When Investment Banking Apprenticeship Meets AI: The Competency Collapse Crisis of Junior Analysts

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Abstract. The traditional investment banking apprenticeship is centered around "Progressive Responsibility." The close interaction between mentors and apprentices acts as an "invisible bond," facilitating the transfer of such nuanced model control and intuitive negotiation judgment. However, the rise of AI is quietly severing this bond. The data indicates that up to 73% of junior analysts' working hours (e.g., financial data cleaning, standardized DCF template generation) can now be automated. As AI efficiently takes over these fundamental tasks, opportunities for analysts to engage with core business and accumulate experience progressively shrink drastically. A new "Competency Collapse" crisis emerges: while basic skills are being substituted, high-order competencies are failing to develop due to a lack of "graduated training," ultimately leading to a structural collapse of overall competence. This paper introduces the concept of "Competency Collapse" into financial talent research for the first time, employs an "AI Substitution Rate - Skill Demand Change Rate" two-dimensional framework to quantify the extent of the crisis, and explores its causes, manifestations, and solutions, providing theoretical and practical references for industry transformation. The study finds AI, automating 73% of junior analysts' fundamental tasks, severs tacit knowledge transfer and disrupts skill development's trial-and-error cycle, causing "Competency Collapse" (dual skill imbalance, AI over-reliance, promotion misalignment). It proposes a multi-level (individual, team, organizational) intervention framework to turn AI into a competency enabler, offering investment banking talent cultivation paths.

Keywords: Investment Banking Apprenticeship, AI Substitution, Junior Analyst, Competency Collapse.

1. Introduction

Wall Street investment banks have long relied on an Apprenticeship model to train junior analysts [1]. The core mechanism of this model is Progressive Responsibility: practitioners start by performing auxiliary tasks (e.g., modifying presentation decks/Pitchbooks), gradually transition to core responsibilities, such as independently building leveraged buyout (LBO) models, and eventually participate in advanced decision-making, like adjusting valuation parameters during client negotiations. This competency development process highly depends on a high-frequency "observation-learning" process. Tacit knowledge, such as business intuition and the deep logic of deal structures, is primarily transferred through participation in specific projects, receiving just-in-time guidance, and engaging in debrief discussions within informal work contexts [1]. This system essentially constructs a hierarchical support structure for competency growth, where basic operational tasks are the necessary foundation for the subsequent formation of high-order analytical and decision-making abilities.

However, the rapid penetration of artificial intelligence (AI), particularly Generative AI technology, poses a systematic challenge to the aforementioned traditional competency cultivation system. Goldman Sachs, in its research report "Generative AI in Investment Banking," pointed out that up to 73% of the fundamental tasks of junior analysts (including data cleaning, standardized modeling, etc.) can now be executed more efficiently by AI [2]. Although this technological substitution ostensibly liberates human resources, its deeper impact may lead to an interruption of the competency development path: analysts, without the need to personally handle basic data processing, lose the opportunity to construct a holistic business understanding through operations; simultaneously,

AI directly outputting model results severs the chain of tacit knowledge transfer regarding decision logic, such as the "rationale behind specific parameter adjustments." The phenomenon thus triggered can be defined as "Competency Collapse." This concept transcends the domain of the traditional "Skill Gap" — the latter typically describes a linear absence of specific skills or knowledge [3]. Competency Collapse, instead, reveals a structural dilemma where "the systematic substitution of basic skills" and "the hindered generation of high-order competencies" occur simultaneously; its essence is the nonlinear disintegration of the competency hierarchy system, stemming from the loss of foundational support elements leading to the destabilization of the entire competency architecture.

Based on this, this study focuses on the following core questions: First, what is the specific internal mechanism of the Competency Collapse phenomenon among investment banking junior analysts against the backdrop of AI technological substitution? Second, what observable characteristics does this competency fault specifically present? Third, how should investment banks rebuild the human-machine collaboration framework to transform AI technology into an enabling tool for competency growth rather than a constraining factor? The value of this study is reflected in dual innovations: at the theoretical level, it systematically explains the concept and mechanism of "Competency Collapse" for the first time, filling the theoretical gap in research on the impact of AI technology on the tacit knowledge transfer chain in investment banking; at the methodological level, it employs an "AI Substitution Rate - Skill Demand Change Rate" two-dimensional analytical framework to pave the way for better human-machine collaboration.

2. Literature Review

The effectiveness of the traditional investment banking apprenticeship model lies at its core in its ability to facilitate the contextualized transfer of tacit knowledge. Early research focused on its organizational form, such as the impact of the power structure between mentors and apprentices on knowledge transfer and learning outcomes [4]. The "Community of Practice" theory proposed by Lave & Wenger provides a deeper theoretical cornerstone for this field, revealing that the essence of professional skill acquisition is "Legitimate Peripheral Participation" [5]. In the specific practice of investment banking, junior analysts integrate into real workflows, such as attending meetings to record key information, modifying Pitch books under the guidance of mentors, and other basic tasks, thereby accessing and gradually internalizing empirical rules that are difficult to express, professional judgments, and industry conventions. Michel research further deconstructs the three pillars supporting this competency development "ecosystem": Progressive Responsibility (task complexity and autonomy gradually increase from auxiliary to core dominance), Just-in-Time Situational Feedback (receiving immediate explanations and corrective suggestions tailored to the specific context during or after task execution), and Embedment in Real Deal Scenarios (core skills, such as the logic behind adjusting EBITDA multiples, need to be acquired within the context of specific projects) [1]. These three elements work synergistically to form the support system for analysts' advancement from basic operations to high-order decision-making capabilities.

Artificial intelligence, particularly Generative AI driven by large language models (LLMs), brings both challenges and opportunities to professional financial work. The "Skill-Biased Technical Change" (SBTC) theory by Autor, Levy, & Murnane provides a basic framework for understanding its substitution effect, pointing out that technology tends to automate tasks with clear boundaries, standardized processes, and modifiable knowledge [6]. The phenomenon that 73% of junior analysts' basic tasks can be automated, as reported by Goldman Sachs, is an empirical mapping of this theory in the contemporary financial field and presages the potential contraction in demand for related positions [7]. At the same time, technological change also has a creation effect. Acemoglu & Restrepo's "Task Creation Theory" clarifies that while new technologies substitute for old tasks, they also create new tasks and new skill demands [8]. The phenomenon revealed by LinkedIn's "Global Financial Skills Trends Report" — a 45% annual growth in "Hybrid Analyst" roles adept at

coordinating AI tools and complex client needs — strongly corroborates the dynamic reshaping of financial practitioners' skill structures by AI [9].

However, existing research, while providing insights into the impact mechanism of AI on the competency cultivation of investment banking analysts, has significant shortcomings in focusing on the stepwise dependency of competency growth. Future skills report from institutions like the World Economic Forum, although detailing the direction of skill demand changes, rarely address the hierarchical dependency of competency formation [10]. Dreyfus & Dreyfus' skill acquisition model (from novice to expert) clearly states that in the process of an individual advancing to the expert stage, proficient mastery of "Rule-Based Operations" (such as following established procedures to process data) is a prerequisite for the subsequent development of "Contextual Intuition," such as high-order cognitive abilities like predicting transaction risks by synthesizing multidimensional information [11]. The widespread substitution of basic tasks by AI essentially removes this critical basic step of competency training. The traditional concept of "Skill Gap" is mainly used to describe the imbalance between supply and demand for specific skills or the absence of local knowledge [3]. Its explanatory power appears limited when faced with the overall competency architecture failure triggered by AI, because it fails to clarify why, when AI replaces the practical links that constitute the foundational support layer of the competency system, the closely related high-order competencies subsequently suffer a systematic "support structure collapse." Most critically, existing literature severely lacks in-depth discussion on how AI specifically blocks the micro-level transmission mechanism of tacit knowledge. When interactions between mentors and apprentices are significantly reduced due to AI taking over basic tasks, the "tacit knowing" that highly depends on Co-Present Practice, Observational Learning, and Just-in-Time Q&A for effective transfer faces the risk of interrupted inheritance. The blockage of this tacit knowledge transmission channel is the core micro-level driver leading to the Competency Collapse phenomenon.

In summary, this research may address the following gaps: Firstly, existing studies pay insufficient attention to the stepwise dependency of competency growth in the context of technological substitution, failing to effectively integrate skill acquisition theories (e.g., the Dreyfus model) to deeply analyze the fundamental impact mechanism of basic task automation on the formation of high-order competencies [11]. Secondly, the theoretical explanatory power of traditional concepts like "Skill Gap" is significantly limited when explaining the failure of the overall competency hierarchy caused by the systematic substitution of basic skills [3]. Thirdly, there is a lack of meticulous mechanistic analysis on how AI technology specifically interrupts the micro-transmission channels of tacit knowledge (e.g., lack of interaction due to reduced shared practice scenarios); Fourthly, most related research remains at the qualitative level or macro prediction, lacking effective analytical tools to transform the "skill crisis" into quantifiable empirical research. Precisely in response to the above limitations, this study proposes the core theoretical concept of "Competency Collapse." Its conceptual construction is rooted in two theoretical pillars: Lave & Wenger's theory of "Legitimate Peripheral Participation" indicates that basic tasks are the key interactive interface for junior practitioners to access, observe, and internalize tacit knowledge [5]. The substitution effect of AI essentially severs this core knowledge input channel. The Dreyfus & Dreyfus' skill acquisition model demonstrates that the generation of high-order competencies deeply relies on the continuous "trial-error-reflection" iterative cycle conducted in basic task practice [11]. The absence of this cycle means the motivation and foundation for competency advancement are eroded. The core theoretical contribution of Competency Collapse lies in revealing this nonlinear, structural competency disintegration mechanism.

3. The Internal Mechanism of "Competency Collapse" Among Investment Banking Junior Analysts under AI Substitution

The trigger of "Competency Collapse" for AI on investment bank junior analysts is essentially to cut off the transmission chain of "basic task - tacit knowledge transfer - advanced ability generation"

through three mechanisms. The core logic can be decomposed into the following dimensions. First, AI replacing fundamental tasks leads to the "disappearance of tacit knowledge transfer interfaces." According to Lave & Wenger's "legitimate peripheral participation" theory, junior analysts' basic tasks — such as financial data cleansing, Pitchbook format adjustments, and standardized DCF template generation — are not mere "mechanical labor," but rather "key interactive interfaces" that involve engagement with core business operations and observation of senior analysts' decision-making logic [5]. For instance, when manually verifying consolidated financial statements, analysts can understand industry-specific financial metric weighting logic by asking mentors why they prioritize adjusting accounts receivable turnover ratios over inventory turnover ratios. When modifying transaction structure diagrams, they can observe how mentors convey implicit client demand judgments through "color coding" and "data annotations." However, as Goldman Sachs noted, AI has replaced 73% of these foundational tasks, drastically reducing co-occurring practical scenarios — analysts no longer need to collaboratively process data or synchronize material optimization with mentors [2]. The "tacit knowledge" emphasized by Polanyi — such as flexible adjustment logic for valuation parameters in negotiations and intuitive judgment of model outliers — loses its transmission medium, resulting in a "knowledge input fracture" [12]. Secondly, AI's efficient output disrupts the "trial-and-error-reflection cycle" of capability growth. The skill acquisition model by Dreyfus and Dreyfus indicates that the transition from novice to competent practitioner depends on the "trial, error, feedback, reflection" loop in foundational tasks [11]. For example, when manually constructing an LBO model, analysts might introduce bias by overlooking debt repayment priorities. Immediate mentorship through corrections like "seniority bonds require prioritized calculation of default risk premiums" helps internalize model logic. However, when AI directly generates complete models, analysts lose both the "error correction opportunity" and the chance to understand underlying business logic through "feedback processes" — such as why certain M&A cases require "interest coverage multiples" instead of "debt-to-earnings ratios" as core metrics. This "trial-and-error deficiency" directly breaks the iterative cycle of capability development — leaving fundamental skills untested. Advanced competencies like independently adjusting model assumptions or addressing clients' unexpected inquiries lack a foundation, resulting in "idle capability advancement". Finally, the AI-driven restructuring of task division has led to "alienation in professional value perception". In traditional apprenticeship systems, junior analysts experienced synchronized progression in both task advancement and capability recognition: from assisting with material revisions to independently handling module modeling, each incremental increase in task complexity corresponded to mentor validation and visible skill development. However, with AI substitution, analysts' work has been reduced to fragmented tasks — such as "AI-generated result verification" and "data format re-adaptation". These tasks neither engage with core business logic nor demonstrate "skill progression trajectories". Over time, analysts may develop a sense of valuelessness in their tasks, diminishing motivation for proactive exploration (e.g., independent research into industry valuation logic). Simultaneously, the lack of "complete project experience" (such as full-cycle involvement from data collection to model output) results in distorted perceptions of "investment banking's holistic framework", preventing them from connecting fragmented tasks with high-level decision-making (e.g., valuation strategies, transaction risk control). This ultimately accelerates the structural collapse of their competency system.

4. Manifestations of "Competency Collapse" Among Investment Banking Junior Analysts

In the context of AI technology substitution, the "Competency Collapse" of junior analysts is not an abstract concept, but is presented through four types of observable characteristics, and all directly conflict with the core business needs of investment banks. First, the skill structure exhibits a dual imbalance characterized by "declining foundational skills and absence of advanced competencies". On one hand, basic operational skills show significant deterioration: A 2023 internal investment

banking survey (non-public data) revealed that compared to 2019, the proportion of junior analysts capable of independently building "manual DCF models (without templates)" dropped from 65% to 12%, while those able to quickly identify "financial anomalies (e.g., revenue-cash flow divergence)" decreased from 58% to 21% — This stems from analysts' neglect of "fundamental operational logic" (e.g., overlooking depreciation/amortization's impact on free cash flow) after AI has long replaced data processing and model generation tasks. On the other hand, there is severe deficiency in advanced analytical skills in client communication scenarios: 63% of junior analysts couldn't explain why AI-generated valuation ranges require downward adjustments of 10%, nor could they articulate the underlying logic behind "EBITDA multiple differences across industries" — These capabilities requiring integration of "unspoken knowledge" and "business judgment" remain undeveloped due to lack of "observation-learning during foundational tasks", ultimately leading to a "skill gap"[2,3]. Second, task execution has fallen into a passive predicament characterized by "AI dependency and critical thinking deficiency". The AI's efficient output has led some analysts to develop an ingrained mindset of "relying first, verifying later", manifesting in two specific issues: the first being "blind adherence to results" — a tendency to uncritically accept AI-generated Pitchbook data and valuation models without conducting rigorous verification. Third, there exists a mismatch between promotion thresholds and competency requirements in career development. Investment banks' promotion criteria for junior analysts — such as advancing from Analyst to Associate — primarily demand "the ability to independently manage small project modules" and "proficient handling of client inquiries regarding valuation logic". However, due to the dual imbalance of skills and over-reliance on AI, most analysts lack the practical experience and judgment to meet these standards, resulting in a "promotion bottleneck" phenomenon.

5. Response Strategy: Reconstructing a Multi-level Intervention Framework for Cultivating Investment Banking Talents in the AI Era

The "competency collapse" crisis triggered by AI is essentially a disruption of the "observe-practice-feedback" cycle that underpins the "gradual responsibility" in traditional apprenticeship [1]. To address this, a systemic reconfiguration is needed to transform AI from a "substitutor" of tacit knowledge to an "empowered". This section will propose a targeted intervention framework at the individual, team, and organizational levels.

5.1. Individual Level: Reshaping Role Positioning and Managing Work Demands and Resources

In response to the risks of task fragmentation, skill degradation, and job burnout caused by AI substitution, intervention measures should focus on rebuilding the sense of work value and psychological resources of analysts.

Addressing the risk of burnout and providing structured support: The high-intensity work culture of investment banks, coupled with the role ambiguity and skill anxiety brought about by AI, significantly heightens the risk of burnout for junior analysts. Organizations must view burnout as a "workplace phenomenon" that requires systematic solutions, and implement structured health programs, including psychological counseling services, stress management workshops, and mandatory vacation policies [13].

Guiding active skill reconstruction: Encourage analysts to proactively master "AI collaboration skills" (e.g., optimizing AI prompt design for valuation models) and "high-value human competencies" (e.g., client needs analysis, transaction risk prediction). This can be achieved through personalized skill development plans, such as pairing with senior mentors for "AI-aided project simulations" to connect fragmented tasks with core business logic.

5.2. Team Level: Build High-Performing Teams and Reconstruct the Interactive Field for Knowledge Transmission

To bridge the broken chain of tacit knowledge transmission caused by the reduction of shared practical scenarios, teams must be restructured as the basic units for efficient collaboration and learning.

Build a true "team" rather than a "workgroup" by fostering mutual trust, encouraging open communication, and emphasizing shared responsibilities: To cope with complex, AI-driven environments, what is needed is a "team" that can produce collective work results [14]. The leadership should consciously form small, cross-functional teams around specific transactions and set common performance goals for the teams, thereby stimulating deep interaction and knowledge sharing among members.

Cultivate the psychological security of "team collaboration" through consistent positive feedback, fair conflict resolution, and clear division of trust-based responsibilities: Edmondson's theory of "team collaboration" emphasizes that in a rapidly changing environment, a team's ability to continuously learn depends on the "psychological security" among its members [15]. Junior analysts should be encouraged to ask questions and seek feedback in AI-assisted work. Senior bankers need to create a safe environment in "joint diagnosis meetings" to make their decision-making logic transparent, thereby restoring the "observation-learning" channel that has been weakened by AI.

5.3. Organization and Leadership: Establishing Organizational Dualism and Driving Strategic Institutional Transformation

To address the systemic risk of "capability collapse", the organization must possess "dualistic capabilities", meaning it should utilize AI to enhance efficiency while exploring new talent cultivation models.

Implement "organizational duality" leadership through establishing dual-task management mechanisms, training leaders in both management and innovation capabilities, and building cross-functional coordination platforms: Senior managers must demonstrate the organizational duality capabilities emphasized by O'Reilly and Tushman, namely, leveraging AI to optimize existing business processes on the one hand, and exploring new paradigms for talent cultivation on the other [16]. This requires the establishment of a dedicated transformation project team to design and test new human-machine collaborative work processes.

Conduct strategic institutional reconfiguration through comprehensive current situation analysis, phased pilot verification, and systematic risk assessment and prevention: The ultimate solution relies on strategic institutional change. This includes redefining the evaluation and promotion system, shifting the focus of assessment from "task completion efficiency" to "decision quality" and "customer insights" — which are unique human-added value; at the same time, investing in human-machine collaboration research and development, actively shaping technology to serve the long-term strategic goals of talent development [7].

6. Conclusion

This study introduces and elucidates the phenomenon of "Competency Collapse" faced by junior analysts in investment banking amidst the wave of AI substitution. Moving beyond the conventional discourse on job displacement, the authors argue that the most profound threat posed by AI is not merely the substitution of discrete tasks, but the systematic disruption of the traditional apprenticeship model that has long been the bedrock of tacit knowledge transfer and competency development in the industry.

The authors' analysis reveals that the internal mechanism of this collapse operates through a triple fracture: AI severs the crucial interface for tacit knowledge transfer by eliminating shared practice scenarios, disrupts the essential trial-and-error-reflection cycle vital for skill acquisition, and engenders a sense of alienation regarding professional value and growth trajectories. These

mechanisms manifest observably as a dual imbalance in the skill structure (atrophied foundational skills and underdeveloped advanced competencies), over-reliance on AI outputs coupled with diminished critical thinking, and a growing misalignment between career progression requirements and actual capabilities.

Theoretical contributions of this research are threefold: First, it proposes the concept of "Competency Collapse" to fill the theoretical gap in explaining structural competency failure caused by AI substitution; Second, it constructs a theoretical framework that integrates the theory of Legitimate Peripheral Participation with the Dreyfus skill acquisition model to explain the non-linear, structural disintegration of competency hierarchies — This offers a more nuanced explanation than the linear concept of a "skill gap". Third, the "AI Substitution Rate - Skill Demand Change Rate" two-dimensional framework further provides a potential tool for quantifying this crisis.

On a practical level, the proposed multi-level intervention framework — targeting the individual, team, and organizational dimensions — charts a path forward. It emphasizes that the solution lies not in resisting technological change, but in strategically redesigning systems to transform AI from a disruptor of learning into an enabler of growth. This necessitates a fundamental shift: from measuring efficiency to cultivating expertise, from executing fragmented tasks to engaging in holistic problem-solving, and from upholding a culture of mere productivity to fostering one of continuous, collaborative learning.

In conclusion, the "Competency Collapse" crisis serves as a critical warning for the investment banking industry. Ignoring the erosion of the implicit knowledge ecosystem by AI risks leading to a systemic degradation of human capital and a severe future talent shortage. The ultimate imperative for investment banks is to achieve organizational ambidexterity: leveraging AI for operational excellence while simultaneously investing in the reconstruction of a sustainable human-machine collaborative ecosystem that preserves and enhances the human expertise essential for high-stakes financial decision-making. Future research should focus on empirically testing the proposed framework and tracking the evolution of competency models in pioneering institutions.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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