2026 ASEE ANNUAL CONFERENCE June 21–24, 2026 | Charlotte Convention Center, NC
Host Sponsor UNC Charlotte
Paper ID #52004

An Exploratory Study of Computer Science Internship Experiences: The Interplay of Impostor Phenomenon, Perceived Success, and Generative AI

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Abstract

This full paper examines how internships shape computer science (CS) students' self-perceptions of competence, confidence, and professional success. While internships bridge academic and professional practice, their relationship with the impostor phenomenon (IP), perceived role legitimacy, team integration, and the use of generative AI (GenAI) tools remains underexplored, especially regarding CS students holding high-responsibility academic roles (e.g., teaching assistants). Guided by the Social Cognitive Career Theory (SCCT), we studied undergraduate CS teaching assistants (n=40) at a large public university in the southeast of the United States using mixed methods. Our findings revealed three analytic domains concerning students' impostor feelings, internship success, and GenAI use, operationalized through seven qualitative themes and supporting statistical analyses. Students reported high impostor feelings (M=65.7, max=90), with 52.5% classified as high IP, 42.5% intermediate, and 5.0% low. Internship success was rated positively (mode = 4; out of a 5-point Likert Scale), with success attributed primarily to skill development (49.3%) and organizational support (36.2%). While most students were allowed to use GenAI tools (65.8%), usage was infrequent, and in-house tools were preferred. Finally, a significant negative correlation was observed between IP and internship success ($r_s=-0.341$, $p<.05$). These findings provide valuable insights for both CS educators and policymakers to improve internship preparation, address IP, and develop ethical GenAI integration guidelines to enhance students' well-being and retention.

Keywords: Computer Science, Internship Experience, Impostor Phenomenon, Generative AI, Self-Perception

1. Introduction

Internships are essential in higher education because they link classroom learning with professional practice and give students the chance to develop their practical skills through real-world experience [1]. These internship experiences as an opportunity allow students to apply their coursework while strengthening other key abilities like problem-solving, collaboration, and adaptability [1], [2]. Given the growing research in CS students' mental health and well-being, which highlights the prevalence of the impostor phenomenon in CS programs and its potential impact on their mental health and professional development [3], [4], [5], [6], it is important to examine how internship experiences may influence students' self-efficacy and perceptions of belonging. In CS, internships are especially essential as the field evolves constantly. They allow students to use algorithms, software development techniques, and data analysis methods to address real problems, deepening their technical understanding and building skills that are directly relevant to the workplace [7], [8]. By contributing to real-world projects, students become familiar with emerging technologies and professional tools, gain confidence, and are better prepared to enter the workforce [9].

2. Background

Existing higher education research generally emphasizes the importance of practical professional engagements, such as internships, in filling the gap between theoretical classroom instruction and the fast-paced demands of the technology sector, particularly within the continuously evolving fields of CS and engineering [10], [11].

2.1. Professional Experience and Self-Perception in Computer Science

Computer science curricula must be updated to keep up with rapid technological advancements to ensure graduates are prepared for future professional roles. They need to establish frameworks that connect academic knowledge with real-world applications through industry partnerships [11], [12]. Internships are essential for translating theory into practice and fostering "work self-efficacy," a construct from academic confidence that includes the ability to navigate professional demands [13], [14]. The Social Cognitive Career Theory (SCCT) offers a useful lens for understanding these dynamics and the role of self-efficacy and outcome expectations in shaping interest and persistence in computing jobs [15], [16]. Research shows that students with stronger perceptions of their skills, community belonging, and career clarity are more likely to remain committed to the field [17]. However, lower grades in CS compared to other disciplines often lead to self-doubt and concerns about long-term success [13], [18]. This pattern leads to attrition, which is increased by psychological barriers and job dissatisfaction, as highlighted in studies such as Ross and Katz [19].

2.2. The Impostor Phenomenon (IP) and Student Well-being in Computer Science

Despite achieving high grades, many CS students experience impostor phenomenon (IP), defined as an internalized sense of intellectual phoniness and an inability to internalize success [20], [21]. Recent studies show that IP is particularly prevalent in computing, with rates significantly higher than in other disciplines; in fact, some studies report ~60% of CS students meet the diagnostic criteria for IP, with women consistently reporting higher rates than men [3], [4], [6]. IP is strongly associated with negative outcomes, including anxiety, depression, and burnout [22], [23], and in academic contexts it negatively correlates with research self-efficacy, reducing students' confidence in their ability to conduct successful research [24]. Moreover, IP undermines collaboration, as fear of evaluation can lead students to withhold ideas and disengage from group work [25]. Although feedback-based interventions have been shown to improve self-assessment accuracy and persistence [2], IP remains a critical factor in student retention [13].

2.3. Generative AI in the Computer Science Workplace

The integration of GenAI into the workforce represents a paradigm shift in the teaching and execution of technical topics. There is a difference between how GenAI is used in academia, which is often viewed through the lens of academic integrity, and its application in industry as a tool for efficiency [19], [7]. While students adopt and use GenAI tools like ChatGPT for programming assistance and exam preparation rapidly [26], curricula are slowly incorporating "prompt engineering" and ethical applications of these tools [27], [19]. Moreover, educators have begun experimenting with integrating GenAI in their courses to better prepare students for industry scenarios [11]. Conversely in the workplace, GenAI has reportedly increased productivity significantly, particularly for novice/lower-skilled workers, by disseminating the tacit knowledge and best practices of high-performing employees [28]. However, this rapid adoption requires new policies for higher education. For example, [10], programs like "Edu Talent Bridge" utilize AI to align university curricula with real-time industry demands and facilitate recruitment through skill matching.

2.4. Student Roles and Team Dynamics in Professional Contexts

Success in software engineering workplaces relies heavily on professional competencies such as communication, teamwork, and leadership, yet recent graduates often struggle in these areas, particularly communication, which is still a gap between academia and industry expectations [29], [10], [30]. While employers emphasize the importance of clear communication and effective collaboration within diverse teams, students underestimate their significance [31]. Team dynamics are important for developing these skills, and SCCT emphasizes team roles and interactions as environmental supports that shape self-efficacy and career interests, with internships offering great opportunities to improve both technical and interpersonal competencies [15], [26]. Positive mentor-student relationships and collaborative experiences during internships also enhance teamwork skills [31]. Moreover, psychological safety, as a shared view that the team environment allows for interpersonal risk-taking, is essential for good team functioning, as its absence can lead to social isolation and hinder the development of professional identities [31]. In addition, supportive supervision strengthens team collaboration, encourages feedback-seeking, and improves commitment and performance [2], [32]. In this study, we consider team dynamics within the internship context as a factor influencing student success and confidence, while focusing our analysis on the impostor phenomenon and GenAI-related aspects of these experiences.

3. Research Gap

Although internships, IP, and GenAI have all been studied, there is a gap in exploring how these elements interact during the critical transition during internships in CS. Specifically, there are few studies about how IP influences students' confidence and adoption of GenAI tools in the workplace or whether GenAI can be a supportive learning help or encourage self-doubt among students having impostor feelings. Despite GenAI's growing importance as an industry competency, academic curricula are often left behind, which leaves students underprepared for experiences such as internships. The impact of team dynamics on these experiences is also less explored, even though such dynamics can reduce IP and foster skill development. Moreover, few studies apply SCCT to understand how these factors shape students' self-efficacy, persistence, and career trajectories. To address this gap, our study focuses on three domains: the prevalence and impact of IP among CS students [18], [21], [32]; the role of self-efficacy and team dynamics in supporting success in computing careers [13], [31]; and the urgent need to integrate GenAI into curricula to enhance professional readiness [27], [7], [29].

4. Theoretical Framework: Social Cognitive Career Theory (SCCT) in Computing Disciplines

Social Cognitive Career Theory (SCCT), which is grounded in Bandura's Social Cognitive Theory, is a strong framework for understanding career development by emphasizing the dynamic interplay of personal, behavioral, and environmental factors [25]. Main components of SCCT are self-efficacy, outcome expectations, and contextual influences, which shape students' career interests, choices, and performance. This theory suggests that self-efficacy and outcome expectations shape career interests as a guide to decisions such as selecting a major, while environmental factors like mentorship or societal stereotypes can either support or hinder these choices [16].

In computing education, SCCT has been applied to explain students' following or avoiding IT-related careers. Also, it offers to evaluate patterns of attrition, including through AI-driven analyses of social media data that link personal and contextual factors to decisions to leave the field [16]. Some empirical studies validate SCCT's predictive power in computing. Lent et al. [15] found that self-efficacy and outcome expectations significantly influence students' interests and persistence goals, with environmental supports and barriers impacting decisions via their impact on self-efficacy. Building on this, Luse et al. [13] used structural equation modeling to show that self-efficacy and positive outcome expectations, such as confidence in IT tasks and anticipated career rewards, are key predictors of students' decision to pursue IT majors. Alshahrani et al. [16] extended SCCT through qualitative interviews with undergraduate CS students, which shows that social support and positive outcome expectations were especially important for female students. Prior hands-on experiences improved self-efficacy, while school curricula often failed to do so, and perceptions of computing as "nerdy" or male-dominated highlighted the importance of addressing contextual barriers. Together, these studies underscore SCCT's relevance in designing interventions that enhance self-efficacy and align expectations in computing fields. In our study context, SCCT helps interpret how internship experiences (serving as mastery experiences), impostor feelings (influencing self-efficacy), and contextual factors like mentorship or GenAI tool availability interact to shape students' career interests and performance.

5. Methods

5.1. Context and participants

This mixed-methods study had 40 adult participants (18 years of age or older) recruited through convenience sampling, which included undergraduate college students working as undergraduate teaching assistants (TAs) in CS courses. We targeted TAs as participants because they often have strong academic records and were likely to have internship experience; indeed, most participants (n=36, 90%) had completed at least one internship in industry. Most participants (n=36) were enrolled in a computing program at a large Southeastern public university in the United States. Only four participants (n=4) reported a different major: Biomedical Engineering (n=1), Mathematics (n=1), and Industrial Engineering (n=2). Participants reported being male (n=24), female (n=14), or other (n=2), and were predominantly Asian (n=24) or White (non-Hispanic/non-Latin American; n=10). We also had some participants from other ethnic groups: Black/African American (n=2), Hispanic/Latin American (n=1), Middle Eastern/North African (n=1), and participants who indicated being multi-racial (n=2). Participants' ages were between 18 and 22 years of age, with most being 20 years of age or older (n=27). All were undergraduate students, mostly in their third academic year or beyond (n=33).

5.2. Data Collection

Data collection took place in the Fall of 2024 at Southeastern University in the United States. Data were gathered through an online survey (four blocks) that integrated quantitative scales with open-ended questions:

- **Block 1 - Informed Consent** featured an informed consent document with details of the study (30 minutes long or less). No compensation was offered or given for participation.
- **Block 2 - Internship Experience Questions** featured eleven open-ended questions about students' internship experiences (e.g., the use of GenAI during their jobs). This block also includes one close-ended question about the season they most recently interned (e.g., Summer) and one 5-point semantic scale question ("How would you rate your most recent internship experience?") to have them rate their most recent internship experience.
- **Block 3 - Impostor Phenomenon** featured the Clance Impostor Phenomenon Scale [20], consisting of 20-item, 5-point Likert scales. The CIPS considers three major categories concerning the intensity of IP: High (>=61), Medium (41-60), and Low (<=40) [20]. The scale showed high internal consistency in this study (Cronbach's $\alpha = 0.92$). This aligns with prior uses of CIPS, which typically report α between 0.85 and 0.95 [22].
- **Block 4 - Demographics** featured 13 questions asking about participants' demographics such as their age, gender, ethnic background, and academic major, among others. Missing data was minimal; all 40 participants completed the key quantitative measures (including CIPS), and the few who skipped open-ended responses were excluded from the qualitative analysis. No data imputation was necessary.

Table 1 - Some Interview Questions

- What was your role? (For example: S/w engineering intern, project management intern, etc.).
    - a. Tell us about your role.
- Was generative AI allowed within your team? Tell us about your experience (if any) with generative AI during your internship.
- Tell us about the generative AI tools you used during your internship. If there was an internal tool that's not public, just say "internal tool."
    - a. How frequently was that tool used in your team?
- How would you rate your most recent internship experience?
    - a. Please explain your selection.
- Tell us about your team.

5.3. Data Analysis

Quantitative data were analyzed through descriptive statistics (e.g., means, medians, modes, and frequencies) and non-parametric tests. We calculated summary measures for key variables (e.g., CIPS scores and internship rating) and used Spearman's rank-order correlation to examine associations, given the non-normal distribution of some measures. We also assessed the reliability of the CIPS: Cronbach's α was 0.92 in our sample, consistent with the high internal consistency reported in prior studies (typically $\alpha \approx 0.85–0.95$) [22].

The qualitative data from open-ended responses were analyzed by using inductive thematic coding. Three researchers independently coded a subset of responses to develop an initial codebook, which was then refined through discussion and consensus. To ensure consistency, intercoder reliability was assessed on some portions of the data, with disagreements resolved via group discussion. Once the codebook was finalized, the team divided the remaining responses and coded them while cross-checking each other's work. This process ended up in seven themes. In addition, certain qualitative data were quantified. For instance, by analyzing students' written explanations of their internship ratings to identify common success factors (allowing multiple factors per respondent), counting mentions, and calculating percentages (which do not sum to 100% since all 40 students responded and could list multiple factors). Throughout the analysis, the research team practiced reflexivity by acknowledging their backgrounds in CS education and industry to ground interpretations in participants' responses rather than personal assumptions. Missing data was minimal; all 40 participants completed the quantitative measures, and the few skipped open-ended questions were simply excluded from relevant analyses.

6. Findings, Results, and Discussion

Overall, our findings highlight the multi-faceted nature of undergraduate CS internship experiences and their psychological impacts. Participants generally reported high levels of internship success, which underscores the beneficial nature of these experiences. Our quantitative analysis revealed elevated levels of IP among students, particularly among female participants. A clear inverse relationship emerged between IP and students' self-reported internship success, which suggests that those experiencing stronger impostor feelings found their internships less successful. To complement these insights, we conducted qualitative analysis and found that the high average internship success rating (mean ~4.1/5) among our participants proves the generally beneficial nature of these internships. Our inductive thematic analysis of open-ended responses from undergraduate CS interns identified seven key Categories: (1) learning and skill development, (2) meaningful project scope and impact, (3) team support and mentorship, (4) work environment dynamics, (5) career fit insights and future plans, (6) organizational and structural challenges, and (7) experiences with generative AI. Each theme is presented with supporting summaries and participants' quotes. Where relevant, we interpret these findings through the lens of SCCT by emphasizing how mastery experiences, outcome expectations, and environmental factors influenced interns' self-efficacy and evolving their career trajectories [6].

In the following sections, we organize the findings and results around our core topics: Internships & IP, GenAI use in internships, and the connections between GenAI and IP, integrating both quantitative results and representative qualitative insights.

6.1. Quantitative Results: Impostor Phenomenon and Internship Success

Consistent with prior studies [6], our students reported elevated levels of IP among participants. The mean CIPS score was 65.7 (SD=12.3, range: 40-90), with 52.5% of students categorized as High IP, 42.5% Moderate, and 5% Low, based on Clance's [20] criteria and aligned with prior computing education research (e.g., Clark et al., [23]). IP was particularly high among female students, with 64.3% of them reporting IP scores above 60. This, in comparison with the 45.8% male student population reporting high IP scores. Moreover, a significant inverse correlation was observed between IP scores and students' self-reported internship success ("How would you rate your most recent internship experience?"), indicating that lower perceived levels of internship success were reported by students with higher IP scores ($r_s=-0.341$, $p<0.05$, $n=40$). Internship self-reported success was shown to have a mode score of 4 (out of a 5-point Likert Scale).

6.2. Qualitative Findings

Theme 1: Internships provide substantial learning opportunities that enhance interns' technical and professional growth. (Category: Learning and skill development)

Skill development and learning emerged as the most dominant theme across all participants. In fact, learning was the most frequently coded benefit, mentioned almost 185 times in responses, indicating that many interns experienced learning gains. *"I learned so much and made many new connections"*, one student noted enthusiastically (GT_001, rating 5/5). Another intern echoed that sentiment: *"I learned the most I ever have"* during the internship (GT_020, 5/5). These experiences allowed interns to apply classroom knowledge to real-world projects by deepening their understanding of software development, cloud computing, and data analysis. Another participant, GT_028, highlighted working on an *"applicable project that entered production,"* adding, *"Learned a lot"* in the process (5/5). Even those who didn't rate their internship a perfect 5 still acknowledged substantial learning; GT_011 wrote, *"I learned a lot, but I didn't feel very valuable"* (4/5), separating the learning aspect from other factors. This shows that learning was a positive outcome for most of the participants, even if other aspects of the experience varied.

Most participants had technical roles, with ~82% interning in software development or engineering positions. These roles involved hands-on coding tasks including coding, testing, and deploying software, which provided rich learning opportunities. Through this, students not only developed technical skills but also gained confidence in their abilities, which is highly aligned with SCCT's concept of mastery experiences enhancing self-efficacy. For instance, one participant built *"a web-testing script using Playwright.js and a deployment pipeline with Jenkins/Groovy"* (GT_009), learning about software testing and DevOps tooling on the fly. Another intern *"implemented an AI assistant using Google's VertexAI and Dialogflow... [for] task automation"* (GT_014), gaining experience in machine learning integration. These examples show how interns applied theoretical knowledge to real products and gained practical skills in the latest industry tools. Quantitatively, the importance of learning is evident; as in the follow-up question, nearly half of the participants (49.3%) explicitly stated that their internship success was due to the tangible skills and knowledge gained during the experience, and this was the largest factor mentioned for success. In SCCT terms, these new skills and the successes interns had in using them are enhancing self-efficacy, which means interns finished their programs feeling more capable as computing professionals, which in turn can fuel their interest and commitment to the field.

Theme 2: Meaningful and impactful projects increase satisfaction, while limited scope or purposeless tasks reduce engagement. (Category: Meaningful project scope and impact)

The nature of assigned work played a critical role in shaping interns' overall satisfaction. Participants consistently reported higher enthusiasm and fulfillment when they worked on meaningful and challenging projects that had real impact, whereas experiences decreased if the intern's responsibilities felt underutilized, or misaligned with their interests. On the positive side, one student said: *"I felt very accomplished... the projects I built were really interesting"*, (GT_021, 5/5), who clearly derived satisfaction from the meaningfulness of the assignment. Another intern worked on a project *"that was very interesting and challenging"* and noted how rewarding it was when the project had a high impact on the company (GT_019, 5/5). Such experiences likely enhance the intern's outcome expectations (SCCT) in a positive way: by accomplishing meaningful tasks, interns see that their effort leads to worthwhile results, thereby reinforcing their expectation that pursuing this career will be rewarding and impactful.

In contrast, several interns who had fewer engaging projects mentioned their intern experience being disappointing or boring, which often coincided with slightly lower satisfaction ratings. *"I enjoyed the team, but I didn't really like my project"*, admitted one intern (GT_004, 4/5). Another bluntly stated, *"I feel like I didn't contribute much"*, highlighting a sense of not being utilized fully (GT_008, 3/5). Another one, GT_017, who rated the experience 2/5, observed, *"My growth was pretty stagnant... didn't gain much* *technical skills"*. This intern felt their project offered little new learning or challenge, leading to dissatisfaction. In a few cases, interns were assigned to work outside their expected role or interest area. For example, one student who hoped to do back-end development was instead given mainly frustrating front-end upkeep tasks (GT_017, 2/5, *"little room for growth; worked on front end rather than backend"*). These examples show how limited scope, lack of challenge, or misalignment with an intern's goals can make the internship feel like a lost opportunity.

In summary, Theme 2 emphasizes that the quality and relevance of internship tasks are important. Purposeful, appropriately challenging projects not only enhance technical skills but also increase interns' confidence and a sense of direction. For educators and employers, this highlights the importance of designing internships that offer meaningful engagement that supports both professional growth and long-term commitment to the field.

Theme 3: Intern experiences are enhanced by supportive teams and effective mentorship, while poor guidance and unpleasant environments reduce enjoyment. (Category: Team support and mentorship)

The second-most cited factor in interns' success was the social and organizational support they received during the internship. Participants reported that having a supportive team, accessible mentors, and a welcoming culture enhanced their experience. In contrast, if interns felt isolated, poorly guided, or encountered a negative team atmosphere, their enjoyment and perceived success dropped. This sentiment captures it well: "My team was very supportive and gave me the tools to succeed" (GT_024, 5/5). Many interns (about 36.2%) described their teams in glowing terms. *"Wonderful team and supportive mentors, great opportunities and rewarding work"*, wrote one intern (GT_006, 5/5), explicitly tying their satisfaction to the team support they had. Another student raved, *"[Company]'s community is amazing. The work-life balance is prioritized, and everyone is there to support the interns"* (GT_020, 5/5). This indicates that the intern felt a sense of community and well-being. Many interns emphasized how receptive their teammates and managers were to questions, which allowed interns to ask and learn quickly without fear of embarrassment. For example, GT_031 noted how a couple of senior architects on the team were *"very helpful in teaching me the codebase and always receptive to questions."* In SCCT terms, such positive team interactions can be seen as social persuasion and learning opportunities that build an intern's self-efficacy.

On the other hand, a minority of interns experienced poor guidance or an unwelcoming team culture, which negatively impacted their experience. GT_005 (3/5) mentioned that *"communication with the* *professor was limited"*, where their supervisor didn't provide much interaction or feedback. Another intern felt *"very out of place... the office culture was harsh"* (GT_038, 2/5), indicating an environment where they perhaps faced bad behavior, ultimately leading to a low evaluation. GT_015 (2/5) similarly noted, *"there was not a lot I could contribute since there was a lack of focus and guidance in the team."* In this case, lack of focus in the company coupled with poor guidance left the intern feeling they couldn't be productive or learn much. These narratives show that when interns do not receive mentorship or feel unwelcome, they can become disconnected and dissatisfied, regardless of how exciting the project might be.

Team size and structure often facilitate the level of support. Many interns were in small teams, which made it easier to form relationships and get individual attention. For example, GT_024 mentioned a *"team of 6 other interns with mentors for each of us"*, highlighting a one-on-one mentorship model in a small intern cohort. In our sample, about two-thirds of participants worked in teams of about 3-7 members (often including one or two other interns plus full-timers), while about one-third were in medium-sized teams of around 8-15 people. Only one or two interns described being in very large teams (20+ people) where an intern might feel more like a small fish in a big pond. Smaller team settings tended to better mentorship and peer support, as interns often collaborated closely with a few engineers rather than being alone in a vast group. Generally, interns' teams also included a mix of senior and junior staff, which helped create a teaching atmosphere: seniors could mentor, while junior or new-grad employees might relate more to interns and provide guidance from recent experience.

Overall, Theme 3 shows that supportive teams and mentors are essential to successful internships, as positive workplace relationships and socialization significantly predict student satisfaction and learning outcomes, as supported by studies like Lent et al. [15] and Luk and Chan [18]. Interns become successful when they feel included, receive guidance, and have colleagues who answer questions, the conditions that boost their self-efficacy and persistence, as emphasized by SCCT [25], [13], [31]. In contrast, poor communication or lack of mentorship can impact their experience, even if other factors are great [15], [32].

Theme 4: Work environment factors such as remote setups, flexibility, and compensation shape overall satisfaction. (Category: Work environment dynamics)

Beyond the work itself and the people, interns' experiences were influenced by various aspects of the work environment. The format of work (remote, hybrid, or in-person), the degree of schedule flexibility, and even perks or pay emerged as noticeable themes in how students evaluated their internships. A prominent work environment factor was the remote vs. in-person dynamic. Many interns in this study interned during a time when remote work was common (post-2020), and several mentioned that being fully remote limited the social side of the internship. *"It wasn't a 5 because it was fully remote, so it was hard to make connections with coworkers,"* one intern noted (GT_036). Another intern (GT_039, 3/5) felt that with the team being entirely remote, they missed out not only on social interaction but also on seeing the direct impact of their work, leading them to feel *"the work I completed was not of much use to my future."* This sentiment might reflect a lack of full engagement; working in person often helps interns feel more involved in day-to-day operations. GT_036 (3/5) similarly said, *"the internship was remote so that made it feel more lonely even if I was part of a team."* These experiences indicate that fully remote internships can sometimes make students feel isolated or less connected, even when the team is supportive. In SCCT terms, a remote setup could be viewed as a slight contextual barrier as an extra challenge to building the network and sense of belonging that reinforce one's commitment to the career path.

On the other hand, some interns appreciated remote or hybrid arrangements for the flexibility they provided. A hybrid schedule, as GT_028 (5/5) mentioned, *"gave me flexibility."* One intern highlighted that they had *"a lot of latitude to lead my own projects"* and continued working part-time after the internship (GT_022, 5/5) and noted *"the pay is very good."* This example shows that autonomy and good compensation can enhance satisfaction, which means the intern felt trusted to (which likely increased their self-efficacy and sense of ownership, aligned with SCCT) and was happy with the financial aspect. While pay was not the central focus of most responses, a few did mention it: one student remarked that any CS internship would be at least a 4/5 *"due to the fact that I would get paid"* (GT_007, 4/5), suggesting that the stipend made the experience worthwhile despite that internship being fully remote and not a "5/5." So, it reinforces a positive outlook on career rewards. Interns also mentioned additional perks and quality-of-life factors. GT_010 (4/5) listed perks like *"[City's Name] location, free food, free housing, free transportation"* provided by the company, which made the internship attractive. Social events, like intern gatherings or outings were valued, as one intern mentioned the company arranged intern networking events such as sporting events and movie nights (GT_040, 4/5 who enjoyed an *"ATL United soccer game & Deadpool movie event"* as part of the program). These not only reward interns but also help build networks. Another participant noted the company *"hosted several events over the summer such as facility tours, intern lectures, and training activities"* (GT_019, 5/5), reflecting an organization investing in a rich internship program. Such efforts can greatly enhance interns' satisfaction by making them feel valued and giving them extra learning/networking opportunities beyond just their work tasks.

Overall, Theme 4 shows that the logistical and cultural aspects of internships, such as remote versus in-person, flexibility, compensation, and perks, influence interns' satisfaction [15], [33]. These factors often impact whether an experience was rated highly or not. According to SCCT, such conditions act as both supports or barriers: for example, paid internships and those offering logistical aid (e.g., housing support) foster focus and persistence, whereas unpaid or isolating positions can decrease the sense of belonging and limit access for underrepresented students [25], [10], [24], [22]. However, it is also clear that these factors alone do not guarantee a high-level experience; rather, they function best together with meaningful work and supportive teams (Themes 2 and 3). Research also indicates that high compensation cannot fully mitigate the negative effects of poor mentorship or lack of task clarity, as supervisor support and mentoring are often stronger predictors of perceived developmental value than pay alone [24], [14].

Theme 5: Internships serve as a lens for career fit and help interns confirm or reconsider their future paths. (Category: Career fit insights and future plans)

For many students, an internship is not just a summer job, but it's a trial run of a potential career. Our analysis found that internships often function as a *"career compass."* After their internships, some students felt more confident than ever that they were on the right career path, while others realized that certain roles or environments were not for them. Numerous interns used their positive experiences to confirm their career choice. One strong example is GT_022, who rated the internship 5/5 and reported, *"I am still working there and have a lot of latitude to lead my own projects!"* This individual not only decided to stay on but also appreciated the trust and responsibility given, which is great for a long-term fit. The same intern mentioned the pay was very good; that also plays into deciding if a career is desirable. Another participant (GT_014, 5/5) said they *"thoroughly enjoyed [the] internship experience"* and particularly valued building connections with a wide range of people (engineers and non-engineers), which likely reinforced their interest in that company or industry. In SCCT terms, the internship strengthened their interest and choice goals, thus encouraging them to set career goals in that direction [15].

On the other hand, a few interns took a more negative and more nuanced message from their internships by realizing that the role or setting might not be the best fit for them. GT_012's comment is saying, *"Personally it pushed me away from CS after seeing how independent and lonely the position was"* (2/5). This student found the work style not appealing, which made them rethink continuing in that kind of job. Similarly, GT_015 (2/5) stated, *"I didn't think I learned a lot... unfortunately I'm not interested in that for my career."* This intern's particular tasks did not spark their interest, and they concluded that the domain or type of work is not something they wish to pursue. These reflections are invaluable outcomes of internships, like better to learn as a student that you dislike a certain path than after you've started a full-time job in it. In SCCT, this would be an outcome where the internship experience gave them negative outcome expectations or lower self-efficacy for that kind of work, thus reducing interest in that path [17].

Many interns fell somewhere between these: they enjoyed some aspects of the internship but also learned more about what they personally wanted. For instance, an intern might have loved coding but realized they prefer a different industry domain or enjoyed the company but wished for a more collaborative role. GT_012 (4/5) said, *"I really enjoyed this internship and found the work interesting, but I wish I got to see/connect with my team more... I didn't have as strong of a relationship as I would like."* This suggests that the student is still interested in the work itself but will look for a work environment in the future that offers more community or mentorship. Another intern (GT_030, 4/5) discovered both positives and negatives: they *"loved the team and the work, [and had] a lot of creative freedom, but sometimes lacked direction."* In other words, interns cleared their preferences: maybe preferring a smaller startup vs. a big corporation, or vice versa, or deciding that they want a role with more customer interaction rather than pure coding, etc. Another intern concluded they preferred *"more structure and a larger company"* (GT_027, 3/5).

In summary, Theme 5 highlights internships as a powerful tool for career self-discovery, offering students a chance to be more aware of their career paths [10], [24]. Many students used the experience to confirm their interest in CS, while others realized specific roles or environments weren't the right fit [15], [24]; both outcomes are valuable. According to SCCT, internships influence career interest and choice by shaping self-efficacy and outcome expectations: positive experiences strengthen commitment to the field, while negative ones help refine future goals [6], [25], [26], [22]. Even less-than-ideal internships taught students what they didn't want and guided them toward more proper choices; for instance, research indicates that internships allow students to "test out different avenues" and see "what they did not want to do" in the future [24].

Theme 6: Organizational challenges such as disorganization, lack of structure, and unclear expectations negatively impact experiences. (Category: Organizational and structural challenges)

While many interns had smooth experiences, some encountered organizational and structural challenges within their internships that impacted their ability to contribute or learn. These issues, such as poorly planned projects, vague objectives, or general company disorganization, form a theme of their own because they were mentioned separately from personal or team factors. This theme highlights that even with a good intern and a supportive mentor, if the project or program itself is not well-organized, the experience can suffer. One common issue was tasks that were not well organized. GT_003 (3/5) reflected, *"I feel like it was good beginner experience, but I would've liked to have actually programmed more than just do data entry in Excel."* This suggests that the internship role wasn't fully fleshed out to provide substantive CS work, so the student ended up doing menial tasks. Another intern (GT_017, 2/5) pointed to a mismatch between their role and what they ended up doing: *"Little room for growth; worked on front end rather than backend development."* This indicates a possible lack of communication or flexibility in the organization to give interns work that fits their learning goals.

Some interns experienced outright disorganization in the company or team. GT_037 gave a scathing review: *"It wasn't paid, and it was a very unorganized internship"* (1/5). The lack of pay aside (that's a big drawback on its own), the intern emphasizes the chaotic nature. Such disorganization can lead interns to feel anxious and undervalued. In this case, it resulted in the lowest possible rating. From an SCCT perspective, these organizational barriers can impede the conversion of an internship into a positive mastery experience. If the intern's experience is one of confusion or feeling unproductive, it can hurt their self-efficacy or at least not improve it as much as a structured experience would. It can also temper their outcome expectations. For example, one participant (GT_027, 3/5) who had an unpaid, perhaps less structured internship expressed, *"I would obviously prefer the next one to be a paid internship at a bigger company,"* indicating that they attributed the bad experience to the nature of the organization and desired a more established environment in the future. However, in positive internship narratives, we do not see those complaints, which implies that those companies had clear plans and roles for their interns. Thus, Theme 6 is a reminder that when internships are poorly structured or organizations are disorganized, student experiences suffer. In conclusion, while most participants in our study found their internship experience beneficial, some were dissatisfied by organizational shortcomings. The students' feedback here is instructive: pay your interns, plan their work meaningfully [24], and provide structure [15], [24].

Notably, Themes 3, 4, and 6 describe (each) aspects of the internship environment, including team support, mentorship, work climate, and organizational structure, all of which align with SCCT's notion of contextual supports and barriers. These overlapping themes illustrate how supportive contexts (e.g., positive team dynamics and clear organizational structure) can foster interns' success and confidence, while negative environments can increase challenges.

Theme 7: GenAI integration in internships is allowed but mostly used for supplementary tasks. (Category: Experience with GenAI)

Our participants provided insight into how (and whether) they used GenAI during their internships, and the central theme is that GenAI was widely accepted, or at least available, in many interns' workplaces, but its use was cautious and limited. Interns typically used these tools for debugging assistance, learning new material, and speeding up small coding jobs, rather than for the core development process. In terms of workplace policy, about two-thirds of the interns said that using GenAI was allowed on their team somehow. Many large tech companies have their own internal versions of AI chatbots, and these were mentioned by participants. *"We had internal equivalents of Copilot and ChatGPT,"* wrote one intern, though adding they *"did not use [them] very much"* (GT_023). Another intern noted, *"[Company] had internal GPT and Bing chat, allowed to use those with internal data"* (GT_009). This suggests companies are aware of the value of AI but are cautious about data privacy; therefore, they provide internal AI tools. About 34% of interns, however, encountered restrictions, either explicit bans or impracticality of using AI for their work. GT_029 stated clearly: *"No! All GenAI was blocked on company devices."* A few others said it wasn't officially allowed for code generation, only for research. For instance, GT_032 mentioned GenAI was *"not allowed when it came to writing code."* However, we were allowed to use things like ChatGPT if we got stuck... to understand concepts."

When GenAI was available, interns' frequency of use varied but was typically low. The majority used it rarely to occasionally. For example, GT_029, despite GenAI being blocked at work, admitted *"I probably used it < 5 times in the summer."* GT_033: *"I used it only occasionally, and other team members seemed to as well."* On the other hand, a smaller group of interns used it frequently, especially those with Copilot integration in their editors or a specific project involving AI. GT_006 noted, *"We all used it a couple times a day."* GT_024 similarly said GitHub Copilot was used *"extremely frequently"* for coding tasks. But these frequent users were exceptions. The overall sense is that interns did not lean too hard on AI; whether out of personal choice, habit, or caution due to accuracy and company guidelines. Almost only 30-35% of interns used GenAI on a daily or very frequent basis, whereas about 40% used it rarely or not at all, with the remainder somewhere in between. In any case, none of the participants indicated that GenAI was a central or indispensable part of their work.

As for what interns used GenAI for, the theme is clear: supplementary and learning tasks rather than major coding. Interns commonly reported using ChatGPT for Debug errors or explain code (e.g., *"I used ChatGPT to help with debugging"* (GT_016)). If an intern encountered a tricky bug or an unfamiliar error message, an AI could sometimes offer quick insight or solutions that saved time. Summarize or learn unfamiliar technologies (*"Used ChatGPT for summarizing documentation for AWS and Terraform that I had not used before"* (GT_025)). This shows interns treating the AI as a tutor or documentation assistant to ramp up on new tools. Generate examples or Boilerplate code (Some mentioned using GitHub Copilot to write boilerplate or repetitive code faster (GT_035: Copilot was *"helpful for boilerplate and tedious tasks"*). A few created test cases or small functions with AI help). Answer conceptual questions (*"asking questions when designing the app in terms of design decisions"* (GT_003) or *"to get feedback on design choices"* (GT_018), who used an internal chatbot for machine learning code optimization). In these cases, the AI acted as an advisor. Notably, almost no one reported using GenAI to write large pieces of production code outright. Interns were either instructed not to (for security reasons) or self-limited because they didn't trust it fully or wanted to learn by doing it themselves. In fact, one intern (GT_002) said generative AI was *"pretty useless"* for their work on legacy code, which underscores that AI can have knowledge gaps. Another (GT_008) observed that while Copilot was encouraged, it *"wasn't always accurate or helpful"* for complex logic, tempering their reliance on it.

Overall, interns' experiences with GenAI tools were somewhat tentative but generally positive when used. Those who used them found them useful in specific instances, especially for learning or speeding up small tasks, which is proved by broader industry findings, like Brynjolfsson et al. [28], that AI can increase productivity, particularly for repeated code or when an engineer is inexperienced. However, interns also experienced the limitations and risks in the way that AI can be inaccurate, and corporate restrictions limit full utilization. From the SCCT viewpoint, exposure to GenAI in internships can influence interns' self-efficacy with these emerging tools. This experience may increase their confidence by seeing that they can use new technology effectively. Conversely, if company policy is restrictive or the intern finds the AI more trouble than help, they might develop a belief that "AI isn't useful for me" or even a wariness about workplaces that heavily regulate technology, which potentially shapes their preferences for future employers. One of our participants, in a Q&A context, reflected that strict GenAI policies or unhelpful experiences can lower an intern's expectation that using AI will lead to positive outcomes, thereby possibly dampening enthusiasm for AI-driven roles. Meanwhile, supportive examples likely boosted their self-efficacy with AI and perhaps their interest in companies at the forefront of AI adoption.

In conclusion, Theme 7 shows that while GenAI is increasingly present in CS internships and the broader technology sector, it currently functions as a supplementary tool rather than replacing core workflows [28], [19]. Most interns and students use GenAI for debugging, generating simplified explanations of complex concepts, and repetitive coding tasks while still relying on their own skills and team support for high-level problem-solving [23], [27]. Usage patterns are shaped by company policies and concerns regarding tool reliability and data security, as the potential for mistakes needs careful experimentation and human oversight [19], [27]. As GenAI tools evolve, there is an urgent need for curricula to train interns and new graduates in "prompt engineering" and ethical application to ensure they can use these tools effectively without losing critical thinking skills [19], [7]. These experiences reflect an industry trend that shows that while GenAI can boost productivity, particularly for novice workers by disseminating tacit knowledge, it has not replaced the foundational learning-by-doing and professional judgment required in engineering careers [28], [19].

Regarding GenAI and the Impostor Phenomenon, our data did not reveal any clear differences in how interns used GenAI based on their IP levels, which may suggest that GenAI use was relatively independent of impostor feelings in this sample. Moreover, no participants explicitly tied their use (or non-use) of GenAI tools to their impostor feelings in the open-ended responses. From an SCCT perspective, one might expect that successfully leveraging GenAI to solve problems could serve as a mastery experience that boosts an intern's self-efficacy (potentially decreasing their impostor feelings), while an intern who relies heavily on GenAI due to self-doubt might have their sense of inadequacy reinforced.

7. Conclusions, Implications, Limitations, and Future Work

7.1. Conclusions

This study offers multidimensional views of how undergraduate CS students experience internships, particularly in relation to their self-perceived success, IP, and exposure to GenAI tools. Our findings, which are aligned with SCCT, show that internships act as one form of mastery experiences that shape students' self-efficacy, outcome expectations, and future career interests. Seven qualitative themes and supporting quantitative data show that most students reported high levels of satisfaction with their internship experiences, which are primarily emphasized by skill development, meaningful project work, and supportive team environments. These factors not only enhanced technical contexts but also increased students' sense of belonging. However, elevated IP scores, especially among female students, were correlated with lower perceived internship success, which shows that psychological barriers persist in academic populations. Regarding the integration of GenAI tools into internship settings, our findings illustrate that the use of GenAI in companies was widespread but cautious. While 65.8% of participants were allowed to use GenAI, their usage was limited and primarily focused on supplementary tasks such as debugging, documentation, and learning support. This suggests that while GenAI is becoming a normalized and necessary part of the computing workplace, it seems that students are still navigating its role and limitations, which are shaped by company policies and personal choices. Importantly, internships also were a lens for career fit. Many students used the experience to assure their interest in computing, while others reconsidered or changed their future career paths based on project relevance, team dynamics, or work environment. Organizational challenges, such as poor structure, unclear expectations, or lack of mentorship, were cited as barriers to success and reinforced the need for intentional internship design. Overall, these findings highlight the importance of internships as transformative learning and practical experiences that go beyond technical training. They emphasized the need for psychologically safe and well-supported environments that promote both competence and confidence.

7.2. Implications

These findings have important implications for educators, industry partners, and policymakers. Educators should prepare students for internships by addressing not only technical competencies but also psychological readiness, particularly in managing impostor feelings; incorporating SCCT-informed strategies like mentorship training, reflective practices, and career confidence workshops can support students in internalizing their achievements and sustaining their engagement in computing careers. For industry, it is essential to design internships that are well-scoped and meaningful, supported by structured mentorship, clear expectations, inclusive team environments, and the thoughtful integration of GenAI tools to boost intern productivity, learning, satisfaction, and overall experience. Curriculum designers should also recognize the growing role of GenAI in internships, highlighting the need to embed AI literacy into computing programs by teaching responsible usage, prompt engineering, and ethical considerations to better equip students for real-world applications.

7.3. Limitations

While this study provides useful findings and insights into the internship experiences of undergraduate CS students, some limitations are acknowledged. First, the data were collected based on self-reported measures, including students' ratings of internship success and their scores on the Clance Impostor Phenomenon Scale (CIPS). Self-assessment is subjective and may be impacted by personal bias, time-based mood of response, or later misinterpretation of experiences. This can cause potential variation in how students perceive and report their own growth and success, challenges, and psychological states. Second, the study employed a cross-sectional design, which captures a single moment in time rather than tracking changes before and after the internship. As a result, it does not account for longitudinal developments in students' self-efficacy, job interests, or comfort of use of GenAI. Internships are dynamic experiences in which students' perceptions may evolve or change before, during, and after their participation. Third, while the study looked at gender differences in IP scores, it did not conduct an in-depth analysis of other demographic factors such as race, ethnicity, socioeconomic status, or first-generation college status. These dimensions can significantly influence students' access to resources, psychological well-being, and impact their overall internship experiences. Finally, the study did not explore how demographic factors may have impacted other key areas, such as general internship satisfaction or the use of GenAI tools, which limits the scope of interpretation across diverse student populations.

7.4. Future Work

By using our findings, future research could aim to expand both the scope and depth. One important direction is to broaden the sample to include students from multiple institutions, geographic regions, and academic disciplines. Future studies may compare the experiences of teaching assistants (TAs) and non-TA interns to explore how academic roles influence internship success. In addition, researchers may consider applying the study's framework and surveying other majors beyond CS to examine disciplinary differences in internship experiences, IP, and GenAI adoption. This approach could reveal unique challenges and supports across fields and offer broader insights into how professional development, particularly internship experience, varies by academic context. Longitudinal studies are also needed to track students over time, before, during, and after their internships, to assess how their self-efficacy, career goals, and impostor feelings change. Such studies would provide a better understanding of how internships influence long-term career trajectories and mental well-being. As GenAI becomes increasingly integrated into the workplace, future studies should evaluate the impact of formal GenAI training in higher education on students' confidence, ethical awareness, and productivity. Understanding how educational preparation influences GenAI adoption and effectiveness in internships will be vital for higher education curriculum design. Future studies should investigate whether and how the use of GenAI tools interacts with the impostor phenomenon among computing students, particularly examining whether GenAI serves as a mastery experience that influences impostor feelings depending on usage patterns and self-efficacy levels. Finally, future work could focus on designing and testing SCCT-based interventions. These could include structured mentorship programs, reflective tools, and career development modules that explicitly target self-efficacy, outcome expectations, and contextual support. By doing so, educators and employers can better support students' transition from academic learning to professional practice in computing fields.

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Appendix

Table 1. Intern Role Distribution and Examples (N=40)

Intern Role Category	Percentage	Representative Titles / Domains
Software Engineering Roles	82.1%	Software Engineer Intern, Full Stack Developer Intern, Frontend/Backend Intern, SWE Intern (ML)
Other Technical/Hybrid Roles	17.9%	Consultant Intern, IT Support Intern, Cybersecurity Intern, Project Management Intern

Table 2. Common Internship Team Structures and Dynamics

Team Aspect	Typical Scenario in Internships
Team Size	Usually small teams (~2-7 members including the intern). Many interns worked closely with a few engineers and perhaps another intern, which allows personalized interaction. Some were in medium teams (~8-15 people), often as part of a bigger project where the intern's sub-team had its own meetings. Very few interns (<5%) were on a large team (20+ people).
Mentorship Structure	Dedicated mentors were often noted. Interns often had a supportive person (or a small set of mentors) who provided one-on-one guidance. Regular check-ins (weekly or even daily stand-ups) were reported. In mentor-rich teams (e.g., one mentor per intern), interns felt highly supported.
Collaboration Mode	For remote/hybrid settings, the majority of interns interacted with team members via online platforms (Microsoft Teams, Slack, Zoom). Some interns never met teammates in person, while others had occasional on-site days or an internship summit. Effective teams compensated with frequent virtual communication. A minority of interns had fully in-person teams.
Team Climate	Described as supportive, inclusive, and learning-oriented in most cases. Interns felt comfortable asking questions and noted that teammates were "nice," "helpful," and "patient." They were encouraged to share their knowledge. A few interns experienced a less ideal climate - e.g. overworked team members who had little time for the intern, or an office culture that was formal and less welcoming, but these were exceptions.

Table 3. Generative AI Usage Patterns in Internships

Generative AI Aspect	Findings
Teams Allowing GenAI	**Yes:** 65.8% (explicitly allowed or provided internal AI tools) **No:** 34.2% (policy forbade external AI or not encouraged)
Tools Used by Interns	Proprietary internal AI assistants: 46.7% Public LLMs (ChatGPT, etc.): 40.0% GitHub Copilot (code autocompletion): (mentioned by several interns, counted within external tools)
Frequency of Use	**Rarely:** 38.7% (used very infrequently or only a few times) **Occasionally:** ~25% (used on an as-needed basis, e.g., when stuck on a problem) **Often (incl. daily):** ~36% (used regularly, e.g., nearly everyday)