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The Effects of Career Interest and Academic Self-Efficacy on Postdoctoral Job Satisfaction: The Mediating Role of Career Expectations and the Moderating Role of Generative Artificial Intelligence Use

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Abstract

The postdoctoral community plays a critical role in scientific innovation and academic development worldwide. This study examines how career interest and academic self-efficacy influence postdoctoral job satisfaction through the mediating role of career expectations and the moderating role of generative artificial intelligence (GAI) use. The analysis was based on secondary data obtained from the Nature 2023 Global Postdoctoral Survey conducted by Springer Nature, covering postdoctoral researchers from 93 countries. After data screening, 948 valid samples were retained for analysis. Partial least squares structural equation modeling (PLS-SEM) was employed to test the proposed hypotheses. The results indicate that career interest ($\beta = 0.498$, $p < 0.001$), academic self-efficacy ($\beta = 0.574$, $p < 0.001$), and career prospect expectations ($\beta = 0.278$, $p < 0.001$) positively influence postdoctoral job satisfaction. Furthermore, academic self-efficacy and career prospect expectations jointly form a significant chain-mediating mechanism between career interest and postdoctoral job satisfaction. Although the direct effect of generative AI use on job satisfaction was not significant, GAI positively moderated the relationship between career interest and postdoctoral job satisfaction ($\beta = 0.087$, $p < 0.05$). The findings extend the literature on postdoctoral career development and provide practical implications for research institutions seeking to improve postdoctoral satisfaction in the AI era.

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1. Introduction

With the accelerating trend of economic globalization, the competition for talents has become the primary issue facing all countries [1]. The postdoctoral stage is not only an important part of one's academic career, but also a key way to enhance academic output and international academic influence [2]. The scientific research potential of the postdoctoral group is of great value to the implementation of the national strategy of scientific and technological innovation and strengthening the country with talents [3]. In the OECD 2021 report, the number of postdoctoral positions globally has increased significantly over the past decade, with the number of postdocs growing by 144% in Finland and 37% in the US since 2003 [4]. According to data released by the China Postdoctoral Committee, only one postdoctoral researcher was admitted in the first recruitment batch, and 44 were admitted in the second batch. As of 2019, the number of standing postdocs has grown to 25,541, and

the number continues to grow at a rate of more than 10% per year [5]. However, under the impact of the surge in size and employment pressure, the job satisfaction of the postdoctoral group is not optimistic. The Nature Global Postdoctoral Survey found significant differences in job satisfaction among postdocs, with a variety of factors contributing to their dissatisfaction, such as unanticipated career prospects, stressful working conditions, and travel pressures [6]. Due to the impact of academic pressures on job satisfaction and the career stress caused by the imbalance between effort and reward, more and more postdocs tend to give up their academic careers, and this phenomenon is gradually showing a clear trend [7]. In view of this, how to stimulate the scientific research potential of postdocs and improve the job satisfaction of postdocs has become an important issue of general concern to the society.

Postdoctoral job satisfaction is an important concept in the field of career development research, which mainly refers to the postdoctoral group's subjective perception of and satisfaction with the academic work environment, career development opportunities, salary and research resources [8]. In essence, postdoctoral job satisfaction involves not only the internal satisfaction perception of one's career development prospect, but also the comprehensive evaluation of external academic environment, supervisor support, interpersonal relationship, salary and benefits, and social recognition and other factors [3,8]. In the existing studies, more attention has been paid to external conditions such as organizational support, policy protection and salary, but not to how postdocs' individual career interests and academic self-efficacy affect their perceptions of job satisfaction [9]. However, with the rise of emerging technologies such as Generative Artificial Intelligence (GAI), postdocs' work environment and individual perceptions are changing. The use of GAI creates technology dependence and competitive anxiety in the postdoctoral community, which in turn reduces academic self-efficacy and may consequently lower expectations of productivity and career prospects [10]. Although existing studies have addressed postdoctoral job satisfaction in terms of working conditions and general expectations, the mechanisms linking individual psychological factors to job satisfaction remain under-theorized. Career expectations can be viewed as a key mediating cognitive process through which career interest and academic self-efficacy shape postdoctoral job satisfaction. In addition, the increasing use of generative artificial intelligence constitutes an important technological context that may moderate this process by influencing how individual resources and expectations translate into job-related evaluations. Yet, such a moderated mediation framework has received little empirical attention. In addition, due to the relatively small size of the postdoctoral community, the coverage of the existing research samples is insufficient, making it difficult to form generally applicable research conclusions [7,9]. In view of this, this study, based on data from the Nature 2023 Global Postdoctoral Survey, focusing on how career interest and academic self-efficacy affect postdoctoral job satisfaction through the mediating role of career prospect expectations, and further analyzing the possible moderating role of generative artificial intelligence in the proposed pathway. By constructing an analytical framework, the findings of the study help to expand the theoretical research perspectives of postdoctoral job satisfaction, and also provide reference for research institutions to optimize the postdoctoral career development support system and improve the attractiveness and stability of their academic careers.

Although previous studies have explored postdoctoral job satisfaction from the perspectives of organizational support, working conditions, and career uncertainty, several important gaps remain unresolved. First, existing studies have largely emphasized external institutional factors while paying insufficient attention to the internal psychological mechanisms through which postdoctoral researchers evaluate their academic careers. Second, limited research has examined how career interest and academic self-efficacy jointly shape postdoctoral job satisfaction through cognitive expectation processes. Third, despite the rapid diffusion of generative artificial intelligence in academic work environments, little empirical evidence exists regarding whether AI use changes the relationships between motivational factors

and job satisfaction among postdoctoral researchers. Therefore, this study develops an integrated moderated mediation framework to explain how career interest, academic self-efficacy, career prospect expectations, and generative AI use interact in shaping postdoctoral job satisfaction.

The objective of this study is to provide answers to the following research questions.

RQ1. How do career interest, academic self-efficacy, Career expectations, and the use of generative AI affect post-doctoral job satisfaction?

RQ2. How do academic self-efficacy and Career expectations mediate the linkages between career interest and post-doctoral job satisfaction?

RQ3. How does the use of generative AI moderate the linkages between career interest, academic self-efficacy, career expectations, and post-doctoral job satisfaction?

The subsequent part of the study is structured as follows: section 2 provides a literature review and introduces the research model and hypotheses. Section 3 outlines the research methodology, including the design and data collection methods. Section 4 describes the discovery and analysis of the data while sections 5, 6 discusses the results and directions to future research directions.

2. Theory and hypotheses

The postdoctoral stage represents a unique transitional period characterized by temporary employment, uncertain career trajectories, intense publication pressure, and highly competitive academic environments. Compared with other occupational groups, postdoctoral researchers are more dependent on intrinsic career motivation, confidence in academic competence, and expectations regarding future academic opportunities. Therefore, career interest, academic self-efficacy, and career prospect expectations are particularly relevant psychological constructs for understanding postdoctoral job satisfaction. Furthermore, as generative AI tools increasingly reshape academic work processes such as writing, coding, and literature review, AI use may influence how postdoctoral researchers perceive the relationship between their intrinsic motivation and career experiences.

2.1. Career interest and postdoctoral job satisfaction

Career Interest is an important psychological variable that influences individuals' career choice, career development and job satisfaction, and is defined as "an individual's persistent preference and psychological tendency for a particular occupational activity or work environment" [11]. Research on career interest can be interpreted from Trait-Matching Theory (TMT) and Dynamic Construction Theory (DCT). TMT suggests that the degree to which an individual's type of occupational interest matches his or her work environment influences his or her occupational achievement and satisfaction [12]. The RIASEC model proposed by Holland classifies career interests into six dimensions: Realistic, Investigative, Artistic, Social, Enterprising and Conventional. It also emphasizes that the fit between an individual's career interest type and the work environment plays a key role in enhancing job satisfaction [13]. In high cognitive demand occupational groups (e.g., researchers), Investigative Interest is highly correlated with job satisfaction, suggesting an optimizing effect of interest matching on work experience [14]. DCT suggests that career interests are not only influenced by individuals' stable personality traits, but also shaped by the dynamics of career contexts, upbringing, and social support [15]. The postdoctoral phase is a critical period in the development of an academic career, with a high degree of autonomy, long-cycle feedback and career uncertainty in its work [16,17]. In such a context, the continued development and strengthening of career interests is particularly important for postdocs' career identity and job satisfaction.

Job satisfaction in the postdoctoral community is influenced by a variety of factors, with career interest playing an important role at the individual level [18,19]. Studies have been conducted to reveal the path of action from three perspectives. First, the Competence-Interest Fit Effect (CIFE). When an individual's occupational interest type matches the actual job content, the phenomenon of "ability-interest resonance" occurs, i.e., it is easier for an individual to utilize his/her own abilities and gain positive occupational experiences in an interest-driven work environment [20,21]. Second, Intrinsic Motivation Mechanism (IMM). According to Self-Determination Theory (SDT), vocational interest enhances intrinsic motivation and job satisfaction by satisfying the three needs of individuals: Autonomy, Competence and Relatedness [22,23]. Third, the Stress Buffering Effect (Stress Buffering Effect). The postdoctoral community generally faces greater career pressures, such as the "promotion-or-retirement" system, competition for project funding, and uncertainty about future careers [19]. Career interest as a psychological resource can reduce burnout and anxiety by buffering the negative effects of stress on an individual's mental state [24-26]. For postdocs, continuous academic curiosity and interest-driven research enthusiasm can play a buffering role in high-stress environments, forming a special path of "pressure-interest transformation". In summary, career interest contributes to positive career experience and overall satisfaction of postdocs through multiple paths such as ability matching, intrinsic motivation stimulation and stress buffering. Therefore, the following hypotheses are proposed in this study:

H1: Career interest positively and significantly affects postdoctoral job satisfaction.

2.2. Academic self-efficacy and postdoctoral job satisfaction

Academic self-efficacy is an individual's confidence in his or her ability to accomplish specific academic tasks. This confidence comes from personal experience, indirect experience (e.g., observing others), verbal persuasion, and emotional-physiological states [27]. Academic self-efficacy not only affects academic behavior, but also has a significant impact on mental health, motivation, and emotion [28]. Social Cognitive Career Theory (SCCT) suggests that the formation of career interest is driven by a combination of self-efficacy and outcome expectations, and that the continued development of interest feeds back into increased self-efficacy [29]. For example, [30] Buenconsejo and Datu (2020) found that growth mindset and academic self-efficacy point directly to career exploration behaviors, and that congruence of career interests enhances an individual's confidence in academic competence through goal setting. This idea is further supported by research in the STEM fields, where a love of math in adolescence significantly increases academic self-efficacy, which in turn sets the stage for a professional career [31]. In addition, feedback perception as an external motivator indirectly contributes to the deepening of career interest by enhancing academic self-efficacy, e.g., vocational college students are more willing to engage in their studies and set higher goals in response to positive feedback [32]. Together, these findings suggest that career interest is not only an outcome variable of academic self-efficacy, but also a driver of its dynamic development.

Postdocs with high academic self-efficacy are more adept at utilizing resources to cope with career stress, and intrinsic perceptions of research competence buffer the negative impact of job uncertainty [3,28]. At the same time, academic self-efficacy creates a virtuous cycle of "competence-achievement-satisfaction" by contributing to the achievement of career goals (e.g., publications, project results) [33]. In summary, career interest contributes to positive career experience and overall satisfaction of postdocs through multiple paths such as ability matching, intrinsic motivation stimulation and stress buffering. Therefore, the following hypotheses are proposed in this study:

H2: Career interest positively and significantly affects academic self-efficacy;

H3: Academic self-efficacy positively and significantly affects postdoctoral job satisfaction;

H4: Career interests influence postdoctoral job satisfaction through academic self-efficacy.

2.3. Career Interests, Academic Self-Efficacy, and Career Prospect Expectations

Career interest, as the core driving force of individual career development, has a significant positive association with career prospect expectations. Research has shown that when individuals have positive expectations about the development opportunities, income potential and promotion space of a specific occupational field, their career interest will be significantly increased [34]. For example, the career interest of accounting students is closely related to their positive judgments about the future of the profession, and such expectations can even offset the negative effects of a high-intensity work environment [34]. Social Cognitive Career Theory (SCCT) suggests that the formation of career interest is not only dependent on personal traits (e.g., proactive personality), but is also influenced by a combination of career self-efficacy and outcome expectations (i.e., career prospect expectations). Specifically, an individual's career interest will enhance his or her confidence in career competence (self-efficacy) through the accumulation of "career learning experiences" (e.g., performance, alternative learning), and further shape expectations of future career rewards, thus forming a dynamic "interest-efficacy-expectations" cycle. The dynamic "interest-efficacy-expectation" cycle is formed [35].

Academic self-efficacy, as an individual's belief in his or her own academic ability, is an important predictor variable of career prospect expectations. High academic self-efficacy individuals tend to translate academic achievement into positive judgments about career advancement, e.g., increased competence through research training significantly enhances postdocs' sense of identity and security in their academic career paths [36]. Mentors support indirect improvements in career prospect expectations through increased academic self-efficacy, which itself positively predicts an individual's career adaptability and employability [37]. This mechanism of action has also been validated in cross-cultural research, where students' sense of control over their career development and outcome expectations are significantly higher when they believe they are competent in their academic tasks, and thus are more likely to proactively explore career opportunities [38].

The mechanism of career prospect expectation as a key mediating variable connecting personal traits and job satisfaction has been validated in multiple dimensions. Career outlook expectations not only directly and positively predicted job satisfaction, but also exerted a partial mediating effect between organizational support (e.g., mentoring, mental health services) and satisfaction [36,39]. This mediating effect has dual explanatory power. On the one hand, a clear career path expectation can ease the career anxiety of the postdoctoral group and enhance their recognition of the value of their current work [8]. On the other hand, optimistic judgments of career prospects promote resource-preserving behaviors (e.g., proactive participation in academic socialization), which in turn enhance satisfaction through the accumulation of academic capital [3]. Based on the above theoretical lineage and empirical evidence, the following hypotheses are proposed:

H5: Career interest positively and significantly influences career prospect expectations;

H6: Academic self-efficacy positively and significantly influences career prospect expectations;

H7: Career prospect expectations positively and significantly affect postdoctoral job satisfaction;

H8: Career interest positively affects postdoctoral job satisfaction through the mediating role of career prospect expectations;

H9: Academic self-efficacy positively affects postdoctoral job satisfaction through the mediation of career prospect expectations;

H10: Career interest positively influences career prospect expectations through academic self-efficacy;

H11: Career interest influences postdoctoral job satisfaction through the chain-mediated effect of academic self-efficacy and career prospect expectations.

2.4. The moderating role of generative artificial intelligence

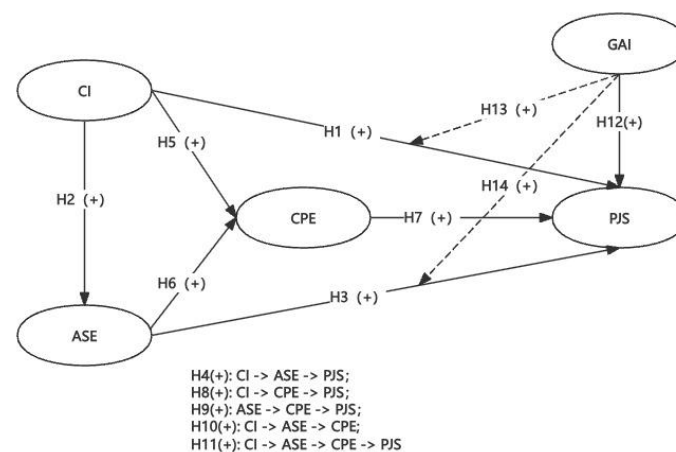
With the rise of GAI, the intersection of occupational psychology and educational technology has come to focus on the impact of GAI on career development. Career interest can significantly increase individuals' job satisfaction through the mechanism of person-job matching, while academic self-efficacy enhances job satisfaction by improving individuals' resource acquisition and stress coping ability. However, how GAI affects the above relationships still lacks in-depth exploration. Specifically, GAI may play a regulatory role through the following three mechanisms. First, GAI personalized content generation capability can improve the fit between career interests and job tasks, for example, AI tools based on Hollander's career interest model can dynamically optimize the path of postdoctoral research direction choice [40]. Second, GAI reduces the complexity of research tasks (e.g., automation of literature review, optimization of experimental design), thus enhancing the user's sense of control over the research task, which further strengthens the individual's academic self-efficacy [41]. Third, AI real-time feedback systems (e.g., intelligent research assistants) can enhance the transparency of the "interest-competence-achievement" chain, thereby strengthening the relationship between positive psychological expectations and satisfaction of users [42]. The realization of the above moderating effects relies on two key technical properties of GAI, technical availability and algorithmic interpretability. Technology availability provides postdocs with an immersive research experience through a multimodal interactive interface [43]. Algorithmic interpretability, on the other hand, enhances the user's sense of control and counteracts uncertainty anxiety through the visualization of decision logic. Therefore, the following hypotheses are proposed:

H12: Generative AI positively affects postdoctoral job satisfaction;

H13: Generative AI positively moderates the relationship between career interest and postdoctoral job satisfaction;

H14: Generative AI positively moderates the relationship between academic self-efficacy and postdoctoral job satisfaction.

2.5. Research Model and Hypotheses



Note(s): CI = Career Interest; ASE = Academic self-efficacy; Career expectations = CPE; PJS = Post-doctoral job satisfaction.

Figure 1. Theoretical model

3. Method

3.1. Data overview

Study data from the 2023 Global Postdoctoral Survey conducted by Springer Nature Publishing in association with Shift Learning, Inc. (Nordling, 2023). The survey had 3,838 respondents from 93 countries who volunteered to participate. To ensure the authenticity and representativeness of the samples, we excluded the samples of non-postdocs, as well as the samples with missing or unspecified responses in the core variables of "use of generative AI", "academic self-efficacy", "job satisfaction", "career interest", and "career prospect expectation", resulting in 948 valid samples for subsequent analysis.

3.2. Measurement indicators

In this study, the variables were measured based on other scholars' studies. Career interest was measured using "My interest in postdoctoral work" [44]. Academic self-efficacy is measured using three items, including satisfaction with personal accomplishment, opportunities to work on interesting projects, and level of independence [10]. Postdoctoral job satisfaction is assessed using two questions: "Satisfaction with organizational management and leadership, and job security" [39,45]. Career expectations as measured by "Respondents' perceptions of job prospects compared to previous generations of postdocs" and "Overall sentiment about future job prospects" [10]. All the above questions were measured using a 7-point Likert scale. GAI use was measured by answering the question "How often is GAI used (e.g., ChatGPT)," with 1 meaning less than once a month, 2 meaning once a month, 3 meaning once a week, and 4 meaning once a day [10].

3.3. Statistical methods

We used Jamovi 2.4 and SmartPLS 4.0 software for statistical analysis. Path analysis uses structural equation modelling (SEM) and SEM is categorized into CB-SEM and PLS-SEM [46]. PLS-SEM was chosen for this study for two main reasons. Firstly, the data do not obey the normal distribution exactly, and secondly, our research model is more complex, containing chained intermediation and moderating effects. Therefore, it is more appropriate to use PLS-SEM [47]. The data analysis section contains three parts: descriptive statistical analysis, measurement modeling, and structural modeling. Descriptive statistical analyses focused on analyzing demographic variables. Measurement models are tested for reliability and validity, as well as issues of covariance and common method bias, as a means of determining whether the next step of the study can be taken [47]. Structural modeling includes testing the direct, mediating, and moderating effects of pathways [47].

In addition, several demographic variables, including gender, age, employment status, disciplinary background, minority status, and geographic region, were statistically examined to reduce potential confounding influences and enhance the robustness of the structural model.

4. Results

4.1. Descriptive statistical analysis

In order to understand the basic background characteristics of the respondents, descriptive statistics were analyzed for the variables of gender, age, ethnic minority, nature of work, professional background, and region of residence of the sample, and the results of the analysis are shown in Table 1. In terms of gender distribution, the proportion of male respondents was 54.2%, slightly higher than the 45.8% of females, indicating that the sample was relatively balanced in terms of gender. In terms of age structure, the sample is mainly concentrated in the 31-40 age group, accounting for 68.2%, indicating that the sample in this study is dominated by young and middle-aged researchers. The introduction of minority status in helps to subsequently explore the potential impact

of diversity factors on research behavior or attitudes. Regarding the nature of work, most respondents were full-time practitioners, and only 3.6% were part-time, indicating that the sample consisted mainly of those who were engaged in full-time research or teaching in scientific research institutes or institutions of higher education. In terms of specialty distribution, the sample is mainly concentrated in biomedical and clinical sciences, indicating a certain degree of discipline concentration in the sample. In terms of regional distribution of residence, the largest number of respondents were from Europe, followed by North or Central America. The proportion of respondents from Asia (including the Middle East) is 10.5%, while the proportion from Africa, Oceania and South America is relatively low, indicating that the sample has a strong geographical representation. In summary, the sample of this study was predominantly full-time young and middle-aged researchers, concentrated in the biomedical field, and geographically predominantly in Europe and North America, which provides a high degree of representativeness and helps to ensure the external validity of the study's findings.

Table 1. Demographic.

Characteristics	Category	Frequency	Percentage
Gender	Female	434	45.8 %
	Male	514	54.2 %
Age in years	22-25 years	2	0.2 %
	26-30 years	208	21.9 %
	31-40 years	647	68.2 %
	41-50 years	78	8.2 %
	51-60 years	12	1.3 %
	61-70 years	1	0.1 %
Whether or not you are a minority	Yes	280	29.5 %
	No	668	70.5 %
Full time or Part time	Full time	914	96.4 %
	Part time	34	3.6 %
Specialization	Agriculture and food	34	3.6 %
	Astronomy and planetary science	10	1.1 %
	Biomedical and clinical sciences (e.g. cellular, developmental, genomic, molecular, physiology)	448	47.3 %
	Chemistry	38	4.0 %
	Computer science and mathematics	27	2.8 %
	Ecology and evolution	73	7.7 %
	Engineering	62	6.5 %
	Geology and environmental science	48	5.1 %
	Health care	47	5.0 %
	Other science-related field	50	5.3 %
	Physics	49	5.2 %
	Social sciences	62	6.5 %
Location of residence	Africa	15	1.6 %
	Asia (including Middle East)	100	10.5 %

Characteristics	Category	Frequency	Percentage
	Australasia	26	2.7 %
	Europe	449	47.4 %
	North or Central America	341	36.0 %
	South America	17	1.8 %

4.2. Measurement Model Analysis

Following the guidelines proposed by Podsakoff et al. (2003), we employed Harman's single-factor analysis to evaluate common method variance. The results showed that a single unrotated factor explained less than 50% of the total variance, suggesting that common method bias was unlikely to significantly influence our study findings [48]. This study initially assessed potential collinearity issues among constructs by examining the variance inflation factor (VIF), adhering to the recommended threshold that VIF values should remain below 5.00 [47]. As shown in Table 2, all VIF values for the variables utilized in this research were below 5.00, confirming that collinearity did not pose a concern in this analysis.

We subsequently evaluated indicator reliability for each of the four reflective constructs by examining factor loadings for statistical significance and magnitude and assessed construct reliability using Cronbach's alpha (α), as well as composite reliability measures. Consistent with Hair et al.'s (2021) guidelines, indicators were retained only if their factor loadings exceeded the recommended threshold of 0.708, confirming adequate reliability. For all reflective constructs examined in this study, Cronbach's alpha values surpassed the threshold of 0.60, indicating strong internal reliability. Additionally, the composite reliability indices for each construct exceeded the recommended 0.70 criterion [47], as detailed in Table 2, further validating construct-level reliability and confirming measurement robustness.

Table 2. Construct Reliability, Factor Loadings and VIF.

Variables	Cronbach's alpha (α)	Composite reliability (CR)	Average variance extracted (AVE)	Items	Factor loadings (FL)	Variance inflation factor (VIF)
CI	-	-	-	Item1	1.000	1.000
ASE	0.756	0.859	0.670	Item1	0.845	1.616
				Item2	0.848	1.537
				Item3	0.760	1.445
CPE	0.643	0.841	0.727	Item1	0.924	1.290
				Item2	0.774	1.290
PJS	0.668	0.856	0.748	Item1	0.829	1.337
				Item2	0.900	1.337

Note(s): CI = Career Interest; ASE = Academic self-efficacy; Career expectations = CPE; PJS = Post-doctoral job satisfaction.

Next, discriminant validity was evaluated following the approach suggested by [49] Fornell and Larcker (1981), which requires the square roots of AVE values for each construct to exceed their correlations with other constructs. Additionally, discriminant validity was further confirmed using the Heterotrait-Monotrait (HTMT) ratio criterion. In line with the guidelines proposed by Hair et al. (2021), the HTMT ratios obtained in this study remained below the acceptable threshold of 0.90, as displayed in Table 3, thereby demonstrating sufficient discriminant validity among constructs.

Table 3. Discriminant Validity.

	ASE	CPE	PJS
CI	0.849	0.251	0.600
ASE	0.819	0.412	0.859
CPE	0.321	0.853	0.658
PJS	0.624	0.447	0.865

Note(s): CI = Career Interest; ASE = Academic self-efficacy; Career expectations = CPE; PJS = Post-doctoral job satisfaction. The lower diagonal is the Fornell-Larcker criterion and the upper diagonal bolded is the HTMT value, bolded is the square root of AVE.

4.3. Structural Model Analysis

4.3.1. Model's fit, explanatory and predictive power

The SRMR value of 0.081 indicates that the model displays an acceptable goodness of fit [50], meeting the recommended threshold of <0.08 marginally [47]. The R² values for ASE (0.564), CPE (0.104), and PJS (0.464) indicated the model's weak-to-moderate explanatory power [51]. Similarly, the f² values reflected relatively small effect sizes [52]. Conversely, the Q² values for ASE (0.369), CPE (0.067), and PJS (0.337) exceeded zero, thereby demonstrating acceptable predictive relevance (Tables 4 and 5).

Table 4. Model's explanatory/predictive power and effect size.

	CI	ASE	CPE	PJS
R2	-	0.564	0.104	0.464
Q2	-	0.369	0.067	0.337
f2				
CI		1.293	0.001	0.005
ASE			0.060	0.173
CPE				0.128

Note(s): CI = Career Interest; ASE = Academic self-efficacy; Career expectations = CPE; PJS = Post-doctoral job satisfaction.

Table 5. Model's goodness of fit.

	Saturated model	Estimated model
SRMR	0.081	0.081
d_ULS	0.294	0.296
d_G	0.154	0.155
Chi-square	907.203	914.512
NFI	0.680	0.678

Note(s): SRMR = Standard Root mean Square Residual; NFI = Normed Fit Index

4.3.2. Hypotheses testing

4.3.2.1 Direct effects

The structural model was analyzed through a bootstrapping procedure involving 10,000 iterations, in accordance with Hair et al.'s (2021) recommendations. Results presented in Table 6 and Figure 2 provide essential evidence regarding the hypothesized relationships within the research framework.

Specifically, the results demonstrate a direct positive association with CI has been empirically substantiated for PJS (H1: $\beta = 0.498$, $p < 0.001$), ASE (H2: $\beta = 0.751$, $p < 0.001$), as well as CPE (H5: $\beta = 0.224$, $p < 0.001$). Similarly, a direct positive association of ASE was also confirmed for both PJS (H3: $\beta = 0.574$, $p < 0.001$) and CPE (H6: $\beta = 0.351$, $p < 0.001$). Furthermore, the direct positive relationship between CPE and PJS (H7: $\beta = 0.278$, $p < 0.001$) was corroborated. However, the hypothesized direct association of GAI with PJS (H12: $\beta = -0.001$, $p > 0.05$) could not be supported.

4.3.2.2 Indirect effects

The results also demonstrated that ASE positively and significantly mediated the CI-PJS linkage (H4: $\beta = 0.358$, $p < 0.001$) and the CI-CPE association (H10: $\beta = 0.264$, $p < 0.001$). Similarly, a significant mediating effect of ASE and CPE was observed in the relationship between CI and PJS (H11: $\beta = 0.073$, $p < 0.001$). Additionally, CPE was confirmed as a significant mediator in the ASE-PJS linkage (H9: $\beta = 0.097$, $p < 0.001$). However, the mediation effect of CPE on the CI-PJS association could not be corroborated (H8: $\beta = -0.011$, $p > 0.05$).

4.3.2.3 Assessment of moderation effects

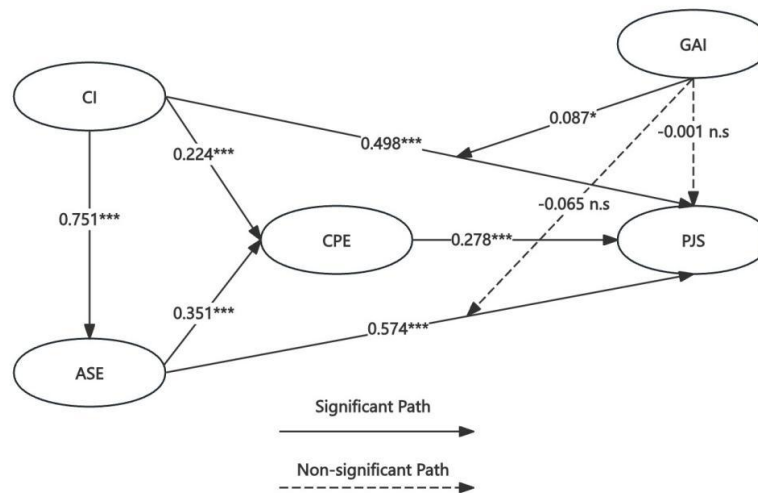
The results further demonstrated that the moderating effect of GAI was positively significant in the relationship between CI and PJS (H13: $\beta = 0.087$, $p < 0.05$). However, the moderating role of GAI in the ASE-PJS linkage (H14: $\beta = -0.065$, $p > 0.05$) could not be corroborated. The results of the moderation effects are shown in Table 6. Figure 3 shows how the degree of GAI influences the impact of career interest (CI) on post-doctoral job satisfaction (PJS). Results demonstrated that the influence of career interest is greater when GAI is relatively high, as shown by the steeper slope.

Table 6. Analysis of the structural model.

Hypotheses	Paths	β	SD	t-values	p-values	LLBCI	ULBCI	Sig.?
Direct effects								
H1	CI → PJS	0.498	0.026	18.800	0.000	0.441	0.548	Yes
H2	CI → ASE	0.751	0.018	42.610	0.000	0.714	0.783	Yes
H3	ASE → PJS	0.574	0.037	15.526	0.000	0.501	0.644	Yes
H5	CI → CPE	0.224	0.031	7.159	0.000	0.160	0.283	Yes
H6	ASE → CPE	0.351	0.045	7.729	0.000	0.260	0.437	Yes
H7	CPE → PJS	0.278	0.026	10.702	0.000	0.227	0.329	Yes
H12	GAI → PJS	-0.001	0.025	0.021	0.983	-0.049	0.047	No
Indirect effects								
H4	CI → ASE → PJS	0.358	0.030	11.759	0.000	0.299	0.418	Yes
H8	CI → CPE → PJS	-0.011	0.014	0.810	0.418	-0.039	0.015	No
H9	ASE → CPE → PJS	0.097	0.016	6.112	0.000	0.069	0.131	Yes
H10	CI → ASE → CPE	0.264	0.036	7.325	0.000	0.196	0.338	Yes
H11	CI → ASE → CPE → PJS	0.073	0.012	5.895	0.000	0.051	0.100	Yes
Moderation effects								
H13	GAI × CI → PJS	0.087	0.041	2.149	0.032	0.010	0.169	Yes

Hypotheses	Paths	β	SD	t-values	p-values	LLBCI	ULBCI	Sig.?
H14	GAI x ASE -> PJS	-0.065	0.041	1.594	0.111	-0.145	0.013	No

Note(s): CI = Career Interest; ASE = Academic self-efficacy; Career expectations = CPE; PJS = Post-doctoral job satisfaction; GAI = Generative artificial intelligence; SD = Standard Deviation; LLBCI = Lower Limit Bias Corrected Confidence Interval; ULBCI = Upper Limit Bias Corrected Confidence Interval; Sig.= Significant



Note(s): CI = Career Interest; ASE = Academic self-efficacy; Career expectations = CPE; PJS = Post-doctoral job satisfaction. * $p < .05$; ** $p < .01$; *** $p < .001$; n.s = Non-significant Path.

Figure 2. The Structural Equation Model Analysis.

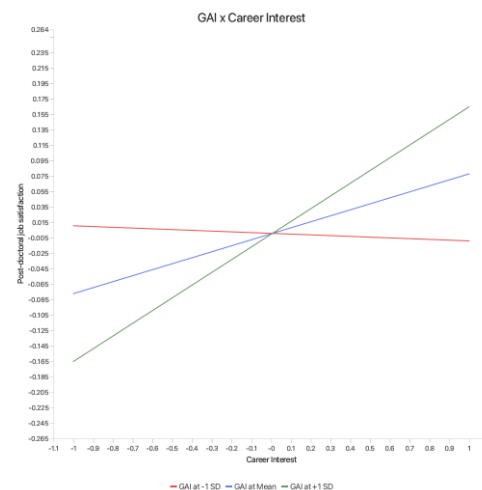


Figure 3. Diagram of the Slope of the Moderating Effect.

5. Discussion

Concerning RQ1, the results revealed that career interest is positively associated with post-doctoral job satisfaction. The results aligned with prior studies emphasizing the role of vocational alignment in enhancing job attitudes [12]. Furthermore, academic self-efficacy is positively associated with post-doctoral job satisfaction. This finding is consistent with earlier work highlighting how confidence in one's scholarly abilities promotes greater workplace well-being [53]. Moreover, career expectations demonstrated a positive association with post-doctoral job satisfaction. These results mirror those of [19,54] Benthem et al. (2020) and van der Weijden et al. (2016), who found that optimistic views of future advancement foster higher satisfaction. Finally, the utilisation of generative AI exhibited

no substantial impact on postdoctoral job satisfaction, indicating that the employment of GenAI tools did not result in elevated job satisfaction within this sample. This finding contrasts sharply with findings from existing studies, such as the positive impact of GAI on job satisfaction [55-57]. The absence of empirical corroboration suggests that alternative factors, such as skill development or organisational support, may potentially moderate the anticipated impact of AI utilisation on satisfaction.

Concerning RQ2, our findings demonstrate that academic self-efficacy serves as a key mediator in the relationship between career interest and post-doctoral job satisfaction, indicating that stronger career interest enhances self-efficacy beliefs, which in turn bolster satisfaction. This aligns with prior research emphasizing the pivotal role of self-efficacy in translating motivational factors into positive work attitudes [53,58]. In addition, career expectations were shown to mediate the link between academic self-efficacy and job satisfaction, suggesting that confidence in one's academic capabilities fosters more optimistic views of future career advancement, which subsequently elevates satisfaction. This result is consistent with studies highlighting the importance of future-oriented expectations in shaping job attitudes [59]. Moreover, our analysis uncovered a significant serial mediation pathway: career interest enhances academic self-efficacy, which increases career expectations, and these elevated expectations then lead to greater post-doctoral job satisfaction. This sequential mechanism underscores the interconnected nature of motivational, cognitive, and evaluative processes in determining job satisfaction, echoing integrative models of career development and well-being [60]. Although the full chain model has yet to be validated in its entirety, there are studies that clearly support the logical path of each segment of the chain [61] (Hernandez-Arriaza et al., 2025), constituting a highly theoretically and empirically consistent framework for the "chain intermediation mechanism".

Concerning RQ3, our results reveal that generative AI use positively moderates the relationship between career interest and post-doctoral job satisfaction, such that the more researchers engage with AI tools, the stronger the impact of their vocational motivations on satisfaction. To date, no studies have examined the moderating effect of generative AI tool use on the relationship between career interest and job satisfaction. However, studies have separately demonstrated a significant positive correlation between career interest and job satisfaction [62], and that the use of generative AI can enhance employee satisfaction [63] and may play a moderating role between personality traits and satisfaction by enhancing individuals' motivational pathways [64], providing theoretical support for the moderating mechanism proposed in this study. In contrast, the moderating role of generative AI on the link between academic self-efficacy and job satisfaction was not supported, indicating that AI engagement does not significantly alter how confidence in scholarly abilities translates into satisfaction. Together, these findings suggest that while generative AI can amplify the motivational pathway from career interest to satisfaction, it does not appreciably influence the efficacy-to-satisfaction process.

The non-significant findings also provide important theoretical implications. Specifically, the absence of a direct relationship between generative AI use and postdoctoral job satisfaction suggests that technological adoption alone may not automatically improve researchers' emotional evaluations of their work. In highly competitive academic environments, AI tools may function primarily as productivity-enhancing instruments rather than sources of psychological fulfillment. Furthermore, the insignificant moderating effect of generative AI on the academic self-efficacy – job satisfaction relationship implies that confidence in academic competence remains relatively stable and internally driven, regardless of technological assistance. These findings indicate that AI may strengthen motivational alignment processes more effectively than competence-based psychological processes.

6. Conclusions, Implications, limitations and suggestions

This study examined how career interest and academic self-efficacy influence postdoctoral job satisfaction through the mediating role of career prospect expectations and the moderating role of generative AI use. Using data from the Nature 2023 Global Postdoctoral Survey, the findings demonstrate that intrinsic motivational and cognitive psychological factors play critical roles in shaping postdoctoral satisfaction. In particular, the study highlights the chain-mediating mechanism linking career interest, academic self-efficacy, career expectations, and job satisfaction, while also revealing that generative AI strengthens the relationship between career interest and satisfaction rather than directly increasing satisfaction itself. These findings contribute to a deeper understanding of postdoctoral career development in the emerging AI-driven academic environment and provide both theoretical and practical insights for universities and research institutions.

6.1. Theoretical contributions

This study contributes to the literature in several important ways. First, the study extends Social Cognitive Career Theory (SCCT) by demonstrating that career interest influences postdoctoral job satisfaction not only directly, but also indirectly through the sequential mechanism of academic self-efficacy and career prospect expectations. This finding highlights the dynamic interaction between motivational, cognitive, and evaluative psychological processes within postdoctoral career development. Second, the study enriches emerging research on generative AI in organizational and academic contexts by identifying AI use as a contextual boundary condition that strengthens the relationship between career interest and job satisfaction. Rather than functioning as a direct source of satisfaction, generative AI appears to amplify the motivational relevance of intrinsic career interests. Third, this study contributes specifically to postdoctoral research by shifting attention from traditional structural explanations (e.g., salary, institutional support, employment precarity) toward internal psychological mechanisms shaping postdoctoral well-being and career evaluation.

6.2. Implication for practices

The study reveals the core driving roles of career interest, academic self-efficacy and career outlook expectation on postdoctoral job satisfaction, and provides various practical insights for research institutions in enhancing postdoctoral job satisfaction. First, research institutions need to strengthen postdoctoral career sense of belonging through personalized career planning and interest-driven resource support (e.g., independent exploration fund), enhance academic confidence through step-by-step competence training and visual feedback of results, and manage career expectations through transparent career paths and grafting of resources from industry, academia and research. Second, research organizations need to focus on how emerging technologies, represented by generative AI, can amplify the positive impact of career interest on job satisfaction. For example, by designing interest-oriented AI tools (e.g., customized literature analysis models for postdocs who prefer theoretical research or developing experimental design optimization assistants for applied scholars), career interests are translated into landable research outputs, thus enhancing job satisfaction. At the same time, there is a need to be wary of the weakening effect of technological dependence on interest-driven endogenous dynamics. It is recommended that an "interest-AI synergy" mechanism be established to retain the core decision-making power of postdocs in AI-assisted tasks (e.g., manually correcting key logic in generating content) to ensure a balance between technological empowerment and interest autonomy. In addition, attempts can be made to embed generative AI into career interest cultivation sessions (e.g., simulating multidisciplinary crossover scenarios through AI to stimulate emerging research directions) to indirectly strengthen the driving effect of interest on satisfaction and provide empirical cases for subsequent research.

From a practical perspective, universities and research institutions should establish structured postdoctoral support systems that integrate career mentoring, AI literacy training, and psychological development programs. For example, research offices may organize AI-assisted research workshops to help postdoctoral researchers apply generative AI tools effectively in literature synthesis, coding, and manuscript preparation. In addition, supervisors should provide regular developmental feedback and individualized career planning sessions to strengthen postdoctoral researchers' academic self-efficacy and career expectations. Institutions may also establish interdisciplinary AI support centers to reduce technological uncertainty and improve researchers' ability to integrate AI into academic workflows without undermining intrinsic research motivation.

6.3. Limitations and suggestions

The current study offers valuable insights into how career interest, academic self-efficacy, career expectations, and generative AI use jointly shape post-doctoral job satisfaction. However, it is an opportunity for future research. First, the research model under consideration is devoid of any distinctions in cultural contexts, institutional policies, and funding structures across countries. Such variations may potentially influence the adoption of generative AI and satisfaction. Therefore, future research could consider incorporating different geographic and cultural contexts to ensure the applicability of research models. Second, the study data came from cross-sectional data, which did not allow for causal inferences. Follow-up studies could use longitudinal data or multi-stage surveys capable of tracking changes in academic self-efficacy, career interest, career expectations, and satisfaction. Third, our operationalization of generative AI use was based on overall frequency of engagement, without distinguishing between different types of AI tools or purposes (e.g., literature review, data analysis, writing support). Future studies could employ more granular measures or qualitative approaches to explore how specific AI functionalities differentially moderate motivational and cognitive processes. Fourth, although we tested both mediation and moderation pathways, other relevant individual differences (e.g., digital literacy, personality traits) and organizational factors (e.g., supervisor support, resource availability) were not included. Incorporating these variables could yield a more comprehensive model of post-doctoral satisfaction in the AI era. Finally, the exclusive focus on quantitative analysis means that the rich, contextual experiences of post-doctoral researchers remain underexplored. Future work might adopt mixed-methods or case-study designs to capture nuanced insights into how AI use intersects with professional identity, work-life balance, and career trajectories.

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Data Availability Statement: The data used in this study were obtained from the Nature 2023 Global Postdoctoral Survey and are publicly available through Springer Nature survey reports and related publications.

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Abbreviations

The following abbreviations are used in this manuscript:

CI	Career Interest
ASE	Academic self-efficacy
CPE	Career expectations
PJS	Post-doctoral job satisfaction.

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