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A Study on the Postgraduate Quality Evaluation Model and Its Recognition Analysis

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Abstract: With the rapid development of generative artificial intelligence technologies, represented by large language models, university-level computer science education is undergoing a critical transition—from knowledge-based instruction to competency-oriented teaching. A postgraduate student competency evaluation model can serve as a framework to organize and guide both teaching and research activities at the postgraduate level. A number of relevant research efforts have already been conducted in this area. Graduate education plays a vital role not only as a continuation and enhancement of undergraduate education but also as essential preparation for future research endeavors. An analysis of the acceptance of competency evaluation models refers to the assessment of how various stakeholders perceive the importance of different components within the model. Investigating the degree of acceptance among diverse groups—such as current undergraduate students, current postgraduate students, graduates with less than three years of work experience, and those with more than three years of work experience—can offer valuable insights for improving and optimizing postgraduate education and training practices.

Keywords: Postgraduate; Quality evaluation model; Importance; Recognition analysis

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1. Introduction

Postgraduate education serves as an important link between undergraduate foundational education and advanced scientific research, and its teaching quality directly influences the output level of high-level talent. Traditional postgraduate training, especially in computer science education, has long relied on the systematic delivery of knowledge points and professional skills training, aiming to build students' solid disciplinary foundation and technical ability to solve specific problems. However, the rapid development and wide application of generative artificial intelligence, represented by large language models, are profoundly reshaping the patterns of knowledge acquisition, technological application, and even innovation and creativity. This presents unprecedented and fundamental challenges to higher education, especially in computer science instruction. University-level computer science education is facing a critical turning point: from knowledge-oriented teaching to competency-

oriented teaching [1–3].

Traditional computer science courses are mostly centered on discrete knowledge units, completing the instructional loop through the sequence of lectures, experiments, and exams. However, large-scale AI tools are now capable of retrieving and assembling optimal solutions within seconds, making the mastery of knowledge points no longer a scarce skill. If students remain at the level of "being able to write a certain piece of code" or "memorizing a specific formula," they will struggle to demonstrate competitiveness in future workplaces or research environments.

With the rise of AI, especially generative AI, competency-based teaching has become essential in computer science education, prompting urgent reforms in university evaluation systems [4–6]. International responses include the University of Michigan–Flint's call to revise assessments for academic integrity [7], the University of Sydney's dual-track approach combining AI use and traditional exams [8], and Khlaif *et al.*'s AAAE framework (Against, Avoid, Adopt, Explore) for assessment adaptation. In China, building a comprehensive postgraduate evaluation model has become a key priority to align with these evolving educational demands [9–11].

This paper proposes a postgraduate quality evaluation model based on the investigation and analysis of current related models. Subsequently, a survey is conducted targeting different groups—current undergraduates, current postgraduates, graduates with less than three years of work experience, and graduates with more than three years of work experience—in order to assess their recognition of various dimensions and key elements involved in the postgraduate quality evaluation model [12]. The survey is conducted in the form of questionnaires to determine how different groups evaluate the importance of various elements in the model. Through analyzing the survey data, the paper identifies both commonalities and differences among the groups in their recognition of the postgraduate quality evaluation model, and further proposes several strategies to improve the quality of postgraduate training [13–15].

2. Survey on the postgraduate quality evaluation model

The process of postgraduate quality evaluation spans the entire cycle of postgraduate training—from admission, through the period of study, to graduation and departure. At the same time, the improvement process and efficiency of postgraduate competencies serve as a concrete reflection of the effectiveness of postgraduate teaching and research organization. Therefore, the methods used for postgraduate quality evaluation will directly influence the formulation of policies related to postgraduate teaching, research, and management within universities, as well as the teaching and research activities of postgraduate supervisors. To carry out objective and accurate postgraduate quality evaluation, the foundation lies in constructing a logically coherent and practically implementable evaluation model system. At present, a series of research achievements have emerged in the field of postgraduate quality evaluation modeling, primarily focusing on the following two stages: (1) proposing the construction principles of the quality evaluation model; and (2) designing the evaluation model itself, along with refining and optimizing it through application in real contexts.

2.1. Principles for constructing the postgraduate quality evaluation model

The construction of this model generally follows two primary approaches: one is rooted in educational theory and practical experience, proposing relevant principles based on the synthesis and reflection of past practices; the other draws on competency evaluation models from other domains as foundational references for building the postgraduate quality evaluation framework.

In 2007, Zhang Qingyi and others proposed a set of construction principles centered on directionality, the combination of relative and absolute evaluation, the integration of qualitative and quantitative assessment, the blending of self-evaluation and peer evaluation, as well as scientific and comprehensive orientation. Directionality refers to aligning with the overarching objectives of postgraduate training and comprehensively assessing students' overall profiles, with a core emphasis on the fundamental connotations of postgraduates' comprehensive competence. The integration of relative and absolute evaluation emphasizes the gradual de-emphasis of relative comparisons, instead highlighting the fundamental value of absolute benchmarks; relative evaluation tends to focus on differences among individuals, whereas absolute evaluation values individual development across stages. The combination of qualitative and quantitative methods calls for the appropriate inclusion of qualitative insights within quantitative frameworks to enrich the interpretation of each indicator, while also incorporating quantitative techniques in qualitative assessment to enhance operability. The integration of self-evaluation and peer evaluation aims to fully activate postgraduates' subjective agency in the evaluation process and improve their self-awareness regarding individual competencies. Lastly, scientific and comprehensive principles emphasize determining evaluation content from multiple dimensions, perspectives, categories, and levels to ensure the model can synthesize varied evaluative input and fully encompass postgraduates' competencies across all stages.

In 2017, Shen Shaobo, after analyzing postgraduate evaluation practices in the United States, the United Kingdom, Germany, and other countries, proposed that postgraduate assessment should combine three aspects: assessment orientation, qualitative evaluation, and quantitative examination. He further designed a three-level indicator system: assessment (first-level), evaluation (second-level), and examination (third-level). The assessment component reflects the overall competency profile of a postgraduate; the evaluation component focuses on research, operational, and practical abilities; and the examination component aims to assess course learning and academic performance comprehensively [16].

The two research outcomes above are primarily based on practical experience and have proposed model-building principles accordingly. In contrast, constructing a postgraduate quality evaluation model by drawing from other domains has also produced a series of research results. Two widely applied competency models from other disciplines are the Theory of Multiple Intelligences by Harvard psychology professor H. Gardner and the Competency Model by Harvard professor D. McClelland.

Research based on or inspired by the Competency Model has yielded even more abundant results in constructing postgraduate quality evaluation frameworks [17–20]. In 1973, D. McClelland published an article titled "Testing for Competence Rather Than Intelligence" in American Psychologist, where he first proposed the concept of the Competency Model. In the article, he argued that traditional intelligence and ability tests fail to predict professional success or other important life achievements and are subjectively unfair to minorities and women. Attributes such as personality, intelligence, and values—often assumed to determine professional performance—do not yield the expected results in practice.

McClelland proposed the Competency Model to identify traits and behaviors key to performance, distinguishing threshold competencies (knowledge, skills) from deeper differentiating competencies (self-concept, traits, motivation). Its comprehensive nature makes it well-suited for postgraduate quality evaluation, leading to extensive research and successful applications. The next section will focus on refining models based on this competency framework [21].

2.2. Postgraduate quality evaluation model

The process of refining and optimizing the postgraduate quality evaluation model mainly includes the following steps:

(1) First, a refined postgraduate competency model is proposed based on model construction principles such as the Competency Model, incorporating more detailed and specific evaluation indicators for postgraduates.

(2) Second, questionnaires are designed based on the refined indicators and targeted at educators and/or students. These are distributed and collected to gather opinions from various groups regarding the importance of different quality evaluation indicators.

(3) Third, a range of analytical methods (such as statistical techniques and big data analysis) is applied to the collected survey data to determine the weights or impact factors of each indicator. This process results in a usable and structured postgraduate quality evaluation model.

(4) Finally, the constructed model is applied across different stages of postgraduate education—such as recruitment, training, and graduation evaluation—and continuously improved through the collection and integration of feedback from these practical applications.

Zhou Ermin and colleagues developed a postgraduate competency model for professional degree programs based on the Competency Model. Through surveys and data analysis, they identified five key dimensions: knowledge and professional foundation, interpersonal communication skills, physical fitness, personality traits, and mindset. The model consists of 28 core elements, each with a defined weight reflecting its relative importance in **Figure 1**.

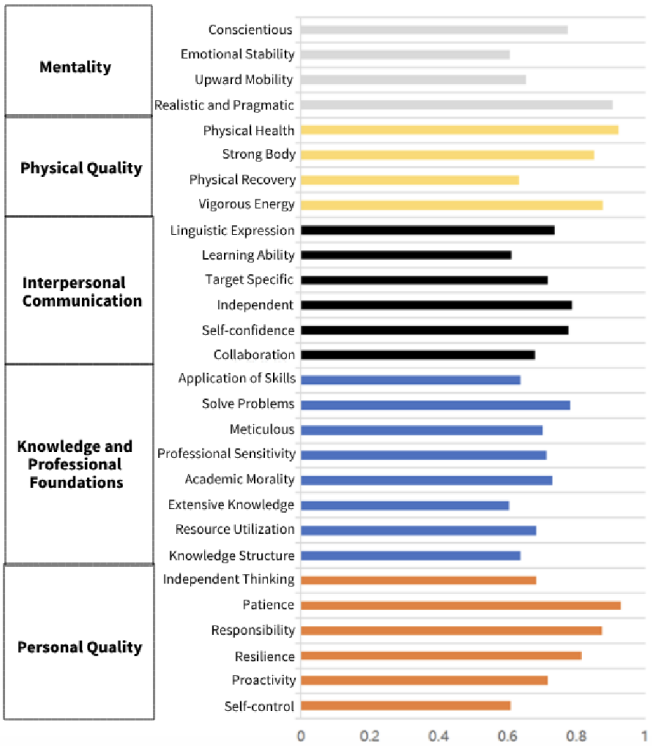

Figure 1. Comprehensive quality assessment indicator system for postgraduates

Zhang Cheng and others constructed a comprehensive evaluation framework for postgraduates, also drawing from the Competency Model. Their system includes six dimensions: motivation, traits, self-concept,

social roles, skills, and knowledge. Based on this framework, they proposed a concrete method for assessing postgraduate quality using 19 key indicators in **Figure 2**.

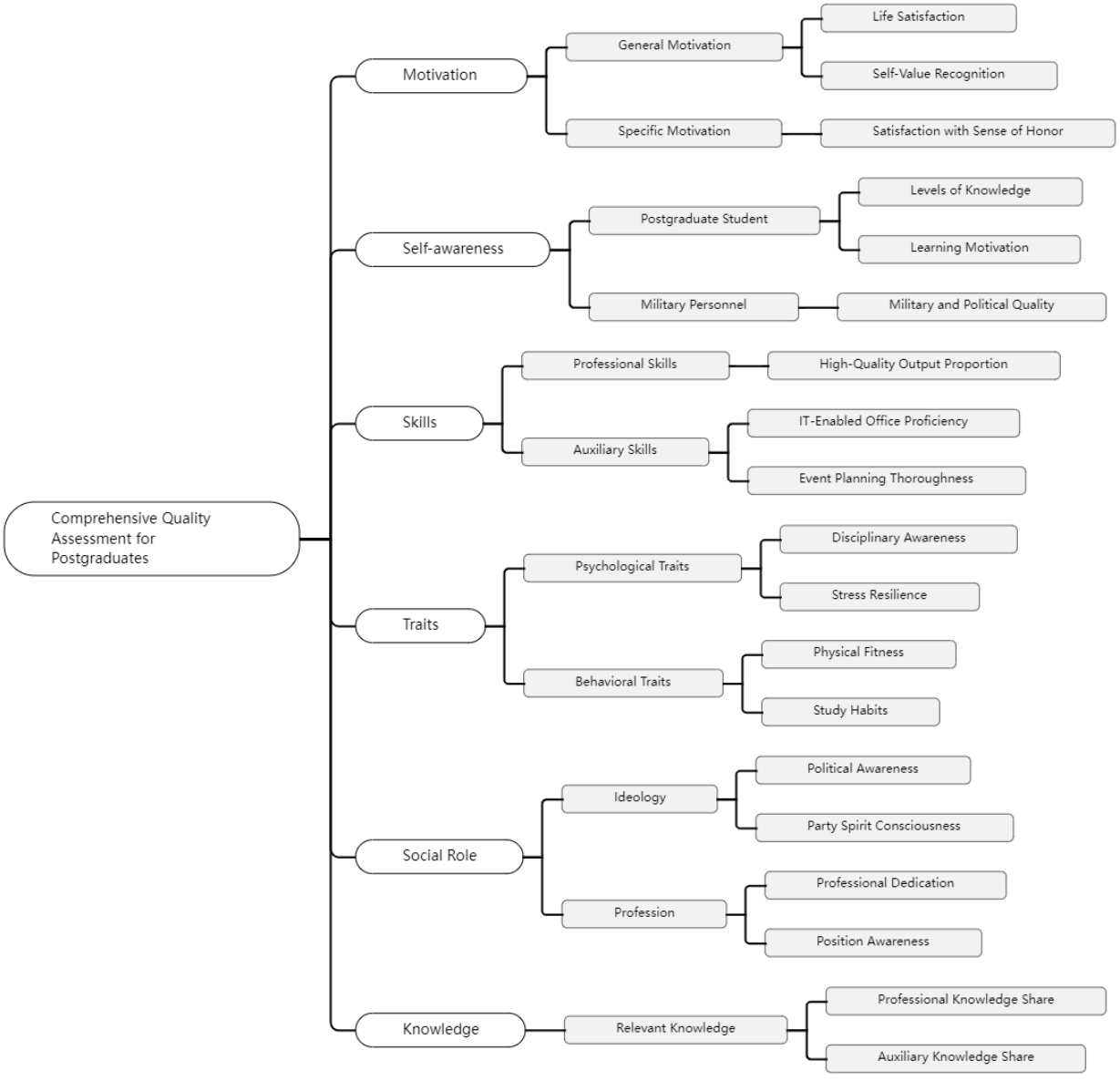

Figure 2. Comprehensive quality assessment indicator system for postgraduates

Chen *et al.* initially proposed a postgraduate competency model with six dimensions and 68 elements. After broader surveys, it was refined to six core areas—research ability, methodology, knowledge, self-management, resilience, and learning attitude—covering 37 key factors. Analysis across universities revealed significant gender and age-related differences in competencies and attitudes. However, no significant competency differences were observed between students from different academic disciplines [22–24].

3. Analysis of the acceptance of the postgraduate quality evaluation model

Postgraduate education serves as both a continuation of undergraduate learning and preparation for

employment. Therefore, the postgraduate quality evaluation model should not be confined to the postgraduate phase—it should connect backward with undergraduate education and forward with career development. This study examines the acceptance of the model, defined as how different groups—undergraduates, postgraduates, and working graduates—evaluate the importance of its key dimensions. Comparing these perspectives helps undergraduates better prepare for postgraduate study and enables postgraduates to align their development with workplace demands.

A quality evaluation model will be proposed based on prior research, followed by the design and distribution of a survey targeting four groups: current undergraduates, current postgraduates, graduates with less than three years of work experience, and those with more than three years. The survey aims to assess how each group understands and accepts the model, with results used to analyze trends and inform future training strategies.

3.1. Questionnaire design

Based on the earlier research and analysis of the postgraduate quality evaluation model, the model adopted in this study includes four dimensions and 20 key elements, as follows:

(1) Physical fitness (2 elements): physical health, energetic status;

(2) Interpersonal skills (4 elements): verbal communication, written communication, teamwork, organizational ability;

(3) Knowledge and skills (6 elements): learning ability, problem-solving ability, rigorous work attitude, professional skills, resource utilization, knowledge structure;

(4) Personal qualities (8 elements): independent thinking, patience, sense of responsibility, resilience, proactiveness, self-control, emotional stability, moral character.

The survey questionnaire adopts a five-point Likert scale. Respondents are required to rate the importance of each of the four dimensions and their respective key elements on a scale from 1 to 5. An open-ended field is also provided after the scoring table to allow respondents to fill in any quality elements they believe are missing from the questionnaire.

3.2. Survey implementation

The survey was conducted using an online form tool. First, the questionnaire was designed using the Kingsoft statistical form platform. Then, it was distributed to various target groups, including current undergraduates, current postgraduates, graduates with less than three years of work experience, and those with more than three years of experience. Survey data were collected through the backend of the platform. A total of 514 valid responses were received, including 244 from undergraduates, 94 from postgraduates, 48 from respondents with less than three years of work experience, and 128 from respondents with over three years of work experience.

3.3. Survey result analysis

Since the number of responses from each group (undergraduates, postgraduates, less experienced, and more experienced graduates) varies, the average score given by each group for each indicator was first calculated, as shown in **Figure 3**. In the figure, key elements with a grey background and bold text represent the top five rated items by that group, while those with a grey background and non-bold text represent the bottom five.

Latitude	Key Elements	Over 3 yesrs	under 3 years	Postgraduate	Undergraduate
Physical Fitness	Vigorous Energy	4.508	4.708	4.574	4.516
	Physical Health	4.523	4.646	4.628	4.525
Interpersonal Communication	Linguistic Expression	4.445	4.833	4.691	4.500
	Textual Expression	4.266	4.313	4.394	4.209
	Collaboration	4.328	4.542	4.713	4.561
	Organizational Capabilities	4.078	4.313	4.277	4.205
Knowledge Skills	Learning Ability	4.563	4.708	4.713	4.631
	Problem-solving Ability	4.703	4.813	4.809	4.656
	Meticulous Work Ethic	4.516	4.333	4.596	4.586
	Professional SkillS	4.117	4.125	4.447	4.439
	Resource Utilization	4.172	4.292	4.404	4.393
	Knowledge Structure	3.984	3.938	4.277	4.250
Personal Qualities	Independent Thinking	4.469	4.604	4.574	4.504
	Patience	4.320	4.375	4.532	4.516
	Responsibility	4.617	4.521	4.606	4.598
	Resilience	4.453	4.604	4.596	4.561
	Proactivity	4.336	4.438	4.404	4.324
	Self-control	4.273	4.313	4.426	4.500
	Emotional Stability	4.313	4.375	4.468	4.439
	Ethical Qualities	4.414	3.896	4.404	4.475

Figure 3. Overall analysis of group acceptance of the quality evaluation model

(1) Rationality analysis of the postgraduate quality evaluation model

The proposed postgraduate quality evaluation model demonstrates a high degree of rationality, as reflected in the following: (a) High overall recognition: All groups gave relatively high scores to the existing elements, with the lowest still above 3.8, indicating strong overall approval. (b) Low recognition deviation: The gap between the most and least valued elements within each group was small, with the largest difference only 18.75%. (c) No missing elements identified: Among 291 suggestions from respondents, most were repetitions, combinations of existing items, or niche topics—confirming the model's completeness.

(2) Commonality analysis of group acceptance

The level of acceptance for different key elements in the postgraduate quality evaluation model does not differ significantly across the surveyed groups. Specifically: (a) There is no overlap between the top five and bottom five elements within each group. (b) Three of the top five elements are consistent across at least three groups: physical health, learning ability, and problem-solving ability, with the latter two recognized by all four groups. (c) Four of the bottom five elements are also shared by at least three groups: written communication, organizational ability, resource utilization, and knowledge structure—with particularly low recognition for the last three across all groups.

(3) Difference analysis of group acceptance

Next, the variation in acceptance across the four core dimensions of the model among different groups is analyzed, as illustrated in **Figure 4**. Substantial differences are evident, shown by numerous intersections in the chart. (a) Knowledge and skills are highly valued by students but less emphasized by employed graduates, reflecting a shift from academic to broader workplace competencies. (b) Interpersonal skills are prioritized by early-career graduates, likely due to their adjustment from academic to professional social environments. (c) Personal qualities are valued by most groups, with a dip among newly employed individuals as they shift mindsets from student to worker. (d) Physical fitness is rated lower only by undergraduates, possibly due to their age and better baseline health.

Further analysis was conducted to compare group-level acceptance for specific key elements within each dimension.

Across the physical fitness, knowledge and skills, and interpersonal skills dimensions, differences among groups were minimal. In **Figures 5** to **7**, this is reflected by either no intersection or very minor deviations between data points.

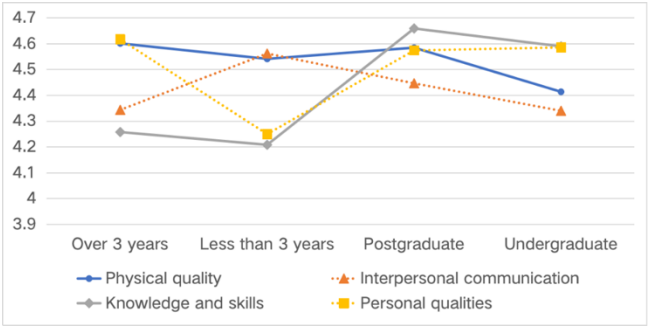

Figure 4. Variance in dimension-level recognition

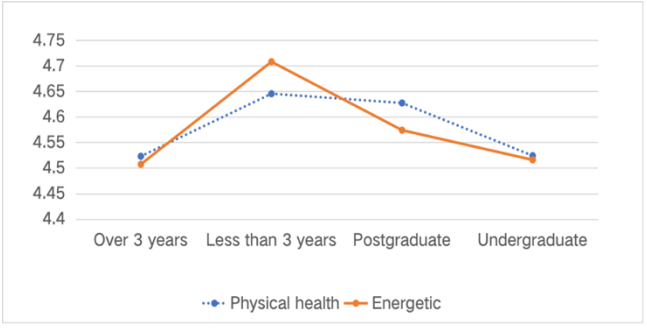

Figure 5. Differences in recognition of physical fitness

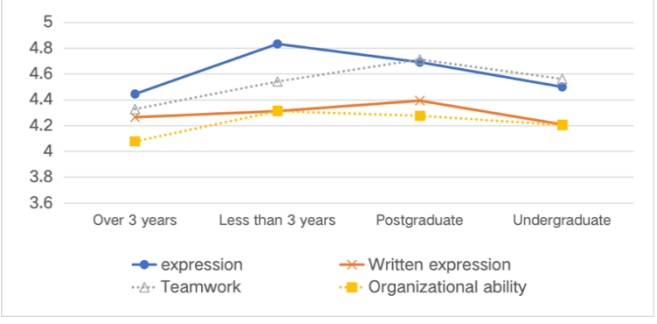

Figure 6. Differences in recognition of interpersonal skills

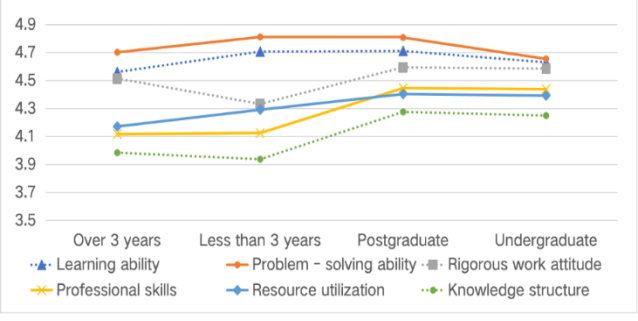

Figure 7. Differences in recognition of knowledge and skills

In contrast, significant differences were observed within the personal qualities dimension, as shown in **Figure 8**. These differences primarily stem from two key elements: moral character and proactiveness. (a) Moral character: The decline in recognition of moral character among newly employed graduates is a striking feature in **Figure 8**. This aligns with earlier observations that their lower acceptance of the personal qualities dimension is largely driven by their views on moral character. (b) Proactiveness: This element receives relatively low scores from students. While low proactiveness among undergraduates may be attributed to a credit-based learning model, the lack of recognition from postgraduates is more concerning. As a bridge between undergraduate education and employment, the postgraduate phase demands higher initiative—not only as preparation for the workplace but also as a driver of learning effectiveness during this critical stage.

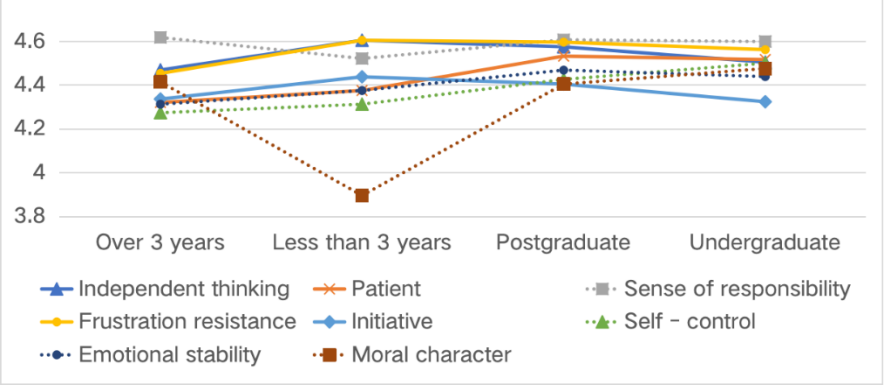

Figure 8. Differences in recognition of personal qualities

4. Conclusion

Based on the above analysis of the commonalities and differences in the acceptance of the postgraduate quality evaluation model across different groups, several suggestions can be proposed to further improve postgraduate training practices.

4.1. Focusing on the sustainable development of postgraduates and promoting reforms in the training system

Postgraduates are the driving force behind technological innovation in society. Therefore, instead of viewing postgraduate training merely as a continuation of undergraduate education, it should be regarded as a preparatory stage for future research work. For all evaluation stakeholders, it is essential to first clarify that the purpose of evaluation is to promote student development. Based on the findings of this study, there is a noticeable difference in the level of acceptance of the postgraduate quality evaluation model between current postgraduates and employed individuals [25]. While it is true that the nature of study and work during the postgraduate stage differs from that of full-time employment—thus making it inappropriate to train postgraduates exactly as working professionals—it is nonetheless critical to help postgraduates better understand the key competencies required in their future careers, and to provide the necessary environment and resources to support that development [26–28].

Moreover, this study reveals a decline in the recognition of moral character among newly employed individuals, which indirectly reflects a gap in current postgraduate training: insufficient support in helping postgraduates adapt quickly to the professional environment and make the necessary psychological transition

after graduation. This shortcoming impacts their competitiveness in the job market and highlights the need for targeted adjustments to the current postgraduate training system.

4.2. Enhancing overall competency development by leveraging highly recognized key elements

Across all surveyed groups, three elements—physical health, learning ability, and problem-solving ability—received consistently high recognition within the postgraduate quality evaluation model, while written communication, resource utilization, and knowledge structure were rated comparatively low. However, from the perspective of postgraduate competency development, all elements are generally of equal importance. Simply emphasizing the significance of low-recognition elements often fails to yield effective implementation outcomes. Since the development of core competencies is not an isolated process, it is advisable to leverage the interconnections among different qualities. In doing so, improvements in highly recognized competencies can be used to drive progress in those that are less recognized.

For example, engaging postgraduates in research and development projects is an effective way to enhance their problem-solving ability. If these projects also incorporate higher and clearer expectations for documentation quality, students' written communication skills can be improved simultaneously. This integrative approach supports balanced and comprehensive competency development.

Disclosure statement

The authors declare no conflict of interest.

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