 Communities of Practice and Social Learning

The findings strongly support the relevance of Communities of Practice in understanding identity formation. Participation in

collaborative learning environments and professional networks allows students to engage in shared practices and gradually assume professional roles (Lave & Wenger, 1991).

Mentorship plays a role in this process by providing guidance, feedback, and role modelling. The presence of supportive mentors enhances students' confidence and helps them navigate the complexities of the profession. This highlights the importance of structured mentorship programs in CSE education.

6.5 Curriculum Reform and Institutional Responsibility

The identified gap between curriculum and professional practice underscores the need for institutional reform. Traditional teaching methods that emphasise theoretical knowledge are insufficient for fostering professional identity. Instead, curricula must be redesigned to incorporate experiential learning, interdisciplinary approaches, and industry engagement.

Educational institutions have a responsibility to create learning environments that support holistic development. This includes providing access to resources, facilitating industry partnerships, and promoting reflective practices that encourage students to critically about their professional identity.

6.6 Digital Identity and the Future of Professional Development

The emergence of digital professional identities represents a significant change in the landscape of CSE education. Online platforms enable students to engage with

global communities, access diverse learning resources, and build professional networks.

From a theoretical standpoint, digital communities can be viewed as extensions of Communities of Practice, where learning transcends geographical and institutional boundaries. These platforms provide opportunities for legitimate participation and recognition, thereby reinforcing identity development.

However, the increasing reliance on digital environments also raises questions of equity and access. Students with limited access to technology may be disadvantaged, highlighting the need for policies that address digital divides.

6.7 Implications for Theory and Practice

The integration of Social Identity Theory, Communities of Practice, and PIF provides a robust framework for understanding professional identity formation. This study contributes to the literature by demonstrating how these theories intersect and complement one another in the context of CSE education.

Practically, the findings suggest that educators and policymakers must adopt a holistic approach to identity development. This includes fostering inclusive environments, integrating experiential learning, and leveraging digital platforms to enhance student engagement.

7. Conclusion

This study set out to explore the lived experiences of Computer Science and Engineering (CSE) undergraduates in

developing their professional identity through a phenomenological lens grounded in secondary qualitative data. The findings demonstrate that professional identity formation is a complex, multifaceted, and evolving process influenced by individual, social, institutional, and technological dimensions.

One of the central insights of the study is that identity development is inherently dynamic and nonlinear. Students often begin their academic journey with uncertainty, self-doubt, and a limited understanding of professional expectations. Over time, through engagement in experiential learning activities, social interactions, and reflective practices, they gradually construct a more coherent sense of professional self. This process aligns with the theoretical perspectives of Professional Identity Formation, which emphasise continuous socialisation and internalisation of professional values.

Experiential learning emerged as a particularly powerful force in shaping identity. Internships, project-based learning, and real-world problem-solving experiences enable students to bridge the gap between theoretical knowledge and practical application. These experiences not only enhance technical competence but also foster confidence, responsibility, and a sense of belonging within the professional community.

The role of mentorship and peer interaction further underscores the importance of social learning environments. Communities of practice, both physical and digital, provide

platforms for collaboration, feedback, and recognition, all of which contribute to identity development. At the same time, the growing influence of digital platforms highlights the role of online engagement in shaping modern professional identities.

However, the study also identifies significant challenges, particularly related to institutional constraints and unequal opportunities. Rigid curricula, limited access to experiential learning, and disparities in technological resources can hinder identity formation and perpetuate inequalities among students. Addressing these challenges requires a holistic approach that integrates curriculum reform, inclusive pedagogies, and enhanced industry-academia collaboration.

In conclusion, the development of professional identity among CSE undergraduates is not merely an outcome of academic instruction but a holistic process shaped by diverse experiences and interactions. Educational institutions must therefore adopt innovative and inclusive strategies to support students in navigating this complex journey. Future research should consider primary data collection and cross-cultural comparisons to further enrich understanding in this field.

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