This is a preprint of an article accepted for publication in Information and Learning Sciences: Stvilia, B. & Gibradze, L. (in press, 2026). Becoming IT professionals: A conceptual framework of community mediated self-directed IT learning on Reddit. Information and Learning Sciences. https://doi.org/10.1108/ILS-12-2025-0242

Becoming IT Professionals: A Conceptual Framework of Community Mediated Self-Directed IT Learning on Reddit

Besiki Stvilia, Leila Gibradze

College of Communication and Information, Florida State University, 142 Collegiate Loop,

Tallahassee, FL 32306-2100, USA

Abstract

Online communities are becoming informal learning spaces for aspiring and current IT professionals. This study examines how participants in IT-focused subreddits describe building competence outside formal coursework and how these spaces support self-directed learning. It collected 464 Reddit posts and 59,471 comments (2015-2025) and segmented them into 15,658 units. Using a codebook with 27 codes in 11 categories grounded in a synthesized general theoretical framework, the analysis combined manual qualitative coding with GPT-5-mini assisted classification and threshold calibration, producing 382 evidence segments used for reporting. The findings were then fed back into the theoretical framework to develop a conceptual framework of community mediated informal IT learning.

Findings suggest that participation in these communities may strengthen motivation and persistence through social support and growth-oriented norms. Some learners described non-linear learning and career trajectories from entry-level roles, such as help desk, toward specializations in cybersecurity, networking, and cloud. They described perceived gains in knowledge, practical skills developed through hands-on projects and home labs, and attitudes such as resilience, curiosity, and self-efficacy alongside an emerging professional identity. They also described self-regulated learning (SRL) strategies, including goal setting, time management, project-based practice, reflective journaling, adaptive help-seeking, and expanding use of AI tools for explanation, self-testing, and feedback. Community interactions appeared to scaffold these strategies through advice exchange, near-peer mentoring, shared learning resources, and public progress reporting. The study's findings are consistent with social views of SRL. At the same time, they refine our understanding of how online communities may function as sociotechnical learning infrastructures that mediate participants' reported competency development and career trajectories in rapidly evolving technical fields.

Introduction

Information Technology (IT) can be defined as the application, integration, deployment, administration, and security of computing systems, networks, software, and information infrastructures to meet organizational and societal needs. The IT discipline emphasizes the selection, implementation, and management of computing technologies rather than the theoretical development of computing systems. IT work is therefore inherently applied and sociotechnical, requiring ongoing competency development across technical, procedural, and collaborative domains (ACM/IEEE, 2017; U.S. Bureau of Labor Statistics, 2024). In the digital age, the ability to seek, evaluate, and use information effectively is essential for building professional competencies (Association of College and Research Libraries, 2016, 2025). This is especially true in information in IT, a field where knowledge evolves rapidly and is often complex and socially distributed across people, documentation, and tools (Johri, 2025; Leiß and Rausch, 2023; Robillard and DeLine, 2011). While the information behavior literature has long examined how people seek and share information and educational research has focused on formal training and hands-on skill acquisition (e.g., Case et al., 2023; Ericsson et al., 1993; O'Grady, 2012), a critical gap remains. Little is known about how aspiring and current IT professionals develop their competencies through informal, self-directed learning in real-world contexts (Eraut, 2004). Few studies have mapped the learning behaviors and trajectories of IT learners outside formal classrooms, leaving an incomplete understanding of how they cultivate the knowledge, skills, and attitudes needed for professional growth (Head et al., 2013; Weiner, 2011).

This gap is especially important in the context of informal, self-directed learning facilitated in online communities. Platforms like Reddit have become key spaces for informal learning through community practices that make it possible to learn "in the wild" via discussion, feedback, and resource sharing (Haythornthwaite et al., 2018; Record et al., 2018; Sengupta, 2021; Stvilia & Gibradze, 2022). Evidence from Q&A programming communities also documents identifiable e-mentoring activities (Kariri and Rodríguez, 2019). However, little research has closely examined how these community behaviors facilitate into IT competency development over time. Furthermore, much of the existing work fails to connect individual learning actions with the broader social systems that support competency building. This analytic connection is emphasized in sociocultural and sociotechnical theories of learning and participation (Baran and Cagiltay, 2010; Engeström, 1987; Rosenbaum and Shachaf, 2010; Wenger, 1998).

This gap is particularly consequential in IT because competency development in this field differs structurally from many other professions. IT knowledge and tools evolve rapidly, requiring continuous updating of competencies beyond formal education and structured workplace training. Disruptive innovations like generative AI are reshaping the IT job market at an unprecedented pace, rendering some skill sets obsolete even as they create demand for new ones (Hazzan and Erez, 2025; Urbaczewski and Keeling, 2025; Eloundou et al., 2023; International Labor Organization, 2025;

World Economic Forum, 2025). This environment of continuous change requires both aspiring and current professionals to be lifelong learners who can constantly update their competencies (World Economic Forum, 2025). Formal curricula and corporate training alone cannot keep pace with the rapid pace of technological advancement, particularly given the scale of expected skills disruption and upskilling/reskilling needs (Hazzan and Erez, 2025; Noe, Clarke et al., 2014; Urbaczewski and Keeling, 2025; World Economic Forum, 2025). This drives many individuals to seek timely knowledge and skills through self-directed channels and informal learning (Cerasoli et al., 2018; Tannenbaum and Wolfson, 2022).

Moreover, IT learning is deeply embedded in distributed sociotechnical systems in which knowledge is externalized across documentation, code repositories, community archives, and technical tools rather than confined to formal instructional settings (Case et al., 2023; Robillard & DeLine, 2011). Informal online communities therefore function not merely as supplementary resources but as critical infrastructures for competency development. They provide access to experiential knowledge, feedback, mentoring, and opportunities for identity formation that may otherwise be unavailable to aspiring professionals (Ardichvili, 2008; Haythornthwaite et al., 2018; Wenger, 1998). Yet despite the centrality of these environments to IT learning, limited research has examined how aspiring and current IT professionals engage in self-directed learning within these communities, how their competencies develop over time, and how individual learning processes interact with broader social and technological systems. Addressing this gap is essential for advancing theoretical understanding of informal learning in sociotechnical professions and for informing education and workforce development in rapidly evolving technological domains.

This study addresses that gap by analyzing Reddit discourse among aspiring and current IT professionals. It investigates how IT learners engage in self-directed learning by examining the following research questions:

1. What competencies do learners describe being developed through participation in IT-focused online community settings?
2. What learning and career trajectories characterize IT learners' self-directed learning when it is mediated through community participation structures?
3. What self-regulatory strategies and tools emerge in these informal, peer-driven environments?

This study makes several contributions. It synthesizes a conceptual framework of community mediated informal IT learning. Theoretically, it integrates activity theory (AT), self-regulated learning (SRL), competency theory, and Communities of Practice (CoP) theory to model how competencies function as the object of community-mediated learning activity. Empirically, it provides an account of the competencies some learners describe developing, the learning and career trajectories they describe, and the self-regulatory practices they report using to adapt to rapid technological change. The study advances a view of online forums as extended sociotechnical learning infrastructures that can scaffold self-directed development. In addition, the study's findings can inform curricula and workforce-

development interventions that connect formal instruction with community-based learning, with implications for other rapidly evolving, knowledge-intensive fields beyond IT.

Related Work

Online communities can be defined as sociotechnical collectives whose characteristics can be analyzed in terms of the people involved, their purposes, norms and policies, and platform features (de Souza & Preece, 2004). These elements shape how members interact and exchange knowledge resources over time (Preece & Maloney-Krichmar, 2005). Online technical forums (e.g., Stack Overflow, Reddit subreddits) often function as CoPs that enable informal learning, peer assistance, and tacit knowledge exchange not easily gleaned from textbooks (Hara & Hew, 2007; Stvilia & Gibradze, 2022; Wasko & Faraj, 2005). These forums provide worked examples, feedback on attempts, and persistent public archives that allow learners to revisit and reuse solutions. Activity-theoretical analyses further suggest that such participation can generate emergent rules and divisions of labor, including roles such as discussants, material sharers, and lurkers (Baran & Cagiltay, 2010). As a result, when one member asks a question, many others can learn indirectly by reading the exchange without posting (Stvlia & Gibradze, 2022; Sun et al., 2014). This form of socially distributed scaffolding resonates with Vygotsky's zone of proximal development (1978). Open-source software ecosystems exemplify these dynamics. Newcomers typically start with peripheral contributions (e.g., small bug fixes), learn through feedback and code review from more experienced developers, and can progress to developer roles (Mockus et al., 2002; von Krogh et al., 2003; Steinmacher et al., 2015). CoPs also sustain motivation and accountability through shared purpose and communal norms (Ardichvili, 2008; Kraut & Resnick, 2012). Studies of open online forums suggest that, in the absence of institutional frames, community members establish and enforce rules, roles, and sanctioning practices, making governance a salient part of the learning environment (Haythornthwaite & Gruzd, 2020).

SRL is a strategic process in which learners set goals, monitor progress, and regulate cognition, motivation, and behavior. Decades of research identify SRL as a key determinant of achievement (Pintrich, 2004; Zimmerman, 1989). Research across K-12, higher, and continuing education shows that cultivating SRL strategies and strengthening self-efficacy is reliably associated with improved academic performance and persistence (Hemmler & Ifenthaler, 2024; Theobald, 2021; Xu et al., 2022). In addition, measurement instruments have been developed and validated to differentiate workers by degree of SRL in workplace settings (Fontana et al., 2015). The literature also shows that in informal communities, relatedness, competence, and autonomy support engagement (Kraut & Resnick, 2012; Ryan & Deci, 2000; Stvilia et al., 2008). Furthermore, a growth-mindset that values incremental progress and reframes failure as information cultivates resilience (Dweck & Leggett, 1988).

Thus, prior scholarship illuminates SRL in formal education and workforce upskilling and documents online communities as fertile sites of practice-based learning. Yet limited research has examined how

these perspectives intersect in practice. In particular, little is known about how aspiring and current IT practitioners engage in SRL processes. This study treats IT-related subreddits as online communities. They support persistent discussion, advice exchange, and peer feedback (Stvilia & Gibradze, 2022). These features make them suitable sites for studying informal learning.

Design

The study's research design was guided by Bailey's (1994) three-level measurement model, which brings together the conceptual, empirical, and operational dimensions of typology development. Using a qualitative research approach, the study unfolded in three phases.

In Phase 1, the study synthesized a general theoretical framework of informal learning mediated by online communities of practice (see Figure 1). In Phase 2, this framework guided the collection and analysis of participants' discourse traces in IT-related Reddit forums. In Phase 3, the findings from that analysis were fed back into the theoretical framework to develop a conceptual framework of community-mediated informal IT learning (see Figure 3).

Theoretical Framework

Online communities can be understood as sociotechnical environments embedded within broader learning systems. They are shaped by participants, shared purposes, community norms, and platform features. These environments provide tools, norms, feedback, and participation structures that can shape participation and, in turn, influence learning opportunities (de Souza & Preece, 2004; Preece & Maloney-Krichmar, 2005). This study employs a synthesized general theoretical framework to capture the complex, evolving nature of informal IT learning in online community settings (see Figure 1).

At the macro level, AT (Kaptelinin & Nardi, 2012) conceptualizes learning as a sociotechnical activity system in which a subject (the learner) acts on an object (the target competency or professional role) through mediating artifacts, as well as shaped by the surrounding community's rules, norms, and division of labor (e.g., advice seekers vs. advice givers on Reddit). Prior work on learning in open online forums highlights that these norms and participation structures are actively maintained by members through moderator oversight, sanctioning practices, and visible reputation systems, making governance itself a salient component of the learning environment (Haythornthwaite & Gruzd, 2020). In this study, such governance mechanisms are conceptualized as part of the rules and division of labor elements within the activity system.

AT has been used as an analytical lens for understanding the social structure of online environments by situating learners within a larger activity system, rather than treating their actions as isolated behaviors (Baran & Cagiltay, 2010). AT's development principle conceptualizes learning as transformative. The object of activity functions both as a motive and as a structuring device, and

competencies change through iterative cycles of practice and feedback (Kaptelinin & Nardi, 2012). This systems view clarifies how individual agency and community arrangements co-produce learning outcomes. A trajectory perspective can further emphasize the temporal development of activity (Corbin & Strauss, 1991; Woll & Bratteteig, 2018). Trajectories describe how activities and roles evolve over time as participants respond to new conditions, contradictions, and opportunities. In the context of informal IT learning, this perspective can highlight how learners' goals, competencies, and career orientations can develop through repeated cycles of participation, feedback, and adjustment within the community activity system.

While AT provides the high-level structure of the learning system, it does not by itself fully specify the internal structure of the learning object, the learner's regulatory processes, or the social mechanisms through which participation supports development. For that reason, the study complements AT with competency theory, SRL, and CoP. To further conceptualize the structure of a learning activity's object or objective, the study draws on the McClelland competency model (McClelland, 1973; Spencer & Spencer, 1993). Competencies are enduring characteristics linked to effective performance and are often depicted via the "iceberg" metaphor. Surface components comprising knowledge (i.e., factual/procedural understanding), skills (i.e., applied capability), and attitudes (i.e., predispositions such as persistence or openness) are visible and trainable (see Figure 1). Beneath the surface lie more stable attributes such as self-concept (values, identity, perceived roles), traits (e.g., conscientiousness, adaptability), and motives (e.g., achievement, affiliation). In this view, KSAs are necessary constituents of competence, while deeper dispositions are core drivers of sustained learning and effective action.

Next, SRL is used to conceptualize *subject's* learning actions (see Figure 1). While this study examines learning in the context of self-directed learning, SRL provides the theoretical lens for analyzing the mechanisms through which learners manage that process. Self-directed learning refers to learners' autonomy in initiating, planning, and managing their own learning trajectories outside formal instructional structures. In contrast, SRL refers to the cognitive, motivational, and behavioral processes learners use to regulate their learning, including goal setting, strategy use, monitoring, and reflection (Zimmerman, 1989; Pintrich, 2004). In this study, self-directed learning defines the broader learning context, while SRL explains the regulatory processes learners employ within that context. The SRL model describes how learners may exercise agency within the constraints and mediating structures conceptualized by AT, while continually adjusting goals, strategies, and effort.

Finally, CoP theory (Lave & Wenger, 1991; Wenger, 1998) can further inform the social mechanisms through which learning and identity development occur within the community component of the activity system. Through a CoP lens, learning can be conceptualized as participation in a shared practice, where learners engage with other members, interpret shared artifacts, exchange assistance, and internalize community norms and values. Such participation can shape individual SRL by providing community models, feedback, norms, and resources that influence goal setting, strategy selection, and self-evaluation. It can also take the form of legitimate peripheral participation. Through

this process, newcomers may initially engage in low-risk, observational, or help-seeking activities and gradually assume more central roles as their competence and confidence increase. Within the broader AT framework, CoP therefore helps explain how the community dimension of the activity system supports learning through participation, identity formation, shared repertoires, and access to more experienced others (see Figure 1).

Together, these complementary perspectives form a coherent framework rather than parallel lenses. Activity theory defines the high level structure of the sociotechnical learning system. SRL explains learner-level regulatory processes within that system. The competency model clarifies the structure of the learning object and outcomes. CoP theory explains the social participation mechanisms through which community interaction supports learning and identity development. Taken together, the framework bridges individual and collective dimensions of informal IT learning in online communities (see Figure 1)

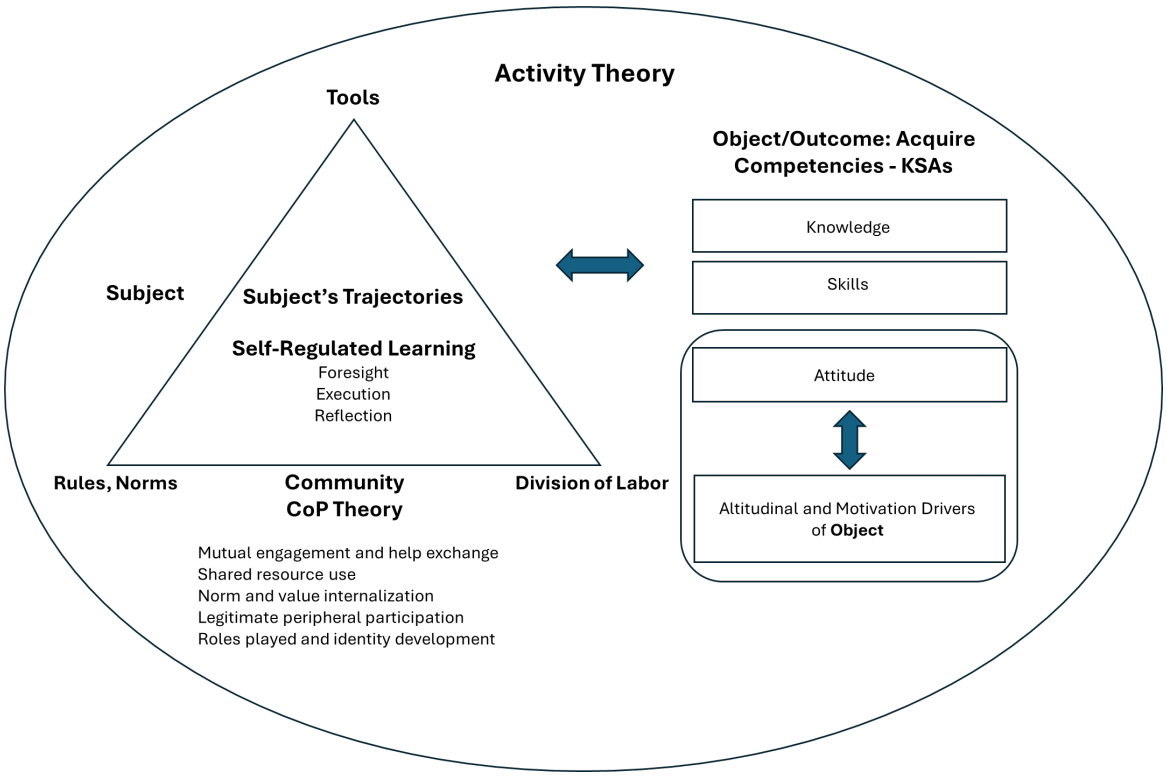

Figure 1. Theoretical framework of self-directed learning in online communities synthesized from AT, SRL, and CoP theory.

Data Collection and Analysis

Data Collection and Preparation

This study analyzed 464 Reddit threads (i.e., each a post plus its full comment tree) containing 59,471 comments. Data were collected on May 20, 2025 via the Reddit API using PRAW from ten IT related subreddits: r/netsec, r/CompTIA, r/cybersecurity, r/learnprogramming, r/networking, r/techsupport, r/ITManagers, r/InformationTechnology, r/ITCareerQuestions, and r/sysadmin. The selected subreddits represent complementary domains within IT competency development. r/learnprogramming supports foundational programming skill acquisition. r/CompTIA centers on entry-level certification pathways frequently used to enter IT roles. r/ITCareerQuestions focuses on career navigation and transition. r/sysadmin, r/networking, r/netsec, and r/cybersecurity correspond to infrastructure, systems, and security specializations. r/InformationTechnology and r/ITManagers reflect broader professional discourse, including organizational and managerial aspects of IT practice.

To capture both temporal variety and platform-mediated prominence, the study sampled from three listing streams ("new," "hot," "top"), limiting requests to 100 posts per stream per subreddit. Sampling across these streams allowed inclusion of both newly emerging discussions and threads that had accumulated high levels of community endorsement determined by Reddit's ranking algorithms and community voting. A regex filter retained content with learning/competency terms (e.g., "learn," "skill," "knowledge," "attitude," "mindset," "competency," "self taught," "certification," "entry level," "struggling"). For matches, the authors stored metadata (i.e., title, flair, score, comment count, subreddit, timestamps) and full text. Although sampling up to 100 posts per each of the three streams per subreddit, creates a theoretical maximum of 3,000 posts, Reddit's listing streams overlap substantially and the Reddit API does not always return a full 100 unique items per stream. After deduplication across streams and subreddits, and application of the regex-based relevancy filter, the final dataset comprised 464 unique threads. The data span April 2015-May 2025 (see Figure 2).

Threads were segmented into 15,658 analyzable units with a Python script. The script split posts into sentences and grouped them into coherent chunks capped at 100 tokens to fit LLM input constraints. Segments under six words were dropped. Comment text followed a lighter procedure. They were split on line breaks and trimmed to preserve user-authored granularity.

Hybrid Human-LLM Coding

The analysis pipeline of the study comprised three stages: Manual qualitative content analysis and codebook development, deductive coding by an LLM, evaluation and calibration, and evidence selection for reporting (see Figure 2).

Codebook Development

The study's initial codebook comprised a priori codes deductively derived from the synthesized theoretical framework. Two authors independently coded a random sample of 40 threads using a priori themes, reconciled differences, and refined the scheme to 27 thematic codes grouped into 11 higher-

level categories aligned with the theoretical framework (see Table 1). The authors then double-coded 10 additional threads to assess reliability, achieving Cohen's kappa of 0.82. The authors discussed the identified disagreements and achieved a consensus, and updated the codebook accordingly. The finalized hierarchical codebook was then applied to analyze the segmented data corpus (see Figure 2).

LLM Coding

To scale deductive coding to the whole data corpus level while preserving theoretical alignment and interpretive rigor, the study employed GPT-5-mini via OpenAI's API as a structured classification engine. The model was used in a constrained deductive mode rather than as a generative summarizer or fine-tuned supervised classifier. This approach aligns with emerging methodological guidance on human-in-the-loop LLM-assisted qualitative analysis, which emphasizes schema constraint, transparency, and validation against human reference coding (Dunivin, 2025; Tai et al., 2024). The structure of the prompt used with the LLM consisted of two components: (1) a fixed system instruction template specifying coding rules and (2) dynamically generated input containing the allowable labels and the target text segment.

The instruction template imposed four requirements. First, the model assigned codes only when a segment described learning or competency-related activity. Second, it selected codes exclusively from the predefined codebook. Third, it supported each assigned code with verbatim textual evidence from the segment. Fourth, it reported a quantitative fit score (0-100) indicating semantic alignment with the code definition.

The allowable labels were programmatically extracted from the codebook schema file and inserted into each prompt as a structured list, preventing the model from generating unsupported categories. Each segment was passed to the model together with its unique identifier. The model returned structured JSON output including the segment identifier, an abstention flag, candidate codes, fit scores, supporting evidence excerpts, and a brief rationale.

The highest-fit code was recorded as the primary candidate, while lower-scoring candidates were retained as alternative interpretations. By embedding the full codebook directly into the prompt and requiring verbatim evidence for each assignment, the automated coding process remained theoretically constrained and transparent.

Evaluation and Calibration

To ensure methodological rigor comparable to supervised classification workflows, the study implemented a structured calibration procedure. A stratified sample of 400 segments was manually coded to balance code frequency, subreddit diversity, temporal distribution, and boundary cases. The study then swept the fit thresholds alpha from 50-100 and computed precision and recall relative to human-coded labels. Thresholds were set at the lowest alpha achieving precision >= 0.85, prioritizing reliability of automatically accepted classifications. Codes with fewer than five positive instances in the calibration set were designated uncalibrated and required manual review.

Additional guardrails were implemented to preserve quality control. Only the top three candidate codes were considered. Per-code thresholds were enforced with a alpha+5 “grey zone”: segments with fit > (alpha+5) were auto-accepted; fit =< (alpha+5) were queued for review. For example, if the calibrated threshold (alpha) for a code was 80, then only segments with a fit score above 85 were automatically accepted for that code. A segment scored at 83 would still be treated as a plausible match, but it would be routed for human review rather than accepted automatically. This conservative buffer reduced the risk of accepting borderline classifications while still allowing the model to surface potentially relevant segments. Cases in which the difference between the top two candidate fit scores was less than 10 points were also flagged for review. All segments assigned uncalibrated codes required manual verification. Segments for which the model returned abstain = true were treated as not applicable.

Across 15,658 segments, the model identified 9,346 as potentially applicable to the coding schema. Of these, 2,665 met automatic acceptance thresholds, 3,885 were routed for review, and the remainder were rejected, including abstentions. This hybrid procedure ensured that automated classifications met predefined reliability criteria while preserving human oversight and interpretive accountability (see Figure 2).

Evidence Selection for Reporting

To ground findings in representative data while maintaining feasibility, the study selected evidence segments from three sources. Archetype quotes were the highest-fit auto-accepted segments (up to 3). Boundary quotes were the nearest above-cutoff items (alpha+5; up to 2). Finally, for uncalibrated codes, the study drew top-fit review items labelled Pending (up to 2). This yielded 86 quotes across 27 codes (37 Archetype, 24 Boundary, 25 Pending). The study then merged these with 306 segments from the 400-segment calibration set for which the human coder and LLM concurred. This process yielded 382 evidence segments used to write the study’s findings (see Figure 2). These segments represented 215 unique Reddit threads and 319 unique Reddit contributors/users (see Table 2). Quoted text was edited to improve clarity and reduce the risk of re-identification, without altering its meaning. This included removing usernames and URLs.

Table 1. Codebook themes and frequencies in the final sample (i.e., 382 segments) used for reporting.

Themess	**Frequency**
Forethought Phase	3
Goal Setting	32
Strategic Planning	96
Self-Efficacy	22
Interest / Intrinsic Motivation	9
Performance / Mastery Orientation	5
Performance Phase	6
Self-Instruction	6

Imagery	1
Attention / Focus Control	6
Task Strategies	34
Reflection Phase / Self-Judgment	14
Reflection Phase / Causal Attribution	22
Reflection Phase / Self-Satisfaction / Affect	14
Reflection Phase / Adaptive / Defensive Inferences	6
Division of Labor	4
Role	6
Norm	5
Mediating Artifact (Tool/Resource)	31
Strategy (General)	11
Object / Goal of Action	5
Object / Motive	5
Mediation in Activity (Workflow)	10
Contradiction	11
Competency / Knowledge	5
Competency / Skill	9
Competency / Attitude	4

Table 2. Distribution of segments, threads, and unique users by subreddit in the evidence segments used for reporting.

Subreddit	**# of segments**	**# of unique threads**	**# of unique contributors/users**
learnprogramming	130	63	105
ITCareerQuestions	106	57	84
CompTIA	50	31	46
InformationTechnology	35	25	29
cybersecurity	24	13	22
networking	13	8	11
sysadmin	11	7	9
ITManagers	9	7	9
techsupport	3	3	3
netsec	1	1	1
	382	**215**	

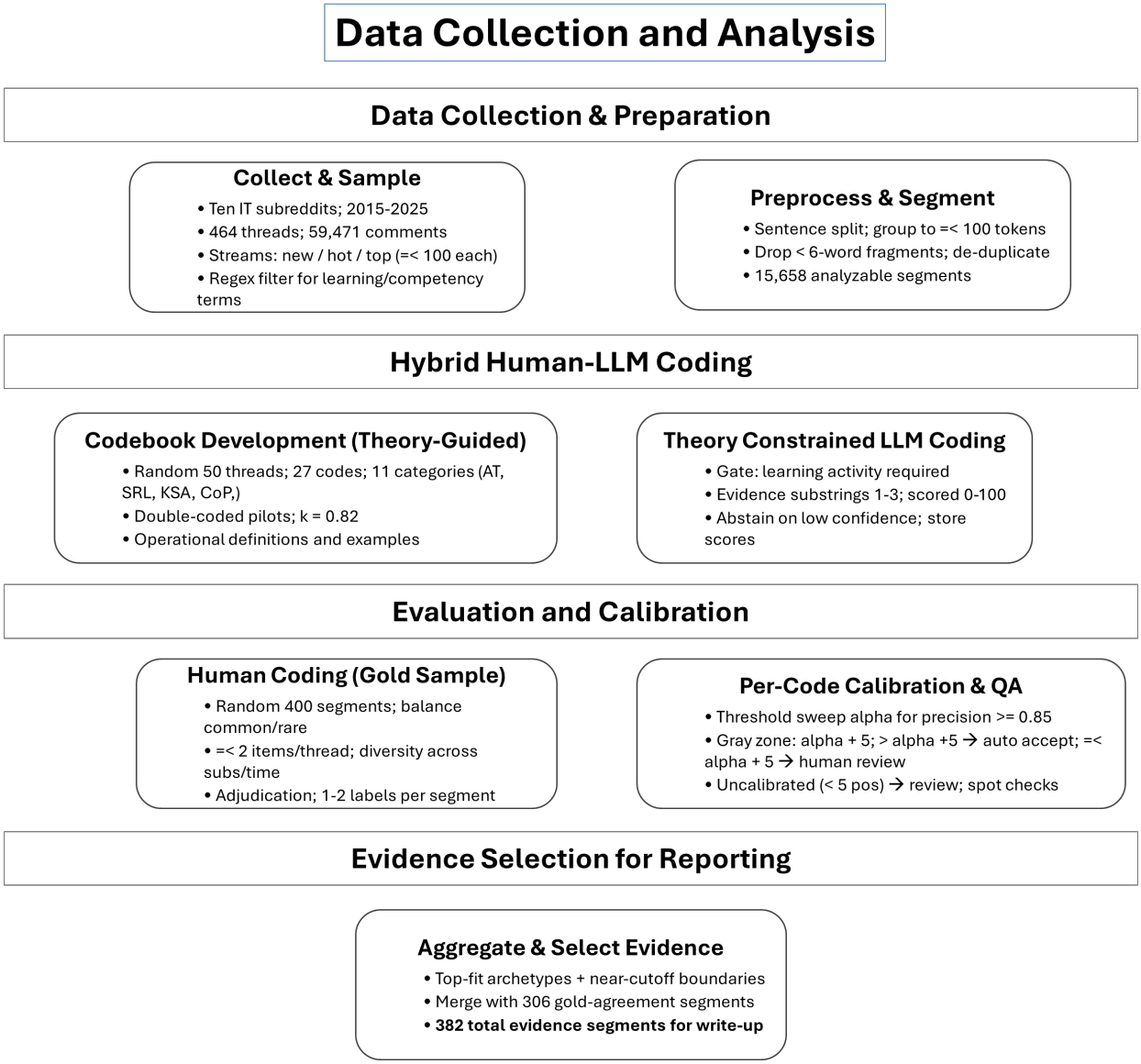

Figure 2. Data collection, coding, and evidence selection process.

Findings and Discussion

Competencies Members Described Developing

Our analysis showed that IT learners described developing a broad suite of competencies through their self-directed engagement. These reported competencies spanned technical knowledge, procedural skills, attitudes, and professional identity (see Figure 3). First, learners reported building technical knowledge and conceptual understanding, the theoretical foundations of IT. Many began with core certifications (e.g., CompTIA A+, Network+, Security+) or canonical textbooks to acquire fundamental concepts. This was often guided by community advice on what to study. However, knowledge is not static. Some learners approached knowledge as something to be deeply understood and continuously updated. As one member reflected, "learning is just going from incompetence to competence… there's a difference between what you've been exposed to and what you actually know how to do on your own" (P004). This sentiment reflects the community ethos that true understanding comes from applying knowledge, not just memorizing it.

Indeed, hands-on skills and procedural know-how were heavily emphasized. Learners described honing practical skills by undertaking self-initiated projects. These included setting up home labs, writing small programs or scripts, solving cybersecurity Capture-the-Flag challenges, contributing to open-source projects, etc. Community members often regarded this experiential "learning-by-doing" as a more effective path to competence than formal coursework. Members shared numerous success stories where self-driven projects led to tangible outcomes. These included stories of landing a job, impressing an interviewer, automating a work task, or accelerating career advancement. For instance, one member built a Raspberry Pi home server, which taught them about networking and containers. It also served as a portfolio project that strongly impressed a job interviewer (P116). These examples suggest that members perceived that procedural know-how (e.g., troubleshooting, scripting, system configuration) as developing interdependently with theoretical knowledge. Community appears to reinforce the importance of such integration of knowledge and skill competencies by upvoting and praising it. Prior research on "learning in the wild" shows that learning in open online forums is partly learning the forum itself. Participants must learn and comply with local norms, posting genres, and community-maintenance practices, including how norm violations are sanctioned (Haythornthwaite et al., 2018). These governance structures (e.g., moderation and reputation markers such as flair) do not constitute IT competencies per se. However, they shape the interactional conditions under which IT competencies are discussed, evaluated, and modeled in community exchanges (Haythornthwaite & Gruzd, 2020).

In addition to knowledge and skills, some learners describe internalizing key attitudinal competencies through community participation. A recurring theme was the importance of mindset and "soft skills." Members frequently stressed that having the right attitude can accelerate one's growth. These discussions reflected not only growth mindset and perseverance but also members developing sense of

self-efficacy, confidence in one's ability to master IT skills over time (see Figure 3). The subreddits appeared to cultivate or reward traits like intellectual curiosity, humility, resilience, adaptability, and a collaborative spirit. For example, effective communication and a customer-oriented mindset were mentioned as keys to standing out in IT roles. One hiring manager in the subreddit advised that "technical skills can be taught, but [traits like] communication and customer focus can put you leaps ahead" (P103). Similarly, some experienced members stressed openness to learning and not fearing ignorance. They encouraged newcomers to ask "dumb" questions and to view mistakes as learning opportunities. Many posts reinforced a growth mindset, suggesting that perseverance and attitude are the "secret sauce" behind success, more than innate genius. As one member emphasized, "The right attitude opens doors… tech skills can be taught, but the right attitude is the foundation" (P289).

Finally, the subreddit appeared to offer a space to envision and begin enacting an identity as an IT professional. Many learners explicitly linked their learning trajectories to desired roles. For example, one wrote, "I'm a helpdesk tech now, aiming to become a cybersecurity engineer" (P246). Learners described building an IT-professional identity by progressing toward self-set goals such as earning certifications, completing projects, and securing entry-level jobs. Each step drew peer recognition that reinforced that identity. After months of study, one learner announced, "Landed a junior sysadmin job, officially part of the sysadmin club now!" (P400), and peers offered congratulations. Such public milestones marked a transition from outsider to insider in both the community and the occupation. Some members also reported developing deeper dispositions, such as perseverance and humility that likely drive long-term success. This aligns with competency models, arguing that surface-level KSAs must be coupled with personal dispositions for sustained superior performance (Spencer & Spencer, 1993). The community appeared to support those deeper competencies. Growth-mindset messages and learning-from-failure narratives were common, echoing research on the importance of mindset for achievement (e.g., Dweck & Leggett, 1988).

These findings also resonate with the literature on informal learning. The emphasis on hands-on projects and real-world practice aligns with what Parker and Roessger (2020) frame as action-in-context. Many Reddit learners practiced deliberately by building projects from scratch or using flashcards to quiz themselves. Those habits functioned as retrieval practice that reinforced conceptual understanding. Scholars in computing education argue that, given the rapid change in computer science and widespread workplace use of GenAI, students need ongoing practice and upskilling to remain job-ready (Hazzan & Erez, 2025; Urbaczewski & Keeling, 2025). Members' self-initiated projects, from home labs to open-source contributions, exemplify the proactive, lifelong learning needed amid continuous change.

The cultivation of professional identity through community participation has been supported in prior studies. Wenger's CoP framework holds that learning and identity formation are inseparable (Wenger, 1998). One becomes a practitioner by engaging in communal practice. Our findings showed that some IT learners described not only gaining skills, but also beginning to see themselves as practitioners. Many adopted the identity of "IT professional" even before their first job. This outcome reflects Gee's

notion of an “affinity identity” (Gee, 2000). It is identification through participation in a shared endeavor. In formal education, identity work is often implicit. In the subreddit communities, it was explicit and celebrated. Members, for example, proudly announced that they had joined the “sysadmin club” (P400).

Prior research shows Reddit communities provide advice, feedback, collaboration, and public praise, enabling mentoring-like learning (Bao et al., 2021; Stvilia & Gibradze, 2022). The present study extends that work. by identifying discourse-level patterns consistent with specific identity-shaping mechanisms. These include explicit role modelling by veteran members, public recognition of milestones, and narrative templates of career progression that newcomers may draw upon and emulate.

Trajectories and Transitions

The analysis showed that members described informal IT learning follows diverse paths with key transition points (see Figure 3). A recurring path used a generalist entry-level role as a springboard to specialization. Many started in broad IT support (e.g., help desk, tech support) to build a foundation. They then aimed at cybersecurity, networking, system administration, or cloud engineering. Members framed entry-level work as valuable but warned against getting “stuck.” They urged newcomers to avoid complacency, set timelines for moving up, and keep building skills. Goal setting for career transitions was common. Some learners shared multi-stage plans (e.g., “earn A+ and Network+, spend 1-2 years in helpdesk, then pursue junior cybersecurity,” P091). They sought validation from experienced members. Senior contributors reinforced foresight and planning (e.g., “Use helpdesk to learn, but don’t stay more than ~2 years,” P402) and offered tactical advice on skills and certifications. Thus, learners appeared to engage in self-regulated career planning. Community feedback might have helped them stay accountable to long-term goals. Viewed through a trajectory perspective, these accounts illustrate how informal IT learning can unfold as an evolving developmental path rather than as a sequence of isolated learning episodes (Corbin & Strauss, 1991; Woll & Bratteteig, 2018). In this perspective, trajectories refer not only to the direction of career movement but also to the ongoing work learners perform to shape those paths. Community members described planning learning sequences, seeking feedback, reassessing goals after setbacks, and adjusting strategies in response to new opportunities (see Figure 3).

Trajectories were rarely linear. Some learners reported reassessing direction after setbacks or new insights. The process resembled SRL’s cycle (i.e., forethought, execution, reflection) and activity learning, where activity contradictions prompt change (Engeström, 2001). One member reported a turning point: “I just bombed an interview HARD… nothing I do in my current role prepared me for those questions” (P038). The post revealed a mismatch between current learning and target-role demands. Community replies provided a course correction. Members pointed out knowledge gaps and suggested mock-interview practice. Failures and feedback spurred adjustments such as further training, a shift in specialization, or new responsibilities to gain needed experience. Over time, growth

accumulated. A mid-career professional described a decade of progress that far exceeded what entry-level certifications cover. Several noted the diminishing value of formal credentials as experience deepened ("my certs expired, but I learned so much beyond them," P244). Real-world practice and continuous learning drove their advancement.

The community often appeared to scaffold these journeys. Reddit's format supports collective, longitudinal mentorship. Newcomers can browse years of "How I broke into X" and "Career progress after five years" threads that serve as roadmaps and cautionary tales. Many users return with updates, creating a public narrative of learning rarely captured in formal education. There appears to be some degree of division of labor. Members at different stages are always present, so a learner can find someone just ahead on the path. Some managers advised technicians considering management, and penetration testers guide help desk staff toward cybersecurity. Near peer mentors can offer stage-appropriate insights. Their knowledge sharing appeared to prepare learners for upcoming challenges and helps them navigate organizational and technical hurdles.

Thus, trajectories in these communities often featured staged progress, adaptive adjustments, and social support at critical junctures. Many learners set early goals, cycled through practice and reflection, and gradually moved from entry-level work roles (e.g., help desk or general technical support) to more specialized or higher-responsibility roles (e.g., cybersecurity, networking, systems administration). These transitions were reflected in codes capturing career roles, competency development, and self-regulatory practices (e.g., goal setting, strategy use, monitoring, and reflection), which documented how learners planned, evaluated, and adjusted their learning in relation to role requirements and opportunities. Both horizontal moves (broadening skills) and vertical moves (greater professional responsibility) occurred. The community functioned in these accounts as a resource for navigating role requirements, helping learners interpret expectations, locate pathways, and obtain feedback (see Figure 3).

These adaptive paths align with modern views of careers as lifelong learning. The IT field changes constantly (Hazzan & Erez, 2025; Urbaczewski & Keeling, 2025). Learners often appeared to engage in expansive learning (Engeström, 2001), redefining goals and practices as conditions shifted. Failed interviews became learning opportunities that triggered new cycles. SRL principles also appeared at the career level. Prior research suggests that online learners who set goals and self-evaluate may achieve more (Kizilcec et al., 2017). The subreddits often appeared to encourage career-level SRL strategies: reflect on each role, plan the next move, and seek feedback. These findings help extend SRL theory into informal professional development.

Social capital and networks shaped these trajectories. Bourdieu argued that durable networks provide mobilizable resources for material and symbolic advantage (Bourdieu, 1986). The community can offer both bridging and bonding social capital (Putnam, 2000). More recent comparative work on programming forums suggests that knowledge-centric exchanges can be understood as resembling bridging capital. In contrast, encouragement and interpersonal support may be interpreted as resembling bonding capital (Sengupta, 2021). This study also found that the subreddits often appeared

to bridge some novices to diverse experts and opportunities. It also appeared to provide bonding support through encouragement and solidarity. This capital might have eased transitions. For example, a help desk worker aspiring to move into cybersecurity reported gaining both knowledge and connections to practitioners, even if only online.

Learning Strategies and Tools

Learners in the Reddit IT communities displayed in their posts a variety of learning strategies. The analysis identified discourse consistent with all three SRL phases: Forethought (planning and goal-setting), performance (execution and monitoring), and self-reflection. It also identified strategies and tools referenced with each phase (see Figure 3).

Planning and Goal-Setting (Forethought)

Many learners appeared to act as their own curriculum designers. They created explicit learning roadmaps or study schedules. For instance, one learner described a 6-9 month plan to go from zero to full-stack developer. They broke the goal into weekly topics and monthly review checkpoints. Learners also articulated metacognitive self-awareness during planning. For example, one individual recognized a tendency to get distracted and committed to "make a plan and schedule and stick to it" (P334).

Planning in this context was often a socially collaborative activity. Learners frequently asked the community for advice on how to plan their learning. For example, one member asked, "Do normal people use Trello? How do you break down and plan projects for yourself?" (P360). That question sparked discussions about project-management methods. The community responded by sharing templates, tool suggestions (e.g., Trello boards, Notion pages, simple to-do lists, etc.), and tips like using the Pomodoro technique for focused study sessions. This peer exchange of planning techniques appeared to crowdsource the forethought phase. It turned what is usually a solitary task into a communal one. Additionally, some learners engaged in public accountability mechanisms. They posted weekly or monthly goals and progress (e.g., by joining "#100DaysOfCode" challenge threads, P049) to leverage social accountability as a motivational tool. This practice transformed planning into a kind of social contract.

Learners also used technology to plan. Some members reported using generative AI for planning and clarification. One noted that while studying for a certification, they wrote down missed questions and then "entered them into ChatGPT to explain in layman's terms." Community-shared resources, such as wikis and flowcharts, also served as planning aids. For example, one learner cited an offensive operations flowchart mapping cybersecurity certifications as the roadmap they followed (P003). Newcomers could adopt these community-curated learning paths (e.g., earn A+, then Network+, then Security+). In doing so, they structured personal goals around collective wisdom. During the

forethought phase, individuals set personal learning goals and relied on communal knowledge and tools to make those goals concrete and achievable.

Execution and Learning Strategies (Performance)

During the performance phase, learners described employing strategies to maintain engagement, comprehend complex material, and solve problems. A prominent approach was independent problem-solving through project-based practice. Veterans frequently advised against over-reliance on step-by-step tutorials. Instead, they encouraged building something from scratch or deliberately tackling problems without an immediate answer key. For example, one member counselled a peer, "If you're stuck, you don't need to find the answer, you need to figure out how to find the answer" (P001). This shifts the focus from getting a quick solution to developing a method for problem-solving. It trains learners *how to learn*. Another member advised a novice programmer on how to build problem-solving skills. They suggested "write projects without tutorials." They also recommended practicing how to break big problems into smaller ones (P367). The community often reinforced these approaches by sharing personal anecdotes of success. That facilitated a culture in which struggle is expected and valued as part of the learning process. For instance, if someone posted about feeling overwhelmed by a project, others would chime in with coping tactics like "take a short break, then break the problem into small pieces" (P061).

Multi-modal learning strategies were also evident. Many members combined multiple modes of learning, such as reading documentation or books, watching tutorial videos, and engaging in hands-on practice. One member detailed a weekly routine of roughly 15 hours split between building projects, reading/watching tutorials, and practicing problem sets (P259). Learners also leveraged a range of tools and technologies during execution. Home lab setups (e.g., virtual machines, networking equipment, Raspberry Pi clusters) were common. Learners treated these personal lab environments as sandboxes to experiment freely. They tried things that would be impossible or too risky in a production environment at work. Traditional tools were often repurposed for learning. Version-control platforms like GitHub became public portfolios where beginners pushed code and invited feedback from others. Some learners used note-taking apps or mind-mapping software to create personalized documentation. One described drawing their own diagrams to visualize an abstract concept (P206). In that case, the act of diagramming became a learning method. For topics that required memorization, such as certification prep, flashcard and spaced-repetition apps (e.g., Anki or Quizlet) were popular.

Adaptive help seeking emerged as a core self-regulatory strategy that the community augmented. Rather than staying stuck on a problem in isolation, some learners learned that asking the community for a hint or nudge is acceptable and efficient. Reddit's Q&A format can act as a real-time support tool. This reflects an interplay of individual regulation with social resources. Knowing when and how to seek help is a metacognitive skill (Hacker et al., 2009). In this environment, self-regulation often includes recognizing when to tap into the distributed cognition of the community. In effect, the community can serve as an extension of one's memory and problem-solving capacity (Hutchins, 1995; Weick, 1995).

Learners also reported integrating new digital tools like AI into the execution phase. Some members used AI chatbots (e.g., ChatGPT or GitHub Copilot) not just in planning but also while practicing skills. For instance, they used GenAI tools to generate custom coding challenges, explain confusing error messages, or simulate a mock technical interview with Q&A (P060, P009). Learners openly exchanged tips on how to use AI tools effectively. For instance, they discussed how to prompt ChatGPT in a way that guides you without simply giving away the solution. This peer-driven experimentation shows the community functioning as a collective innovation hub for learning strategies. Members used GenAI-based techniques (e.g., leveraging AI for self-testing or on-demand tutoring) that formal education is only beginning to explore (Hazzan & Erez, 2025; Urbaczewski & Keeling, 2025).

Reflection and Adaptive Regulation (Self-Reflection)

In the final SRL phase, learners may reflect on their performance and adapt future strategies. Some members engaged in metacognitive reflection. It was common for members to post about outcomes (both successes and failures) and analyze what worked or what needed to change. For example, after completing a project or passing an exam, learners often shared "What I learned" posts (P029, P045). They listed tactics they used or pitfalls they encountered. These posts served as self-assessment for the author and as advice for others. In one case, a member who failed a job interview received crowd-sourced advice on turning that failure into a learning plan. Peers suggested specific topics to study and recommended mock-interview techniques.

Some learners also kept personal learning logs or journals. They shared excerpts on Reddit to track progress over months or years. This journaling functioned as a reflection tool that made growth visible and could help maintain motivation over long periods. Some described using checklists for self-evaluation (P014, P027). Because such checklists and reflective practices were shared in the community, individual reflection often became a communal artifact. Others could adopt or adapt the same self-evaluation techniques for their own purposes.

Some learners also brought AI into the reflection phase. For example, they used ChatGPT to explain why a solution works (to ensure true understanding) or to simulate an expert reviewing their approach. These uses helped confirm understanding and reveal misconceptions (P336, P347). In effect, AI acted as a personalized tutor during reflection.

These findings align with existing SRL research and extend it to informal settings. The observed strategies (i.e., goal-setting, time management, self-monitoring, and help-seeking) are well-documented predictors of success (Pintrich, 2004; Zimmerman & Martinez-Pons, 1986). For example, Pintrich (2004) emphasizes setting specific goals and maintaining self-efficacy as foundational. Broadbent and Poon's (2015) review of online learning found that high-achieving students use more self-management strategies. These include scheduling study time and seeking help when needed. Kizilcec et al. (2017) found that in MOOCs, goal setting and strategic planning predict attainment of personal course goals, including certification. Consistent with this literature, participants in IT-related subreddits described adopting comparable practices. Furthermore, the analysis identified discourse

consistent with metacognitive processes such as self-reflection and subsequent adjustment of tactics. This supports Zimmerman's (1989) assertion that the self-reflection phase closes the learning cycle by informing the next round of forethought.

These findings align with prior research on SRL and extend it to informal, community-mediated settings. The strategies identified in participants' accounts (e.g., goal setting, time management, self-monitoring, and help-seeking) are well-established predictors of learning success (Pintrich, 2004; Zimmerman & Martinez-Pons, 1986). For example, Pintrich (2004) emphasizes the role of goal setting and self-efficacy, while Broadbent and Poon (2015) show that higher-performing online learners tend to employ more self-management strategies, including time planning and help-seeking. Similarly, Kizilcec et al. (2017) find that goal setting and strategic planning in MOOCs are associated with attainment of personal learning goals. Consistent with this literature, participants in IT-related subreddits described adopting comparable practices. In addition, the analysis identified discourse consistent with metacognitive processes such as self-reflection and subsequent adjustment of strategies, supporting Zimmerman's (1989) model in which reflection informs subsequent cycles of forethought.

The creative use of tools (e.g., mind-maps, AI assistants, and version control for feedback) also corresponds to prior findings. Garcia, Falkner, and Vivian (2018) note that e-learning tools can scaffold SRL strategies in computer science education.

A key contribution of this study is the demonstration of how social context can amplify SRL. Traditional SRL models have primarily conceptualized regulation at the individual level, with less attention to social and contextual dynamics. Recent work calls for incorporating these factors (Panadero, 2017). This study's findings answer that call by identifying the instances of community-supported self-regulation in practice. Some peers in the subreddits provided what, in classroom settings, might be teacher scaffolding or structured support. They shared strategies, offered feedback, and held members accountable. In doing so, they provided SRL supports that instructional designers often seek to build into formal courses (e.g., goal-setting prompts and peer-feedback systems; Bernard et al., 2014). This amplification is consistent with research on "learning in the wild," which argues that open online forums sustain learning in general through internally developed governance and norm-setting practices, such as moderation, reputation signals like flair, and the sanctioning of norm violations, that shape participation and knowledge exchange (Haythornthwaite & Gruzd, 2020; Haythornthwaite et al., 2018).

The integration of AI tools has implications for both practice and research. Generative AI is changing how computing-related disciplines are learned (Hazzan and Erez, 2025). Educators may need to rethink traditional pedagogies. Some members' use of ChatGPT as a tutor, quizzer, and explainer suggests that informal learners are at the frontier of AI-supported learning. Their accounts illustrate how AI can provide on-demand clarification of doubts or simulate interview scenarios for self-testing. This supports Urbaczewski and Keeling's (2025) point that future IS education must integrate AI.

Finally, these results underscore that *self-regulation is itself an essential competency for IT professionals.* Many members implicitly or explicitly recognized that knowing how to learn is as important as knowing what to learn. This aligns with the computing education literature showing that students must learn how to learn, not only what to learn, and that SRL skills are critical for that (Domino, 2024). Professionals in fast-changing fields often have to take charge of their development. This study contributes to the literature by detailing how that self-regulation is described in informal settings and which tools and strategies participants report employing.

Thus, the study findings suggest that informal, peer-driven environments can scaffold valuable self-regulatory practices. Rather than diminishing individual agency, the social context may enhance it by providing access to collective knowledge, accountability, and emotional support (see Figure 3).

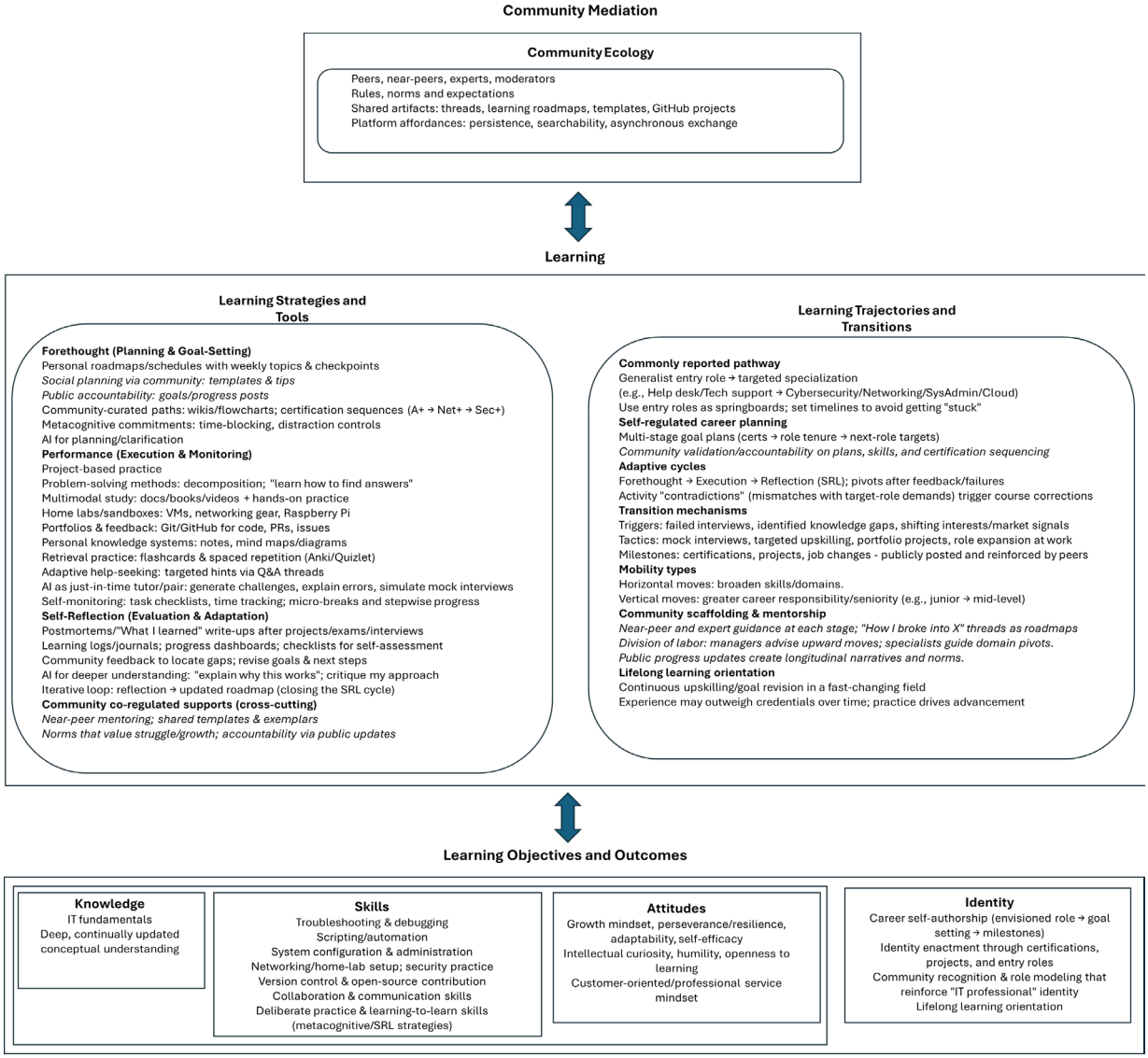

Figure 3. Conceptual framework of community mediated informal IT learning and competency development. *Note: Community mediation in the learning process is indicated in italics.*

Conclusion

This study examined posts and comments from IT-focused Reddit communities and synthesized a conceptual framework of community mediated self-directed IT learning (see Figure 3). The study identified discourse consistent with all three SRL phases: forethought, performance, and reflection. Accounts from IT learners showed a supportive, peer-driven context for growth. The subreddit communities were characterized in these data by encouragement, growth-mindset norms, and recognition. This was also aligned with participants' reported competency development. Some learners reported gains in technical knowledge and practical skills through projects and troubleshooting. They also emphasized attitudes such as self-efficacy, resilience, curiosity, adaptability, and clear communication. Many described an emerging professional identity as they documented progress and received peer feedback. Learning paths appeared diverse and often non-linear. Many began at the entry-level work roles working in help desk roles, and later moved toward specialized positions. Near-peer guidance, explicit goal setting, and adapting after setbacks were recurring themes. Learners reported using a wide repertoire of self-regulated strategies. These included planning study paths, project-based practice, reflective journaling, and targeted help-seeking. Learners used digital tools to lower the cost of feedback, search, and iteration. These findings are consistent with social views of SRL. At the same time, they refine our understanding of how informal communities can mediate IT learning.

This study contributes to research on SRL, sociotechnical learning, and competency development. It shows that, in participants' accounts, informal IT learning in online communities is regulated not only by individual learners but also by community interaction, shared artifacts, and distributed expertise. The findings indicate that goal setting, strategy use, monitoring, and reflection were frequently described as being shaped by peer feedback, exemplars, accountability, and collective problem solving. In this sense, the study extends social views of SRL by showing how regulatory processes can be scaffolded through participation in online communities rather than treated solely as individual cognitive activity.

The findings also refine activity-theoretical and competency-based views of learning while contributing more explicitly to online communities research. In participants' accounts, online communities functioned as sociotechnical activity systems that mediated access to tools, norms, and expertise, while competency development emerged through iterative interaction among learners, technological artifacts, and other community members. More broadly, the findings extend prior work that conceptualizes online forums as spaces of informal and socially distributed learning by showing how self-organizing forums such as Reddit may support learning not only through information exchange, but also through the interaction of social, technical, and normative structures that shape

participation and visibility (de Souza & Preece, 2004; Haythornthwaite et al., 2018; Preece & Maloney-Krichmar, 2005). In our data, learning was supported not simply by access to answers, but also by visible examples of progress, public troubleshooting, near-peer guidance, shared repertoires of resources, and recurring norms around persistence, experimentation, and self-improvement. Across the data, learners described developing technical knowledge, hands-on skills, attitudes such as self-efficacy, resilience, curiosity, and adaptability, and an emerging professional identity. These competencies were described as not developing in isolation. They appeared to co-evolve through participation in shared practices, public feedback, and community recognition, supporting a view of professional competence as simultaneously cognitive, behavioral, and identity-based (see Figure 3).

The study also contributes a trajectory perspective on informal IT learning. Learners' accounts showed that development was often non-linear and marked by transitions, setbacks, reassessments, and adaptive adjustments. Many described movement from entry-level or peripheral roles toward more specialized positions, while using community advice, exemplars, and near-peer guidance to plan and redirect their paths. These findings suggest that informal IT learning is best understood not as a set of isolated episodes, but as a community-mediated developmental trajectory in which goals, strategies, competencies, and career directions are progressively reshaped over time.

The framework and study findings also have practical implications for educators, workforce development professionals, and platform designers. Formal IT education can benefit from incorporating stronger support for SRL through structured goal setting, reflective practice, project-based learning, peer feedback, and participation in community-like learning environments. Workforce development programs and career advising can encourage engagement in professional communities as sources of mentorship, tacit knowledge, and identity formation. Online platforms can further strengthen their role as learning infrastructures by supporting peer guidance, progress tracking, exemplar pathways, and reflective knowledge sharing. The findings also highlight the growing role of AI tools as mediating artifacts that learners use for explanation, feedback, self-testing, and reflection, suggesting that AI-supported learning environments should be designed to strengthen learners' self-regulation rather than replace it.

At the same time, the study suggests that the ability to regulate one's own learning is itself a core professional competency in IT. In a rapidly changing field, the capacity to acquire, update, and apply knowledge independently may be as important as any specific technical skill. This makes community-mediated self-regulation especially important for preparing aspiring and early-career professionals for sustained development in evolving technological environments.

Several limitations should be noted. The data were drawn from IT-focused subreddits and may not represent informal learning in other online environments. The narratives were self-reported, and the descriptive design does not support causal claims. Future research could compare how different online communities mediate learning through their norms, moderation practices, governance structures, and platform affordances. Comparative analyses at the level of individual subreddits may clarify how community structure shapes competency development. Further research could also examine human-AI

collaboration in SRL within communities of practice and explore how the model summarized in Figure 3 may be extended to support upskilling in generative AI-infused self-directed learning without contributing to learner deskilling.

Although Reddit posts are public, using conversation logs for research raises ethical concerns. Users did not write these posts as research participants. They may expect a smaller or different audience. They may not expect formal analysis in an academic article. This mismatch can create privacy risks and chances of indirect re-identification. To mitigate these risks, the study removed usernames and URLs, editing quotes to remove identifying detail while preserving their meaning.

As described in the design section above, the authors used a generative AI tool (Open AI's API with GPT-5 mini) to support qualitative data analysis (e.g., coding suggestions and thematic exploration). All outputs generated by the AI tool that are used in this paper were critically reviewed and verified by the authors.

References

ACM/IEEE-CS Joint Task Force on Computing Curricula. (2017). Information Technology Curricula 2017: Curriculum Guidelines for Undergraduate Degree Programs in Information Technology. Association for Computing Machinery. Available at: https://www.ala.org/acrl/standards/ilframework (Accessed: 2 March 2026).

Association of College and Research Libraries (2016) Framework for Information Literacy for Higher Education. Chicago, IL: American Library Association. Available at: https://www.ala.org/acrl/standards/ilframework (Accessed: 21 December 2025).

Association of College and Research Libraries (2025) AI Competencies for Academic Library Workers. Chicago, IL: American Library Association. Available at: https://www.ala.org/acrl/standards/ai (Accessed: 21 December 2025).

Ardichvili, A. (2008) 'Learning and knowledge sharing in virtual communities of practice: Motivators, barriers, and enablers', Advances in Developing Human Resources, vol. 10, no. 4, pp. 541-554. https://doi.org/10.1177/1523422308319536

Bao, J., Wu, J., Zhang, Y., Chandrasekharan, E. and Jurgens, D. (2021) 'Conversations gone alright: Quantifying and predicting prosocial outcomes in online conversations', The Web Conference 2021 (WWW '21). https://doi.org/10.1145/3442381.3450122

Baran, B. and Cagiltay, K., 2010. The dynamics of online communities in the activity theory framework. Journal of Educational Technology & Society, 13(4), pp.155–166.

Bailey, K.D. (1994), Typologies and taxonomies: An introduction to classification techniques, Sage, Thousand Oaks, CA.

Bernard, R. M., Borokhovski, E., Schmid, R. F., Tamim, R. M. and Abrami, P. C. (2014) 'A meta-analysis of blended learning and technology use in higher education: From the general to the applied', Journal of Computing in Higher Education, vol. 26, no. 1, pp. 87-122. https://doi.org/10.1007/s12528-013-9077-3

Bourdieu, P. (1986) 'The forms of capital', in J. G. Richardson (ed.), Handbook of Theory and Research for the Sociology of Education, pp. 241-258. Greenwood Press.

Broadbent, J. and Poon, W. L. (2015) 'Self-regulated learning strategies & academic achievement in online higher education learning environments: A systematic review', The internet and higher education, vol. 27, pp. 1-13. https://doi.org/10.1016/j.iheduc.2015.04.007

Case, D. O., Given, L. M. and Willson, R. (2023) Looking for information: Examining research on how people engage with information, 5th ed., Emerald.

Cerasoli, C.P., Alliger, G.M., Donsbach, J.S., Mathieu, J.E., Tannenbaum, S.I. and Orvis, K.A. (2018) 'Antecedents and outcomes of informal learning behaviors: a meta-analysis', Journal of Business and Psychology, 33(2), pp. 203-230. https://doi.org/10.1007/s10869-017-9492-y

Corbin, J.M., 1991. A nursing model for chronic illness management based upon the trajectory framework. Research and Theory for Nursing Practice, 5(3), p.155. https://doi.org/10.1891/0889-7182.5.3.155

de Souza, C. S., & Preece, J. (2004). A framework for analyzing and understanding online communities. Interacting with Computers, 16(3), 579-610. https://doi.org/10.1016/j.intcom.2003.12.006

Domino, M., Edmison, B., Edwards, S. H., Mansur, R. S., Thompson, A. and Shaffer, C. A. (2024) 'Identifying critical self-regulated learning skills: a Delphi process study', Computer Science Education, pp. 1-28. https://doi.org/10.1080/08993408.2024.2382631

Dunivin, Z.O. (2025) 'Scaling hermeneutics: A guide to qualitative coding with LLMs for reflexive content analysis', EPJ Data Science, 14(1), 28. Available at: https://doi.org/10.1140/epjds/s13688-025-00548-8

Dweck, C. S. and Leggett, E. L. (1988) 'A social-cognitive approach to motivation and personality', Psychological Review, vol. 95, no. 2, pp. 256-273. https://doi.org/10.1037/0033-295X.95.2.256

Eloundou, T., Manning, S., Mishkin, P. and Rock, D. (2023) 'GPTs are GPTs: An early look at the labor market impact potential of large language models', arXiv (econ.GN), arXiv:2303.10130. https://doi.org/10.48550/arXiv.2303.10130

Engeström, Y. (2001) 'Expansive learning at work: Toward an activity theoretical reconceptualization', Journal of Education and Work, vol. 14, no. 1, pp. 133-156. https://doi.org/10.1080/13639080020028747

Eraut, M. (2004) ‘Informal learning in the workplace’, Studies in Continuing Education, 26(2), pp. 247-273. doi:10.1080/158037042000225245.

Ericsson, K. A., Krampe, R. T. and Tesch-Römer, C. (1993) 'The role of deliberate practice in the acquisition of expert performance', Psychological Review, vol. 100, no. 3, pp. 363-406. https://doi.org/10.1037/0033-295X.100.3.363

Fontana, R.P., Milligan, C., Littlejohn, A. and Margaryan, A. (2015) ', Measuring SRL in the workplace', International Journal of Training and Development, vol. 19, pp. 32-52. https://doi.org/10.1111/ijtd.12046

Garcia, R., Falkner, K. and Vivian, R. (2018) 'Systematic literature review: Self-Regulated Learning strategies using e-learning tools for Computer Science', Computers & Education, vol. 123, pp. 150-163. https://doi.org/10.1016/j.compedu.2018.05.006

Gee, J. P. (2000) 'Chapter 3 : Identity as an analytic lens for research in education', Review of Research in Education, vol. 25, no. 1, pp. 99-125. https://doi.org/10.3102/0091732X025001099

Hacker, D.J., Dunlosky, J. and Graesser, A.C. (eds.) (2009) Handbook of Metacognition in Education, 1st ed., Routledge. https://doi.org/10.4324/9780203876428

Hara, N. and Hew, K. F. (2007) 'Knowledge sharing in an online community of health-care professionals', Information Technology & People, vol. 20, no. 3, pp. 235-261. https://doi.org/10.1108/09593840710822859

Haythornthwaite, C., Kumar, P., Gruzd, A., Gilbert, S. and Esteve Del Valle, M. (2018) ‘Learning in the wild: Coding for learning and practice on Reddit’, Learning, Media and Technology, 43(3), pp. 219-235. https://doi.org/10.1080/17439884.2018.1498356

Haythornthwaite, C., & Gruzd, A. (2020). Learning in the wild: Exploring the practice of learning in open, online forums. In Proceedings of the International Conference on Networked Learning (Vol. 12, pp. 214-222).

Hazzan, O. and Erez, Y. (2025) 'Rethinking computer science education in the age of GenAI', ACM Transactions on Computing Education, vol. 25, no. 3, Article 26, pp. 1-9. https://doi.org/10.1145/3732792

Head, A.J., Van Hoeck, M., Eschler, J. and Fullerton, S. (2013) ‘What information competencies matter in today’s workplace?’, Library and Information Research, 37(114). Available at: https://lirgjournal.org.uk/index.php/lir/article/view/557 (Accessed: 21 December 2025).

Hemmler, Y. M. and Ifenthaler, D. (2024) 'Self-regulated learning strategies in continuing education: A systematic review and meta-analysis', Educational Research Review, vol. 45, Article 100629. https://doi.org/10.1016/j.edurev.2024.100629

Hutchins, E. (1995) Cognition in the wild, MIT Press.

International Labour Organization (2025) ‘One in four jobs at risk of being transformed by GenAI, new ILO-NASK Global Index shows’ (News release, 20 May 2025). https://www.ilo.org/resource/news/one-four-jobs-risk-being-transformed-genai-new-ilo%E2%80%93nask-global-index-shows

Johri, A. (2025) ‘A qualitative field study of computing professionals’ dispositions for lifelong learning in the workplace’, ACM Transactions on Computing Education, 25(4), Article 43. doi:10.1145/3749994.

Kaptelinin, V. and Nardi, B. A. (2012) Activity theory in HCI: Fundamentals and reflections (Vol. 13), Morgan & Claypool Publishers.

Kariri, E. and Rodríguez, C. (2019) ‘e-mentoring activities in online programming communities: An empirical study on Stack Overflow’, in Service research and innovation. Lecture Notes in Business Information Processing. Cham: Springer, pp. 123-138. https://doi.org/10.1007/978-3-030-32242-7_10

Kizilcec, R. F., Pérez-Sanagustín, M. and Maldonado, J. J. (2017) 'Self-regulated learning strategies predict learner behavior and goal attainment in Massive Open Online Courses', Computers & education, vol. 104, pp. 18-33. https://doi.org/10.1016/j.compedu.2016.10.001

Kraut, R. E. and Resnick, P. (2012) Building successful online communities: Evidence-based social design, MIT Press.

Lave, J. and Wenger, E. (1991) Situated learning: Legitimate peripheral participation, Cambridge University Press. https://doi.org/10.1017/CBO9780511815355

Leiß, T.V. and Rausch, A., 2023. Informal learning from dealing with software-related problems in the digital workplace. Journal of Workplace Learning, 35(9), pp.291-310.

McClelland, D. C. (1973) 'Testing for competence rather than for intelligence', American Psychologist, vol. 28, no. 1, pp. 1-14. https://doi.org/10.1037/h0034092

Mockus, A., Fielding, R. T. and Herbsleb, J. D. (2002) 'Two case studies of open source software development: Apache and Mozilla', ACM Transactions on Software Engineering and Methodology (TOSEM), vol. 11, no. 3, pp. 309-346. https://doi.org/10.1145/567793.567795

Noe, R.A., Clarke, A.D.M. and Klein, H.J. (2014) ‘Learning in the twenty-first-century workplace’, Annual Review of Organizational Psychology and Organizational Behavior, 1, pp. 245-275. https://doi.org/10.1146/annurev-orgpsych-031413-091321

O'Grady, M. J. (2012) 'Practical problem-based learning in computing education', ACM Transactions on Computing Education, vol. 12, no. 3, Article 10. https://doi.org/10.1145/2275597.2275599

Panadero, E. (2017) 'A review of self-regulated learning: Six models and four directions for research', Frontiers in Psychology, vol. 8, p. 422. https://doi.org/10.3389/fpsyg.2017.00422

Parker, D. A. and Roessger, K. M. (2020) 'Self-directed learning and retrieval practice: building a bridge through functional contextualism', International Journal of Lifelong Education, vol. 39, no. 2, pp. 205-218. http://dx.doi.org/10.1080/02601370.2020.1743375

Pintrich, P. R. (2004) 'A conceptual framework for assessing motivation and self-regulated learning in college students', Educational Psychology Review, vol. 16, no. 4, pp. 385-407. https://doi.org/10.1007/s10648-004-0006-x

Preece, J., & Maloney-Krichmar, D. (2005). Online communities: Design, theory, and practice. Journal of Computer-Mediated Communication, 10(4), JCMC10410. https://doi.org/10.1111/j.1083-6101.2005.tb00264.x

Putnam, R. D. (2000) Bowling alone: The collapse and revival of American community, Simon & Schuster.

Record, R. A., Silberman, W. R., Santiago, J. E. and Ham, T. (2018) 'I Sought It, I Reddit: Examining Health Information Engagement Behaviors among Reddit Users', Journal of Health Communication, vol. 23, no. 5, pp. 470-476. https://doi.org/10.1080/10810730.2018.1465493

Robillard, M. P., & DeLine, R. (2011). A field study of API learning obstacles. *Empirical Software Engineering, 16*(6), 703-732. https://doi.org/10.1007/s10664-010-9150-8

Rosenbaum, H. and Shachaf, P. (2010) 'A structuration approach to online communities of practice: The case of Q&A communities', Journal of the American Society for Information Science and Technology, 61(9), pp. 1933-1944. https://doi.org/10.1002/asi.21340

Ryan, R. M. and Deci, E. L. (2000) 'Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being', American Psychologist, vol. 55, no. 1, pp. 68-78. https://doi.org/10.1037/0003-066X.55.1.68

Sengupta, S. (2021) 'A Tale of Two Virtual Communities: A comparative analysis of culture and discourse in two online programming communities', Proceedings of the 54th Hawaii International Conference on System Sciences (HICSS-54). https://doi.org/10.24251/HICSS.2021.005

Spencer, L. M. and Spencer, S. M. (1993) Competence at work: Models for superior performance, John Wiley & Sons.

Steinmacher, I., Silva, M. A. G., Gerosa, M. A. and Redmiles, D. F. (2015) 'A systematic literature review on the barriers faced by newcomers to open source software projects', Information and Software Technology, vol. 59, pp. 67-85. https://doi.org/10.1016/j.infsof.2014.11.001

Stvilia, B. and Gibradze, L. (2022), "Seeking and sharing datasets in an online community of data enthusiasts", Library & Information Science Research, Vol. 44 No. 3, p. 101160. https://doi.org/10.1016/j.lisr.2022.101160

Stvilia, B., Twidale, M., Smith, L.C. and Gasser, L. (2008), "Information quality work organization in Wikipedia", Journal of the American Society for Information Science and Technology, Vol. 59 No. 6, pp. 983–1001, https://doi.org/10.1002/asi.20813

Sun, N., Rau, P.-L. P. and Ma, L. (2014) 'Understanding lurkers in online communities: A literature review', Computers in Human Behavior, vol. 38, pp. 110-117. https://doi.org/10.1016/j.chb.2014.05.022

Tannenbaum, S.I. and Wolfson, N.E. (2022) 'Informal field-based learning: theories, measures, and future directions', Annual Review of Organizational Psychology and Organizational Behavior, 9, pp. 251-276. https://doi.org/10.1146/annurev-orgpsych-012420-083050

Tai, R.H., Bentley, L.R., Xia, X., Sitt, J.M., Fankhauser, S.C., Chicas-Mosier, A.M. and Monteith, B.G. (2024) 'An examination of the use of large language models to aid analysis of textual data', International Journal of Qualitative Methods, 23, 16094069241231168. https://doi.org/10.1177/16094069241231168

Theobald, M. (2021) 'Self-regulated learning training programs enhance university students' academic performance, self-regulated learning strategies, and motivation: A meta-analysis', Contemporary Educational Psychology, vol. 66, Article 101976. https://doi.org/10.1016/j.cedpsych.2021.101976

Urbaczewski, A. and Keeling, K. (2025) 'G(AI)etting with the program: Teaching IS and Analytics in the age of GAI', Communications of the Association for Information Systems, vol. 56, pp. 1104-1117. https://doi.org/10.17705/1CAIS.05642

U.S. Bureau of Labor Statistics. (2024). Computer and Information Technology Occupations. Occupational Outlook Handbook. Available at: https://www.bls.gov/ooh/computer-and-information-technology/home.htm (Accessed: 2 March, 2026).

Von Krogh, G., Spaeth, S. and Lakhani, K. R. (2003) 'Community, joining, and specialization in open source software innovation: a case study', Research policy, vol. 32, no. 7, pp. 1217-1241. https://doi.org/10.1016/S0048-7333(03)00050-7

Vygotsky, L. (1978) Mind in society, Harvard University Press, Cambridge, MA.

Wasko, M. M. and Faraj, S. (2005) 'Why Should I Share? Examining Social Capital and Knowledge Contribution in Electronic Networks of Practice', MIS Quarterly, vol. 29, no. 1, pp. 35-57. https://doi.org/10.2307/25148667

Weick, K. E. (1995) Sensemaking in organizations, Sage.

Weiner, S.A. (2011) 'Information literacy and the workforce: a review', Education Libraries, 34(2). doi:10.26443/el.v34i2.306.

Wenger, E. (1998) Communities of practice: Learning, meaning, and identity, Cambridge University Press. https://doi.org/10.1017/CBO9780511803932

Woll, A. and Bratteteig, T. (2018) 'Activity theory as a framework to analyze technology-mediated elderly care', Mind, Culture, and Activity, 25(1), pp. 6–21. https://doi.org/10.1080/10749039.2017.1375528

World Economic Forum (2025) The Future of Jobs Report 2025: Digest (Published 7 January 2025). https://www.weforum.org/publications/the-future-of-jobs-report-2025/digest/

Xu, Z., Zhao, Y., Zhang, B., Liew, J. and Kogut, A. (2022) 'A meta-analysis of the efficacy of self-regulated learning interventions on academic achievement in online and blended environments in K-12 and higher education', Behaviour & Information Technology, vol. 42, no. 16, pp. 2911-2931. https://doi.org/10.1080/0144929X.2022.2151935

Zimmerman, B. J. (1989) 'A social cognitive view of self-regulated academic learning', Journal of Educational Psychology, vol. 81, no. 3, pp. 329-339. https://doi.org/10.1037/0022-0663.81.3.329